Endangered Species Act - Section 7 Consultation
Biological Opinion

Action Agency:	National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS), Southeast Regional Office (SERO), Sustainable Fisheries Division (F/SER2)
Activity:	Endangered Species Act (ESA) Section 7 Consultation on the Continued Authorization of Snapper-Grouper Fishing in the U.S. South Atlantic Exclusive Economic Zone (EEZ) as Managed under the Snapper-Grouper Fishery Management Plan (SGFMP) of the South Atlantic Region, including Proposed Regulatory Amendment 16 to the SGFMP (SER-2016-17768)
Consulting Agency:	NOAA, NMFS, SERO, Protected Resources Division (F/SER3)
Date Issued:	12/1/2016
Approved By:	[signature]

For Roy E. Crabtree, Ph.D.
Regional Administrator

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List of Frequently Used Acronyms

ALWTRP	Atlantic Large Whale Take Reduction Plan
BSB	Black Sea Bass
CFLP	Coastal Fisheries Logbook Program
CPUE	Catch Per Unit Effort
DPS	Distinct Population Segment
DWH	Deepwater Horizon
EEZ	Exclusive Economic Zone
ESA	Endangered Species Act
FMU	Fishery Management Units
F/SER1	NMFS - Southeast Regional Office - Operations, Management, and Information Services Division
F/SER2	NMFS- Southeast Regional Office- Sustainable Fisheries Division
F/SER3	NMFS - Southeast Regional Office - Protected Resources Division
FIM	Fisheries Independent Monitoring
FMP	Fishery Management Plan
FWS	United States Fish and Wildlife Service
FMU	Fishery Management Unit
GADNR	Georgia Department of Natural Resources
GARFO	Greater Atlantic Regional Fisheries Office-Protected Resources Division
PRD	Protected Resources Division
HMS	Highly Migratory Species
ITS	Incidental Take Statement
MMPA	Marine Mammal Protection Act
MRIP	Marine Recreational Improvement Program
MRFSS	Marine Recreational Fishery Statistical Survey
NARW	North Atlantic Right Whale
NERO	Northeast Regional Office
NMFS	National Marine Fisheries Service
nmi	Nautical Mile
NOAA	National Oceanic and Atmospheric Administration
OST	Office of Science and Technology
RPMs	Reasonable and Prudent Measures
SAFMC	South Atlantic Fishery Management Council
SEDAR	Southeast Data, Assessment, and Review
SDDP	Supplemental Discard Data Program
SEFSC	Southeast Fisheries Science Center
SERO	Southeast Regional Office
SRP	Scientific Research Permit
STSSN	Sea Turtle Stranding and Salvage Network
T/C	Terms and Conditions
TED	Turtle Excluder Device
TEWG	Turtle Expert Working Group
USFWS	United States Fish and Wildlife Service

Introduction

Section 7(a)(2) of the ESA of 1973, as amended (16 U.S.C. § 1531 et seq.), requires each federal agency to ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of any critical habitat of such species. To fulfill this obligation, Section 7(a)(2) requires federal agencies to consult with the appropriate Secretary on any action they propose that "may affect" listed species or designated critical habitat. NMFS and the U.S. Fish and Wildlife Service (USFWS) share responsibilities for administering the ESA.

A federal action agency requests consultation when it determines that a proposed action "may affect" listed species or designated critical habitat. Consultations on most listed marine species and their designated critical habitat are conducted between the action agency and NMFS. The consultation is concluded after NMFS concurs with an action agency that its action is not likely to adversely affect listed species or critical habitat or issues a Biological Opinion ("Opinion") that identifies whether a proposed action is likely to jeopardize the continued existence of a listed species, or destroy or adversely modify its critical habitat. If jeopardy or destruction or adverse modification is found to be likely, the Opinion identifies reasonable and prudent alternatives (RPAs) to the action as proposed, if any, that can avoid jeopardizing listed species or resulting in the destruction/adverse modification of critical habitat. The Opinion states the amount or extent of incidental take of the listed species that may occur, specifies reasonable and prudent measures (RPMs) that are required to minimize the impacts of incidental take and monitoring to validate the expected effects of the action, and recommends conservation measures to further conserve the species.

This document represents NMFS's Opinion on the effects of its continued authorization of fishing for species managed by the SGFMP in the U.S. Atlantic Exclusive Economic Zone (EEZ) on threatened and endangered species and designated critical habitat, in accordance with Section 7 of the ESA. NMFS has dual responsibilities as both the action agency under the MSFCMA (16 U.S.C. §1801 et seq.) and the consulting agency under the ESA. For the purposes of this consultation, F/SER2 is considered the action agency and the consulting agency is F/SER3.

This Opinion has been prepared in accordance with Section 7 of the ESA and regulations promulgated to implement that section of the ESA. It is based on information provided in the original SGFMP and subsequent amendments to the SGFMP, as well as information provided in recovery plans, research, population modeling efforts, and other relevant published and unpublished scientific and commercial data cited in the Literature Cited section of this document.

1.0 Consultation History

An informal Section 7 consultation was conducted on the South Atlantic Snapper-Grouper Fishery Management Plan (SGFMP) after its implementation in 1983. NMFS concluded the management measures proposed in the SGFMP were not likely to adversely affect ESA-listed species. The consultation did not analyze the effects of the fishery itself.

The effects of the South Atlantic snapper-grouper fishery on threatened and endangered species were examined as part of a larger, April 28, 1989 Opinion analyzing the impacts of all commercial fishing activities in the Southeast Region. In that Opinion, NMFS concluded that commercial fishing activities in the Southeast Region were not likely to jeopardize the continued existence of any threatened or endangered species. The incidental take of 10 documented green, hawksbill, Kemp's ridley, or leatherback sea turtles; 100 loggerhead sea turtles; and 100 shortnose sturgeon was allotted to each fishery identified in the ITS. The amount of incidental take was later reduced in a July 5, 1989 Opinion to only 10 documented green, hawksbill, Kemp's ridley, or leatherback sea turtles; 100 loggerhead sea turtles; and 100 shortnose sturgeon for all commercial fishing activities conducted in the South Atlantic and the Gulf of Mexico fisheries combined.

Between 1990 and 2005, Snapper Grouper Amendments 1 through 12, 13A; an emergency interim rule; and 8 regulatory amendments to the SGFMP were all either consulted on informally and found not likely to adversely affect threatened or endangered species, or were determined by F/SER2 to have no effect on ESA-listed species and not warrant consultation. NMFS believed those changes would not alter the prosecution of the snapper-grouper fishery in ways not previously considered. They were also expected to not significantly alter the potential impacts to threatened and endangered species, or their designated critical habitats, in ways not previously considered in the July 5, 1989 Opinion.

On March 30, 2006, F/SER2 requested reinitiation of formal consultation on the SGFMP, including Amendment 13C to address new data availability and the listing of a new species that may be affected. As provided in 50 CFR 402.16, reinitiation of formal consultation is required when discretionary involvement or control over the action has been retained (or is authorized by law) and: (1) the amount or extent of the incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not previously considered; or (4) if a new species is listed or critical habitat designated that may be affected by the identified action. New information on the impacts of South Atlantic snapper-grouper fishing on ESA-listed species had emerged over the 22 years since the last formal consultation. Additionally, the impacts of snapper-grouper fishing on the U.S. distinct population segment (DPS) of smalltooth sawfish (listed as endangered in April 2003) were not analyzed in previous consultations. The presence of those reinitiating factors led F/SER2 to request reinitiation of consultation on the South Atlantic snapper-grouper fishery.

On June 7, 2006, NMFS completed the new Opinion (NMFS 2006a) on the continued authorization of the Snapper-Grouper FMP, including the proposed Amendment 13C. In the Opinion, NMFS determined that its continued authorization of the SGFMP was likely to adversely affect sea turtles and smalltooth sawfish, but was not likely to jeopardize their continued existence. An incidental take statement was issued for green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles, as well as smalltooth sawfish. Reasonable and prudent measures to minimize the impact of these incidental takes were specified, along with terms and conditions to implement them. NMFS determined other listed species in the exclusive economic zone (EEZ) of the South Atlantic Region were not likely to be adversely affected.

Between 2006 and 2015, NMFS made some modifications to the list of protected species for which they are responsible, which required consultation. Listings actions pertinent to the South Atlantic EEZ included the following: (1) the listing of 2 species of *Acropora* coral (71 FR 26852, May 9, 2006), (2) the designation of *Acropora* critical habitat (73 FR 72210, November 26, 2008), (3) the determination that the loggerhead sea turtle population consists of 9 DPSs (76 FR 58868, September 22, 2011), (4) the listing of 5 DPSs of Atlantic sturgeon (77 FR 5914, February 6, 2012, and 77 FR 5880, February 6, 2012), (5) the listing of 5 additional coral species found in the South Atlantic EEZ (79 FR 53851, September 10, 2014), and (6) the designation of critical habitat for the northwest Atlantic Ocean (NWA) loggerhead sea turtle DPS (79 FR 39856, July 10, 2014).

NMFS addressed the ESA-listing actions in a series of consultation memoranda. NMFS concluded that the continued authorization of the South Atlantic snapper-grouper fishery was not likely to adversely affect elkhorn or staghorn coral (via a July 9, 2007, memorandum), *Acropora* critical habitat (via a December 2, 2008, memorandum), and Atlantic sturgeon (via a February 15, 2012, memorandum). The February 15, 2012 Memorandum also stated that, as the 2006 Opinion had evaluated the impacts of the snapper-grouper fishery on the loggerhead sea turtle subpopulations now wholly contained within the Northwest Atlantic DPS, the Opinion's conclusion that the fishery is not likely to jeopardize the continued existence of loggerhead sea turtles remained valid. In a memorandum dated September 11, 2014, NMFS evaluated the effects of continued authorization of the snapper-grouper fishery on *Acropora* listed corals plus the 5 additional listed coral species. NMFS concluded that any adverse effects on these species from the snapper-grouper fishery are extremely unlikely to occur and are therefore discountable. In a memorandum dated September 16, 2014, NMFS evaluated the potential impacts all federally managed fisheries in the Gulf of Mexico and South Atlantic regions may have on the NWA loggerhead sea turtle DPS critical habitat. The evaluation concluded the snapper-grouper fishery uses fishing methods and gear types that either will have no effect or are highly unlikely to adversely affect any of the primary constituent elements; thus, any adverse effects from this fishery were discountable.

Regulatory Amendment 16 is the first SGFMP proposed action to trigger reinitiation of formal consultation since 2006. Although NMFS has amended the SGFMP numerous times over the last 10 years (see Appendix 1), each time F/SER2 determined the changes would ultimately have no effect on ESA-listed species and did not warrant reinitiation of consultation.

On February 11, 2016, F/SER2 requested reinitiation of Section 7 consultation on the Snapper-Grouper FMP to address: (1) the proposed measures in Regulatory Amendment 16 to the Snapper-Grouper FMP, which would modify the proposed action in a manner that may cause an effect to listed species or critical habitat that was not previously considered, and (2) new information on the seasonal distribution of endangered large whales (i.e., North Atlantic right whales [NARW] and humpback whales[1]) that may reveal new effects of the black sea bass (BSB) pot sector on large whales in a manner or to an extent not previously considered in the last consultation. F/SER2 also indicated that NMFS's expansion of critical habitat designated for NARW (February 26, 2016, 81 FR 4838) might be affected by the proposed action.

[1] On September 7, 2016, NMFS revised the ESA listing for the humpback whale to identify 14 Distinct Population Segments (DPS) of humpback whales, listing 1 as threatened, 4 as endangered, and identifying 9 others as not warranted for listing. Of these DPSs, only humpback whales from the West Indies DPS occur in the Southeast Region, and this DPS was not listed; no threatened and endangered humpback whale DPSs occur in the Southeast Region. All humpback whales do remain protected in U.S. waters and on the high seas (from takes by any person subject to U.S. jurisdiction) under the Marine Mammal Protection Act (MMPA), regardless of their ESA listing status.

In the memorandum requesting reinitiation of consultation, F/SER2 indicated they would provide F/SER3 with an electronic copy of the final version of Regulatory Amendment 16 when it became available to serve as the biological assessment and with an updated the summary of the snapper-grouper fishery by February 19, 2016. F/SER2 provided F/SER3 with updated summary snapper-grouper regulatory information on February 19, 2016 and with updated fishery data on April 17, 2016. On March 7, 2016, F/SER2 provided F/SER3 with an electronic copy of the Final Regulatory Amendment.

On April 6, 2016, NMFS and the Fish and Wildlife Service (FWS) published a Final Rule in the Federal Register (81 FR 20057) removing the range-wide and breeding population ESA listings of the green sea turtle, and in their place, listing 8 green sea turtle DPSs as threatened and 3 green sea turtle DPSs as endangered, effective May 6, 2016. Two of the green sea turtle DPSs, the North Atlantic DPS and the South Atlantic DPS, occur in the South Atlantic Region and may be affected by snapper-grouper fishing, based on the existing 2006 Opinion's analysis for green sea turtles as previously listed. Therefore, the Final Listing Rule created an additional issue for the ongoing consultation to address.

In an April 7, 2016, memorandum to the file, SERO determined that allowing the snapper-grouper fishery to continue during the reinitiation period will not violate Sections 7(a)(2) or 7(d) of the ESA (Attachment 2).

On June 29, 2016, NMFS published a Final Rule in the Federal Register listing Nassau grouper as threatened under the Endangered Species Act, effective July 29, 2016. Consequently, the ongoing consultation on the continued authorization of snapper-grouper fishing was expanded to consider potential effects on Nassau grouper. Although snapper-grouper regulations prohibit retention of the species, which is part of the snapper-grouper species complex managed under the snapper-grouper FMP, Nassau grouper can still be incidentally caught during fishing for other snapper-grouper species off Florida, so it may be adversely affected. On July 6, 2016, F/SER2 requested data on the number of Nassau grouper regulatory discards in federal snapper-grouper fisheries as well as the best available information (e.g., proxy) on which to estimate post-release mortality. F/SER3 provided the data the next day.

F/SER3 worked with F/SER2 throughout July 2016, to clarify information and data analysis with regards to Nassau grouper and sea turtle interactions and effects with the fishery.

2.0 Description of the Proposed Action

Regulatory Amendment 16

The black sea bass stock in the South Atlantic was assessed through the Southeast Data, Assessment, and Review (SEDAR) stock assessment process in 2013 (SEDAR 25 Update 2013). The SEDAR 25 Update indicated that the BSB commercial and recreational sector annual catch limits (ACL) could be increased without jeopardizing the health of the population. The BSB commercial and recreational ACLs were increased through Regulatory Amendment 19 to the FMP (78 FR 58249, September 23, 2013).

The South Atlantic Fishery Management Council (SAFMC) and NMFS, also through Regulatory Amendment 19, established a prohibition on the use of BSB pots from November 1 through April 30, each year. During this closure, no person is allowed to harvest or possess BSB in or from the South Atlantic EEZ, either with sea bass pots or from a vessel with sea bass pots on board. In addition, sea bass pots must be removed from the water in the South Atlantic EEZ prior to November 1, and may not be on board a vessel in the South Atlantic EEZ during this seasonal closure. The BSB pot seasonal prohibition became effective on October 23, 2013.

The seasonal sea bass pot prohibition was established as a precautionary measure to prevent interactions between BSB pot gear and whales during periods of large whale migrations and during the NARW calving season off the U.S. southeastern coast. The large whale migration period and the NARW calving season in the South Atlantic extends from approximately November 1 through April 30, each year. Since 2010, BSB harvest levels have reached the commercial ACL, triggering accountability measures (AMs) to close the commercial sector. Because these in-season commercial AM closures have occurred prior to November 1 since 2010, SAFMC and NMFS actions to prevent BSB pot gear from being in the water during periods of higher whale concentrations have been unnecessary. But NMFS determined that the increase in the BSB commercial ACL implemented through Regulatory Amendment 19 could extend the commercial BSB fishing season beyond November 1 and into a time period when a higher concentration of NARW are known to migrate through BSB fishing grounds.

The SAFMC and NMFS, through Regulatory Amendment 16, are proposing modifications to the closure. The purpose is to reduce the adverse socioeconomic impacts resulting from the annual November 1 through April 30 prohibition on the use of BSB pot gear and increase the flexibility of BSB pot endorsement holders to fish with this gear while continuing to protect ESA-listed whales in the South Atlantic region. If modified, the prohibition on the use of BSB pots would be as follows:

> From November 1 through 30 and from April 1 through 30 each year, the BSB pot closure applies to waters inshore of points 1-35 listed in Table 2.1: approximately Daytona Beach, Florida, to Cape Hatteras, North Carolina (Figure 2.1). From December 1 through March 31, the BSB pot closure applies to waters inshore of points 1-28 listed in Table 2.2: approximately Cape Canaveral, Florida, to Cape Hatteras, North Carolina (Figure 2.2).

Table 2.1. Eastern Boundary Coordinates for the Proposed BSB Pot Closure in Preferred Alternative 11 from November 1 through November 30 and April 1 through April 30

Point	N Latitude	W Longitude	Point	N Latitude	W Longitude
1	35° 15’	State/EEZ Boundary	19	33° 06’	78° 31’
2	35° 15’	75° 09’	20	33° 05’	78° 40’
3	35° 06’	75° 22’	21	33° 01’	78° 43’
4	35° 06’	75° 39’	22	32° 56’	78° 57’
5	35° 01’	75° 47’	23	32° 44’	79° 04’
6	34° 54’	75° 46’	24	32° 42’	79° 13’
7	34° 52’	76° 04’	25	32° 34’	79° 23’
8	34° 33’	76° 22’	26	32° 25’	79° 25’
9	34° 23’	76° 18’	27	32° 23’	79° 37
10	34° 21’	76° 27’	28	31° 53’	80° 09’
11	34° 25’	76° 51’	29	31º 31’	80º 33’
12	34° 09’	77° 19’	30	30º 43’	80º 49’
13	33° 44’	77° 38’	31	30º 30’	81º 01’
14	33° 25’	77° 27’	32	29º 45’	81º 01’
15	33° 22’	77° 40’	33	29º 31’	80º 58’
16	33° 28’	77° 41’	34	29º 13’	80º 52’
17	33° 32’	77° 53’	35	29º 13’	State/EEZ Boundary
18	33° 22’	78° 26’			

(Source: Amanda Frick, NMFS SERO)

Table 2.2. Eastern Boundary Coordinates for the Proposed BSB Pot Closure in Preferred Alternative 11 for December 1 through March 31

Point	N Latitude	W Longitude	Point	N Latitude	W Longitude
1	35°15’	State/EEZ boundary	15	33° 01’	78° 38’
2	35°15’	75° 08’	16	32° 40’	79° 01’
3	34°58’	75° 41’	17	32° 36’	79° 18’
4	34°49’	75° 50’	18	32° 19’	79° 22’
5	34°47’	76° 05’	19	32° 16’	79° 37’
6	34°31’	76° 18’	20	32° 03’	79° 48’
7	34°20’	76° 13	21	31° 39’	80° 27’
8	34°12’	77° 00’	22	30° 58’	80° 47’
9	33°43’	77° 30’	23	30° 13’	81° 01’
10	33°21’	77° 21’	24	29° 32’	80° 39’
11	33°18’	77° 41’	25	29° 22’	80° 44’
12	33°22’	77° 56’	26	28° 50’	80° 22’
13	33°12’	78° 20’	27	28° 21’	80° 18’
14	33°05’	78° 22’	28	28° 21’	State/EEZ boundary

Source: Amanda Frick, NMFS SERO

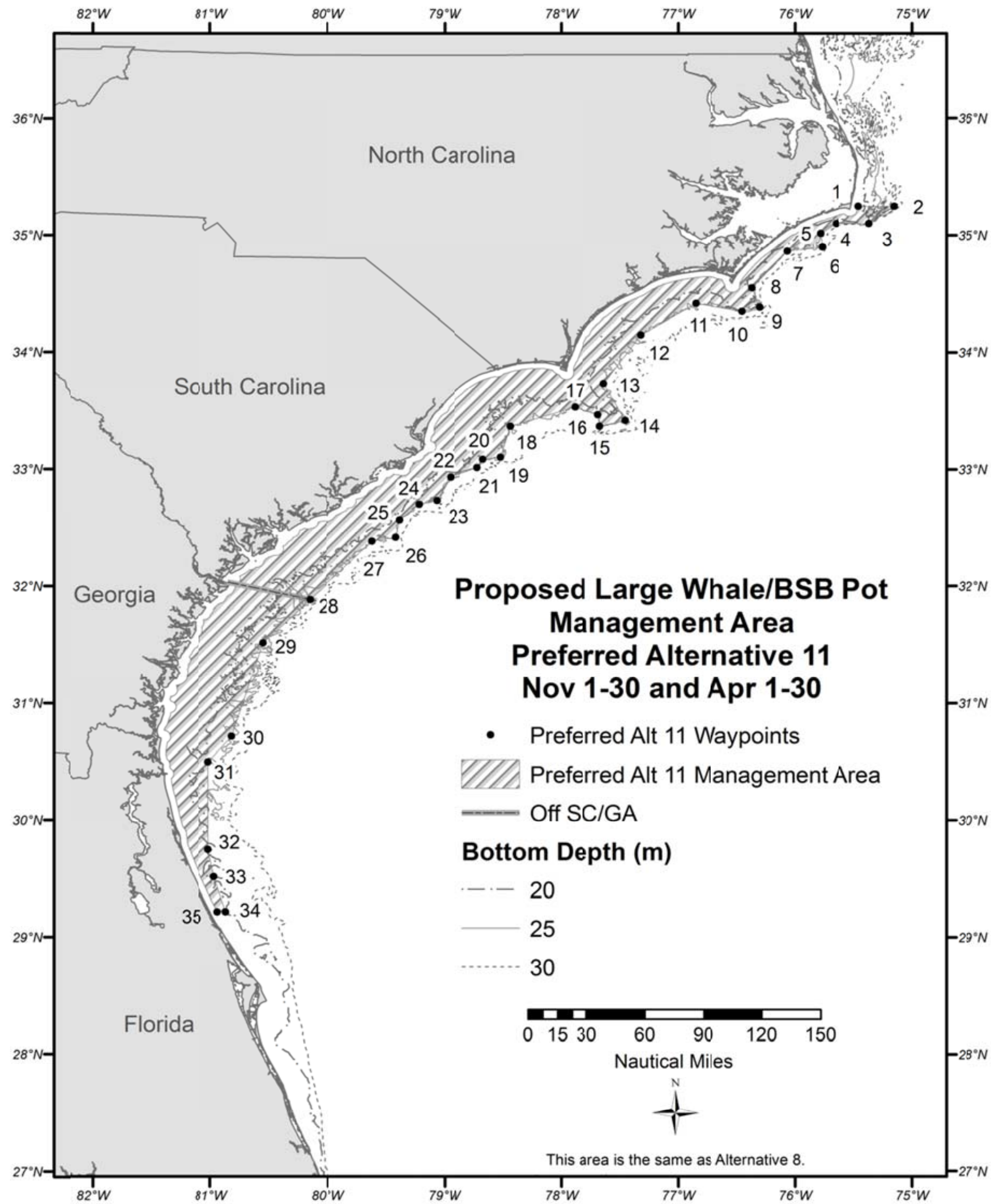

Figure 2.1. Area for the proposed BSB pot closure in Preferred Alternative 11 from November 1 through November 30 and April 1 through April 30 (Source: Amanda Frick, NMFS SERO)

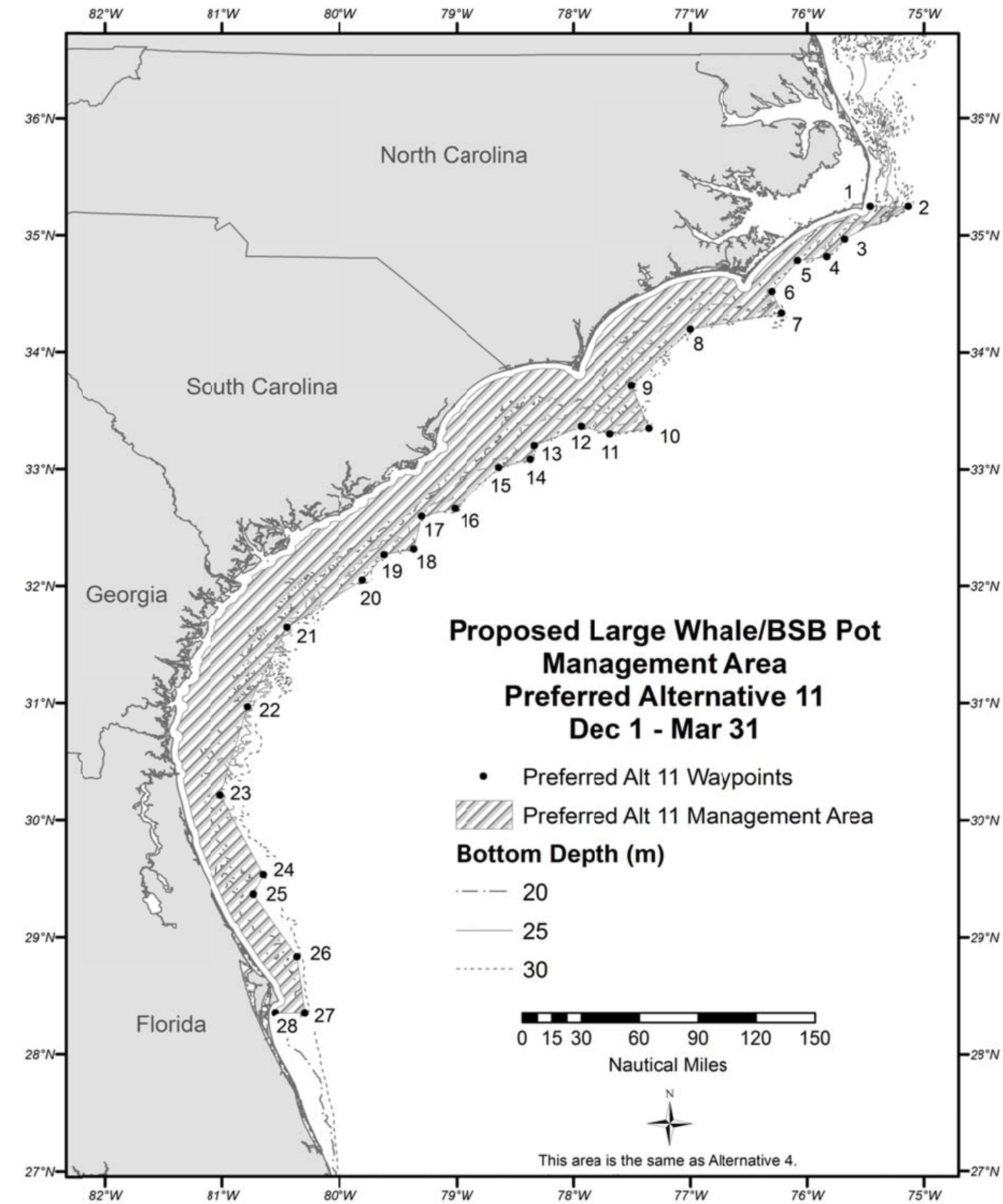

Figure 2.2. Area for the proposed BSB pot closure in Preferred Alternative 11 from December 1 through March 31 (Source: Amanda Frick, NMFS SERO)

The SAFMC and NMFS, through Regulatory Amendment 16, are also proposing to enhance buoy line rope marking for black sea bass pots. These rope markings would be in addition to other gear marking requirements already required by the Atlantic Large Whale Take Reduction Plan (ALWTP). A summary of all of the ALWTRP requirements applicable to BSB fishers may be reviewed at 50 CFR 229.32. In addition to the ALWTRP's rope marking requirements, the proposal is to include a feature to specifically distinguish the commercial South Atlantic black sea bass pot component of the snapper grouper fishery. Currently the ALWTRP requires three 12-inch color marks at the top, midway, and bottom sections of the buoy line specified for the individual management area in which the gear are deployed. The proposed action would require an additional 12-inch wide purple band be added at the end of each required 12-inch colored mark. Each of the three marks would be a total of 24 inches in length. The additional gear marking requirements of this action would be required in federal waters from November 15 through April 15 (Southeast Restricted Area North), September 1 through May 31 (Offshore Trap/Pot Area), and September 1 through May 31 (Southern Nearshore Trap/Pot Waters Area).

When consulting on FMP actions, NMFS must consider not only the effects of the specific management measures proposed but also the effects of all fishing activity authorized under the FMP. An overview of SGFMP management and regulations is provided in Section 2.1, followed by a description of the South Atlantic snapper-grouper fishery in Section 2.2. BSB is 1 of 59 species managed in the South Atlantic snapper-grouper fishery. Therefore, the following sections are not specific to only BSB. Instead, they provide a summary of the overall characteristics of the South Atlantic snapper-grouper fishery authorized under the SGFMP, which are relevant to the analysis of its potential effects on threatened and endangered species.

2.1 Overview of Management and Regulations

The SAFMC has jurisdiction from the North Carolina/Virginia border to the Atlantic side of Key West, Florida. The snapper-grouper fishery of the South Atlantic has been regulated since the implementation of its Fishery Management Plan/Environmental Impact Statement (FMP/EIS) in 1983. The SAFMC currently manages snapper-grouper stocks via fisheries management units (FMUs). Each regional fishery management council FMP defines an FMU, which identifies the specific fishery (or portion thereof) that is relevant to the FMP's management objectives. The SAFMC's snapper-grouper FMU is currently composed of 59 species. The snapper-grouper complex was established because these species are subtropical/tropical in distribution and mostly limited to areas of the east coast, south of Cape Hatteras. The snapper-grouper complex is comprised of the overlapping ranges of a large multi-species fishery. By developing a single, comprehensive plan to manage all these species within the South Atlantic region, the costs of management are greatly reduced (SAFMC 1983).

The fishery management plan (FMP) for the snapper grouper resource was first implemented in 1983. Over the next 2 decades, subsequent amendments to that FMP were made to institute a variety of regulatory measures to further protect and manage the resource (Appendix 1). Because of its mixed species nature, this fishery offers the greatest challenge for the Council to manage successfully. Initially, FMP regulations consisted of minimum sizes, gear restrictions and a provision for the designation of special management zones (SMZs). Early attempts to develop more effective management measures were thwarted by lack of data on both the resource and the fishery. The condition of many of the species within the snapper grouper complex was, and still is, unknown. Improved data collection (in terms of quantity and quality) has provided more management information on some of the more commercially and recreationally valuable species, but lack of basic management data on many of the species still remains the major obstacle to successful management. See list of species in Snapper Grouper Management Complex.

Snapper grouper management is also difficult because many of these species are slow growing, late maturing and long lived, so rebuilding efforts for some species will take years to produce full recovery. Strict management measures, including prohibition of harvest in some cases, have been implemented to rebuild overfished species in the snapper grouper complex. For example, both Goliath grouper (since 1990) and Nassau grouper (since 1992) are protected from any harvest and strict limits have been implemented for speckled hind and warsaw grouper. In addition, the Council has used traditional management tools such as bag limits, size limits, trip limits, commercial quotas, and spawning season closures to help rebuild stocks. The Council also approved Amendment 14 to create a system of 8 deepwater marine protected areas to help further protect deepwater snapper grouper species and their associated habitat.

To address overcapitalization in the fishery, the Council established a program to limit effort. Beginning in 1998, anyone wishing to enter the commercial fishery must buy two transferable vessel permits in order to qualify for a newly issued permit, thus eliminating one permit each time a new person enters the fishery. Known as the "2 for 1" program, this management measure has been effective in reducing participation in the fishery and pressure on the resource. This program will continue until the number of permits has been reduced to an optimum level to be determined based on the long-term yield of the fishery. More recently, the Council has explored the use of Limited Access Privilege Programs for the snapper grouper fishery, but they are not being considered at this time. Endorsement programs for the commercial black sea bass pot fishery and commercial golden tilefish fisheries are under development.

The 2006 Magnuson-Stevens Reauthorization Act includes mandates to end overfishing by providing authority to the Scientific and Statistical Committee to set Overfishing Levels (OFLs) and an Acceptable Biological Catch (ABC) that cannot be exceeded by managers. The Council has met the requirements of the reauthorized Act to establish Annual Catch Limits (ACLs) and Accountability Measures (AMs) for species designated as undergoing overfishing by 2010 and for all species managed by the Council by 2011 through implementation of recent amendments to the FMP.

The current management objectives in the SGFMP as amended are:

1. Prevent overfishing.
2. Collect necessary data.
3. Promote orderly utilization of the resource.
4. Provide for a flexible management system.
5. Minimize habitat damage.
6. Promote public compliance and enforcement.
7. Provide a mechanism to vest participants.
8. Promote stability and facilitate long-run planning.
9. Create market-driven harvest pace and increase product continuity.
10. Minimize gear and area conflicts among fishermen.
11. Decrease incentives for overcapitalization.
12. Prevent continual dissipation of returns from fishing through open access.
13. Evaluate and minimize localized depletion.
14. End overfishing of snapper grouper stocks undergoing overfishing.
15. Rebuild stocks declared overfished.

Numerous permit and reporting requirements, commercial and recreational species regulations, gear restrictions, and other miscellaneous regulations have been implemented over the years to manage the South Atlantic snapper grouper fishery. Federal fishing permits are required for any vessel engaging in commercial and for-hire fishing for species in the snapper grouper fishery management unit in the EEZ. In 1998, the Council established a program to limit initial eligibility for the snapper grouper fishery: Fishermen must have demonstrated landings of any species in the snapper grouper FMU in 1993, 1994, 1995 or 1996; and have held a valid snapper grouper permit between 02/11/96 and 02/11/97. The Council granted a transferable permit with unlimited landings if vessel landed ≥ 1,000 pounds (lb) of snapper grouper species in any of the years and granted a non-transferable permit with a 225 lb trip limit to all other vessels.

The harvest of many of the species in the snapper grouper FMU is managed with minimum size limits, recreational bag limits, commercial trip limits, quotas, and various time, area, and/or gear-based fishing prohibitions and restrictions. Commercial snapper-grouper fishing is managed primarily using "hard quotas" (i.e., fishery closures when monitoring indicates commercial quotas are harvested). ACLs have been established for all species. Recreational snapper-grouper fishing is managed primarily using minimum size limits and bag limits, but other regulations apply as well. A complete history of management of the snapper-grouper fishery is provided in Appendix 1. A summary of commercial and recreational species regulations are provided in the following tables (i.e., Tables 2.3 through 2.4). All of these regulations are compiled in 50 CFR Part 622.

Table 2.3. A summary of commercial regulations in the South Atlantic Region for species in the Snapper-Grouper FMU as of August 3, 2016.

Common Name	Local Names (if any different from common)	Size Limit	Trip Limits
Black Grouper*	Blackfin Grouper	24” TL	None
Black Sea Bass	Sea Bass, Blackfish	11”TL	Fishing Year is January 1 - December 31 annually; Pot fishery: Trip limit = 1,000-lbs (gw)/1,180-lbs (ww) Hook and Line: Trip limit=1,000-lbs (gw) (May 1-Dec. 31); 300 lb
Blackfin Snapper	None known	12” TL	None
Cubera Snapper	Cuban Snapper	12” TL	2 per person (not to exceed 2 per vessel) for fish 30” TL or larger off East Florida.
Dog Snapper	None known	12” TL	None
Gag*	Charcoal Belly	24” TL	Until 75% of quota reached, 1,000 lb (gw); after 75% of quota reached, 500 lb (gw)
Gray Snapper	Mangrove Snapper	12” TL	None
Gray Triggerfish	Triggerfish	14” FL off East Florida 12” FL off NC, SC, GA	Split season (Jan-June; July-Dec) annually; Trip Limit = 1,000-lb (ww)
Greater Amberjack	Amberjack, A.J.	36” FL; no coring	1,200-lb (gw) trip limit
Hogfish	Hog Snapper	12” FL	None
Goliath Grouper	Jewfish, Giant Seabass	Closed to possession or harvest	
Lane Snapper	Redtail Snapper, Candy Snapper	8” TL	None
Mahogany Snapper	None known	12” TL	None

Common Name	Local Names (if any different from common)	Size Limit	Trip Limits
Mutton Snapper	Muttonfish	16” TL	During May and June, possession limited to 10/person per day or per trip, whichever is more
Nassau Grouper	None known	Closed to possession or harvest	
Queen Snapper	None known	12” TL	None
Red Grouper*	None known	20” TL	None
Red Porgy	Pink Porgy, Silver Snapper, Pink Snapper	14” TL	120 fish trip limit from May 1 to December 31
Red Snapper	Mules, Sow Snapper, Spot Snapper, American Snapper	CURRENTLY CLOSED TO POSSESSION OR HARVEST	
Scamp*	Broomtail	20” TL	None
Schoolmaster		12” TL	None
Silk Snapper	Yelloweye Snapper	12” TL	None
Snowy Grouper	Snowflake	None	200-lbs (gw)
Speckled Hind	Strawberry Grouper, Kitty Mitchell, Calico Grouper	Closed to possession or harvest	
Golden, Blueline, Sand Tilefish	Golden - Rainbow Tilefish; Blueline - Gray Tilefish	Golden tilefish longline component: 4,000 lb (gw). Hook and line component: 500-lb (gw); Blueline = trip limit 300-lb; No size limit for golden, blueline or sand tilefish; Sand tilefish = no trip limits	
Vermilion Snapper	Beeliner, Night Snapper	12” TL	Until 75% of quota reached, 1,000 lb (gw); after 75% of quota reached, 500 lb (gw)
Warsaw Grouper	Jewfish (Miscalled), Grouper	Closed to possession or harvest	
Wreckfish	Individual Transfer Quota (ITQ) Program in place. Spawning season closure: January 15-April 15.		
Yellowfin Grouper*		20” TL	None
Yellowtail Snapper		12” TL	None
Yellowmouth Grouper*	Yellowtail	20” TL	None

***Indicates species included in the Annual Shallow-water Grouper Spawning Season Closure January 1 through April 30.

Table 2.4. A summary of the regulations for species in the snapper-grouper fishery management unit for the recreational sector as August 1, 2016.

Common Name	Local Names (if any known and different from common)	Size Limit	Daily Bag Limits
Black Grouper*	Blackfin Grouper	24" TL	Included in the 3 grouper aggregate daily bag limit; Maximum of 1 gag or black grouper (but not both) per person/day
Black Sea Bass	Sea Bass, Blackfish	13" TL	5 per person/day
Blackfin Snapper		12" TL	Included in 10 snapper per person limit
Cubera Snapper	Cuban Snapper	12" TL	2 per person (not to exceed 2 per vessel) for fish 30" TL or larger off East Florida. See "Retention Limits"
Dog Snapper		12" TL	Included in 10 snapper per person limit
Gag*	Charcoal Belly	24" TL	Included in the 3 grouper aggregate daily bag limit; Maximum of 1 gag or black grouper (but not both) per person/day
Gray Snapper	Mangrove Snapper	12" TL	Included in 10 snapper per person limit
Gray Triggerfish	Triggerfish	Included in 20 fish snapper grouper aggregate; See "allowable gear" at www.safmc.net 14" FL off East Florida; 12" FL off NC, SC, GA	
Greater Amberjack	Amberjack, A.J.	28" FL; no coring	1 per person/day (In April, for-hire/charter vessels limited to 1 per person/day or 1/per person/trip.)
Hogfish	Hog Snapper	Minimum size limit = 12" FL; Daily bag limit of 5 fish off east Florida; no bag limit elsewhere	
Goliath Grouper	Jewfish, Giant Seabass	Closed to possession or harvest	
Lane Snapper	Redtail Snapper, Candy Snapper	8" TL	Included in 10 snapper per person/day
Mahogany Snapper		12" TL	Included in 10 snapper per person/day
Mutton Snapper	Muttonfish	16" TL	Included in 10 snapper per person/day
Nassau Grouper		Closed to possession or harvest	
Queen Snapper		12" TL	Included in 10 snapper per person/day

Common Name	Local Names (if any known and different from common)	Size Limit	Daily Bag Limits
Red Grouper*		20" TL	Included in the 3 grouper aggregate daily bag limit
Red Porgy	Pink Porgy, Silver Snapper Pink Snapper	14" TL	3 per person/day (or 3 per person/trip, whichever is more restrictive)
Red Snapper	Mules, Sow Snapper, Spot Snapper, American Snapper	Closed to possession or harvest	
Scamp*	Broomtail	20" TL	Included in the 3 grouper aggregate daily bag limit
Silk Snapper	Yelloweye snapper	12" TL	Included in 10 snapper per person/day
Snowy Grouper	Snowflake	None	Included in the 3 grouper aggregate daily bag limit; Only 1 fish per VESSEL per day (May - August only)
Speckled Hind	Strawberry Grouper, Kitty Mitchell, Calico Grouper	Closed to possession or harvest	
Golden, Blueline and Sand Tilefish	Golden - Rainbow Tilefish; Blueline - Gray Tilefish	None	Included in 3 grouper bag limit; Blueline tilefish - 3 fish per person per day (May-August only)
Vermilion Snapper	Beeliner, Night Snapper	12" TL	5 per person/day (in addition to the snapper bag limit)
Warsaw Grouper	Jewfish (Miscalled), Grouper	Closed to possession or harvest	
Wreckfish		None	1 per vessel per day (July 1 – August 31)
Yellowedge Grouper		None	Included in 3 grouper per person/day
Yellowfin Grouper*		20" TL	Included in the 3 grouper aggregate daily bag limit
Yellowtail Snapper		12" TL	Included in 10 snapper per person/day
Yellowmouth Grouper*		20" TL	Included in the 3 grouper aggregate daily bag limit

*Annual January 1 to April 30 Shallow Water Grouper Spawning Season Closure includes: gag, black grouper, red grouper, scamp, red hind, rock hind, coney, graysby, yellowfin grouper, and yellowmouth grouper.

A longline may not be used to fish in the EEZ for South Atlantic snapper-grouper south of 27°10′ N. lat. (due east of the entrance to St. Lucie Inlet, FL); or north of 27°10′ N. lat. where the charted depth is less than 50 fathoms (91.4 m), as shown on the latest edition of the largest scale NOAA chart of the location. A person aboard a vessel with a longline on board that fishes on a trip in the South Atlantic EEZ south of 27°10′ N. lat., or north of 27°10′ N. lat. where the charted depth is less than 50 fathoms (91.4 m), is limited on that trip to the bag limit for South Atlantic snapper-grouper for which a bag limit is specified in §622.187(b), and to zero for all other South Atlantic snapper-grouper. For the purpose of this paragraph, a vessel is considered to have a longline on board when a power-operated longline hauler, a cable or monofilament of diameter and length suitable for use in the longline fishery, and gangions are on board. Removal of any one of these three elements constitutes removal of a longline. A vessel that has on board a valid Federal commercial permit for South Atlantic snapper-grouper, excluding wreckfish, which fishes in the EEZ on a trip with a longline on board, may possess only the following South Atlantic snapper-grouper: snowy grouper, yellow edge grouper, misty grouper, golden tilefish, blueline tilefish, and sand tilefish. See §622.170(f) for the requirement to possess a valid South Atlantic golden tilefish longline endorsement to fish for golden tilefish in the South Atlantic EEZ using longline gear.

Some gear restrictions and requirements apply to the snapper grouper fishery. For both the commercial and recreational sectors, dehooking devices are required when harvesting snapper grouper in the South Atlantic. Non-stainless steel circle hooks are required to be used when fishing with hook-and-line gear and natural baits north of 28° N. lat. Goliath grouper, Nassau grouper, speckled hind, and warsaw grouper taken in the South Atlantic EEZ incidentally by hook-and-line must be released immediately by cutting the line without removing the fish from the water. A bottom longline may not be used to fish for wreckfish in the South Atlantic EEZ. Finally, all vessels with snapper-grouper permits must have the appropriate sea turtle release gear and documents aboard when harvesting snapper-grouper FMU species. A permitted vessel with a freeboard height of four feet or less must have on board a: Dipnet; short-handled dehooker; long-nose or needle-nose pliers; bolt cutters; monofilament line cutters; and at least two types of mouth openers/mouth gags. A permitted vessel with a freeboard height of greater than four feet must have on board a: Dipnet; long-handled line clipper; short-handled and a long-handled dehooker; long-nose or needle-nose pliers; bolt cutters; monofilament line cutters; and at least two types of mouth openers/mouth gags. All vessels, regardless of freeboard, also need an auto tire or some other cushioned surface to rest a sea turtle on if it is boated. Other cushioned surfaces include life rings, seat cushions, life jackets, or life vests.

No person may fish for a South Atlantic snapper-grouper in an MPA, and no person may possess a South Atlantic snapper-grouper in an MPA. However, the prohibition on possession does not apply to a person aboard a vessel that is in transit with fishing gear appropriately stowed as specified in paragraph (a)(1)(ii) of this section. In addition to these restrictions, see §635.21(d)(1)(iii) regarding restrictions applicable within these MPAs for any vessel issued a permit under part 635 that has longline gear on board. The Council also has implemented gear-restrictions in special management zones.

The Council has managed the species with seasonal prohibitions. During January through April each year, no person may fish for, harvest, or possess in or from the South Atlantic EEZ any

South Atlantic shallow-water grouper (SASWG) (gag, black grouper, red grouper, scamp, red hind, rock hind, yellowmouth grouper, yellowfin grouper, graysby, and coney). In addition, for a person on board a vessel for which a valid Federal commercial or charter vessel/headboat permit for South Atlantic snapper-grouper has been issued, the provisions of this closure apply in the South Atlantic, regardless of where such fish are harvested, i.e., in state or Federal waters. From January 15 through April 15, each year, no person may harvest or possess on a fishing vessel wreckfish in or from the EEZ; offload wreckfish from the EEZ; or sell or purchase wreckfish in or from the EEZ. The prohibition on sale or purchase of wreckfish does not apply to trade in wreckfish that were harvested, offloaded, and sold or purchased prior to January 15 and were held in cold storage by a dealer or processor. From November 1 through April 30, each year, the commercial black sea bass pot component of the snapper-grouper fishery is closed. During this closure, no person may harvest or possess black sea bass in or from the South Atlantic EEZ either with sea bass pots or from a vessel with sea bass pots on board. In addition, sea bass pots must be removed from the water in the South Atlantic EEZ before November 1, and may not be on board a vessel in the South Atlantic EEZ during this closure. The recreational sector for blueline tilefish in or from the South Atlantic EEZ is closed from January 1 through April 30, and September 1 through December 31, each year. During a closure, the bag and possession limit for blueline tilefish in or from the South Atlantic EEZ is zero. The recreational sector for snowy grouper in or from the South Atlantic EEZ is closed from January 1 through April 30, and September 1 through December 31, each year. During a closure, the bag and possession limit for snowy grouper in or from the South Atlantic EEZ is zero. The commercial and recreational sectors for red snapper are closed (i.e., red snapper may not be harvested or possessed, or sold or purchased) in or from the South Atlantic EEZ, except if NMFS determines a limited amount of red snapper may be harvested or possessed in or from the South Atlantic EEZ, as specified in §622.193(y). If NMFS determines that commercial and recreational fishing seasons for red snapper may be established in a given fishing year, NMFS will announce the season opening dates in the Federal Register. The recreational fishing season would consist of consecutive Fridays, Saturdays, and Sundays, unless otherwise specified. NMFS will project the length of the recreational fishing season and announce the recreational fishing season end date in the Federal Register. See 622.193(y), for establishing the end date of the commercial fishing season.

2.1.1 Management of South Atlantic Snapper-Grouper Exempted Fishing, Scientific Research, and Exempted Educational Activity

Regulations at 50 CFR 600.745 allow the Regional Administrator of NMFS's SERO to authorize the target or incidental harvest of species managed under an FMP or fishery regulations that would otherwise be prohibited, for limited testing, public display, data collection, exploratory fishing, compensation fishing, conservation engineering, health and safety surveys, environmental cleanup, hazard removal purposes and/or educational activities Every year, SERO may issue a small number of exempted fishing permits (EFPs), and/or exempted educational activity authorizations (EEAAs). These permits exempt the collection of a limited number of snapper-grouper species occurring in South Atlantic federal waters from regulations implementing the SGFMP. For example, SERO may issue exemptions to scientists affiliated with universities, in collaboration with fishers, to obtain fish for scientific purposes. Aquariums may request exemptions from the regulations to collect fish for display purposes. These EFPs and EEAAs involve fishing by commercial or research vessels, using fishing methods similar or identical to those of the snapper-grouper fishery. The types and rates of interactions with listed species from the EFP and EEAA activities would be expected to be similar to those analyzed in this Opinion. If the fishing type is similar and the associated fishing effort does not represent a significant increase beyond the levels expected in the fishery considered herein, then issuance of the EFPs and EEAAs would be expected to fall within the level of effort and impacts considered in this Opinion. For example, issuance of an EFP to an active commercial vessel likely does not add additional effects than would otherwise accrue from the vessel's normal commercial activities. Similarly, issuance of an EFP or EEAA to a vessel to conduct a minimal number of snapper-grouper trips with vertical line (commercial or recreational) or bottom longline gear likely would not appreciably change fishing effort within the fishery in a given year. Therefore, we consider the issuance of most EFPs and EEAAs by SERO to be within the scope of this Opinion. The included EFPs and EEAAs would be those involving fishing consistent with the description of snapper-grouper fishing in Section 2 and not expected to increase fishing effort significantly.

2.1.2 South Atlantic Snapper-Grouper Fishery Monitoring and Reporting

Current regulations (50 CFR Part 622.5) require commercial and recreational for-hire participants in the South Atlantic snapper-grouper fishery, selected by the Southeast Science and Research Director (SRD), to maintain and submit a fishing record, on forms provided by the SRD (i.e., a logbook). Private and charter recreational participants in the South Atlantic snapper-grouper fishery are monitored mainly by the Marine Recreational Improvement Program (MRIP). Harvest from for-hire headboats is monitored by the NMFS SEFSC Beaufort Laboratory. Information describing monitoring and reporting by vessel type is presented below.

Commercial Vessels

Logbook reports have been required of all vessels with commercial South Atlantic snapper-grouper permits since 1992. All commercial snapper-grouper fishers are required to report their catch and effort data per trip via the NMFS Southeast Fisheries Science Center's (SEFSC's) Coastal Fisheries Logbook Program (CFLP). Information on the quantity caught for each species (reported in pounds), the area of catch, the type and quantity of gear, the dates of departure and return, the dealer and location where the catch was unloaded (county and state), the duration of the trip (time away from dock), an estimate of the fishing time, and the number of crew is required.

An approximately 20% random sample of commercial snapper-grouper fishers are also required, if selected, to report their discard data via the NMFS SEFSC's Supplementary Discard Data Program (SDDP). The SEFSC developed a supplemental form that is used with the CFLP to collect these discard data as mandated by the Sustainable Fisheries Act. Commercial snapper-grouper fishers are required, if selected, to report the number and average size of fish being discarded by species and the reasons for those discards (regulatory or market conditions). The bycatch data are collected using the supplemental form sent to a stratified, random sample of the commercial snapper-grouper permit holders (20% coverage). When the discard program was initiated in 2001, sample selections were made in July of each year, and the selected fishers (vessels) were required to complete and submit the SDDP discard forms along with their CFLP logbook forms for each trip they made during August through July of the following year. The 2004/2005 reporting period was extended to run from August 2004 to December 31, 2005; all participants selected thereafter were selected and report on a calendar year basis. The sampling system is designed so that the 20% of fishers selected to report for a given year are not selected for the next 4 years, so that over the course of a 5-year period, 100% of snapper-grouper permit holders have been required to report. Failure to comply with reporting requirements can result in sanctions, precluding permit renewal.

For-hire Charter Vessels and Private Recreational Fishing Vessels

Harvest and bycatch in the recreational for-hire charter vessel sector and the private recreational sector have been consistently monitored since 1979. Monitoring is accomplished primarily through MRIP. The survey uses a combination of random-digit-dialed telephone intercepts of coastal households for effort information and dock-side intercepts of individual trips for catch information to statistically estimate total trips, catch, and discards by species, for each subregion, state, mode, primary area, and wave.[2] Bycatch is enumerated by a disposition code for each fish caught but not kept.

Prior to 2000, sampling of the charter vessel sector resulted in highly variable estimates of catch. In 2000, a new charter vessel sampling methodology was implemented and now a 10% sample of charter vessel captains is called weekly to obtain trip level information. The standard dockside intercept data are now also collected from charter vessels, and charter vessel clients are sampled through the standard random digit dialing of coastal households. Precision of charter vessel effort estimates has improved by more than 50% due to these changes (Van Voorhees et al. 2000).

For-Hire Headboats

The SEFSC Beaufort Laboratory has monitored harvest from headboats since 1986, but no bycatch information is routinely collected. Prior to 1986, headboats were monitored through MRFSS. Daily catch records (trip reports) are filled out by headboat operators; or, in some cases, by NMFS-approved headboat samplers based on their communications with captains or

[2] Waves are 2-month sampling periods.

crew. Headboat samplers sub-sample headboat trips for data on species' lengths and weights. Biological samples (scales, otoliths, spines, gonads, and stomachs) are taken as time permits. Occasionally, onboard headboat samplers will record lengths of discarded fish; however, these trips are rare, and the data do not become part of the headboat database.

2.1.3 Other Requirements Applicable to the Proposed Action

ATLWTRP

Black sea bass trap/pot fishers are currently subject to fishing restrictions under the ALWTRP that are designed to reduce large whale entanglements in commercial fishing gear, particularly trap/pots. Gear modifications include weak link and vertical line breaking strength requirements which are dependent on the time of year and the location of fishing. All buoys must be attached to buoy line with a weak link and designed in such a way that the bitter end of the buoy line is clean and free of any knots when the weak link breaks. Weak links must be chosen from the list of NMFS-approved gear, which includes: off the shelf weak links, rope of appropriate breaking strength, hog rings, and other materials or devices approved in writing.

In addition, within the Southeast Restricted Area North (defined in the ALWTRP, 50 CFR 229.32), no trawls are permitted; only one trap per buoy line is permissible. The buoy line must be made of sinking line and free of objects (e.g. weights, floats, etc.) except where it attaches to the buoy and trap/pot.

All buoys must be marked with an official number. When marking is not already required by state or federal regulations, the letters and numbers to mark gear must be at least 1 inch (2.5 cm) in height, block letters or Arabic numbers, in a color that contrasts with the color of the buoy.

Line gear marking is also required per the ALWTRP and is dependent on the time of year and location of fishing. Buoy lines must be marked with three 12-inch colored marks -one at the top, one midway, and one at the bottom of the buoy line with appropriate marking color based on area and season. If the mark consists of two colors, each color mark may be 6-inches for a total mark of 12-inches. Each color code must be permanently affixed on or along the line and each color code must be clearly visible when the gear is hauled or removed from the water.

For more details or specific time/area gear regulations under the ALWTRP, please see 50 CFR 229.32.

Sea Turtle Handling and Resuscitation Techniques

NMFS published a final rule (66 FR 67495, December 31, 2001) detailing handling and resuscitation techniques for sea turtles that are incidentally caught during scientific research or fishing activities. As stated in 50 CFR 223.206(d)(1)(B)(1-3), resuscitation must be attempted on sea turtles that are comatose or inactive in the following manner:

- Place the sea turtle on its bottom shell (plastron) so that the sea turtle is right side up and elevating its hindquarters at least six inches for a period of 4 to 24 hours. The amount of elevation depends on the size of the sea turtle; greater elevations are needed for larger sea turtles. Periodically, rock the sea turtle gently left to right and right to left by holding the outer edge of the shell (carapace) and lifting one side about three inches, then alternate to the other side. Gently touch the eye and pinch the tail (reflex test) periodically to see if there is a response.

- Sea turtles being resuscitated must be shaded and kept damp or moist but under no circumstance be placed into a container holding water. A water-soaked towel placed over the head, carapace, and flippers is the most effective method in keeping a sea turtle moist.
- Sea turtles that revive and become active must be released over the stern of the boat only when fishing or scientific collection gear is not in use, when the engine gears are in neutral position, and in areas where they are unlikely to be recaptured or injured by vessels. Sea turtles that fail to respond to the reflex test or fail to move within four hours (up to 24, if possible) must be returned to the water in the same manner as that for actively moving sea turtles.
- A sea turtle is determined to be dead if the muscles are stiff (rigor mortis) and/or the flesh has begun to rot; otherwise, the sea turtle is determined to be comatose or inactive and resuscitation attempts are necessary.
- Any sea turtle so taken must not be consumed, sold, landed, offloaded, transshipped, or kept below deck.

2.2 Description of the South Atlantic Snapper-Grouper Fishery

2.2.1 Overview of the Commercial Sector

The SAFMC has jurisdiction from the North Carolina/Virginia border to the Atlantic side of Key West, Florida. Within these waters, legal methods of harvest in the South Atlantic commercial snapper-grouper fishery include hook-and-line, BSB pots, and powerheads or spears (except where prohibited in the EEZ). Hook-and-line gear authorized in the South Atlantic commercial snapper grouper fishery includes both bottom longline and vertical line (handline, hydraulic or electric reel (i.e., bandit gear), buoy gear, and rod and reel).

Any fishing vessel that harvests and sells any of the snapper grouper species from the South Atlantic EEZ must have a valid South Atlantic commercial snapper grouper permit. A limited access program in the South Atlantic snapper-grouper fishery was implemented in 1998/1999. As of April 14, 2016, there are 564 South Atlantic Snapper Grouper Unlimited Permits and 116 225-lb Trip Limited Permits (Table 2.3). After a permit expires, it can be renewed and transferred up to 1 year after the date of expiration.

Table 2.5. Number of South Atlantic Commercial Snapper Grouper Permits (2009 through 2015)

Year	Unlimited	225-lb Trip Limit
2009	639	144
2010	624	139
2011	615	138
2012	604	132
2013	592	129
2014	584	125
2015	571	121
as of 4/14/2016	564	116

(Source: Southeast Permits Database, NOAA Fisheries, SERO)

An economic survey of commercial snapper-grouper vessels in the South Atlantic region, done in the mid-1990s, found that on average, boats were 32.7 ft in length, and most boats were less than 50 ft long. Bottom longline vessels tended to be the longest, had the most powerful engines, the greatest fuel capacities, and the largest holding boxes for fish and ice. Vertical line vessels, especially in the southern South Atlantic region, tended to be the shortest, least powerful, with the smallest fuel capacities, and the smallest holding boxes for fish and ice (Waters et al. 1997).

Most (77%) snapper-grouper species are caught by vessels using vertical line gear. The longline vessels target the deepwater grouper and tilefish species in the snapper-grouper fishery. Longline vessels represented 59% of the snapper-grouper species in terms of total catch (Table 2.4).

Table 2.6. The Relative Importance of Different Gear Types in the Snapper-Grouper Fishery (average for 2012-2014)

	Bandit/Handline	Longline	Pot/Trap	Powerhead/Spear
Percentage of snapper-grouper landings by gear type	77%	14%	4%	5%

(Source: Southeast Logbook, NMFS, SEFSC)

2.2.2 Commercial Sector Gear Types and Techniques

Vertical Lines

Vertical line gear in the commercial sector is used throughout the SAFMC's area of jurisdiction. This fishery takes place in about 13-110 fathoms (78-660 ft or 78-202 m) of water both during day and night.

The SEFSC conducted a pilot mandatory observer project in the southeastern U.S. Atlantic vertical line reef fish fishery (including the commercial vertical line component of the snapper-grouper fishery) targeting mid-shelf and deep-water reef fish fisheries from February 2014 through January 2015 (Enzenauer et al. 2015). Over that time, the SEFSC observed 53 hauls on 10 trips targeting reef fish using unpowered vertical line gear. The average fishing depth was

38.6 m (SD 16.5) and an average bottom depth of 40.4 (SD 13.6). The number of hook hours ranged from 0.1 to 19.5 with a mean of 3.2 hook hours (SD 4.1). The most commonly used hook was the 4.0 circle hook (48.1%). There were 7 hauls (14.8%) that employed a 2.0 circle hook and a 1.0 J hook. Of the 53 hauls, gear configurations ranged from 1 to 4 hooks, the most common configurations being used were 1 hook (46.5%) of the time fished) and 3 hooks (28.3% of the time fished). The SEFSC also observed 249 hauls on 11 trips targeting reef fish fishes with powered vertical line gear. The average fishing depth was 51.6 m (SD 38.4) and an average bottom depth of 53.7 m (SD 37.7). The number of hook-hours ranged from 0.05 to 29.1 with a mean of 2.5 hook-hours (SD 3.4). The most commonly used hook was the 13.0 circle hook (26.8%), and the second most commonly used hook was the 6.0 J hook (18.4%). There were 50 hauls (20%) that employed a 13.0 circle hook and a 3.0 circle hook. There were 29 hauls (11.6%) that employed a 15.0 circle hook, a 1.0 J hook, and a 12.0 circle hook. Of the 249 hauls, gear configurations used ranged from 1 to 6 hooks with the most common configuration used being 2 hooks (67.2% of the time fished) and 3 hooks (23.5% of the time fished).

Fishers targeting deepwater snapper-grouper species (primarily targeting snowy grouper, but also catching large red porgy, blue line tilefish, warsaw grouper, and speckled hind) often fish between 50-100 fathoms (300-600 ft). They utilize multi-hook rigs (with anywhere from 2-10 circle hooks) and use squid, Boston mackerel, and other cut baits.

The majority of vertical line fishers use either electric or hydraulic reels known as "bandit" gear.[3] Boats generally employ 2-4 bandit reels, usually attached to the gunwale. This gear often consists of a fiberglass reel that holds about 1,000 ft of cable, an L-bar or spreader that keeps the leader from tangling with the main line, a pulley to feed the cable from the reel through the L-bar, a fiberglass arm, and an electronic or hydraulic reel motor (Figure 2.3).

Bandit reels are fished by throwing a baited line out over the gunwale of the boat as the drag on the spool of the bandit reel is released, sending the line down to the bottom or desired depth. If fishing a spot for the first time, a fisher may vary the depth at which he/she fishes.

Figure 2.3. Bandit reel used in the South Atlantic snapper-grouper fishery (NMFS 2006a)

Captains fishing with bandit gear often maneuver the boat back and forth across an area of high relief in search of fish. Locations are selected by using fish-finding sonar and by relying on

[3] So named because of its resemblance to one-armed bandit machines used in casinos.

fishing spots previously marked on their plotter. A fish-finding sonar allows the captain to differentiate between different bottom types. An experienced captain can also use the device to distinguish different species of fish by evaluating where they occur in the water column, the size of the air bladder as displayed on the screen, and how the fish are congregated.

Those fishers participating in the mid-shelf fishery tend to either “sit and soak”[4] or “get up and down.”[5] Sitting and soaking consists of fishing live or dead baits, with circle or J-hooks, at or near the bottom, for anywhere from 15 minutes to an hour. “Sit-and-soak” rigs are generally a 20- to 40-ft leader with 2 hooks. Fishers using this method typically fish in about 13-50 fathoms (78-300 ft) of water. Fishers “getting up and down,” actively fish 2-3 J-hooks per reel with cut bait. This method requires the line to be tended constantly and is brought to the surface as soon as a bite is felt. Most vermilion snapper, triggerfish, and porgies are caught this way. Fishers also employ this method when fishing for grouper but use much larger hooks.

A fishery for yellowtail snapper also exists off South Florida. This is primarily a day boat fishery. Chum is utilized in this fishery to aggregate fish into schools, which makes them easier to catch. Fish are caught on handlines with J-hooks and chill-killed to preserve the quality of the fish. Some fishers also use a splatter or spider pole[6] to catch the fish when chumming.

Other than the yellowtail fishery off South Florida, there is no consistent day/night pattern in the vertical line fishery. The time of day fished varies from captain to captain and is a matter of personal preference. The majority of the bandit fleet fishes year-round. The only seasonal differences in catch are associated with the regulatory spawning season closures in March and April for gag. Most fluctuations in fishing effort are a result of the weather. Trips can be limited during hurricane season (June through November) and also during the winter months (December through March).

Longline

The use of bottom longlines is only permitted in depths greater than 50 fathoms and only north of St. Lucie Inlet, Florida (27°10’N). Both pelagic and bottom longline gears are authorized for use in the South Atlantic snapper-grouper fishery (except in prohibited areas, see above), but the behavior of the species targeted makes bottom longline the primary type of longline gear used in this fishery.

Longline vessels operating in the snapper-grouper fishery are generally larger than bandit boats. Their trips are often longer and costlier because they operate farther offshore. For example, a vessel leaving port from Charleston, South Carolina, may travel 90 miles offshore to reach the fishing grounds and stay out for as many as 9 or 10 days. The cost of such a trip may be $2,500 or more.

The actual longline is located on a spool (Figure 2.4) about midway back on the stern deck of the boat. In the South Atlantic snapper-grouper fishery, a spool generally holds about 15 miles of cable or “mainline.” When fishing begins, the cable is paid out at the stern of the boat and a

[4] The target species with this method is primarily groupers.
[5] The target species with this method is primarily vermilion snapper.
[6] This is a 10- to 12-ft bamboo pole with a single line and a barbless hook attached.

polyball and a high-flyer are attached to mark that end of the longline (End X). At the stern, members of the crew (usually 2) stand near baskets of previously baited hooks and leaders. They snap these leaders onto the mainline, about every 2 ft, as the line pays out. As the gear deploys, the captain may steer in a zigzag fashion or make exaggerated turns to set the gear in the ideal location. Some fishers attach weights to the mainline as they make big turns to prevent it from rolling over and drifting on top of itself. When the desired amount of longline is paid out, the crew cuts the line from the spool and snaps on another polyball and high-flyer to indicate the end of the longline (End Y).[7]

The length of mainline paid out and the amount of time it is allowed to soak varies by boat and circumstance. Some vessels set out 5 miles of cable at a time, making as many as 4 or more sets a day, while others deploy 15 miles at a time and make only 2 sets a day. Soak times vary depending on the bottom depth fishing, current, and success of fishing.

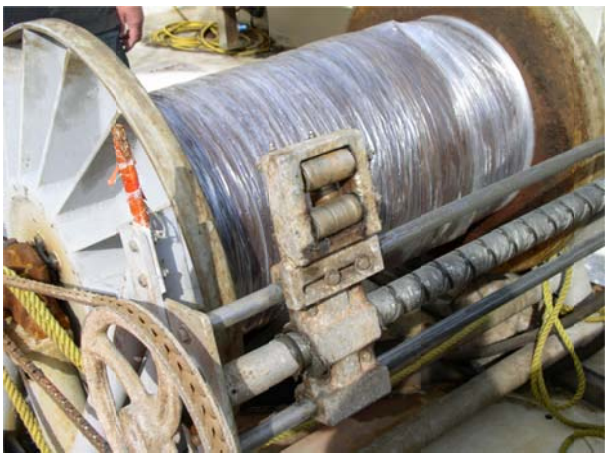

Figure 2.4. Example of a longline spool (NMFS 2006a)

Gear may be hauled back by either retrieving End X or End Y first. Retrieving End X first allows each hook about the same soak time. Fishers might retrieve End Y first instead, which means the hooks retrieved first have a shorter average soak time than those hooks deployed first.

The gear is retrieved from a haulback station equipped with a boom, which swings out over the side of the boat to help feed the cable through a block and pulley system. As the line is hauled back the catch is removed from the leaders and the main line is fed back onto the spool.

Longlines are only fished from daylight to dark because nocturnal sea lice eat the flesh of hooked fish while waiting for the line to be hauled in, subsequently reducing the quality of the fish. This fishery operates all year long with little or no seasonal fluctuation, barring a busy hurricane season.

Black Sea Bass Pots
A sea bass pot that is used or possessed in the South Atlantic EEZ between 35°15.19′N latitude (due east of Cape Hatteras Light, NC) and 28°35.1′N latitude (due east of the NASA Vehicle

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[7] The terms “End X” and “End Y” are used here to improve the clarity of our discussion regarding gear retrieval techniques, and do not have any other meaning.

Assembly Building, Cape Canaveral, FL) is required to have the following: (1) on at least 1 side, excluding top and bottom, a panel or door with an opening equal to or larger than the interior end of the trap's throat (funnel); and (2) an unobstructed escape vent opening on at least 2 opposite vertical sides, excluding top and bottom. The hinges and fasteners of each panel or door must be made of one of the following degradable materials: (1) Ungalvanized or uncoated iron wire with a diameter not exceeding 0.041 inches (1.0 millimeter [m]), that is, 19 gauge wire or (2) galvanic timed-release mechanisms with a letter grade designation (degradability index) no higher than J. The minimum dimensions of an escape vent opening (based on inside measurement) are: (1) 11⁄8 by 53⁄4 inches (2.9 by 14.6 cm) for a rectangular vent; (2) 1.75 by 1.75 inches (4.5 by 4.5 cm) for a square vent; and (3) 2.0-in (5.1-cm) diameter for a round vent. In addition, a sea bass pot used or possessed in the South Atlantic EEZ must have mesh sizes as follows (based on centerline measurements between opposite, parallel wires or netting strands): For sides of the pot other than the back panel, hexagonal mesh (chicken wire)—at least 1.5 in (3.8 cm) between the wrapped sides, square mesh—at least 1.5 in (3.8 cm) between sides, or rectangular mesh—at least 1 in (2.5 cm) between the longer sides and 2 inches (5.1 cm) between the shorter sides. For the entire back panel, i.e., the side of the pot opposite the side that contains the pot entrance, mesh that is at least 2 in (5.1 cm) between sides.

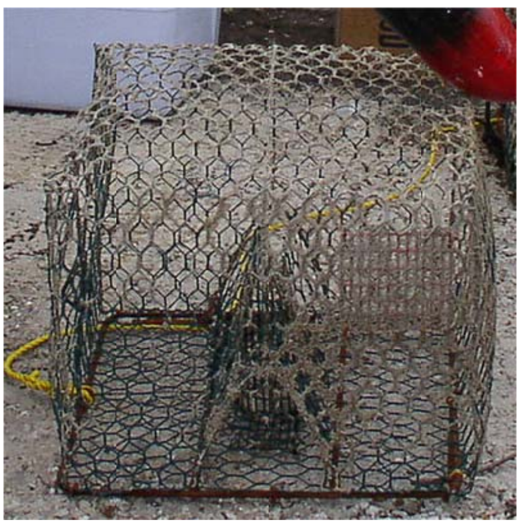

Figure 2.5. Example of a black sea bass pot (NMFS 2006a)

Fishing practices within the BSB pot fishery are diverse. A fisher's technique varies depending on the fisher, season, and area. Many fishers set individual pots with a single buoy line per pot. Other fishers string 2 or more pots together using a ground line and a buoy line. This configuration is commonly referred to as a "trawl." Anecdotal accounts suggest that only 1 person in North Carolina may be fishing with "trawls." No buoy lines may float at the water's surface, all ground lines must be made of sinking line, trawls with 5 or fewer traps may only have 1 buoy line, and all buoys must be attached with a weak link of 600-lb or 1,500-lb maximum breaking strength, contingent upon area fished (50 CFR 229.32). Most buoy lines are about 150-300 ft (45-90 meters [m]) in length. Levesque (2009) found buoy lines in the southeastern U.S. BSB pot commercial fishery were 1/4 in (6.4 millimeter [mm]), 5/16 in (7.9 mm), or 3/8 in (9.5 mm) with greater line diameters used off North Carolina. Line was constructed of polypropylene or a blend of polypropylene and Dacron. Rope diameter and material affect rope tensile (breaking) strength (Table 2.5). In the South Atlantic EEZ, the use of buoys is not required but, if used, each buoy must display the vessel's assigned official number and color code.

Table 2.7. Buoy Line Diameters Used in the BSB Trap/Pot Fishery (Levesque 2009) and Breaking Strength

Line Diameter	Tensile Strength in Pounds (Kilogram)	
	Polypropylene	Polypropylene/Dacron Blend
1/4 inch (6.4 mm)	1,250 (567)	1,500 lb
5/16 inch (7.9 mm)	1,900 (861)	N/A
3/8 inch (9.5 mm)	2,700 (1,225)	3,000 lb

(Source: http://www.jbropesupply.com/ on July 25, 2016)

The most common technique for targeting BSB is "precision setting." Fishers use on-board electronics to identify suspected aggregations of fish and will set their pots accordingly. With this technique, pots are pulled and moved frequently, depending on the success of fishing. Depending on the availability of hard bottom and how successful the catch, pots may be clustered in some areas and spread out over others. Spacing between pots can range from 3-5 miles (4.8-8 kilometers) or just 10-15 ft (3-4.5 m). Other fishers set out and leave many pots scattered over a wide area or in rows, regardless of bottom habitat, with the intention of attracting the fish to the pot. This technique targets more migratory individuals and the pots tend to stay in the water for a longer period of time.

The following are excerpts from Regulatory Amendment 16 (SAFMC 2016):

> Some fishers have reported the importance of fishing in the winter months for BSB using pot gear. They have reported that, during winter months, (1) the price per pound is higher, (2) fish migrate southward and are generally found closer to shore making them easier to harvest, and (3) fish tend to be darker and larger, which commands a higher price on the market. The BSB stock in the Mid-Atlantic region is closed in winter, which increases the price for fish harvested in the South Atlantic region.
>
> Most commercial fisheries are subject to seasonality, perhaps due to weather, regulations, markets for the fish, and the like. The commercial BSB segment of the snapper grouper fishery is no exception. For purposes of showing how seasonality possibly changed over time, three sub-periods are considered, 2000/01-2005/06, 2006/07-2009/10, and 2010/11-2012/13. The second sub-period starts right about the time the fishing season was changed from a calendar year to June 1-May 31, and the third sub-period starts at about the time closures to commercial harvest of BSB began to be implemented. Overall, a relatively strong seasonality characterizes the commercial landings (and revenues) for BSB. The first two sub-periods show about similar seasonality pattern: landings started at relatively low levels from June through October, rose in November with a peak in December and dropped thereafter. Apparently, the change in the fishing season did not alter the seasonality pattern of landings. The third sub-period is markedly different from the other two. Peak landings occurred at the start of the fishing season and dropped

rather steeply through November, with a spike in December. The landings spike in December is similar to that of the other two sub-periods. The change in seasonality pattern in the third period may be mainly attributed to fishing closures that reduced landings in the latter part of the season and that also motivated fishers to fish harder at the start of the next fishing season. The three sub-periods also show different levels of average landings per month. From October through May, average monthly landings were highest in the first sub-period and lowest in the third sub-period, with those in the second sub-period falling between those of the first and third sub-periods. The reverse holds for the months of June through September, with the third sub-period showing the highest monthly landings and the first sub-period, the lowest monthly landings.

Among the various states, North Carolina accounted for the largest amount of landings for BSB by weight and revenue (SAFMC 2016). South Carolina generally came in second, and Florida/Georgia third. In 2011/12, however, Florida/Georgia landings by weight and revenues increased quite substantially, topping South Carolina. North Carolina landings include BSB landings that were likely caught in the South Atlantic but reported by dealers in the Northeast. Such landings annually averaged about 49,000 lb gw with a dockside value of $137,000 for fishing years 2010/11 through 2012/13. Prior to those fishing years, there were virtually no such reported landings. As of August 20, 2015, 14 endorsements are associated with communities in North Carolina, 8 endorsements with communities in South Carolina, two endorsements in Georgia, and 8 endorsements with Florida communities (SAFMC 2016).

Spearfishing and Powerheads

Commercial spearfishing and powerhead use is most commonly practiced off the coast of Florida. The use of powerheads to kill snapper-grouper species is illegal off the coast of South Carolina and in Special Management Zones.

Powerheads, or bangsticks, are underwater firearms that usually use 12-gauge or .357 Magnum rounds. Sharp contact from a thrust against a solid object activates a heavy, spring loaded, stainless steel firing pin that detonates the round from a short barrel. Much of the damage inflicted on a fish comes from the rapidly expanding gases forced into its body from the barrel end (Bannerot and Bannerot 2000).

There are 3 common methods for using powerheads to kill fish. The traditional method uses a spear tip to cause the initial injury to the fish and a powerhead is used to kill it. Another method, used in clear water, utilizes only a spear tip without a powerhead, as it is often more accurate at longer distances (40-50 ft) than a powerhead. The spear is often not physically connected to the fisher and once it's shot, the fisher must actively pursue and retrieve the dead or dying fish. The third method is a hybrid of the previous two. This method attaches a powerhead to the shaft, in place of a spear tip and is shot at a fish like a spear. Once the powerhead hits the fish, the round detonates in the fish, causing fatal injuries.

Scuba diving is the most common way to fish using powerheads. Powerhead and spearfishing effort is greatly impacted by depth, which directly influences the amount of time (bottom time) a diver can spend fishing. It is important to separate total dive time from actual working time on the dive. These differences are important to note when evaluating the overall fishing effort in these fisheries (SAFMC 2001).

2.2.3 Recreational Sector

The recreational sector of the snapper grouper fishery is comprised of the private sector and the for-hire sector. The private sector includes private/rental boats. The for-hire sector is composed of the charter boat and headboat (also called party boat) sectors. Charter boats generally carry fewer passengers and charge a fee on an entire vessel basis, whereas headboats carry more passengers and payment is per person.

Charter and Private Recreational
It is not possible to determine the number of those that target snapper-grouper species but testimony at public hearings, Council meetings, and overall public interest indicates that recreational snapper-grouper fishing is growing in popularity. Recreational fishers for the most part use vertical line gear, although in some areas spearfishing is popular.

Recreational fishers use very diverse methods to fish for snapper-grouper. The distance people can go offshore in search of snapper-grouper depends in part on the size of their boat, engine power, fuel prices, and comfort level. Experience levels vary among recreational fishers, and consequently, fishing methods and efficiency differ. Bottom fishing for snapper and shallow-water grouper can be accessible to many recreational fishers, as they do not have to travel as far offshore. There is somewhat less skill involved when fishing for these species, compared to deeper fishing that targets mostly big grouper. As with the commercial fleet, many recreational anglers rely on technology such as fish finders and color machines to find fish. There is little or no technology gap between the professional (for-hire and commercial) fishers and those in the private sectors.

Recreational anglers use both electric and manual reels for bottom fishing. Twelve-volt electric reels, commonly called “elec-tra-mates,” attach to fishing rods and reels to assist fishers in reeling in catches from deep water. People who use electric reels tend to be more serious about fishing or fish deeper water.

Fishers choose lighter or heavier tackle based on which species they are targeting, the level of skill of the fishers, and a multitude of other factors including limiting gear loss. Generally, when fishing for grouper they will use heavier line (80- to 120-lb test) and larger hooks (6/0 and larger), which in turn call for larger weights. Fishing for snappers, porgies, and grunts generally means lighter tackle (1/0 to 4/0 hooks and 20- and 40-lb test line).

Like tackle, the use of bait also varies widely depending on the region, fishers’ preference, and target species. Cut bait, live baits, and even artificial plugs are all used to fish for various snapper and grouper species. Popular cut baits include menhaden, herring, bluefish, sardines, and cigar minnows.

Headboat
Headboats (also called party boats) are popular in the Southeast. These vessels are larger than the commercial hook-and-line vessels and private and charter boats. Many are longer than 100 ft. They provide easy and economical access to successful fishing for the beginning angler and tourist. These boats take as many as 100 people offshore to fish for snapper-grouper species and a host of other fish.

Fishing trips on headboats can either be an all-day (11 hours) or half-day (4 hours) experience. Generally, when fishing off the Carolinas on half-day trips, headboats target sea bass, porgies, sharks, flounder, and other bottom species. All-day headboat trips often fish 40-50 miles offshore to target snapper, grouper, large sea bass, and trigger fish. In general, headboats are fishing the same grounds as the commercial fleet and they can often be seen fishing side by side. Headboats will make special trips to fish during the night.
Headboat customers are generally provided with gear and bait. The fishing methods on headboats for snapper-grouper species are similar to those of the commercial sector and the private charter sector. Customers will be set up with a 4/0 or 6/0 reel rigged with 80-lb test monofilament, a rig with a 16-ounce weight, and the same variety of hook sizes as used by the commercial fleet. Most reels will be set up with two hook rigs. Cut squid is generally the preferred bait among headboat crews because it is easy to prepare and stays on the hook longer than other baits.

2.3 Action Area

The action area for an Opinion is defined as the area affected directly or indirectly by the federal action and not merely the immediate area involved in the action. The South Atlantic snapper-grouper fishery is managed by the SGFMP, and overseen by the SAFMC. The SAFMC has jurisdiction throughout the South Atlantic states' EEZs, which extends from 3 nautical miles (nmi) seaward of Florida, Georgia, South Carolina, and North Carolina to 200 nmi.[8] Throughout its range of operation, the South Atlantic snapper-grouper fishery may affect one or more of the listed species (detailed discussion in Section 3) known to occur with the South Atlantic; therefore, the action area for this consultation includes all of the U.S. South Atlantic EEZ. BSB and scup are not managed by Council north of 35°15.9′N latitude—the latitude of Cape Hatteras Light, North Carolina.

[8] The EEZ off of southern Florida does not extend all the way out 200 nmi due to the close proximity of The Bahamas.

3.0 Status of Listed Species and Critical Habitat

Table 3.1. ESA-Listed Species Under NMFS's Purview in the South Atlantic		
Marine mammals	Scientific Name	Status
Blue whale	*Balaenoptera musculus*	Endangered
Fin whale	*Balaenoptera physalus*	Endangered
NARW	*Eubalaena glacialis*	Endangered
Sei whale	*Balaenoptera borealis*	Endangered
Sperm whale	*Physeter macrocephalus*	Endangered
Sea Turtles	Scientific Name	Status
Green sea turtle	*Chelonia mydas*	Threatened*
Hawksbill sea turtle	*Eretmochelys imbricata*	Endangered
Leatherback sea turtle	*Dermochelys coriacea*	Endangered
Loggerhead sea turtle	*Caretta caretta*	Threatened**
Kemp's ridley sea turtle	*Lepidochelys kempii*	Threatened
Invertebrates		
Elkhorn coral	*Acropora palmata*	Threatened
Staghorn coral	*Acropora cervicornis*	Threatened
Rough cactus coral	*Mycetophyllia ferox*	Threatened
Pillar coral	*Dendrogyra cylindrus*	Threatened
Lobed star coral	*Orbicella annularis*	Threatened
Mountainous star coral	*Orbicella faveolata*	Threatened
Boulder star coral	*Orbicella franksi*	Threatened
Fish	Scientific Name	Status
Smalltooth sawfish	*Pristis pectinata*	Endangered ***
Atlantic sturgeon	*Acipenser oxyrinchus oxyrinchus*	Endangered/Threatened ****
Nassau grouper	*Epinephelus striatus*	Threatened
Critical Habitat		
Elkhorn and staghorn coral critical habitat		
NARW critical habitat		
Northwest Atlantic DPS of loggerhead sea turtle critical habitat		
*The North Atlantic DPS and South Atlantic DPS **The Northwest Atlantic DPS. ***The United States DPS. ****The New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs are listed as endangered; the Gulf of Maine DPS is listed as threatened.		

3.1 Analysis of Species and Critical Habitat Not Likely to be Adversely Affected

We have determined that the proposed action being considered in this Opinion is not likely to adversely affect the following listed species or critical habitat under the ESA: blue whales, sei whales, sperm whales, fin whales, any DPS of Atlantic sturgeon, elkhorn coral, staghorn coral, rough cactus coral, pillar coral, lobed star coral, mountainous star coral, boulder coral, NWA loggerhead DPS critical habitat, elkhorn and staghorn critical habitat, and NARW critical habitat**.** These species and critical habitats are therefore excluded from further analysis and consideration in this Opinion. The following discussion summarizes our rationale for these determinations.

3.1.1 Marine Mammals and Marine Mammal Critical Habitat

Blue, Sei, and Sperm Whales

In the southeast U.S. Atlantic region, blue, sei, and sperm whales are predominantly found seaward of the continental shelf in deeper waters (CETAP 1982; NMFS 2011e; Waring et al. 2013a; Wenzel et al. 1988). The depth at which these species are found greatly reduces the likelihood of any overlap between these whales and the South Atlantic Snapper-Grouper fishery, and there are no documented interactions with the fishery. The probability of these species' interacting with fishery activities is extremely low. For these reasons, we believe the likelihood of these species being adversely affected by the proposed action is extremely low and therefore discountable.

Fin Whales

Fin whales are baleen whales generally found along the 100 m isobath with sightings also spread over deeper water including canyons along the shelf break (Waring et al. 2012). The fin whale's association with the 100 m isobath does put it within the range of the vertical line (commonly occurring between 23-201 m) and the longline (only allowed beyond 91m) portions of the fishery. As a result, interactions are possible between fin whales and the vertical and longline gear portions of the fishery. However, commercial snapper-grouper vertical line and longline fisheries are listed as Category III fisheries on the 2016 List of Fisheries (81 FR 20550, April 8, 2016) in part because there have been no documented interactions of whales in these fisheries, and the likelihood of such interactions are remote [MMPA § 118 (c)(1)(A)(iii)]. Though fin whale distributions may overlap with some portions of this fishery, given the likelihood of interactions is so extremely low, we believe any adverse effect from continued authorization of fishing is discountable.

NARW Critical Habitat

NMFS originally designated critical habitat for NARW in the North Atlantic Ocean when the species was listed globally as a single species (59 FR 28793, July 5, 1994). On January 27, 2016, NMFS published a Final Rule expanding the critical habitat designation for the NARW (81 FR 4838). The new boundaries of the calving critical habitat that is within the action area include the marine waters from Cape Fear, North Carolina, southward to 28°N latitude (approximately 31 miles south of Cape Canaveral, Florida) (Figure 3.1). The revision identifies the physical features of right whale calving habitat that are essential to the conservation of the NARW to be: (1) calm sea surface conditions of Force 4 or less on the Beaufort Wind Scale; (2) sea surface temperatures from a minimum of 7°C, and never more than 17°C; and (3) water depths of 6-28 m, where these features simultaneously co-occur over contiguous areas of at least 231 km^2 of ocean waters during the months of November through April. None of the gear types/techniques or vessel activities associated with the proposed action will affect these essential features, because these activities have no ability to alter sea state, sea surface temperature, or water depth, individually or when they co-occur.

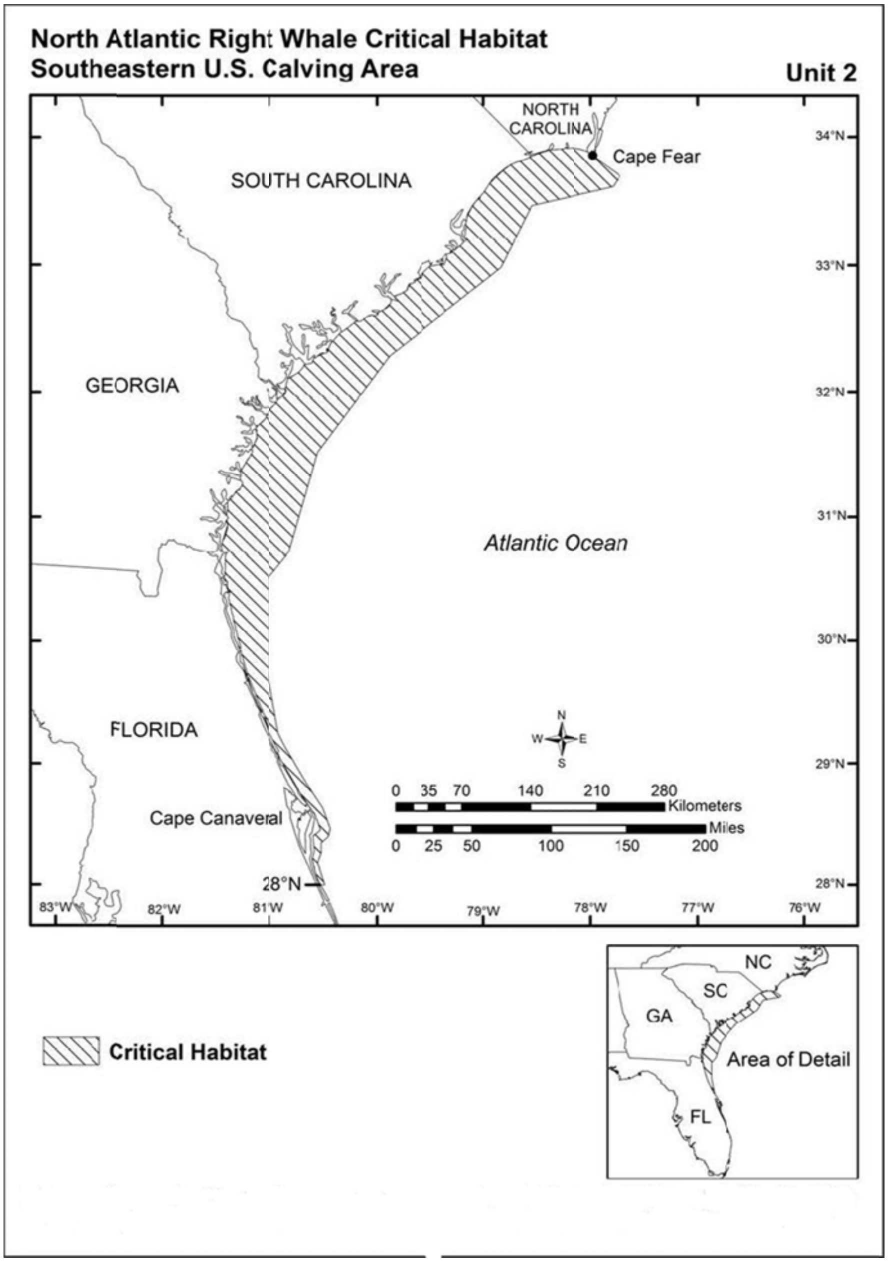

Figure 3.1. NARW critical habitat in the action area (Source: 81 FR4838, January 27, 2016)

3.1.2 Elkhorn, Staghorn, Rough Cactus, Pillar, Lobed Star, Mountainous Star, and Boulder Star Corals

We evaluated the potential threat that fishery related activities might pose to ESA-listed corals based on the information provided in the species status reviews and the Final Listing Rules (71 FR 26852, May 09, 2006; 79 FR 53852, Sept. 10, 2014).

The known routes of effect from fishing on ESA-listed corals are a result of man-made abrasion and breakage resulting from vessel groundings, damaging fishing practices (and associated diver/snorkeler interactions and anchoring), and fishing/marine debris (ABRT et al. 2005) The

South Atlantic snapper-grouper fishery does not capture herbivorous fish, so there are no potential trophic effects to the listed corals.

Vessel groundings are possible as a result of the continued authorization of the fishery, but we believe these events are extremely unlikely to occur. Most of the commercial fishers participating in the South Atlantic snapper-grouper fishery are professional captains with years of experience operating vessels. Over the past 20 years, technological advancements and accessibility to depth gauges and GPS units has also increased vessel operators' ability to detect bottom features and calculate vessel position in relation to mapped coral structures. Experience and the use of technology greatly reduce the likelihood of vessels groundings. Additionally, some of these corals occur within the FKNMS (where prohibitions to injure or damage coral exist) or within 3 nmi of shore (i.e., and thus are not within the action area). FKNMS regulations govern the operations of vessels within its borders and prohibit vessels from striking or otherwise injuring corals (15 CFR 922.163(a)(5)(i)) (Table 3.2). The presence of navigational aids throughout the FKNMS is likely to further reduce the potential for vessel groundings. Given the experience of the vast majority of vessel operators, technology available, and the existence of navigational aids and regulations prohibiting vessel groundings, we believe adverse effects to and from such events are extremely unlikely to occur, and are therefore discountable.

Within the area where these species and the fishery overlap, only vertical line and spearfishing/powerhead gears are used or allowed. Thus, only the potential impacts from fishing operations utilizing these gear types are considered herein. The vertical line gear used in the South Atlantic snapper-grouper fishery is fished in water depths ranging from shallow estuaries to several hundred fathoms. Anglers fishing in the deeper portions of this range typically use rigs with anywhere from 2-10 circle hooks. Squid, Boston mackerel, and other cut baits are most frequently used at this depth. Fishers targeting shallower species typically use rigs with 1 to 2 circle or J hooks fished at or near the bottom, for anywhere from 15 minutes to 1 hour. Live or dead baits are used, depending on fisher preference (SAFMC 2006).

The information in Chiappone et al. (2005) suggests that the level of lost gear from hook-and-line fishing effort needed to impact coral is very high. They report, that while lost hook-and-line fishing gear was ubiquitous in the Florida Keys, it was estimated that < 0.2% of the milleporid hydrocorals, stony corals, and gorgonians in the habitats studied showed injury (e.g., colony abrasions and partial mortality) as a result of lost hook-and-line gear interactions. In Monroe County, Florida (i.e., the Florida Keys), the number of angler trips reporting landings of finfish (i.e., species likely to be targeting with hook-and-line gear) was 32,751 (https://public.myfwc.com/FWRI/PFDM/ ReportCreator.aspx) for the year that Chiappone et al. (2005) conducted their study. This suggests that lost gear resulting from fishing effort of 32,751 sets per year, likely affected less than 0.2% of the milleporid hydrocorals, stony corals, and gorgonians.

Impacts to corals from hook-and-line fisheries interactions are most common to column and branching coral morphology that are more likely to become entangled by line or broken by gear. The rough cactus, lobed star, mountainous star, and boulder star coral species are characterized as boulder/mound or encrusting corals and area generally flat or round. In all cases, these species lack the branching morphology that greatly increases the potential risk of becoming fouled by fishing lines. We believe any adverse effects from fishing line entanglement to these 4 corals are extremely unlikely to occur and are discountable. Pillar coral has protruding columns and the *Acropora* species have a branching morphology. However, given the low density of these listed corals where the fishery's gear could occur (the South Atlantic EEZ), we expect the probability of interaction between the fishery gear and these species to be extremely low, and thus entanglement in the fishery is discountable.

Spearfishing and powerhead gears are most commonly fished using SCUBA gear.[9] Upon visually identifying a target fish, divers use pneumatic or rubber band guns or slings to hurl a spear shaft toward it. Commercial divers sometimes employ a powerhead at the shaft tip, which efficiently delivers a lethal charge to their quarry (Barnette 2001).

SCUBA divers' (i.e., spearfishers') targeting snapper-grouper species, divers can accidentally damage corals. Also, speared fish may "hole up" under ledges, which may require spearfishers to come in close or direct contact with the bottom. However, impacts would generally be limited to a very temporary and extremely localized increase in sedimentation or incidental contact with the bottom. Those species of listed corals that are round/encrusting are less likely to be subject to significant damage by accidental contact or activity from divers. Spearfishers targeting snapper-grouper species are generally competent divers, which further reduces the likelihood of accidental contact with all of the listed coral species (and greatly minimizes the potential for adverse effects) considered in this analysis. Additionally, in the FKNMS, there are regulations (Table 3.2) in place that prohibit damaging, breaking, cutting, or otherwise disturbing corals (15 CFR 922.163(a)(2)). FKNMS regulations also prohibit the taking or possessing of wildlife protected under the ESA (15 CFR 922.163(a)(10)). Mooring buoys have also been deployed throughout the FKNMS, reducing boaters' need to anchor. Based on the general skill of the divers and the regulations in place to avoid and protect these corals, and the low probability of interaction with any of the species, we believe any adverse effects to listed coral species from spearfishers targeting snapper-grouper species are extremely unlikely to occur and are therefore discountable. Regulations at 15 CFR §922.163 also prohibit the discharge of fishing/marine debris into the waters of the FKNMS. Regulations at 15 CFR §922.164 provide additional protection for corals occurring within existing management areas. Given the regulatory requirements, effects from this potential impact are considered extremely unlikely to occur, and are therefore discountable.

[9] Powerheads are underwater firearms that usually use 12-gauge or .357 Magnum rounds.

Table 3.2. Regulations Protecting Corals within the Florida Keys National Marine Sanctuary

<table>
<tr><th colspan="2">Sanctuary Wide Prohibitions</th></tr>
<tr><td>15 CFR §922.163(a)(2)</td><td>Removal of, injury to, or possession of coral or live rock.
(i) Moving, removing, taking, harvesting, damaging, disturbing, breaking, cutting, or otherwise injuring, or possessing (regardless of where taken from) any living or dead coral, or coral formation, or attempting any of these activities, except as permitted under 50 CFR part 638.</td></tr>
<tr><td>15 CFR §922.163(a)(4)</td><td>Discharge or deposit of materials or other matter.
(i) Discharging or depositing, from within the boundary of the Sanctuary, any material or other matter, except:
(A) Fish, fish parts, chumming materials, or bait used or produced incidental to and while conducting a traditional fishing activity in the Sanctuary;
(B) Biodegradable effluent incidental to vessel use and generated by a marine sanitation device approved in accordance with section 312 of the Federal Water Pollution Control Act, as amended, (FWPCA), 33 U.S.C. 1322 et seq.;
(C) Water generated by routine vessel operations (e.g., deck wash down and graywater as defined in section 312 of the FWPCA), excluding oily wastes from bilge pumping; or
(D) Cooling water from vessels or engine exhaust;
(ii) Discharging or depositing, from beyond the boundary of the Sanctuary, any material or other matter that subsequently enters the Sanctuary and injures a Sanctuary resource or quality, except those listed in paragraph (a)(4)(i) (A) through (D) of this section.</td></tr>
<tr><td>15 CFR §922.163(a)(5)</td><td>Operation of vessels.
(i) Operating a vessel in such a manner as to strike or otherwise injure coral, seagrass, or any other immobile organism attached to the seabed, including, but not limited to, operating a vessel in such a manner as to cause prop-scarring.
(ii) Having a vessel anchored on living coral other than hardbottom in water depths less than 40 feet when visibility is such that the seabed can be seen.</td></tr>
<tr><td>15 CFR §922.163(a)(10)</td><td>Take or possession of protected wildlife.
Taking any marine mammal, sea turtle, or seabird in or above the Sanctuary, except as authorized by the Marine Mammal Protection Act, as amended, (MMPA), 16 U.S.C. 1361 et seq., the Endangered Species Act, as amended, (ESA), 16 U.S.C. 1531 et seq., and the Migratory Bird Treaty Act, as amended, (MBTA) 16 U.S.C. 703 et seq.</td></tr>
</table>

Table 3.2 Regulations Protecting Corals within the Florida Keys National Marine Sanctuary. (continued)

Prohibitions Specific to Existing Management Areas	
15 CFR §922.164(b)	*Key Largo and Looe Key Management Areas.* (i) Removing, taking, damaging, harmfully disturbing, breaking, cutting, spearing or similarly injuring any coral or other marine invertebrate, or any plant, soil, rock, or other material, except commercial taking of spiny lobster and stone crab by trap and recreational taking of spiny lobster by hand or by hand gear which is consistent with these regulations and the applicable regulations implementing the applicable Fishery Management Plan. (iii) Fishing with wire fish traps, bottom trawls, dredges, fish sleds, or similar vessel-towed or anchored bottom fishing gear or nets.
15 CFR §922.164(d)(ii)	*Ecological Reserves and Sanctuary Preservation Areas.* Possessing, moving, harvesting, removing, taking, damaging, disturbing, breaking, cutting, spearing, or otherwise injuring any coral, marine invertebrate, fish, bottom formation, algae, seagrass or other living or dead organism, including shells, or attempting any of these activities.
15 CFR §922.164(d)(v)	*Anchoring in the Tortugas Ecological Reserve.* In all other Ecological Reserves and Sanctuary Preservation Areas, placing any anchor in a way that allows the anchor or any portion of the anchor apparatus (including the anchor, chain or rope) to touch living or dead coral, or any attached living organism. When anchoring dive boats, the first diver down must inspect the anchor to ensure that it is not touching living or dead coral, and will not shift in such a way as to touch such coral or other attached organism. No further diving shall take place until the anchor is placed in accordance with these requirements.

To summarize, the unlikely interaction of the fishery with listed coral species, in combination with the measures in place to protect listed coral species where they do occur and avoid such interaction, makes any adverse effect on these species from the proposed action extremely unlikely to occur. Based on this information and the discussion provided in this section, effects on the listed coral species from the continued authorization of the South Atlantic snapper-grouper fishery as managed under the SGFMP are discountable.

Elkhorn and Staghorn Critical Habitat

The potential route of effect from the proposed action on elkhorn and staghorn designated critical habitat is physical damage from vessels fishing for snapper-grouper in federal waters. Areas of critical habitat occurring in the action area are limited to a small portion of the South Atlantic. The feature essential to the conservation of elkhorn and staghorn corals is substrate of suitable quality and availability (i.e., "natural consolidated hard substrate or dead coral skeleton that is free from fleshy or turf macroalgae cover and sediment cover"), in water depths from the mean high water line to 30 m. While fishing would not target this type of habitat, it would be possible for fishers or gear to interact with sediment near it. Fishing activity could potentially result in some minor disturbance to sediment, but not at levels that could significantly alter essential features. NMFS would be unable to meaningfully measure, detect, or evaluate the effects to sediment cover. Additionally, fishing would not increase nutrients in the water and stimulate or promote algae growth and would have no impact on algae density that would result in any change to macroalgae cover. Thus, any effects from the proposed action on the essential features and the conservation value of elkhorn and staghorn coral critical habitat are expected to be insignificant.

3.1.3 Atlantic sturgeon

Vessel traffic, both recreational and commercial, has been documented to adversely affect protected species such as marine mammals and sea turtles, which breathe air at the water's surface. But Atlantic sturgeon, a fish that is primarily demersal (at or near the bottom of a body of water), rarely, if ever, would be at risk from moving vessels in the action area. Subadults and adults live in coastal waters and estuaries when not spawning, generally in shallow (10-50 m depth) nearshore areas dominated by gravel and sand substrates (77 FR 5914, February 6, 2012). Atlantic sturgeon are benthic foragers and prey upon a variety of species in marine and estuarine environment (81 FR 36078, June 16, 2016). In the ocean, Atlantic sturgeon typically occur in waters less than 50 m deep, travel long distances, exhibit seasonal coastal movements, and aggregate in estuarine and ocean waters at certain times of the year (81 FR 36078, June 16, 2016).

While vessel traffic (e.g., container ships) can be an issue for this species in shallow nearshore waters or in river systems, particularly in dredged channels at low tide with loaded vessels, it is not considered to be an issue offshore in the action area as interactions are expected to be extremely unlikely due to water depth and very low species density (S. Bolden, NMFS SERO PRD, pers. comm. to P. Opay, NMFS SERO PRD, July 19, 2016). Therefore, we expect any vessel effects to be discountable.

The current allowable gear types in the South Atlantic snapper-grouper fishery include: longline, rod-and-reel gear, bandit gear, handlines, spears, powerheads, and BSB pots (50 CFR 600.725). Hook-and-line gear (i.e., longlines, rod-and-reel gear, bandit gear, handlines) is not likely to adversely affect Atlantic sturgeon because of their diets and feeding mechanism. Atlantic sturgeons are described generally as being omnivorous benthic feeders that filter large quantities of substrate when they suction food into their protrusible mouth. In the marine environment, Atlantic sturgeon feed on mollusks, polychaete worms, gastropods, shrimps, amphipods, isopods, and small fishes, especially sand lances (Scott and Crossman 1973). These species are generally not used as bait when targeting snapper-grouper species, so Atlantic sturgeon are unlikely to be attracted to the baits used for snapper-grouper species and are unlikely to feed on baited hooks. Given the lack of any previously documented entanglements in snapper-grouper hook-and-line and the typical use of non-prey as bait, we believe any adverse effects from snapper-grouper hook-and-line gear type are extremely unlikely to occur and are discountable. Snapper-grouper spears and powerheads are also not likely to adversely affect Atlantic sturgeon. These gears require the fisher to make visual contact with the target species. Atlantic sturgeon are readily identifiable as non-snapper-grouper species, and fishers will be easily able to avoid incidentally catching them with these gear types in the unlikely case they are encountered. Therefore, any adverse effects from spear and powerhead gear are extremely unlikely to occur and are discountable.

Finally, BSB pots are used in the action area of the proposed action. The Atlantic sturgeon that would be offshore where BSB pots are set would be subadults or adults (> 76 cm TL) and too large to enter the pot, thus there is no risk of incidental capture. The only potential route of effect on Atlantic sturgeon from BSB pots is via entanglement in buoy lines and is extremely unlikely. Atlantic sturgeon are benthic (live at the substrate) and their morphology (e.g., cone-shaped head with small fins and bony plates) is prone to entanglement in gillnet and webbing. Still, the thicker vertical line that attaches from the pot to the surface buoy is very unlikely to entangle sturgeons given they do not swim in the water column and the external morphology. We are not aware of any entanglement of an Atlantic sturgeon in a pot line, buoy line, or rope. Atlantic sturgeon are not likely to be attracted to a baited BSB pot as they forage by benthic cruising using special morphological adaptations (i.e., lack of articulation of the upper jaw, subterminal placement of a protrusible jaw, and chemoreceptors on barbels that detect benthic prey). Predominant prey items for post-juveniles (the size class expected in the proposed area) include benthic macroinvertebrates including mollusks, gastropods, amphipods, and isopods. Atlantic sturgeon are unlikely to be attracted to the bait within the BSB pots, which further reduces the unlikely interaction with pots. Any adverse effects from black sea pots are extremely unlikely to occur and are discountable.

3.1.4 Sea Turtle Critical Habitat

Northwest Atlantic Loggerhead DPS Critical Habitat

Critical habitat for the NWA DPS of loggerhead sea turtles in the South Atlantic is defined by 5 specific habitat types: nearshore reproductive, winter concentration, concentrated breeding, constricted migratory, and *Sargassum*. Specifics of these habitats, including the primary constituent elements (PCEs) supporting each, can be found in Table 3.3. Destruction or adverse modification means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features.

The snapper-grouper fishery uses fishing methods and gear types that either will have no effect or are highly unlikely to adversely affect any of the primary constituent elements; thus, any adverse effects from this fishery will not occur or are insignificant. Our rationale for each unit is summarized below.

The proposed action will have no effect on nearshore reproductive habitat (Units LOGG-N-3 through N-36) and winter concentration habitat (Units LOGG-N-1and N-2). Nearshore reproductive habitats are those waters adjacent to nesting beaches and extend from the waterline out 1 mile. Snapper-grouper fishers operate a minimum of 2 miles offshore of the 1-mile boundary, so there will be no possibility of impacting the PCEs of this critical habitat. Winter concentration habitat only occurs off the coast of North Carolina between Cape Hatteras and

Cape Lookout. While snapper-grouper fishing occurs in this region, it is not capable of affecting the PCEs of water temperature, the proximity of shelf waters in relation to the Gulf Stream, and water depth.

NMFS designated two concentrated breeding habitat units (Units LOGG-N-17 and N-19) along the east coast of Florida as essential for the conservation of the species. The PCEs that support this habitat are (1) high densities of reproductive male and female loggerheads, (2) proximity to primary Florida migratory corridor, and (3) proximity to Florida nesting grounds.

The snapper-grouper fishery has the potential to capture protected loggerhead sea turtles as analyzed in later in this Opinion, but we do not believe this will noticeably affect the density of reproductive males and females in the area. Most fisheries only capture a handful of loggerheads at any one time and most of these captured animals are released alive within the same area they were caught. Therefore, any effects on the first PCE are considered insignificant. Further, we believe the snapper-grouper fishery has no means by which to affect the other PCEs of concentrated breeding habitat. The gears and activities in these fisheries do not have the capacity to affect the distance of the concentrated breeding habitat in relation to the Florida migratory corridor or the Florida nesting grounds.

NMFS designated four constricted migratory habitat units along the east coast of Florida Habitat (Units LOGG-N-1 and LOGG-N-17 through N-19). Two of these habitat units directly overlap with the two concentrated breeding habitat units described above. The PCEs that support this critical habitat are (1) constricted continental shelf area relative to nearby continental shelf waters that concentrate migratory pathways, and (2) passage conditions to allow for migration to and from nesting, breeding, and/or foraging areas.

The snapper-grouper fishery may operate within the constricted migratory corridor units. Given its activities and gear types it does not have the capacity to modify the first PCE. The snapper-grouper fishery deploys in Atlantic waters that could possibly affect passage conditions (the second PCE). Yet, because any gears deployed in these areas are temporary, we do not expect them to meaningfully alter the passage conditions that allow migration to and from nesting, breeding, or feeding habitats. Any effects to the second PCE will be insignificant.

Two units of *Sargassum* critical habitat (LOGG-S-01 and LOGG-S-02) were designated to conserve loggerhead sea turtles by protecting essential forage, cover, and transport habitat for post-hatchlings and early juveniles. The PCEs that support this habitat are: (1) convergence zones, surface-water downwelling areas, the margins of major boundary currents, and other locations where there are concentrated components of the *Sargassum* community, (2) *Sargassum* in concentrations that support adequate prey abundance and cover, (3) available prey and other material associated with *Sargassum* habitat, and (4) sufficient water depth and proximity to available currents to ensure offshore transport, foraging, and cover requirements for post-hatchlings.

The snapper-grouper fishery could operate in the widespread areas of the *Sargassum* critical habitat units, but we believe any effects to the PCEs will be insignificant. The fishery does not have the capability to affect the location of convergence zones, surface-water downwelling (the movement of denser water downward in the water column) areas, or other locations where there are concentrated components of the *Sargassum* community in water temperatures suitable for optimal growth of *Sargassum* and inhabitance of loggerheads. The fishery would have no effect on availability of prey for hatchling loggerhead sea turtles or other material associated with *Sargassum* habitat because the fishery does not target or incidentally harvest smaller prey species or *Sargassum*. The fishery does not have the capability to affect the water depth or proximity to currents necessary for offshore transport, foraging, and cover. While some vessels associated with the snapper-grouper fishery may transit through *Sargassum* habitats, those vessel tracks are not anticipated to scatter *Sargassum* mats to the point of affecting the functionality of the PCEs. Further, the wakes and surface water disruption associated with these vessels are not of sufficient magnitude to result in significant effects to the distribution of *Sargassum* mats. Temporary and incidental removal of Sargassum via fishing gear could occur, though any incidental harvest is not anticipated to be at such a level that functionality of the PCEs will be affected. Therefore, any adverse effects to the PCEs of Sargassum habitat will be insignificant.

In conclusion, activities associated with the snapper-grouper fishery will not adversely affect any of the NWA loggerhead DPS critical habitat units. The snapper-grouper fishery will either have no effect on the critical habitat due to location or methods, or will have insignificant effects that will not adversely affect the habitat's conservation value.

Table 3.3. Details Regarding the PCEs of Critical Habitat for NWA DPS of Loggerhead Sea Turtles

Habitat Type	Units	State	Physical And Biological Features	Primary Constituent Elements
Nearshore Reproductive Habitat	LOGG-N-3, N-4, N-5, N-6	NC	Portion of nearshore waters adjacent to nesting beaches that hatchlings use as egress to the open-water environment. Also used by nesting females to transit between beach and open water during the nesting season.	1) Nearshore waters with direct proximity to nesting beaches that support critical aggregations of nesting turtles (e.g., highest density nesting beaches) to 1.6 kilometer (1 mile) offshore 2) Waters sufficiently free of obstructions or artificial lighting to allow transit through the surf zone and outward toward open water 3) Waters with minimal manmade structures that could promote predators (i.e., nearshore predator concentration caused by submerged and emergent offshore structures), disrupt wave patterns necessary for orientation, and/or create excessive longshore currents
	LOGG-N-7, N-8, N-9, N-10, N-11	SC		
	LOGG-N-12, N-13	GA		
	LOGG-N-14, N-15, N-16, N-17, N-18, N-19, N-20, N-21, N-22, N-23, N-24, N-25, N-26, N-27, N-28, N-29, N-30, N-31, N-32	FL		
	LOGG-N-34, N-35, N-36	AL & MS		
Winter Concentration Habitat	LOGG-N-1, N-2	NC	Warm water habitat south of Cape Hatteras, near the western edge of the Gulf Stream, which supports meaningful aggregations of juveniles and adults during the winter months	1) Water temperatures above 10°C during the colder months of November through April 2) Continental shelf waters in proximity to the western boundary of the Gulf Stream 3) Water depths between 20-100 meters (m)
Concentrated Breeding Habitat	LOGG-N-17, N-19	FL	Sites that support meaningful aggregations of both male and female adult individuals during the breeding season	1) Meaningful concentrations of reproductive male and female loggerheads 2) Proximity to primary Florida migratory corridor 3) Proximity to Florida nesting grounds
Constricted Migratory Corridor Habitat	LOGG-N-1	NC	High-use migratory corridors that are constricted (limited in width) by land on 1 side and the edge of the continental shelf and Gulf Stream on the other side	1) Constricted continental shelf area relative to nearby continental shelf waters that concentrate migratory pathways 2) Passage conditions to allow for migration to and from nesting, breeding, and/or foraging areas
	LOGG-N-17, N-18, N-19	FL		
Sargassum Habitat	LOGG-S-1, S-2	Atlantic Ocean & Gulf of Mexico	Developmental and foraging habitat for young loggerheads where surface waters form accumulations of floating material, especially *Sargassum*	1) Convergence zones, surface-water downwelling areas, and other locations where there are concentrated components of the *Sargassum* community in water temperatures suitable for optimal growth of *Sargassum* and inhabitance of loggerheads 2) *Sargassum* in concentrations that support adequate prey abundance and cover 3) Available prey and other material associated with *Sargassum* habitat such as, but not limited to, plants and cyanobacteria and animals endemic to the *Sargassum* community such as hydroids and copepods 4) Sufficient water depth and proximity to available currents to ensure offshore transport, and foraging and cover requirements by Sargassum for post-hatchling loggerheads (i.e., >10 m depth to ensure not in surf zone)

3.2 Analysis of Species Likely to be Adversely Affected

3.2.1 NARWs

In 1970, northern right whales were listed as endangered under the Endangered Species Conservation Act (35 FR 8495, June 2, 1970). Subsequently, when the Endangered Species Act (ESA) became law in 1973, the right whales were included on the list of endangered species under that statute. In 2008, NMFS listed right whales in the North Atlantic and North Pacific as separate endangered species under the ESA (73 FR 12024, March 6, 2008).

Species Description

The NARW, *Eubalaena glacialis* (Rosenbaum et al. 2000), is a large baleen whale. Right whales have a stocky body; are generally black (some individuals have white patches on their undersides); don't have a dorsal fin; have a large head (about 1/4 of the body length) with a strongly bowed margin of the lower lip; long, narrow rostrum; and roughened patches of skin called callosities on the head region. Whale lice colonize callosities giving them a white appearance. Two rows of long (up to 8 ft in length), dark, closely spaced baleen plates hang from the upper jaw. The all-black tail is broad and deeply notched with a smooth trailing edge. NARW are associated with high latitude offshore areas as well as shallow water coastal areas along the Atlantic coast of North America (NMFS 2006b).

Life History Information

Kraus et al. (2001) have estimated the mean age at first calving for female right whales to be 9.53 (+/- 2.32) years (Reeves et al. 2001). NARW give birth to a single calf after a gestation period of about 1 year (Lockyer 1984). After the calf is weaned in about 1 year, 1 resting year is typically required by the female to rebuild her energy supplies prior to becoming pregnant again (Knowlton et al. 1994). Consequently, 3 years is considered a "healthy," successful calving interval for NARW (Best et al. 2001b; Burnell 2001; Elwen and Best 2004; Knowlton et al. 1994). An analysis of calving intervals through the 1997/1998 season suggested that the mean calving interval had increased since 1992 from 3.67 years to more than 5 years, which is a significant trend (Kraus et al. 2001). An International Whaling Commission workshop on status and trends of the NARW agreed that calving intervals had increased and that the reproduction rate was approximately half that reported from studied populations of southern right whales (Reeves et al. 2001). More recent analysis found that calving intervals were closer to 3 years (Kraus et al. 2007).

Mean calf production for the period 1993 through 2009 was 17.2 (Waring et al. 2012) but highly variable (SD = 9.8). NARW calves are about 13 ft (4 m) long and weigh about 1 metric ton (1,000 kg) when born (Fortune et al. 2012; Moore et al. 2004). Calves grow rapidly during their first year of life, at a rate of about .7 in (1.7 cm) a day (Fortune et al. 2012). By the time they are 1 year old, NARW are about 11.3 yd (10.3 m) long and weigh 13.5 t (13,500 kg) (Fortune et al. 2012). Adults are generally between 14.2 yd (13 m) and 17.5 yd (16 m) long and can weigh up to 71 t (71,000 kg). Females are larger than males. Females as young as 5 yrs and as old as 21 yrs have been observed with first calves, with a mean of 10.1 yrs (Kraus et al. 2007). Browning et al. (2009) hypothesized, and Fortune et al. (2012) agreed, that females believed to have given first birth at an older age likely experienced reproductive failure at an earlier age. Right whale life expectancy is unclear, but 1 individual is known to have reached 65+ yrs of age (Hamilton et al. 1998; Kenney 2002).

Diving and Social Behavior

NARW dive as deep as 306 m (1,003 ft) (Mate et al. 1992). In the Great South Channel, average diving time is close to 2 minutes; average dive depth is 7.3 m (23.95 ft) with a maximum of 85.3 m (279.85 ft) (Winn et al. 1995). In the U.S. Outer Continental Shelf, the average diving time is about 7 min, although maximum dive durations are considerably longer (CETAP 1982). For example, Baumgartner and Mate (2003a) reported right whale feeding dives were characterized by a rapid descent from the surface to a particular depth between 80 and 175 m (262 and 574 ft) with animals' remaining at those depths for 5-14 min, then ascending quickly to the surface (Baumgartner and Mate 2003b). Longer surface intervals have been observed for reproductively active females and their calves (Baumgartner and Mate 2003b).

Feeding

Right whales are ram filter feeders –they open their mouth and swim forward slowly, capturing and filtering prey continuously. Feeding takes place subsurface (subsurface feeding) or at the water's surface (surface skim feeding), depending on the vertical distribution of their food species. The number and type of prey species that right whales feed on are likely limited by baleen filtering efficiency and the right whale's slow swimming speed -prey that are too small (< 0.333 mm) won't be trapped by baleen and prey that swim fast will evade a slow moving feeding right whale (Baumgartner et al. 2007). Consequently, right whales feed on larger species of zooplankton and almost exclusively on copepods. Of the different kinds of copepods, North Atlantic right whales feed primarily on late stage *Calanus finmarchicus* –a marine animal about the size of a grain of rice (Kenney 2002; Mayo and Marx 1990).

Vocalizations and Hearing

NARWs produce a variety of sounds, including moans, screams, gunshots, blows, upcalls, downcalls, and warbles that are often linked to specific behaviors (Laurinolli et al. 2003; Matthews et al. 2001; Parks et al. 2005; Parks and Tyack 2005; Vanderlaan et al. 2003). Sounds can be divided into three main categories: (1) blow sounds; (2) broadband impulsive sounds; and (3) tonal call types (Parks and Clark 2007). Blow sounds are those coinciding with an exhalation; it is not known whether these are intentional communication signals or just produced incidentally (Parks and Clark 2007).

Broadband sounds include non-vocal slaps (when the whale strikes the surface of the water with parts of its body) and the "gunshot" sound; data suggests that the latter serves a communicative purpose (Parks and Clark 2007). Tonal calls can be divided into simple, low-frequency, stereo-typed calls and more complex, frequency-modulated, higher-frequency calls (Parks and Clark 2007). Most of these sounds range in frequency from 0.02 to 15 kHz (dominant frequency range from 0.02 to less than 2 kHz; durations typically range from 0.01 to multiple seconds) with some sounds having multiple harmonics (Parks and Tyack 2005).

Source levels for some of these sounds have been measured as ranging from 137 to 192 dB root-mean-square (rms) re 1 µPa-m (decibels at the reference level of one micropascal at one meter) (Parks et al. 2005; Parks and Tyack 2005). Parks and Clark (2007) suggested that the frequency of right whale vocalizations increases significantly during the period from dusk until dawn. Recent morphometric analyses of NARW inner ears estimates a hearing range of approximately 0.01 to 22 kHz based on established marine mammal models (Parks et al. 2007b; Parks and Tyack 2005). In addition, Parks et al. (2007b) estimated the functional hearing range for right whales to be 15 Hz to 18 kHz.

Status and Distribution

An estimate of pre-exploitation population size is not available. Reeves et al. (2007) *Population Dynamics* calculated that a minimum of 5,500 NARW were taken in the western North Atlantic between 1634 and 1950, and concluded, “there were at least a few thousand whales present in the mid-1600s.” The authors cautioned, however, that the record of removals is incomplete, the results were preliminary, and refinements are required. Based on back calculations using the present population size and growth rate, the population may have numbered less than a few hundred individuals when international protection for NARW came into effect (Braham and Rice 1984; Reeves et al. 1992).

The NARW population was at least 476 in 2011 (Waring et al. 2016). Population models suggest that their abundance may have increased at a rate of approximately 2 % per year during the 1980s, but that it declined at about the same rate in the 1990s (Caswell et al. 1999; Waring et al. 2012). Analysis of data on the minimum number of whales alive during 1990–2010 (based on October 2013 analysis) suggests a positive and slowly accelerating trend in population size. These data reveal an increase in the number of catalogued whales with a geometric mean growth rate for the period of 2.6% (Waring et al. 2015). These population trends are low compared to those for populations of other large whales that are recovering, such as south Atlantic right whales and taxonomically similar western Arctic bowhead whales, which have had growth rates of 4%–7% or more per year for decades. An analysis of the age structure of this population suggests that it contains a smaller proportion of juvenile whales than expected (Best et al. 2001b; Hamilton et al. 1998), which may reflect lowered recruitment and/or high juvenile mortality.

Because of the species’ low reproductive output and small population size, even low levels of human-caused mortality can pose a significant obstacle for NARW recovery. Population modeling studies in the late 1990s (Caswell et al. 1999; Fujiwara and Caswell 2001) indicated that preventing the death of 2 adult females per year could be sufficient to reverse the slow decline detected in right whale population trends in the 1990s.

Historically, the NARW ranged throughout the temperate, subarctic, coastal, and continental shelf waters of the North Atlantic Ocean (Braham and Rice 1984; Perry et al. 1999). Currently, the western NARW population ranges primarily from calving grounds in coastal waters of the southeastern United States to feeding grounds in New England waters and the Canadian Bay of Fundy, Scotian Shelf, and Gulf of St. Lawrence. Knowlton et al. (1992) reported several long-distance movements as far north as Newfoundland, the Labrador Basin, and southeast of Greenland. In addition, recent sightings of previously identified individuals have been made off Iceland, in the old Cape Farewell whaling ground east of Greenland (Hamilton et al. 2007), northern Norway (Jacobsen et al. 2004), and the Azores (Silva et al. 2012). The September 1999 Norwegian sighting represents 1 of only 2 published sightings this century of a right whale in Norwegian waters, and the first since 1926. Together, these long-range matches indicate an extended range for at least some individuals and perhaps the existence of important habitat areas not presently well described. The few published records from the Gulf of Mexico (Moore and Clark 1963; Schmidly et al. 1972; Ward-Geiger et al. 2011) represent either distributional anomalies, normal wanderings of occasional animals, or a more extensive historic range beyond the wintering and sole known calving area in the waters of the southeastern United States. Whatever the case, the location of some portions of the population is unknown during the winter.

Research results suggest the existence of six major habitats or aggregation areas for western NARW: the coastal waters of the southeastern United States; the Great South Channel; Georges Bank/Gulf of Maine; Cape Cod and Massachusetts Bays; the Bay of Fundy; and the Scotian Shelf. NARW follow a general annual pattern of migration between low latitude winter calving grounds and high latitude summer foraging grounds (Kenney 2002; Perry et al. 1999). Still, movements within and between habitats are extensive. In 2000, a particular whale was photographed in Florida waters on 12 January, then again 11 days later (23 January) in Cape Cod Bay, less than a month later off Georgia (16 February), and back in Cape Cod Bay on 23 March; effectively making the round-trip migration to the Southeast and back at least twice during the winter season (Brown and Marx 2000). Results from satellite tags clearly indicate that sightings separated by perhaps 2 weeks should not necessarily be assumed to indicate a stationary or resident animal. Instead, telemetry data have shown rather lengthy and somewhat distant excursions, including into deep water off the continental shelf (Baumgartner and Mate 2005; Mate et al. 1997).

The coastal waters of the southeastern United States are a wintering and sole known calving area for NARW. Sighting records of NARW spotted in the core calving area off Georgia and Florida consist of mostly mother-calf pairs and juveniles but also some adult males and females without calves (Cole et al. 2013; Kraus and Rolland 2007; Parks et al. 2007a). Based on preliminary photo-identification analysis of right whale photographs collected in the southeastern U.S., the median number of NARWs (including calves, but excluding reported or assumed calf mortalities) documented in the southeastern U.S. from the 2009-2013 calving seasons is 165 (Right Whale Consortium 2014; K. Jackson, personal communication, July 21, 2016; Waring et al. 2016). Right whale concentrations are highest in the core calving area from November 15 through April 15 (71 FR 36299, June 26, 2006); on rare occasions, right whales have been spotted as early as September and as late as July (Taylor et al. 2010). Most calves are likely born early in the calving season. NARW distribution off Georgia and Florida is restricted to the south and east by the warm waters of the Gulf Stream, which serves as a thermal limit for NARW (Keller et al. 2006).

Water temperature, bathymetry, and surface chop are factors in the distribution of calving NARW in the southeastern U.S. (Good 2008; Keller et al. 2012). Systematic surveys conducted off the coast of North Carolina during the winters of 2001 and 2002 sighted 8 calves, suggest the calving grounds may extend as far north as Cape Fear. Four of the calves were not sighted by surveys conducted further south. One of the cows photographed was new to researchers, having effectively eluded identification over the period of its maturation (McLellan et al. 2003). NARW generally occur off South and North Carolina from November 1 through April 30 (NMFS 2008d) and have been sighted as far as about 30 nmi offshore (Knowlton et al. 2002; Pabst et al. 2009).

NARW have been observed from the Mid-Atlantic Bight northward through the Gulf of Maine during all months of the year (NMFS 2006b). Foraging NARW (and their habitat) appear to be concentrated in New England waters. Variation in the abundance and development of suitable food patches appears to modify the general patterns of movement by reducing peak numbers, stay durations and specific locales (Brown et al. 2001; Kenney 2001). In particular, large changes in the typical pattern of food abundance will dramatically change the general pattern of NARW habitat use (Kenney 2001).

Threats

The NARW was severely depleted by commercial whaling. By the early 1900s, the remaining population off North America was reduced to no more than a few hundred whales. Despite the existence of protection from commercial whaling since 1935, the remaining population has failed to recover. Given the small population size and low annual reproductive rate of NARW, human sources of mortality may have a greater effect to relative population growth rate than for other large whale species (Waring et al. 2014).

The primary causes of the NARW's failure to recover are deaths resulting from collisions with ships and entanglement in commercial fishing gear (Clapham et al. 1999; Knowlton and Kraus 2001; Moore et al. 2007; NMFS 2005c). NARW may not die immediately as the result of a vessel strike or entanglement but may gradually weaken or otherwise be affected so that further injury or death is likely (Waring et al. 2014). Collisions or entanglements may result in systemic infection, debilitation from tissue damage and emaciation from a negative energy budget (Cassoff et al. 2011; van der Hoop et al. 2013). Any injury or entanglement that restricts a NARW from rotating its jaw while feeding, prevents it from forming a hydrostatic oral seal, compromises the integrity of its baleen, or swim at speeds necessary to capture preferred prey will have a negative effect on its foraging capabilities and may lead to starvation (Cassoff et al. 2011).

The occurrence of skin lesions has been documented, in NARW with an apparent increase in frequency culminating in the late 1990s. Of 439 NARW sighted between 1980 and 2002, 51.7% exhibited white skin lesions (Hamilton and Marx 2005). The origins and significance of these lesions are unknown, and further research is required to determine whether they represent a topical or systemic health problem for the affected animals.

Vessel Collisions

An average of approximately 2 *known* vessel collision-related NARW deaths have occurred annually over the last decade (Henry et al. 2012; Waring et al. 2012) and an average of 1.2 known vessel-strike related fatalities occurred in the period 2006–2010 (Waring et al. 2012). NOAA believes the actual number of deaths can possibly be higher than those documented, as some deaths likely go undetected or unreported. In many cases when deaths are observed, it is not possible to determine the cause of death from recovered carcasses due, for example, to advanced decomposition. Kraus et al. (2005) reported that the number of documented deaths may be as little as 17% percent of the actual number of deaths from all sources. Studies indicate that female (van der Hoop et al. 2013) and sub-adult (Knowlton and Kraus 2001) NARW are more often ship-strike victims than are other age and gender classes. Although the reasons for this are not clear, one factor may be that pregnant females and females with nursing calves may spend more time at the surface where they are vulnerable to being struck. The effect of this on population recovery may be particularly profound if the lost female is at the height of, or just entering, her most reproductively active years because of the loss of her reproductive potential, and that of her female offspring, indefinitely.

The number of NARW deaths resulting from vessel collisions appears to be related to an overlap between important right whale feeding, calving, and migratory habitats and shipping corridors along the eastern United States and Canada. Most NARW that died as a result of ship collisions were first reported dead in or near major shipping channels off east coast ports between Jacksonville, Florida, and New Brunswick, Canada. NARW appear to be particularly vulnerable to ship strikes in the calving and nursery area off Georgia/Florida (Vanderlaan et al. 2009). Based on massive injuries to whales killed by ships (e.g., crushed skulls, internal hemorrhaging, severed tail stocks, and deep, broad propeller wounds) (Campbell-Malone et al. 2008), it appears that many NARW killed by vessels are victims of collisions with large ships.

Vessel speed has been implicated as a principal causal factor in the severity of vessel collisions with large whales (73 FR 60173, October 10, 2008). As vessel speed increases, the probability of serious injury or death of a whale involved in a strike increases (Pace III and Silber 2005; Vanderlaan and Taggart 2007). Additionally, as vessel speed increases, so does both the size of the zone of influence around the hull of a vessel (i.e., the area in which a whale is vulnerable to a strike or might be drawn into a strike) and acceleration (i.e., impact velocity) experienced by the whale involved in a collision (Campbell-Malone 2007; Silber et al. 2010). Conversely, restricting vessel speeds to 10-knots (11.5 mph) or less likely reduces the risk of ship strike by 80-90% (Conn and Silber 2013).

Various types and sizes of vessels have been involved in ship strikes with large whales, including container/cargo ships/freighters, tankers, steamships, U.S. Coast Guard vessels, Navy vessels, cruise ships, ferries, recreational vessels, fishing vessels, whale-watching vessels, and other vessels (Jensen and Silber 2003). In March 2008, a 43-ft vessel traveling at 18-19 knots (20.7 – 21.86 mph) struck and seriously injured an adult female NARW, e.g., No. 2324, about 8 nmi off the north end of Cumberland Island, Georgia (George and Naessig 2006; Zoodsma 2005). This animal was last seen in September 2005 when she was spotted in Massachusetts Bay in exceptionally poor health (Waring et al. 2012) and is presumed dead. In May 2009, a 33.7- ft vessel reportedly struck and killed a 21.3- ft southern right whale calf in New South Wales, Australia (Service 2009).

Fisheries

Entanglement in fixed fishing gear is another leading cause of NARW mortality (Knowlton et al. 2012; NMFS 2005c). Entanglement mortality and its effects on the NARW population are likely underestimated because fishers may not report entanglements, and it's likely that carcasses from offshore are not detected or recovered (Cole et al. 2006). From 2006 through 2010, 9 of 15 records of mortality or serious injury involved entanglement or fishery interactions (Waring et al. 2012). Entanglement records from 1990 through 2010 maintained by NMFS Northeast Regional Office (NMFS, unpublished data) included 74 confirmed NARW entanglements, including NARW in weirs, gillnets, and trailing line and buoys. Because whales sometimes free themselves of gear following an entanglement event, scarring may be a better indicator of fisheries interaction than entanglement records. In an analysis of the scarification of NARW, 519 of 626 (83%) whales examined had been scarred at least once by fishing gear (Knowlton et al. 2005). Knowlton et al. (2012) also found that on average, 26% of all NARW are entangled annually. Over time, there has been a trend in entanglement severity and a disproportionate number of the severe entanglements involve juveniles (Knowlton et al. 2012).

Information from an entanglement event seldom includes the detail necessary to assign the entanglements to a particular fishery or location. Johnson et al. (2005) analyzed entanglements of 31 right whales and found that all types of fixed fishing gear and any part of the gear were involved in entanglements. When gear type was identified, pot gear and gillnet gear represented 71% and 14% of entanglements, respectively. The authors pointed out that buoy lines were involved in 51% of entanglements and suggested that entanglement risk is elevated by any line that rises in the water column. Mouth entanglements were both frequent and deadly. Mouth entanglements likely occur when a whale's mouth is open giving rise to speculation that entanglements occur when whales are feeding (Johnson et al. 2005). Occasionally, right whales with open mouths are observed in the southeastern U.S. calving area. A single female right whale was seen skim feeding off Georgia in February 2013 (A. Knowlton, New England Aquarium, pers. comm. to B. Zoodsma, NMFS SERO PRD, March 31, 2015).

Calves and juveniles become entangled more than adults; they are also more likely to suffer deep wounds (>8 cm) from entanglement. Knowlton et al. (2011) studied ropes that were removed from entangled right whales (dead and alive) and suggested that a whale's ability to break free of entangling gear is related to its age. Breaking strength of rope also influences a whale's ability to break free of entangling gear. Knowlton et al. (2015) suggests that use of ropes with breaking strengths less than or equal to 1700 lbs may reduce the number of life-threatening entanglements for large whales by at least 72%.

Gear trailing behind a right whale creates substantial drag and may also inhibit foraging (van der Hoop et al. 2014). Entanglements may reduce a whale's ability to maneuver, making it more susceptible to ship strikes (NMFS 2006b).

Man-made Noise

Noise in the marine environment has received a lot of attention in recent years and is likely to continue to receive attention in the foreseeable future. Several investigators have argued that anthropogenic sources of noise have increased ambient noise levels in the ocean over the last 50 years (D'Spain 2003; Jasny et al. 2005; Richardson et al. 1995). Man-made noises that could affect ambient noise arise from the following general types of activities in and near the sea, any combination of which can contribute to the total noise at any one place and time. These noises include maritime activities, dredging, construction; mineral exploration in offshore areas; geophysical (seismic) surveys; sonars; explosions; and ocean research activities. Much of the increase in ambient noise is due to increased shipping as ships become more numerous and of larger tonnage and seismic exploration (D'Spain 2003; Hildebrand 2009). Commercial fishing vessels, cruise ships, transport boats, airplanes, helicopters and recreational boats all contribute sound into the ocean (D'Spain 2003; Richardson et al. 1995). The military uses sound to test the construction of new vessels as well as for naval operations. Energy exploration and construction is expected to accelerate along the Southeast U.S. coast.

Surface shipping is the most widespread source of man-made, low frequency (0 to 1,000 Hz) noise in the oceans (Simmonds and Hutchinson 1996). Source levels for commercial ships range from 180-195 dB re 1 μPa which dominate underwater noise in the 10-500 Hz frequency bands (D'Spain 2003; Hildebrand 2009). The Navy estimated that the 60,000 vessels of the world's merchant fleet annually emit low frequency sound into the world's oceans for the equivalent of 21.9 million days, assuming that 80 % of the merchant ships are at sea at any one time (NMFS and USN). Ross (1976) has estimated that between 1950 and 1975 shipping had caused a rise in ambient ocean noise levels of 10 dB with propeller cavitation primarily responsible for the increase. He predicted that this would increase by another 5 dB by the beginning of the twenty-first century.

Jasny et al. (2005) and more recently Clark et al. (2009a) identified the increasing levels of man-made noise as a habitat concern for whales because of its potential effect on their ability to communicate. Masking can reduce the range of communication particularly long-range communication. Communication masking appears to be of particular concern for NARW because their predicted hearing range, 12 Hz–22 kHz, and lower source levels of their contact calls overlaps with most noises from shipping activities (Clark et al. 2009b; Parks 2003; Parks and Clark 2007). Acoustic disruptions that interfere with communication may affect NARWs' ability to find mates and learn about feeding opportunities (Clark et al. 2009a). Rolland et al. (2012) found that ship noise increases stress in NARW. Chronic stress can suppress growth, immune system function and reproduction (Rolland et al. 2012). NARW are likely to be more vulnerable to harmful effects of communication masking than other large whales because of their low population size and low call density (Hatch et al. 2012).

Recent scientific evidence suggests that right whales compensate for masking by changing the frequency, source level, redundancy, or timing of their signals, but the long-term implications of these adjustments are currently unknown (Parks 2003; Parks and Tyack 2005).

Many researchers have described behavioral responses of marine mammals to the sounds produced by helicopters and fixed-wing aircraft, boats and ships, as well as dredging and construction (Richardson et al. 1995). Most observations have been limited to short term behavioral responses, which included cessation of feeding, resting, or social interactions, however, habitat abandonment can lead to more long-term effects which may have implications at the population level. Because responses to man-made noise vary between species and individuals within species, it is difficult to determine long-term effects.

<u>"Small Population Dynamics"</u>

The legacy effects of whaling are still present in the NARW population in that the population is sufficiently small to experience "small population dynamics" (Caughley 1994; Lande 1993; Lande et al. 2003; Melbourne and Hastings 2008). That is, we expect NARW to have higher probabilities of becoming extinct because of demographic stochasticity (Coulson et al. 2006), demographic heterogeneity (Fox 2005) -including stochastic sex determination (Lande et al. 2003) -and the effects of these phenomena interacting with environmental variability. Demographic stochasticity refers to the randomness in the birth or death of an individual in a population, which results in random variation on how many young that individuals produce during their lifetime and when they die. Demographic heterogeneity refers to variation in lifetime reproductive success of individuals in a population (generally, the number of reproductive adults an individual produces over their reproductive lifespan), such that the deaths of different individuals have different effects on the growth or decline of a population (Coulson et al. 2006). Stochastic sex determination refers to the randomness in the sex of offspring such that sexual ratios in population fluctuate over time (Melbourne and Hastings 2008).

At small population sizes, populations experience higher extinction probabilities because of their population size, because stochastic sexual determination can leave them with all males or all females (which occurred to the heath hen and dusky seaside sparrow just before they became extinct), or because the loss of individuals with high reproductive success has a disproportionate effect on the rate at which the population declines (Coulson et al. 2006). In general, an individual's contribution to the growth (or decline) of the population it represents depends, in part, on the number of individuals in the population: the smaller the population, the more the performance of a single individual is likely to affect the population's growth or decline (Coulson et al. 2006). Given the small size of the NARW population, the performance ("fitness" measured as the longevity of individuals and their reproductive success over their lifespan) of individual whales would be expected to have appreciable consequences for the growth or decline of the population. Evidence of the small population dynamics of NARW appears in demographic models that suggest that the death or survival of 1 or 2 individual animals is sufficient to determine whether NARW are likely to accelerate or abate the rate at which their population continues to decline (Fujiwara and Caswell 2001).

These phenomena would increase the extinction probability of NARW and amplify the potential consequences of human-related activities on this species. Based on their population size and population ecology (that is, slow-growing mammals that give birth to single calves with several years between births), we assume that NARW would have elevated extinction probabilities because of exogenous threats caused by anthropogenic activities that result in the death or injury of individual whales (for example, ship strikes or entanglement) and natural phenomena (such as disease, predation, or changes in the distribution and abundance of their prey in response to changing climate) *as well as* endogenous threats resulting from the small size of their population. Based on the number of other species in similar circumstances that have become extinct (and the small number of species that have avoided extinction in similar circumstances), the longer NARW remain in these circumstances, the greater their extinction probability becomes.

Decreased Reproductive Rate and Genetic Diversity
Healthy reproduction is critical for the recovery of the NARW (Kraus et al. 2007); however, some suggest that the population has been affected by a decreased reproductive rate (Best et al. 2001b; Kraus et al. 2001). Possible factors affecting the NARW reproductive rate include reduced genetic diversity (and/or inbreeding), contaminants, biotoxins, disease, and nutritional stress (see Environmental Contamination, Biotoxins, Disease, and Food Limitations sections for information on those topics).

The legacy effects of whaling may be a loss of genetic diversity which could affect the ability of the current population to successfully reproduce. (i.e., decreased conceptions, increased abortions, and increased neonate mortality). One hypothesis is that the low level of genetic variability in this species produces a high rate of mate incompatibility and unsuccessful pregnancies (Frasier et al. 2007). Studies by Schaeff et al. (1997) and Malik et al. (2000) indicate that NARW are less genetically diverse than South Atlantic right whales (*Eubalaena australis*). Still, several apparently healthy populations of cetaceans, such as sperm whales and pilot whales, have even lower genetic diversity than observed for western NARW (IWC 2001).

Environmental Contamination and Endocrine Disruptors
Similarly, while contaminant studies have confirmed that NARW are exposed to and accumulate contaminants, researchers could not conclude that these contaminant loads were negatively affecting NARW reproductive success since concentrations were lower than those found in marine mammals proven to be affected by polychlorinated biphenyls (PCBs), and dichlorodiphenyltrichloroethane (DDT) (Weisbrod et al. 2000). Another suite of contaminants (i.e., antifouling agents and flame retardants) that have been proven to disrupt reproductive patterns and have been found in other marine animals, have raised new concerns (Kraus et al. 2007). Recent data also support a hypothesis that chromium, an industrial pollutant, may be a concern for the health of the NARW and that inhalation may be an important exposure route (Wise et al. 2008).

A number of diseases could be also affecting reproduction; however, tools for assessing disease factors in free-swimming large whales currently do not exist (Kraus et al. 2007). Once developed, such methods may allow for the evaluation of disease effects on NARW.

Harmful Algal Blooms and Biotoxins
Impacts of biotoxins on marine mammals are also poorly understood, yet data is showing that marine algal toxins may play significant roles in mass mortalities of large marine

mammals (Rolland et al. 2007). Fourteen humpback whales found dead in Cape Cod Bay, Massachusetts, in the late 1980's apparently died as the result of eating Atlantic mackerel containing paralytic shellfish poisoning (PSP) toxins. Marine mammals are adapted to deep dives by directing blood flow primarily to their heart and brain during deep dives; consequently, blood bypasses the organs that "filter" and detoxify blood. Geraci et al. (1989) suggested this adaptation resulted in channeling the toxins directly to the heart and brain killing the humpback whales. Although there are no published data concerning the effects of biotoxins on NARW, researchers are now certain that NARW are being exposed to measurable quantities of paralytic shellfish poisoning toxins and domoic acid because these biotoxins are found in prey upon which right whales feed (Doucette et al. 2006; Durbin et al. 2002; Rolland et al. 2007).

Nutritional Stress

Data indicating whether NARW are food-limited are difficult to evaluate (Kraus et al. 2007). NARW seem to have thinner blubber than right whales living in the southern Atlantic ocean (i.e., south of the equator) (Kenney 2002; Miller et al. 2011). Miller et al. (2011) suggests that lipids in the blubber are used as energetic support for reproduction in female NARW. In the same study, blubber thickness was also compared among years of differing prey abundances. During a year of low prey abundances, NARW had significantly thinner blubber than during years of greater prey abundances. The results suggest that blubber thickness is indicative of NARW energy balance and that the marked fluctuations in the NARW reproduction have a nutritional component (Miller et al. 2011).

Modeling work by Caswell et al. (1999) and Fujiwara and Caswell (2001) suggests that the North Atlantic Oscillation (NAO), a naturally occurring climatic event, affects the survival of mothers and the reproductive rate of mature females, and it also seems to affect calf survival (Clapham et al. 2002). Greene et al. (2003) described the potential oceanographic processes linking climate variability to the reproduction of NARW. Climate-driven changes in ocean circulation have had a significant impact on the plankton ecology of the Gulf of Maine, including effects on *Calanus finmarchicus*, a primary prey resource for NARW. Researchers found that during the 1980s, when the NAO index was predominately positive, *C. finmarchicus* abundance was also high; when a record drop occurred in the NAO index in 1996, *C. finmarchicus* abundance levels also decreased significantly. Greene et al. (2003) examined right whale calving rate patterns since the early 1980s and found that major multi-year declines in right whale calving rates have tracked major multi-year declines in *C. finmarchicus* abundance since 1982.

Interspecific competition with either sei whales (*Balaenoptera borealis*) or planktivorous fish may limit northern right whale prey consumption (Kraus et al. 1988; Mitchell 1975; Payne et al. 1990). There is also speculation about competition with certain species of fish in the Gulf of Maine, including sand lance (*Ammodytes* spp.), herring (*Clupea* spp.), Atlantic mackerel (*Scomber scombrus*), river herrings (shad, blueback; *Alosa* spp.), menhaden (*Brevoortia tyrannus*), and basking sharks (*Cetorhinus maximus*). While the potential for interference competition exists for right whales, direct evidence is essentially absent. As noted by Clapham and Brownell Jr. (1996), assertions regarding interspecific competition are rarely well defined or ecologically based.

Atmospheric Carbon Dioxide and Climate Change

There is a large and growing body of literature on past, present, and future impacts of global climate change. Global climate change is exacerbated and accelerated by human activities such as burning fossil fuels which releases carbon dioxide into the atmosphere. Some of the likely effects commonly mentioned are increased frequency of severe weather events, changes in sea temperatures and salinity (due to melting ice and increased rainfall), ocean currents, and ocean acidification. NOAA's climate information portal provides basic background information on these and other measured or anticipated effects (see http://www.climate.gov).

NARW currently have a range of sub-polar to sub-tropical waters. An increase in water temperature would likely result in a northward shift of range, with both the northern and southern limits moving poleward. The northern limit, which may be determined by feeding habitat and the distribution of preferred prey, may shift to a greater extent than the southern limit, which requires ideal temperature and water depth for calving. This may result in an unfavorable effect on the NARW due to an increase in the length of migrations (MacLeod 2009), or a favorable effect by allowing them to expand their range. However, a northward shift in the suitable calving grounds off the southeast United States based on optimal temperatures would involve calving in waters that are generally rougher and thus more hazardous for newborn calves.

An increase in atmospheric carbon dioxide may affect the marine plankton species –a vital food source of NARW. The ocean will absorb most atmospheric carbon dioxide released by burning fossil fuels. When the ocean absorbs carbon dioxide, pH levels decrease and the ocean becomes more acidic (Caldeira and Wickett 2003). Cripps et al. (2014) examined copepod response to increased carbon dioxide levels and found that early stage copepod mortality rate increased while reproduction was detrimentally effected by a 35% decline in recruitment. A decline in the marine plankton could have serious consequences for the marine food web upon which NARW rely.

Global climate change may affect the timing and extent of population movements, abundance, recruitment, distribution, and species composition of prey (Learmonth et al. 2006). Changes in distribution including displacement from ideal habitats, decline in fitness of individuals, population size due to the potential loss of foraging opportunities, abundance, migration, community structure, susceptibility to disease and contaminants, and reproductive success are all possible effects that may occur as the result of climate change (MacLeod 2009). Global climate change may also result in changes to the range and abundance of competitors and predators, which will also indirectly affect marine mammals (Learmonth et al. 2006). More information is needed to better determine the full and entire suite of impacts of climate change on NARW (Learmonth et al. 2006).

Predators

Predation by various large marine aquatic predators is a threat to NARW and, in particular, to compromised adults, juveniles, and calves. Killer whales and large predatory sharks have been known to prey on NARW (Kraus 1990; Taylor et al. 2013).

Actions Taken to Reduce Threats

Right Whale Minimum Approach Regulation. On February 13, 1997, NMFS published a regulation (62 FR 6729, February 13, 1997), prohibiting all approaches within 500 yd (460 m) of any right whale, whether by vessel, aircraft or other means. The goal was to limit disturbance of right whales.

Mandatory Ship Reporting System (MSRS). Established in July 1999, the MSRS requires all commercial ships 300 gross tons or greater to report into a shore-based station when entering 2 key NARW aggregation areas, one each in waters off the U.S. northeastern and southeastern coasts. The U.S. northeast system operates year round; the U.S. southeast system is in effect from November 15 to April 15, when right whales aggregate in these waters. The MSRS requires mariners to report such things as entry location, destination, and ship speed. Reporting prompts an automated return message providing NARW sighting locations and information on how collisions can be avoided, thereby providing information on right whales directly to mariners as they enter right whale habitat.

Updating Navigational Aids and Publications: The *U.S. Coast Pilot* is a set of regionally-specific references on marine environmental conditions, navigation hazards, and regulations. Currently, captains of commercial vessels 1600 gross tons and above are required to carry the *Coast Pilot* when operating in U.S. waters. Since 1997, NMFS has provided updated information for U.S. eastern seaboard *Coast Pilot* guides, including information on the status of right whales, times and areas that they occur, threats posed by ships, the MSRS, and advice on measures mariners can take to reduce the likelihood of hitting right whales.

Right Whale Recovery Plan Implementation Teams: Following completion of the 1991 Right Whale Recovery Plan, NMFS established Recovery Plan Implementation Teams, comprised of federal and state agencies and other organizations, to advise NMFS on actions to aid in the recovery of the species. Many of the Teams' activities have centered on reducing ship strikes. Both the Northeast and Southeast Implementation Teams were instrumental in developing and operating the aircraft survey programs described above. In addition, the Teams have developed and disseminated right whale material to mariners including brochures, placards, and training videos. The Teams have also funded various studies and have been an important conduit for information to and from the shipping industry and between Federal agencies.

Shipping Routes: NOAA has worked with the U.S. Coast Guard, other Federal and state agencies, and the International Maritime Organization to modify customary shipping routes to reduce the co-occurrence of vessels and NARW. This has included, for example, establishing recommended vessel routes within Cape Cod Bay and in NARW nursery areas in waters off Georgia and Florida (*http://www.nmfs.noaa.gov/pr/shipstrike/routes.htm*); (Lagueux et al. 2011) modifying the vessel Traffic Separation Scheme servicing Boston; and creating an Area To Be Avoided in NARW feeding areas off New England.

Ship Speed Rule
In October 2008, NMFS established regulations that implement a "10-knot speed restriction" for all vessels 65 ft (19.8 m) or longer in certain locations along the east coast of the U.S. Atlantic seaboard at certain times of the year to reduce the likelihood of deaths and serious injuries to endangered NARW that result from collisions with ships (73 FR 60173, October 10, 2008). The regulations limit ship speed during times and in areas where relatively high right whale and ship densities overlap near a number of U.S. east coast ports, at calving/nursery areas in waters off Georgia and Florida, and in New England waters. The regulations were made permanent effective December 6, 2013 (78 FR 73726, December 9, 2013).

Atlantic Large Whale Take Reduction Plan (ALWTRP).
The ALWTRP seeks to reduce serious injury to and/or mortality of North Atlantic right and other large whales due to incidental entanglement in U.S. commercial fishing gear. Since its implementation in 1997, NMFS has modified the ALWTRP on several occasions to address the risk of entanglement in gear employed by gillnet and trap/pot fisheries. The ALWTRP consists of restrictions on where and how gear can be set; research into whale populations, whale behavior, and fishing gear; outreach to inform fishers of the entanglement problem and to seek their help in understanding and solving the problem; and a program to disentangle whales that do get caught in gear.

3.2.2 General Threats Faced by All Sea Turtle Species

Sea turtles face numerous natural and man-made threats that shape their status and affect their ability to recover. Many of the threats are either the same or similar in nature for all listed sea turtle species, those identified in this section are discussed in a general sense for all sea turtles. Threat information specific to a particular species are then discussed in the corresponding status sections where appropriate.

Fisheries
Incidental bycatch in commercial fisheries is identified as a major contributor to past declines, and threat to future recovery, for all of the sea turtle species (NMFS and USFWS 1991; NMFS and USFWS 1992; NMFS and USFWS 1993; NMFS and USFWS 2008; NMFS et al. 2011b). Domestic fisheries often capture, injure, and kill sea turtles at various life stages. Sea turtles in the pelagic environment are exposed to U.S. Atlantic pelagic longline fisheries. Sea turtles in the benthic environment in waters off the coastal United States are exposed to a suite of other fisheries in federal and state waters. These fishing methods include trawls, gillnets, purse seines, hook-and-line gear (including bottom longlines and vertical lines [e.g., bandit gear, handlines, and rod-reel]), pound nets, and trap fisheries. Refer to the Environmental Baseline section of this opinion for more specific information regarding federal and state managed fisheries affecting sea turtles within the action area). The Southeast U.S. shrimp fisheries have historically been the largest fishery threat to benthic sea turtles in the southeastern United States, and continue to interact with and kill large numbers of sea turtles each year.

In addition to domestic fisheries, sea turtles are subject to direct as well as incidental capture in numerous foreign fisheries, further impeding the ability of sea turtles to survive and recover on a global scale. For example, pelagic stage sea turtles, especially loggerheads and leatherbacks, circumnavigating the Atlantic are susceptible to international longline fisheries including the Azorean, Spanish, and various other fleets (Aguilar et al. 1994; Bolten et al. 1994). Bottom longlines and gillnet fishing is known to occur in many foreign waters, including (but not limited to) the northwest Atlantic, western Mediterranean, South America, West Africa, Central America, and the Caribbean. Shrimp trawl fisheries are also occurring off the shores of numerous foreign countries and pose a significant threat to sea turtles similar to the impacts seen in U.S. waters. Many unreported takes or incomplete records by foreign fleets make it difficult to characterize the total impact that international fishing pressure is having on listed sea turtles. Nevertheless, international fisheries represent a continuing threat to sea turtle survival and recovery throughout their respective ranges.

Non-Fishery In-Water Activities

There are also many non-fishery impacts affecting the status of sea turtle species, both in the ocean and on land. In nearshore waters of the United States, the construction and maintenance of federal navigation channels has been identified as a source of sea turtle mortality. Hopper dredges, which are frequently used in ocean bar channels and sometimes in harbor channels and offshore borrow areas, move relatively rapidly and can entrain and kill sea turtles (NMFS 1997). Sea turtles entering coastal or inshore areas have also been affected by entrainment in the cooling-water systems of electrical generating plants. Other nearshore threats include harassment and/or injury resulting from private and commercial vessel operations, military detonations and training exercises, in-water construction activities, and scientific research activities.

Coastal Development and Erosion Control

Coastal development can deter or interfere with nesting, affect nesting success, and degrade nesting habitats for sea turtles. Structural impacts to nesting habitat include the construction of buildings and pilings, beach armoring and renourishment, and sand extraction (Bouchard et al. 1998; Lutcavage et al. 1997). These factors may decrease the amount of nesting area available to females and change the natural behaviors of both adults and hatchlings, directly or indirectly, through loss of beach habitat or changing thermal profiles and increasing erosion, respectively (Ackerman 1997; Witherington et al. 2003; Witherington et al. 2007). In addition, coastal development is usually accompanied by artificial lighting which can alter the behavior of nesting adults (Witherington 1992) and is often fatal to emerging hatchlings that are drawn away from the water (Witherington and Bjorndal 1991). In-water erosion control structures such as breakwaters, groins, and jetties can impact nesting females and hatchling as they approach and leave the surf zone or head out to sea by creating physical blockage, concentrating predators, creating longshore currents, and disrupting of wave patterns.

Environmental Contamination

Multiple municipal, industrial, and household sources, as well as atmospheric transport, introduce various pollutants such as pesticides, hydrocarbons, organochlorides (e.g., dichlorodiphenyltrichloroethane [DDT], polychlorinated biphenyls [PCB], and perfluorinated chemicals [PFC]), and others that may cause adverse health effects to sea turtles (Garrett 2004; Grant and Ross 2002; Hartwell 2004; Iwata et al. 1993). Acute exposure to hydrocarbons from petroleum products released into the environment via oil spills and other discharges may directly injure individuals through skin contact with oils (Geraci 1990), inhalation at the water's surface, and ingesting compounds while feeding (Matkin and Saulitis 1997). Hydrocarbons also have the potential to impact prey populations, and therefore may affect listed species indirectly by reducing food availability in the action area.

The April 20, 2010, explosion of the *Deepwater Horizon* (DWH) oil rig affected sea turtles in the Gulf of Mexico. An assessment has been completed on the injury to Gulf of Mexico marine life, including sea turtles, resulting from the spill (DWH Trustees 2015). Following the spill, juvenile Kemp's ridley, green, and loggerhead sea turtles were found in *Sargassum* algae mats in the convergence zones, where currents meet and oil collected. Sea turtles found in these areas were often coated in oil and/or had ingested oil. The spill resulted in the direct mortality of many sea turtles and may have had sublethal effects or caused environmental damage that will impact other sea turtles into the future. Information on the spill impacts to individual sea turtle species is presented in the *Status of the Species* sections for each species.

Marine debris is a continuing problem for sea turtles. Sea turtles living in the pelagic environment commonly eat or become entangled in marine debris (e.g., tar balls, plastic bags/pellets, balloons, and ghost fishing gear) as they feed along oceanographic fronts where debris and their natural food items converge. This is especially problematic for sea turtles that spend all or significant portions of their life cycle in the pelagic environment (i.e., leatherbacks, juvenile loggerheads, and juvenile green turtles).

Climate Change

There is a large and growing body of literature on past, present, and future impacts of global climate change, exacerbated and accelerated by human activities. Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events, and change in air and water temperatures. NOAA's climate information portal provides basic background information on these and other measured or anticipated effects (see http://www.climate.gov).

Climate change impacts on sea turtles currently cannot be predicted with any degree of certainty; however, significant impacts to the hatchling sex ratios of sea turtles may result (NMFS and USFWS 2007c). In sea turtles, sex is determined by the ambient sand temperature (during the middle third of incubation) with female offspring produced at higher temperatures and males at lower temperatures within a thermal tolerance range of 25°-35°C (Ackerman 1997). Increases in global temperature could potentially skew future sex ratios toward higher numbers of females (NMFS and USFWS 2007c).

The effects from increased temperatures may be intensified on developed nesting beaches where shoreline armoring and construction have denuded vegetation. Erosion control structures could potentially result in the permanent loss of nesting beach habitat or deter nesting females (NRC 1990). These impacts will be exacerbated by sea level rise. If females nest on the seaward side of the erosion control structures, nests may be exposed to repeated tidal overwash (NMFS and USFWS 2007e). Sea level rise from global climate change is also a potential problem for areas with low-lying beaches where sand depth is a limiting factor, as the sea may inundate nesting sites and decrease available nesting habitat (Baker et al. 2006; Daniels et al. 1993; Fish et al. 2005). The loss of habitat as a result of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as an increase in the frequency of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion (Antonelis et al. 2006; Baker et al. 2006).

Other changes in the marine ecosystem caused by global climate change (e.g., ocean acidification, salinity, oceanic currents, dissolved oxygen levels, nutrient distribution) could influence the distribution and abundance of lower trophic levels (e.g., phytoplankton, zooplankton, submerged aquatic vegetation, crustaceans, mollusks, forage fish) which could ultimately affect the primary foraging areas of sea turtles.

Other Threats
Predation by various land predators is a threat to developing nests and emerging hatchlings. The major natural predators of sea turtle nests are mammals, including raccoons, dogs, pigs, skunks, and badgers. Emergent hatchlings are preyed upon by these mammals as well as ghost crabs, laughing gulls, and the exotic South American fire ant (*Solenopsis invicta*). In addition to natural predation, direct harvest of eggs and adults from beaches in foreign countries continues to be a problem for various sea turtle species throughout their ranges (NMFS and USFWS 2008).

Diseases, toxic blooms from algae and other microorganisms, and cold stunning events are additional sources of mortality that can range from local and limited to wide-scale and impacting hundreds or thousands of animals.

3.2.3 Loggerhead Sea Turtles – Northwest Atlantic DPS

The loggerhead sea turtle was listed as a threatened species throughout its global range on July 28, 1978. NMFS and USFWS published a Final Rule which designated 9 DPSs for loggerhead sea turtles (76 FR 58868, September 22, 2011, and effective October 24, 2011). This rule listed the following DPSs: (1) Northwest Atlantic Ocean (threatened), (2) Northeast Atlantic Ocean (endangered), (3) South Atlantic Ocean (threatened), (4) Mediterranean Sea (endangered), (5) North Pacific Ocean (endangered), (6) South Pacific Ocean (endangered), (7) North Indian Ocean (endangered), (8) Southeast Indo-Pacific Ocean (endangered), and (9) Southwest Indian Ocean (threatened). The Northwest Atlantic (NWA) DPS is the only one that occurs within the action area, and therefore it is the only one considered in this Opinion.

Species Description and Distribution

Loggerheads are large sea turtles. Adults in the southeast United States average about 3 ft (92 cm) long, measured as a straight carapace length (SCL), and weigh approximately 255 lb (116 kg) (Ehrhart and Yoder 1978). Adult and subadult loggerhead sea turtles typically have a light yellow plastron and a reddish brown carapace covered by non-overlapping scutes that meet along seam lines. They typically have 11 or 12 pairs of marginal scutes, 5 pairs of costal scutes, 5 vertebral scutes, and a nuchal (precentral) scute that is in contact with the first pair of costal scutes (Dodd Jr. 1988).

The loggerhead sea turtle inhabits continental shelf and estuarine environments throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans (Dodd Jr. 1988). Habitat uses within these areas vary by life stage. Juveniles are omnivorous and forage on crabs, mollusks, jellyfish, and vegetation at or near the surface (Dodd Jr. 1988). Subadult and adult loggerheads are primarily found in coastal waters and eat benthic invertebrates such as mollusks and decapod crustaceans in hard bottom habitats.

The majority of loggerhead nesting occurs at the western rims of the Atlantic and Indian Oceans concentrated in the north and south temperate zones and subtropics (NRC 1990). For the NWA DPS, most nesting occurs along the coast of the United States, from southern Virginia to Alabama. Additional nesting beaches for this DPS are found along the northern and western Gulf of Mexico, eastern Yucatán Peninsula, at Cay Sal Bank in the eastern Bahamas (Addison 1997; Addison and Morford 1996), off the southwestern coast of Cuba (Moncada Gavilan 2001), and along the coasts of Central America, Colombia, Venezuela, and the eastern Caribbean Islands.

Non-nesting, adult female loggerheads are reported throughout the U.S. Atlantic, Gulf of Mexico, and Caribbean Sea. Little is known about the distribution of adult males who are seasonally abundant near nesting beaches. Aerial surveys suggest that loggerheads as a whole are distributed in U.S. waters as follows: 54% off the southeast U.S. coast, 29% off the northeast U.S. coast, 12% in the eastern Gulf of Mexico, and 5% in the western Gulf of Mexico (TEWG 1998a).

Within the NWA DPS, most loggerhead sea turtles nest from North Carolina to Florida and along the Gulf Coast of Florida. Previous Section 7 analyses have recognized at least 5 western Atlantic subpopulations, divided geographically as follows: (1) a Northern nesting subpopulation, occurring from North Carolina to northeast Florida at about 29ºN; (2) a South Florida nesting subpopulation, occurring from 29°N on the east coast of the state to Sarasota on the west coast; (3) a Florida Panhandle nesting subpopulation, occurring at Eglin Air Force Base and the beaches near Panama City, Florida; (4) a Yucatán nesting subpopulation, occurring on the eastern Yucatán Peninsula, Mexico (Márquez M. 1990; TEWG 2000a); and (5) a Dry Tortugas nesting subpopulation, occurring in the islands of the Dry Tortugas, near Key West, Florida (NMFS 2001).

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. It also concluded that specific boundaries for subpopulations could not be designated based on genetic differences alone. Thus, the recovery plan uses a combination of geographic distribution of nesting densities, geographic separation, and geopolitical boundaries, in addition to genetic differences, to identify recovery units. The recovery units are as follows: (1) the Northern Recovery Unit (Florida/Georgia border north through southern Virginia), (2) the Peninsular Florida Recovery Unit (Florida/Georgia border through Pinellas County, Florida), (3) the Dry Tortugas Recovery Unit (islands located west of Key West, Florida), (4) the Northern Gulf of Mexico Recovery Unit (Franklin County, Florida, through Texas), and (5) the Greater Caribbean Recovery Unit (Mexico through French Guiana, the Bahamas, Lesser Antilles, and Greater Antilles) (NMFS and USFWS 2008). The recovery plan concluded that all recovery units are essential to the recovery of the species. Although the recovery plan was written prior to the listing of the NWA DPS, the recovery units for what was then termed the Northwest Atlantic population apply to the NWA DPS.

Life History Information

The Northwest Atlantic Loggerhead Recovery Team defined the following 8 life stages for the loggerhead life cycle, which include the ecosystems those stages generally use: (1) egg (terrestrial zone), (2) hatchling stage (terrestrial zone), (3) hatchling swim frenzy and transitional stage (neritic zone[10]), (4) juvenile stage (oceanic zone), (5) juvenile stage (neritic zone), (6) adult stage (oceanic zone), (7) adult stage (neritic zone), and (8) nesting female (terrestrial zone) (NMFS and USFWS 2008). Loggerheads are long-lived animals. They reach sexual maturity between 20-38 years of age, although age of maturity varies widely among populations (Frazer and Ehrhart 1985; NMFS 2001). The annual mating season occurs from late March to early June, and female turtles lay eggs throughout the summer months. Females deposit an average of 4.1 nests within a nesting season (Murphy and Hopkins 1984), but an individual female only nests every 3.7 years on average (Tucker 2010). Each nest contains an average of 100-126 eggs (Dodd Jr. 1988) which incubate for 42-75 days before hatching (NMFS and USFWS 2008). Loggerhead hatchlings are 1.5-2 in long and weigh about 0.7 oz (20 g).

As post-hatchlings, loggerheads hatched on U.S. beaches enter the “oceanic juvenile” life stage, migrating offshore and becoming associated with *Sargassum* habitats, driftlines, and other convergence zones (Carr 1986; Conant et al. 2009; Witherington 2002). Oceanic juveniles grow at rates of 1-2 in (2.9-5.4 cm) per year (Bjorndal et al. 2003; Snover 2002) over a period as long as 7-12 years (Bolten et al. 1998) before moving to more coastal habitats. Studies have suggested that not all loggerhead sea turtles follow the model of circumnavigating the North Atlantic Gyre as pelagic juveniles, followed by permanent settlement into benthic environments (Bolten and Witherington 2003; Laurent et al. 1998). These studies suggest some turtles may either remain in the oceanic habitat in the North Atlantic longer than hypothesized, or they move back and forth between oceanic and coastal habitats interchangeably (Witzell 2002). Stranding records indicate that when immature loggerheads reach 15-24 in (40-60 cm) SCL, they begin to reside in coastal inshore waters of the continental shelf throughout the U.S. Atlantic and Gulf of Mexico (Witzell 2002).

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[10] Neritic refers to the nearshore marine environment from the surface to the sea floor where water depths do not exceed 200 meters.

After departing the oceanic zone, neritic juvenile loggerheads in the Northwest Atlantic inhabit continental shelf waters from Cape Cod Bay, Massachusetts, south through Florida, The Bahamas, Cuba, and the Gulf of Mexico. Estuarine waters of the United States, including areas such as Long Island Sound, Chesapeake Bay, Pamlico and Core Sounds, Mosquito and Indian River Lagoons, Biscayne Bay, Florida Bay, as well as numerous embayments fringing the Gulf of Mexico, comprise important inshore habitat. Along the Atlantic and Gulf of Mexico shoreline, essentially all shelf waters are inhabited by loggerheads (Conant et al. 2009).

Like juveniles, non-nesting adult loggerheads also use the neritic zone. However, these adult loggerheads do not use the relatively enclosed shallow-water estuarine habitats with limited ocean access as frequently as juveniles. Areas such as Pamlico Sound, North Carolina, and the Indian River Lagoon, Florida, are regularly used by juveniles but not by adult loggerheads. Adult loggerheads do tend to use estuarine areas with more open ocean access, such as the Chesapeake Bay in the U.S. mid-Atlantic. Shallow-water habitats with large expanses of open ocean access, such as Florida Bay, provide year-round resident foraging areas for significant numbers of male and female adult loggerheads (Conant et al. 2009).

Offshore, adults primarily inhabit continental shelf waters, from New York south through Florida, The Bahamas, Cuba, and the Gulf of Mexico. Seasonal use of mid-Atlantic shelf waters, especially offshore New Jersey, Delaware, and Virginia during summer months, and offshore shelf waters, such as Onslow Bay (off the North Carolina coast), during winter months has also been documented (Hawkes et al. 2007); Georgia Department of Natural Resources, unpublished data; South Carolina Department of Natural Resources, unpublished data). Satellite telemetry has identified the shelf waters along the west Florida coast, The Bahamas, Cuba, and the Yucatán Peninsula as important resident areas for adult female loggerheads that nest in Florida (Foley et al. 2008a; Girard et al. 2009; Hart et al. 2012). The southern edge of the Grand Bahama Bank is important habitat for loggerheads nesting on the Cay Sal Bank in The Bahamas, but nesting females are also resident in the bights of Eleuthera, Long Island, and Ragged Islands. They also reside in Florida Bay in the United States, and along the north coast of Cuba (A. Bolten and K. Bjorndal, University of Florida, unpublished data). Moncada et al. (2010) report the recapture of 5 adult female loggerheads in Cuban waters originally flipper-tagged in Quintana Roo, Mexico, which indicates that Cuban shelf waters likely also provide foraging habitat for adult females that nest in Mexico.

Status and Population Dynamics

A number of stock assessments and similar reviews (Conant et al. 2009; Heppell et al. 2003a; NMFS-SEFSC 2009; NMFS 2001; NMFS and USFWS 2008; TEWG 1998a; TEWG 2000a; TEWG 2009) have examined the stock status of loggerheads in the Atlantic Ocean, but none have been able to develop a reliable estimate of absolute population size.

Numbers of nests and nesting females can vary widely from year to year. Nesting beach surveys, though, can provide a reliable assessment of trends in the adult female population, due to the strong nest site fidelity of female loggerhead sea turtles, as long as such studies are sufficiently long and survey effort and methods are standardized (e.g., (NMFS and USFWS 2008). NMFS and USFWS (2008) concluded that the lack of change in 2 important demographic parameters of loggerheads, remigration interval and clutch frequency, indicate that time series on numbers of nests can provide reliable information on trends in the female population.

Peninsular Florida Recovery Unit

The Peninsular Florida Recovery Unit (PFRU) is the largest loggerhead nesting assemblage in the Northwest Atlantic. A near-complete nest census (all beaches including index nesting beaches) undertaken from 1989 to 2007 showed an average of 64,513 loggerhead nests per year, representing approximately 15,735 nesting females per year (NMFS and USFWS 2008). The statewide estimated total for 2013 was 77,975 nests (FWRI nesting database).

In addition to the total nest count estimates, the Florida Fish and Wildlife Research Institute (FWRI) uses an index nesting beach survey method. The index survey uses standardized data-collection criteria to measure seasonal nesting and allow accurate comparisons between beaches and between years. This provides a better tool for understanding the nesting trends (Figure 3.2). FWRI performed a detailed analysis of the long-term loggerhead index nesting data (1989-2015; http://myfwc.com/research/wildlife/sea-turtles/nesting/loggerhead-trends/). Over that time period, 3 distinct trends were identified. From 1989-1998, there was a 24% increase that was followed by a sharp decline over the subsequent 9 years. A large increase in loggerhead nesting has occurred since, as indicated by the 74% increase in nesting between 2008 and 2015. FWRI examined the trend from the 1998 nesting high through 2015 and found that the decade-long post-1998 decline was replaced with a slight but nonsignificant increasing trend. Looking at the data from 1989 through 2015 (an increase of over 38%), FWRI concluded that there was an overall positive change in the nest counts (http://myfwc.com/research/wildlife/sea-turtles/nesting/loggerhead-trends/).

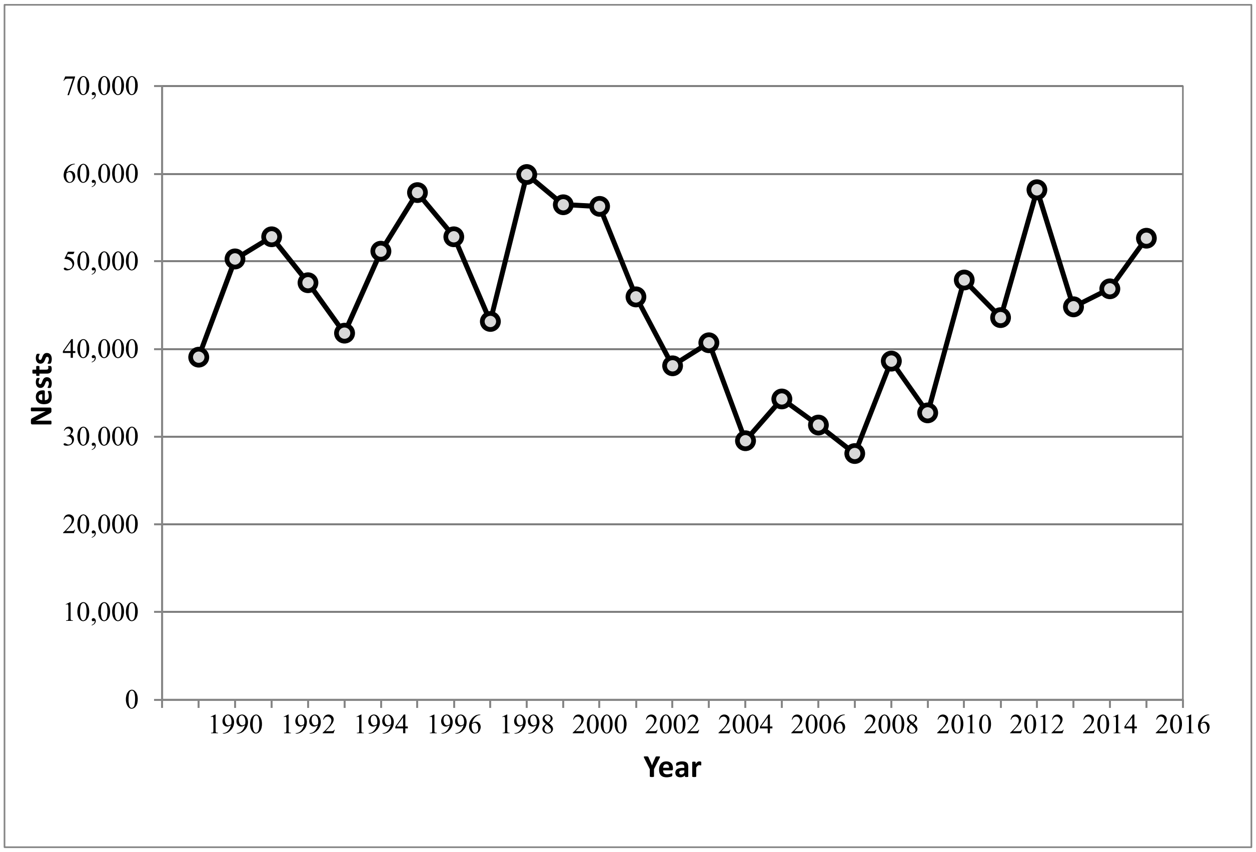

Figure 3.2. Loggerhead sea turtle nesting at Florida index beaches since 1989

<u>Northern Recovery Unit</u>

Annual nest totals from beaches within the Northern Recovery Unit (NRU) averaged 5,215 nests from 1989-2008, a period of near-complete surveys of NRU nesting beaches (Georgia Department of Natural Resources [GADNR] unpublished data, North Carolina Wildlife Resources Commission [NCWRC] unpublished data, South Carolina Department of Natural Resources [SCDNR] unpublished data), and represent approximately 1,272 nesting females per year, assuming 4.1 nests per female (Murphy and Hopkins 1984). The loggerhead nesting trend from daily beach surveys showed a significant decline of 1.3% annually from 1989-2008. Nest totals from aerial surveys conducted by SCDNR showed a 1.9% annual decline in nesting in South Carolina from 1980-2008. Overall, there are strong statistical data to suggest the NRU had experienced a long-term decline over that period of time.

Data since that analysis (Table 3.4) are showing improved nesting numbers and a departure from the declining trend. Georgia nesting has rebounded to show the first statistically significant increasing trend since comprehensive nesting surveys began in 1989 (Mark Dodd, GADNR press release, http://www.georgiawildlife.com/node/3139). South Carolina and North Carolina nesting have also begun to improve.

Table 3.4. Total Number of Northern Recovery Units Loggerhead Nests
(GADNR, SCDNR, and NCWRC nesting datasets)

Nests Recorded	2008	2009	2010	2011	2012	2013	2014
Georgia	1,649	998	1,760	1,992	2,241	2,289	1,196
South Carolina	4,500	2,182	3,141	4,015	4,615	5,193	2,083
North Carolina	841	302	856	950	1,074	1,260	542
Total	**6,990**	**3,472**	**5,757**	**6,957**	**7,930**	**8,742**	**3,821**

South Carolina also conducts an index beach nesting survey similar to the one described for Florida. Although the survey only includes a subset of nesting, the standardized effort and locations allow for a better representation of the nesting trend over time. Increases in nesting were seen for the period from 2009-2012, and 2012 shows the highest index nesting total since the start of the program (Figure 3.3).

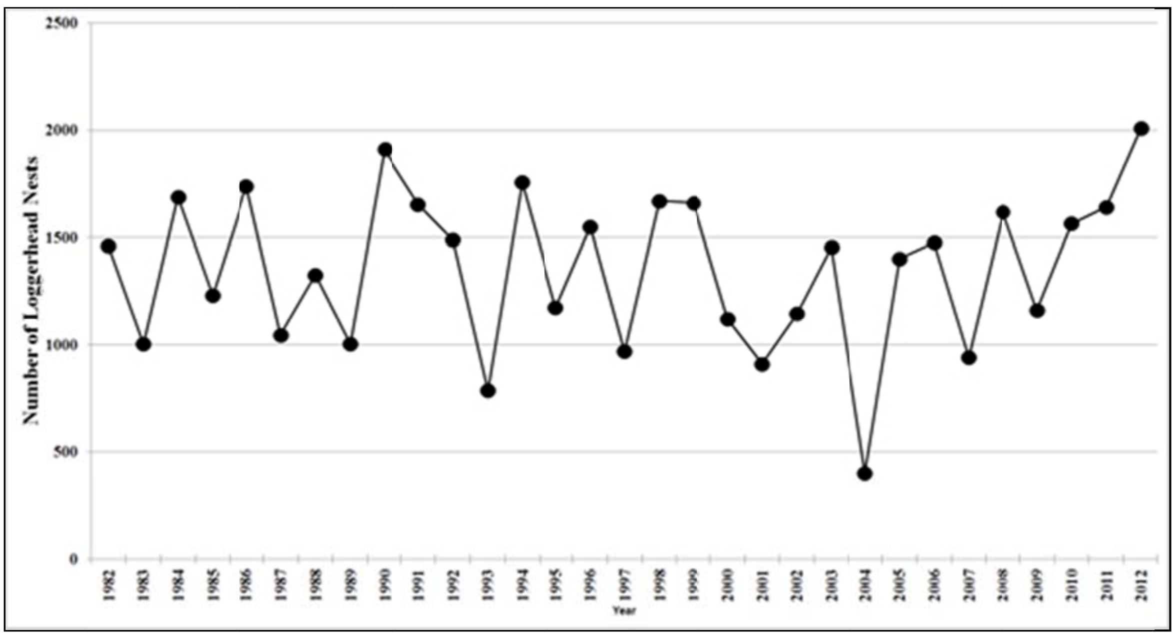

Figure 3.3. South Carolina index nesting beach counts for loggerhead sea turtles (from the SCDNR website: http://www.dnr.sc.gov/seaturtle/nest.htm)

<u>Other Northwest Atlantic DPS Recovery Units</u>
The remaining 3 recovery units—Dry Tortugas (DTRU), Northern Gulf of Mexico (NGMRU), and Greater Caribbean (GCRU)—are much smaller nesting assemblages, but they are still considered essential to the continued existence of the species. Nesting surveys for the DTRU are conducted as part of Florida's statewide survey program. Survey effort was relatively stable during the 9-year period from 1995-2004, although the 2002 year was missed. Nest counts ranged from 168-270, with a mean of 246, but there was no detectable trend during this period (NMFS and USFWS 2008). Nest counts for the NGMRU are focused on index beaches rather than all beaches where nesting occurs.

Analysis of the 12-year dataset (1997-2008) of index nesting beaches in the area shows a statistically significant declining trend of 4.7% annually. Nesting on the Florida Panhandle index beaches, which represents the majority of NGMRU nesting, had shown a large increase in 2008, but then declined again in 2009 and 2010 before rising back to a level similar to the 2003-2007 average in 2011. Nesting survey effort has been inconsistent among the GCRU nesting beaches, and no trend can be determined for this subpopulation (NMFS and USFWS 2008). Zurita et al. (2003) found a statistically significant increase in the number of nests on 7 of the beaches on Quintana Roo, Mexico, from 1987-2001, where survey effort was consistent during the period. Nonetheless, nesting has declined since 2001, and the previously reported increasing trend appears to not have been sustained (NMFS and USFWS 2008).

In-water Trends

Nesting data are the best current indicator of sea turtle population trends, but in-water data also provide some insight. In-water research suggests the abundance of neritic juvenile loggerheads is steady or increasing. Although Ehrhart et al. (2007) found no significant regression-line trend in a long-term dataset, researchers have observed notable increases in catch per unit effort (CPUE) (Arendt et al. 2009; Ehrhart et al. 2007; Epperly et al. 2007). Researchers believe that this increase in CPUE is likely linked to an increase in juvenile abundance, although it is unclear whether this increase in abundance represents a true population increase among juveniles or merely a shift in spatial occurrence. Bjorndal et al. (2005), cited in NMFS and USFWS (2008), caution about extrapolating localized in-water trends to the broader population and relating localized trends in neritic sites to population trends at nesting beaches. The apparent overall increase in the abundance of neritic loggerheads in the southeastern United States may be due to increased abundance of the largest oceanic/neritic juveniles (historically referred to as small benthic juveniles), which could indicate a relatively large number of individuals around the same age may mature in the near future (TEWG 2009). Past in-water studies throughout the eastern United States, however, indicated a substantial decrease in the abundance of the smallest oceanic/neritic juvenile loggerheads, a pattern corroborated by stranding data (TEWG 2009), but newer analysis is needed to determine if this pattern still applies.

Population Estimate

The NMFS Southeast Fisheries Science Center developed a preliminary stage/age demographic model to help determine the estimated impacts of mortality reductions on loggerhead sea turtle population dynamics (NMFS-SEFSC 2009). The model uses the range of published information for the various parameters including mortality by stage, stage duration (years in a stage), and fecundity parameters such as eggs per nest, nests per nesting female, hatchling emergence success, sex ratio, and remigration interval. Resulting trajectories of model runs for each individual recovery unit, and the western North Atlantic population as a whole, were found to be very similar. The model run estimates from the adult female population size for the western North Atlantic (from the 2004-2008 time frame), suggest the adult female population size is approximately 20,000-40,000 individuals, with a low likelihood of females' numbering up to 70,000 (NMFS-SEFSC 2009). A less robust estimate for total benthic females in the western North Atlantic was also obtained, yielding approximately 30,000-300,000 individuals, up to less than 1 million

(NMFS-SEFSC 2009). A preliminary regional abundance survey of loggerheads within the northwestern Atlantic continental shelf for positively identified loggerhead in all strata estimated about 588,000 loggerheads (interquartile range of 382,000-817,000). When correcting for unidentified turtles in proportion to the ratio of identified turtles, the estimate increased to about 801,000 loggerheads (interquartile range of 521,000-1,111,000) (NMFS-NEFSC 2011).

Threats (Specific to Loggerhead Sea Turtles)
The threats faced by loggerhead sea turtles are well summarized in the general discussion of threats in Section 3.2.2. Yet the impact of fishery interactions is a point of further emphasis for this species. The joint NMFS and USFWS Loggerhead Biological Review Team determined that the greatest threats to the NWA DPS of loggerheads result from cumulative fishery bycatch in neritic and oceanic habitats (Conant et al. 2009).

Regarding the impacts of pollution, loggerheads may be particularly affected by organochlorine contaminants; they have the highest organochlorine concentrations (Storelli et al. 2008a) and metal loads (D'Ilio et al. 2011) in sampled tissues among the sea turtle species. It is thought that food choices were likely to be the main differentiating factor among sea turtle species. Storelli et al. (2008a) analyzed tissues from stranded loggerhead sea turtles and found that mercury accumulates in sea turtle livers while cadmium accumulates in their kidneys, as has been reported for other marine organisms like dolphins, seals, and porpoises (Law et al. 1991b).

While oil spill impacts are discussed generally for all species in Section 3.2.2, specific impacts of the DWH oil spill event on loggerhead sea turtles are considered here. Impacts to loggerhead sea turtles occurred to offshore small juveniles as well as large juveniles and adults. A total of 30,800 small juvenile loggerheads (7.3% of the total small juvenile sea turtle exposures to oil from the spill) were estimated to have been exposed to oil. Of those exposed, 10,700 small juveniles are estimated to have died as a result of the exposure. In contrast to small juveniles, loggerheads represented a large proportion of the adults and large juveniles exposed to and killed by the oil. There were 30,000 exposures (almost 52% of all exposures for those age/size classes) and 3,600 estimated mortalities. A total of 265 nests (27,618 eggs) were also translocated during response efforts, with 14,216 hatchlings released, the fate of which is unknown (DWH Trustees 2015). Additional unquantified effects may have included inhalation of volatile compounds, disruption of foraging or migratory movements due to surface or subsurface oil, ingestion of prey species contaminated with oil and/or dispersants, and loss of foraging resources which could lead to compromised growth and/or reproductive potential. There is no information currently available to determine the extent of those impacts, if they occurred.

Unlike Kemp’s ridleys, the majority of nesting for the Northwest Atlantic Ocean loggerhead DPS occurs on the Atlantic coast, and thus loggerheads were impacted to a relatively lesser degree. However, it is likely that impacts to the NGMRU of the NWA loggerhead DPS would be proportionally much greater than the impacts occurring to other recovery units. Impacts to nesting and oiling effects on a large proportion of the NGMRU recovery unit, especially mating and nesting adults likely had an impact on the NGMRU.

Based on the response injury evaluations for Florida Panhandle and Alabama nesting beaches (which fall under the NFMRU), the Trustees estimated that approximately 20,000 loggerhead hatchlings were lost due to DWH oil spill response activities on nesting beaches. Although the long-term effects remain unknown, the DWH oil spill event impacts to the Northern Gulf of Mexico Recovery Unit may result in some nesting declines in the future due to a large reduction of oceanic age classes during the DWH oil spill event. Although adverse impacts occurred to loggerheads, the proportion of the population that is expected to have been exposed to and directly impacted by the DWH oil spill event is relatively low. Thus we do not believe a population-level impact occurred due to the widespread distribution and nesting location outside of the Gulf of Mexico for this species.

Specific information regarding potential climate change impacts on loggerheads is also available. Modeling suggests an increase of 2°C in air temperature would result in a sex ratio of over 80% female offspring for loggerheads nesting near Southport, North Carolina. The same increase in air temperatures at nesting beaches in Cape Canaveral, Florida, would result in close to 100% female offspring. Such highly skewed sex ratios could undermine the reproductive capacity of the species. More ominously, an air temperature increase of 3°C is likely to exceed the thermal threshold of most nests, leading to egg mortality (Hawkes et al. 2007). Warmer sea surface temperatures have also been correlated with an earlier onset of loggerhead nesting in the spring (Hawkes et al. 2007; Weishampel et al. 2004), short inter-nesting intervals (Hays et al. 2002), and shorter nesting seasons (Pike et al. 2006).

3.2.4 Leatherback Sea Turtles

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.

Species Description and Distribution

The leatherback is the largest sea turtle in the world, with a curved carapace length (CCL) that often exceeds 5 ft (150 cm) and front flippers that can span almost 9 ft (270 cm) (NMFS and USFWS 1998b). Mature males and females can reach lengths of over 6 ft (2 m) and weigh close to 2,000 lb (900 kg). The leatherback does not have a bony shell. Instead, its shell is approximately 1.5 in (4 cm) thick and consists of a leathery, oil-saturated connective tissue overlaying loosely interlocking dermal bones. The ridged shell and large flippers help the leatherback during its long-distance trips in search of food.

Unlike other sea turtles, leatherbacks have several unique traits that enable them to live in cold water. For example, leatherbacks have a countercurrent circulatory system (Greer et al. 1973),[11] a thick layer of insulating fat (Davenport et al. 1990; Goff and Lien 1988),

[11] Countercurrent circulation is a highly efficient means of minimizing heat loss through the skin's surface because heat is recycled. For example, a countercurrent circulation system often has an artery containing warm blood from the heart surrounded by a bundle of veins containing cool blood from the body's surface. As the warm blood flows away from the heart, it passes much of its heat to the colder blood returning to the heart via the veins. This conserves heat by recirculating it back to the body's core

gigantothermy (Paladino et al. 1990),[12] and they can increase their body temperature through increased metabolic activity (Bostrom and Jones 2007; Southwood et al. 2005). These adaptations allow leatherbacks to be comfortable in a wide range of temperatures, which helps them to travel further than any other sea turtle species (NMFS and USFWS 1995). For example, a leatherback may swim more than 6,000 miles (10,000 km) in a single year (Benson et al. 2007a; Benson et al. 2011; Eckert 2006; Eckert et al. 2006). They search for food between latitudes 71°N and 47°S in all oceans, and travel extensively to and from their 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 2001).

While leatherbacks will look for food in coastal waters, they appear to prefer the open ocean at all life stages (Heppell et al. 2003b). Leatherbacks have pointed tooth-like cusps and sharp-edged jaws that are adapted for a diet of soft-bodied prey such as jellyfish and salps. A leatherback's mouth and throat also have backward-pointing spines that help retain jelly-like prey. Leatherbacks' favorite prey (e.g., jellyfish) occur commonly in temperate and northern or sub-arctic latitudes and likely has a strong influence on leatherback distribution in these areas (Plotkin 2003). Leatherbacks are known to be deep divers, with recorded depths in excess of a half-mile (Eckert et al. 1989), but they may also come into shallow waters to locate prey items.

Genetic analyses using microsatellite markers along with mitochondrial DNA and tagging data indicate there are 7 groups or breeding populations in the Atlantic Ocean: 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 7 nesting assemblages, although data to support this is limited in most cases.

Life History Information

The leatherback life cycle is broken into several stages: (1) egg/hatchling, (2) post-hatchling, (3) juvenile, (4) subadult, and (5) adult. Leatherbacks are a long-lived species that delay age of maturity, have low and variable survival in the egg and juvenile stages, and have relatively high and constant annual survival in the subadult and adult life stages (Chaloupka 2002; Crouse 1999; Heppell et al. 1999; Heppell et al. 2003b; Spotila et al. 1996; Spotila et al. 2000). While a robust estimate of the leatherback sea turtle's life span does not exist, the current best estimate for the maximum age is 43 (Avens et al. 2009). It is still unclear when leatherbacks first become sexually mature. Using skeletochronological data, Avens et al. (2009) estimated that leatherbacks in the western North Atlantic may not reach maturity until 29 years of age, which is longer than earlier estimates of 2-3 years by Pritchard and Trebbau (1984), of 3-6 years by Rhodin (1985), of 13-14 years for females by Zug and Parham (1996), and 12-14 years for leatherbacks nesting in the U.S. Virgin Islands by Dutton et al. (2005). A more recent study that examined leatherback growth rates estimated an age at maturity of 16.1 years (Jones et al. 2011).

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[12] "Gigantothermy" refers to a condition when an animal has relatively high volume compared to its surface area, and as a result, it loses less heat.

The average size of reproductively active females in the Atlantic is generally 5-5.5 ft (150-162 cm) CCL (Benson et al. 2007a; Hirth et al. 1993; Starbird and Suarez 1994). Still, females as small as 3.5-4 ft (105-125 cm) CCL have been observed nesting at various sites (Stewart et al. 2007).

Female leatherbacks typically nest on sandy, tropical beaches at intervals of 2-4 years (Garcia M. and Sarti 2000; McDonald and Dutton 1996; Spotila et al. 2000). Unlike other sea turtle species, female leatherbacks do not always nest at the same beach year after year; some females may even nest at different beaches during the same year (Dutton et al. 2005; Eckert 1989; Keinath and Musick 1993; Steyermark et al. 1996). Individual female leatherbacks have been observed with fertility spans as long as 25 years (Hughes 1996). Females usually lay up to 10 nests during the 3-6 month nesting season (March through July in the United States), typically 8-12 days apart, with 100 eggs or more per nest (Eckert et al. 2012; Eckert 1989; Maharaj 2004; Matos 1986; Stewart and Johnson 2006; Tucker 1988). Yet, up to approximately 30% of the eggs may be infertile (Eckert 1989; Eckert et al. 1984; Maharaj 2004; Matos 1986; Stewart and Johnson 2006; Tucker 1988). The number of leatherback hatchlings that make it out of the nest on to the beach (i.e., emergent success) is approximately 50% worldwide (Eckert et al. 2012), which is lower than the greater than 80% reported for other sea turtle species (Miller 1997). In the United States, the emergent success is higher at 54-72% (Eckert and Eckert 1990; Stewart and Johnson 2006; Tucker 1988). Thus the number of hatchlings in a given year may be less than the total number of eggs produced in a season. Eggs hatch after 60-65 days, and the hatchlings have white striping along the ridges of their backs and on the edges of the flippers. Leatherback hatchlings weigh approximately 1.5-2 oz (40-50 g), and have length of approximately 2-3 in (51-76 mm), with fore flippers as long as their bodies. Hatchlings grow rapidly with reported growth rates for leatherbacks from 2.5-27.6 in (6-70 cm) in length, estimated at 12.6 in (32 cm) per year (Jones et al. 2011).

In the Atlantic, the sex ratio appears to be skewed toward females. The Turtle Expert Working Group (TEWG) reports that nearshore and onshore strandings data from the U.S. Atlantic and Gulf of Mexico coasts indicate that 60% of strandings were females (TEWG 2007). Those data also show that the proportion of females among adults (57%) and juveniles (61%) was also skewed toward females in these areas (TEWG 2007). James et al. (2007) collected size and sex data from large subadult and adult leatherbacks off Nova Scotia and also concluded a bias toward females at a rate of 1.86:1.

The survival and mortality rates for leatherbacks are difficult to estimate and vary by location. For example, the annual mortality rate for leatherbacks that nested at Playa Grande, Costa Rica, was estimated to be 34.6% in 1993-1994, and 34.0% in 1994-1995 (Spotila et al. 2000). In contrast, leatherbacks nesting in French Guiana and St. Croix had estimated annual survival rates of 91% (Rivalan et al. 2005) and 89% (Dutton et al. 2005), respectively. For the St. Croix population, the average annual juvenile survival rate was estimated to be approximately 63% and the total survival rate from hatchling to first year of reproduction for a female was estimated to be between 0.4% and 2%, assuming age at first reproduction is between 9-13 years (Eguchi et al. 2006). Spotila et al. (1996) estimated first-year survival rates for leatherbacks at 6.25%.

Migratory routes of leatherbacks are not entirely known; however, recent information from satellite tags have documented long travels between nesting beaches and foraging areas in the Atlantic and Pacific Ocean basins (Benson et al. 2007a; Benson et al. 2011; Eckert 2006; Eckert et al. 2006; Ferraroli et al. 2004; Hays et al. 2004; James et al. 2005). Leatherbacks nesting in Central America and Mexico travel thousands of miles through tropical and temperate waters of the South Pacific (Eckert and Sarti 1997; Shillinger et al. 2008). Data from satellite tagged leatherbacks suggest that they may be traveling in search of seasonal aggregations of jellyfish (Benson et al. 2007b; Bowlby et al. 1994; Graham 2009; Shenker 1984; Starbird et al. 1993; Suchman and Brodeur 2005).

Status and Population Dynamics

The status of the Atlantic leatherback population has been less clear than the Pacific population, which has shown dramatic declines at many nesting sites (Santidrián Tomillo et al. 2007; Sarti Martínez et al. 2007; Spotila et al. 2000). This uncertainty has been a result of inconsistent beach and aerial surveys, cycles of erosion, and reformation of nesting beaches in the Guianas (representing the largest nesting area). Leatherbacks also show a lesser degree of nest-site fidelity than occurs with the hardshell sea turtle species. Coordinated efforts of data collection and analyses by the leatherback Turtle Expert Working Group have helped to clarify the understanding of the Atlantic population status (TEWG 2007).

The Southern Caribbean/Guianas stock is the largest known Atlantic leatherback nesting aggregation (TEWG 2007). This area includes the Guianas (Guyana, Suriname, and French Guiana), Trinidad, Dominica, and Venezuela, with most of the nesting occurring in the Guianas and Trinidad. The Southern Caribbean/Guianas stock of leatherbacks was designated after genetics studies indicated that animals from the Guianas (and possibly Trinidad) should be viewed as a single population. Using nesting females as a proxy for population, the TEWG (2007) determined that the Southern Caribbean/Guianas stock had demonstrated a long-term, positive population growth rate. TEWG observed positive growth within major nesting areas for the stock, including Trinidad, Guyana, and the combined beaches of Suriname and French Guiana (TEWG 2007). Wallace et al. (2014) report estimated three-generation abundance increases in Trinidad, Guyana, Suriname, and French Guiana.

Researchers believe the cyclical pattern of beach erosion and then reformation has affected leatherback nesting patterns in the Guianas. For example, between 1979 and 1986, the number of leatherback nests in French Guiana had increased by about 15% annually (NMFS 2001). This increase was then followed by a nesting decline of about 15% annually. This decline corresponded with the erosion of beaches in French Guiana and increased nesting in Suriname. This pattern suggests that the declines observed since 1987 might actually be a part of a nesting cycle that coincides with cyclic beach erosion in Guiana (Schulz 1975). Researchers think that the cycle of erosion and reformation of beaches may have changed where leatherbacks nest throughout this region. The idea of shifting nesting beach locations was supported by increased nesting in Suriname,[13] while

[13] Leatherback nesting in Suriname increased by more than 10,000 nests per year since 1999 with a peak of 30,000 nests in 2001.

the number of nests was declining at beaches in Guiana (Hilterman et al. 2003). Though this information suggested the long-term trend for the overall Suriname and French Guiana population was increasing.

The Western Caribbean stock includes nesting beaches from Honduras to Colombia. Across the Western Caribbean, nesting is most prevalent in Costa Rica, Panama, and the Gulf of Uraba in Colombia (Duque et al. 2000). The Caribbean coastline of Costa Rica and extending through Chiriquí Beach, Panama, represents the fourth largest known leatherback rookery in the world (Troëng et al. 2004). Examination of data from index nesting beaches in Tortuguero, Gandoca, and Pacuaré in Costa Rica indicate that the nesting population likely was not growing over the 1995-2005 time series (TEWG 2007). Other modeling of the nesting data for Tortuguero indicates a possible 67.8% decline between 1995 and 2006 (Troëng et al. 2007). Wallace et al. (2014) report an estimated three-generation abundance change of -72%, -24%, and +6% for Tortuguero, Gandoca, and Pacuare, respectively.

Nesting data for the Northern Caribbean stock is available from Puerto Rico, St. Croix (U.S. Virgin Islands), and the British Virgin Islands (Tortola). In Puerto Rico, the primary nesting beaches are at Fajardo and on the island of Culebra. Nesting between 1978 and 2005 has ranged between 469-882 nests, and the population has been growing since 1978, with an overall annual growth rate of 1.1% (TEWG 2007). Wallace et al. (2014) report an estimated three-generation abundance change of -4% and +5,583% at Culebra and Fajardo, respectively. At the primary nesting beach on St. Croix, the Sandy Point National Wildlife Refuge, nesting has varied from a few hundred nests to a high of 1,008 in 2001, and the average annual growth rate has been approximately 1.1% from 1986-2004 (TEWG 2007). From 2006-2010, Wallace et al. (2014) report an annual growth rate of +7.5% in St. Croix and a three-generation abundance change of +1,058%. Nesting in Tortola is limited, but has been increasing from 0-6 nests per year in the late 1980s to 35-65 per year in the 2000s, with an annual growth rate of approximately 1.2% between 1994 and 2004 (TEWG 2007).

The Florida nesting stock nests primarily along the east coast of Florida. This stock is of growing importance, with total nests between 800-900 per year in the 2000s following nesting totals fewer than 100 nests per year in the 1980s (Florida Fish and Wildlife Conservation Commission, unpublished data). Using data from the index nesting beach surveys, the TEWG (2007) estimated a significant annual nesting growth rate of 1.17% between 1989 and 2005. FWC Index Nesting Beach Survey Data generally indicates biennial peaks in nesting abundance beginning in 2007 (Figure 3.4 and Table 3.5). A similar pattern was also observed statewide (Table 3.5). This up-and-down pattern is thought to be a result of the cyclical nature of leatherback nesting, similar to the biennial cycle of green turtle nesting. Overall, the trend shows growth on Florida's east coast beaches. Wallace et al. (2014) report an annual growth rate of 9.7% and a three-generation abundance change of +1,863%.

Table 3.5. Number of Leatherback Sea Turtle Nests in Florida

Nests Recorded	2011	2012	2013	2014	2015
Index Nesting Beaches	625	515	322	641	489
Statewide	1,653	1,712	896	1,604	1493

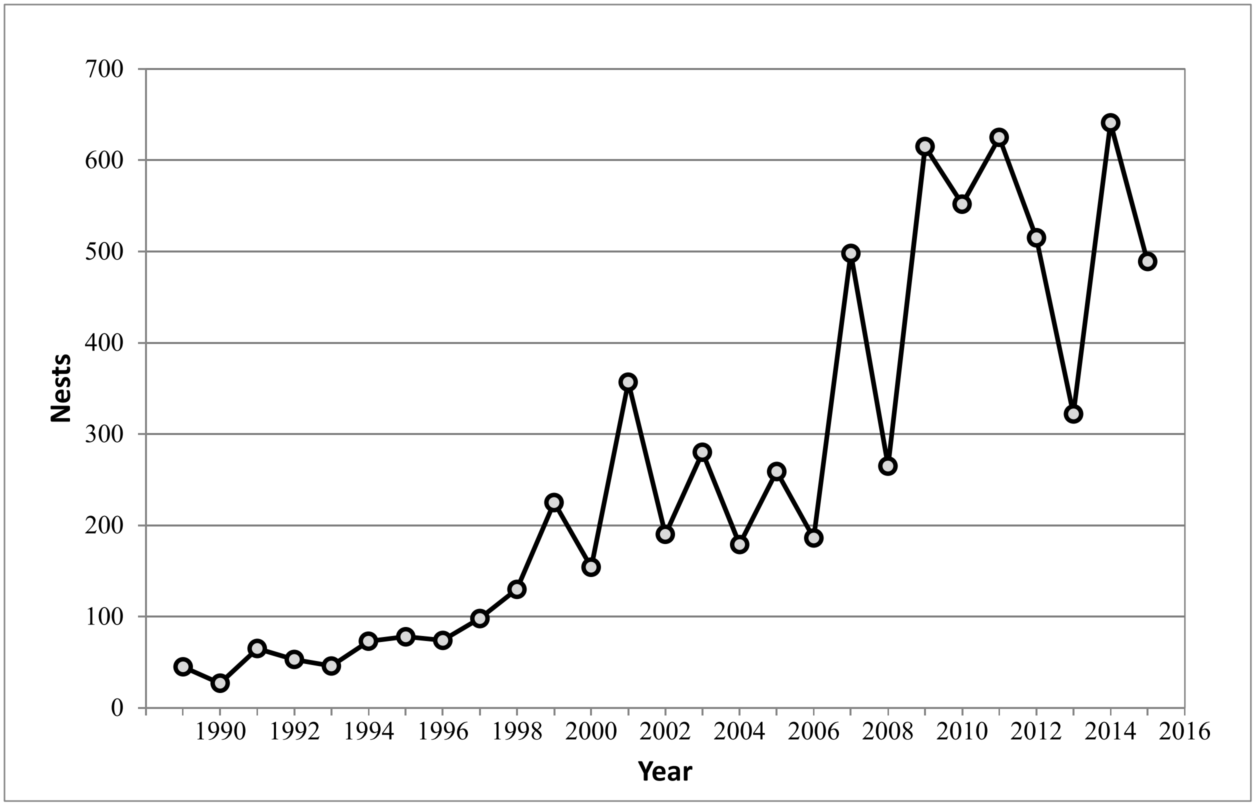

Figure 3.4. Leatherback sea turtle nesting at Florida index beaches since 1989

The West African nesting stock of leatherbacks is large and important, but it is a mostly unstudied aggregation. Nesting occurs in various countries along Africa's Atlantic coast, but much of the nesting is undocumented and the data are inconsistent. Gabon has a very large amount of leatherback nesting, with at least 30,000 nests laid along its coast in a single season (Fretey et al. 2007). Fretey et al. (2007) provide detailed information about other known nesting beaches and survey efforts along the Atlantic African coast. Because of the lack of consistent effort and minimal available data, trend analyses were not possible for this stock (TEWG 2007).

Two other small but growing stocks nest on the beaches of Brazil and South Africa. Based on the data available, there was a positive annual average growth rate between 1.07% and 1.08% from 1988 and 2003 for the Brazilian stock and an estimated annual average growth rate between 1.04% and 1.06% for the South African stock (TEWG (2007).

Because the available nesting information is inconsistent, it is difficult to estimate the total population size for Atlantic leatherbacks. Spotila et al. (1996) characterized the entire Western Atlantic population as stable at best and estimated a population of 18,800 nesting females. Spotila et al. (1996) further estimated that the adult female leatherback population for the entire Atlantic basin, including all nesting beaches in the Americas, the Caribbean, and West Africa, was about 27,600 (considering both nesting and interesting females), with an estimated range of 20,082-35,133. This is consistent with the estimate of 34,000-95,000 total adults (20,000-56,000 adult females; 10,000-21,000 nesting females) determined by the TEWG (2007). The TEWG (2007) also determined that at of the time of their publication, leatherback sea turtle populations in the Atlantic were all stable or increasing with the exception of the Western Caribbean and West Africa populations. The latest review by NMFS USFWS (2013) suggests the leatherback nesting population is stable in most nesting regions of the Atlantic Ocean.

Threats

Leatherbacks face many of the same threats as other sea turtle species, including destruction of nesting habitat from storm events, oceanic events such as cold-stunning, pollution (plastics, petroleum products, petrochemicals, etc.), ecosystem alterations (nesting beach development, beach nourishment and shoreline stabilization, vegetation changes, etc.), poaching, global climate change, fisheries interactions, natural predation, and disease. A discussion on general sea turtle threats can be found in Section 3.2.2; the remainder of this section will expand on a few of the aforementioned threats and how they may specifically impact leatherback sea turtles.

Of all sea turtle species, leatherbacks seem to be the most vulnerable to entanglement in fishing gear, especially gillnet and pot/trap lines. This vulnerability may be because of their body type (large size, long pectoral flippers, and lack of a hard shell), their attraction to gelatinous organisms and algae that collect on buoys and buoy lines at or near the surface, their method of locomotion, and/or their attraction to the lightsticks used to attract target species in longline fisheries. From 1990-2000, 92 entangled leatherbacks were reported from New York through Maine and many other stranded individuals exhibited evidence of prior entanglement (Dwyer et al. 2003). Zug and Parham (1996) point out that a combination of the loss of long-lived adults in fishery-related mortalities and a lack of recruitment from intense egg harvesting in some areas has caused a sharp decline in leatherback sea turtle populations and represents a significant threat to survival and recovery of the species worldwide.

Leatherback sea turtles may also be more susceptible to marine debris ingestion than other sea turtle species due to their predominantly pelagic existence and the tendency of floating debris to concentrate in convergence zones that adults and juveniles use for feeding and migratory purposes (Lutcavage et al. 1997; Shoop and Kenney 1992). The stomach contents of leatherback sea turtles revealed that a substantial percentage (33.8% or 138 of 408 cases examined) contained some form of plastic debris (Mrosovsky et al. 2009). Blocking of the gut by plastic to an extent that could have caused death was evident in 8.7% of all leatherbacks that ingested plastic (Mrosovsky et al. 2009). Mrosovsky et al. (2009) also note that in a number of cases, the ingestion of plastic may not cause death outright, but could cause the animal to absorb fewer nutrients from food, eat less in general, etc. - factors which could cause other adverse effects. The presence of plastic in the digestive tract suggests that leatherbacks might not be able to distinguish between prey items and forms of debris such a plastic bags (Mrosovsky et al. 2009). Balazs (1985a) speculated that the plastic object might resemble a food item by its shape, color, size, or even movement as it drifts about, and therefore induce a feeding response in leatherbacks.

As discussed in Section 3.2.2, global climate change can be expected to have various impacts on all sea turtles, including leatherbacks. Global climate change is likely to also influence the distribution and abundance of jellyfish, the primary prey item of leatherbacks (NMFS and USFWS 2007d). Several studies have shown leatherback distribution is influenced by jellyfish abundance (e.g., (Houghton et al. 2006; Witt et al. 2007; Witt et al. 2006); however, more studies need to be done to monitor how changes to prey items affect distribution and foraging success of leatherbacks so population-level effects can be determined.

While oil spill impacts are discussed generally for all species in Section 3.2.2, specific impacts of the DWH oil spill on leatherback sea turtles are considered here. Available information indicates leatherback sea turtles (along with hawksbill turtles) were likely least directly affected by the oil spill. Leatherbacks were documented in the spill area, but the number of affected leatherbacks was not estimated due to a lack of information compared to other species. But given that the northern Gulf of Mexico is important habitat for leatherback migration and foraging (TEWG 2007), and documentation of leatherbacks in the DWH oil spill zone during the spill period, the Trustees conclude that leatherbacks were exposed to DWH oil, and some portion of those exposed leatherbacks likely died. (After the Deepwater Horizon oil spill, federal and state agencies came together to form the Deepwater Horizon Natural Resource Damage Assessment Trustee Council ("Trustees"). The Council studied the effects of the oil spill and continues to restore the Gulf of Mexico to the condition it would have been in if the spill had not happened.) Potential DWH-related impacts to leatherback sea turtles include direct oiling or contact with dispersants from surface and subsurface oil and dispersants, inhalation of volatile compounds, disruption of foraging or migratory movements due to surface or subsurface oil, ingestion of prey species contaminated with oil and/or dispersants, and loss of foraging resources which could lead to compromised growth and/or reproductive potential. There is no information currently available to determine the extent of those impacts, if they occurred. Although adverse impacts likely occurred to leatherbacks, the relative proportion of the population that is expected to have been exposed to and directly impacted by the DWH event may be relatively low. Thus, a population-level impact may not have occurred due to the widespread distribution and nesting location outside of the Gulf of Mexico for this species.

3.2.5 Kemp's Ridley Sea Turtle

The Kemp's ridley sea turtle was listed as endangered on December 2, 1970, under the Endangered Species Conservation Act of 1969, a precursor to the ESA. Internationally, the Kemp's ridley is considered the most endangered sea turtle (Groombridge 1982; TEWG 2000a; Zwinenberg 1977).

Species Description and Distribution
The Kemp's ridley sea turtle is the smallest of all sea turtles. Adults generally weigh less than 100 lb (45 kg) and have a carapace length of around 2.1 ft (65 cm). Adult Kemp's ridley shells are almost as wide as they are long. Coloration changes significantly during development from the grey-black dorsum and plastron of hatchlings, a grey-black dorsum with a yellowish-white plastron as post-pelagic juveniles, and then to the lighter grey-olive carapace and cream-white or yellowish plastron of adults. There are 2 pairs of prefrontal scales on the head, 5 vertebral scutes, usually 5 pairs of costal scutes, and generally 12 pairs of marginal scutes on the carapace. In each bridge adjoining the plastron to the carapace, there are 4 scutes, each of which is perforated by a pore.

Kemp's ridley habitat largely consists of sandy and muddy areas in shallow, nearshore waters less than 120 ft (37 m) deep, although they can also be found in deeper offshore waters. These areas support the primary prey species of the Kemp's ridley sea turtle, which consist of swimming crabs, but may also include fish, jellyfish, and an array of mollusks.

The primary range of Kemp's ridley sea turtles is within the Gulf of Mexico basin, though they also occur in coastal and offshore waters of the U.S. Atlantic Ocean. Juvenile Kemp's ridley sea turtles, possibly carried by oceanic currents, have been recorded as far north as Nova Scotia. Historic records indicate a nesting range from Mustang Island, Texas, in the north to Veracruz, Mexico, in the south. Kemp's ridley sea turtles have recently been nesting along the Atlantic Coast of the United States, with nests recorded from beaches in Florida, Georgia, and the Carolinas. In 2012, the first Kemp's ridley sea turtle nest was recorded in Virginia. The Kemp's ridley nesting population had been exponentially increasing prior to the recent low nesting years, which may indicate that the population had been experiencing a similar increase. Additional nesting data in the coming years will be required to determine what the recent nesting decline means for the population trajectory.

Life History Information
Kemp's ridley sea turtles share a general life history pattern similar to other sea turtles. Females lay their eggs on coastal beaches where the eggs incubate in sandy nests. After 45-58 days of embryonic development, the hatchlings emerge and swim offshore into deeper, ocean water where they feed and grow until returning at a larger size. Hatchlings generally range from 1.65-1.89 in (42-48 mm) straight carapace length (SCL), 1.26-1.73 in (32-44 mm) in width, and 0.3-0.4 lb (15-20 g) in weight. Their return to nearshore coastal habitats typically occurs around 2 years of age (Ogren 1989a), although the time spent in the oceanic zone may vary from 1-4 years or perhaps more (TEWG 2000). Juvenile Kemp's ridley sea turtles use these nearshore coastal habitats from April through November, but they move towards more suitable overwintering habitat in deeper offshore waters (or more southern waters along the Atlantic coast) as water temperature drops.

The average rates of growth may vary by location, with a rate of 2.9 in/year (7.5 cm/year) in the Gulf of Mexico, and 2.2 in/year (5.5 cm/year) in the Atlantic, (Schmid and Barichivich 2006; Schmid and Woodhead 2000). The average rates of growth may vary by location, with a rate of 2.9 in/year (7.5 cm/year) in the Gulf of Mexico, and 2.2 in/year (5.5

cm/year) in the Atlantic, (Schmid and Barichivich 2006; Schmid and Woodhead 2000). Age to sexual maturity ranges greatly from 5-16 years, though NMFS et al. (2011b) determined the best estimate of age to maturity for Kemp's ridley sea turtles was 12 years. It is unlikely that most adults grow very much after maturity. While some sea turtles nest annually, the weighted mean remigration rate for Kemp's ridley sea turtles is approximately 2 years. Nesting generally occurs from April to July. Females lay approximately 2.5 nests per season with each nest containing approximately 100 eggs (Márquez M. 1994).

Population Dynamics

Of the 7 species of sea turtles in the world, the Kemp's ridley has declined to the lowest population level. Most of the population of adult females nest on the beaches of Rancho Nuevo, Mexico (Pritchard 1969). When nesting aggregations at Rancho Nuevo were discovered in 1947, adult female populations were estimated to be in excess of 40,000 individuals (Hildebrand 1963). By the mid-1980s, however, nesting numbers from Rancho Nuevo and adjacent Mexican beaches were below 1,000, with a low of 702 nests in 1985. Yet, nesting steadily increased through the 1990s, and then accelerated during the first decade of the twenty-first century (Figure 3.5), which indicates the species is recovering.

It is worth noting that when the Bi-National Kemp's Ridley Sea Turtle Population Restoration Project was initiated in 1978, only Rancho Nuevo nests were recorded. In 1988, nesting data from southern beaches at Playa Dos and Barra del Tordo were added. In 1989, data from the northern beaches of Barra Ostionales and Tepehuajes were added, and most recently in 1996, data from La Pesca and Altamira beaches were recorded. Currently, nesting at Rancho Nuevo accounts for just over 81% of all recorded Kemp's ridley nests in Mexico. Following a significant, unexplained 1-year decline in 2010, Kemp's ridley nests in Mexico reached a record high of 21,797 in 2012 (Gladys Porter Zoo 2013). From 2013 through 2014, there was a second significant decline, as only 16,385 and 11,279 nests were recorded, respectively. In 2015, nesting in Mexico improved to 14,006 recorded nests (J. Pena, Gladys Porter Zoo, pers. comm. to M. Barnette, NMFS SERO PRD, October 19, 2015). At this time, it is unclear if future nesting will steadily and continuously increase, similar to what occurred from 1990-2009, or if nesting will continue to exhibit sporadic declines and increases as recorded in the past 5 years.

A small nesting population is also emerging in the United States, primarily in Texas, rising from 6 nests in 1996 to 42 in 2004, to a record high of 209 nests in 2012 (National Park Service data, http://www.nps.gov/pais/naturescience/strp.htm, http://www.nps.gov/pais/naturescience/current-season.htm). It is worth noting that nesting in Texas has paralleled the trends observed in Mexico, with a significant decline in 2010 followed by a second decline in 2013-2014. Nesting rebounded in 2015, as 159 nests were documented along the Texas coast (D. Shaver, National Park Service, pers. comm. to M. Barnette, NMFS SERO PRD, October 28, 2015).

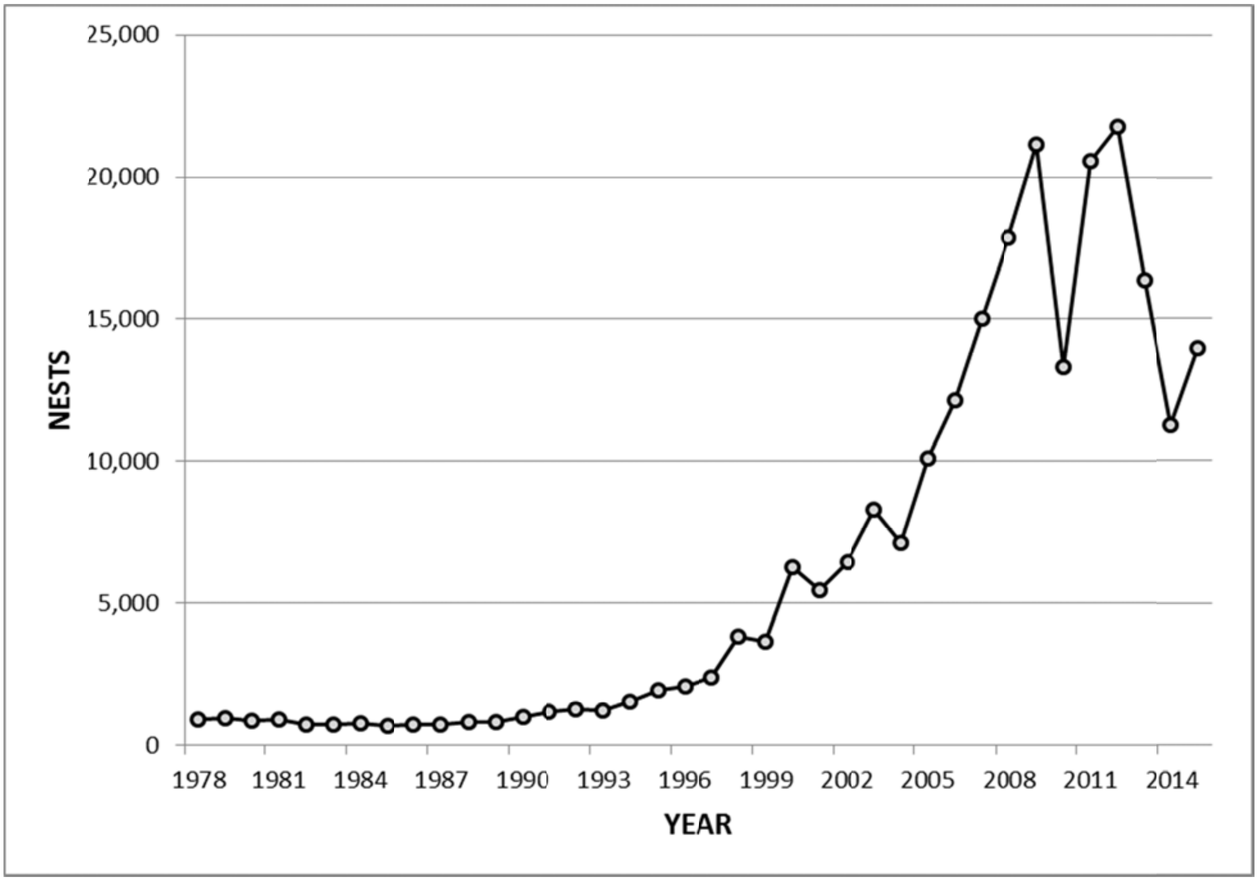

Figure 3.5. Kemp's ridley nest totals from Mexican beaches (Gladys Porter Zoo nesting database 2015)

Through modelling, Heppell et al. (2005) predicted the population is expected to increase at least 12-16% per year and could reach at least 10,000 females nesting on Mexico beaches by 2015. NMFS et al. (2011b) produced an updated model that predicted the population to increase 19% per year and to attain at least 10,000 females nesting on Mexico beaches by 2011. Approximately 25,000 nests would be needed for an estimate of 10,000 nesters on the beach, based on an average 2.5 nests/nesting female. While counts did not reach 25,000 nests by 2015, it is clear that the population has increased over the long term. The increases in Kemp's ridley sea turtle nesting over the last 2 decades is likely due to a combination of management measures including elimination of direct harvest, nest protection, the use of TEDs, reduced trawling effort in Mexico and the United States, and possibly other changes in vital rates (TEWG 1998a; TEWG 2000a). While these results are encouraging, the species' limited range as well as low global abundance makes it particularly vulnerable to new sources of mortality as well as demographic and environmental randomness, all factors which are often difficult to predict with any certainty. Additionally, the significant nesting declines observed in 2010 and 2013-2014 potentially indicate a serious population-level impact, and there is cause for concern regarding the ongoing recovery trajectory.

Threats

Kemp's ridley sea turtles face many of the same threats as other sea turtle species, including destruction of nesting habitat from storm events, oceanic events such as cold-stunning, pollution (plastics, petroleum products, petrochemicals, etc.), ecosystem alterations (nesting beach development, beach nourishment and shoreline stabilization, vegetation changes, etc.), poaching, global climate change, fisheries interactions, natural predation, and disease. A discussion on general sea turtle threats can be found in Section 3.2.2; the remainder of this section will expand on a few of the aforementioned threats and how they may specifically impact Kemp's ridley sea turtles.

As Kemp's ridley sea turtles continue to recover and nesting arribadas[14] are increasingly established, bacterial and fungal pathogens in nests are also likely to increase. Bacterial and fungal pathogen impacts have been well documented in the large arribadas of the olive ridley at Nancite in Costa Rica (Mo 1988). In some years, and on some sections of the beach, the hatching success can be as low as 5% (Mo 1988). As the Kemp's ridley nest density at Rancho Nuevo and adjacent beaches continues to increase, appropriate monitoring of emergence success will be necessary to determine if there are any density-dependent effects.

Over the past 6 years, NMFS has documented (via the Sea Turtle Stranding and Salvage Network data, http://www.sefsc.noaa.gov/species/turtles/strandings.htm) elevated sea turtle strandings in the Northern Gulf of Mexico, particularly throughout the Mississippi Sound area. In the first 3 weeks of June 2010, over 120 sea turtle strandings were reported from Mississippi and Alabama waters, none of which exhibited any signs of external oiling to indicate effects associated with the DWH oil spill event. A total of 644 sea turtle strandings were reported in 2010 from Louisiana, Mississippi, and Alabama waters, 561 (87%) of which were Kemp's ridley sea turtles. During March through May of 2011, 267 sea turtle strandings were reported from Mississippi and Alabama waters alone. A total of 525 sea turtle strandings were reported in 2011 from Louisiana, Mississippi, and Alabama waters, with the majority (455) having occurred from March through July, 390 (86%) of which were Kemp's ridley sea turtles. During 2012, a total of 384 sea turtles were reported from Louisiana, Mississippi, and Alabama waters. Of these reported strandings, 343 (89%) were Kemp's ridley sea turtles. During 2014, a total of 285 sea turtles were reported from Louisiana, Mississippi, and Alabama waters, though the data is incomplete. Of these reported strandings, 229 (80%) were Kemp's ridley sea turtles. These stranding numbers are significantly greater than reported in past years; Louisiana, Mississippi, and Alabama waters reported 42 and 73 sea turtle strandings for 2008 and 2009, respectively. It should be noted that stranding coverage has increased considerably due to the DWH oil spill event.

Nonetheless, considering that strandings typically represent only a small fraction of actual mortality, these stranding events potentially represent a serious impact to the recovery and survival of the local sea turtle populations. While a definitive cause for these strandings has not been identified, necropsy results indicate a significant number of stranded turtles from these events likely perished due to forced submergence, which is commonly associated with fishery interactions (B. Stacy, NMFS, pers. comm. to M. Barnette, NMFS SERO PRD, March 2012). Yet, available information indicates fishery effort was

[14] Arribada is the Spanish word for "arrival" and is the term used for massive synchronized nesting within the genus *Lepidochelys.*

extremely limited during the stranding events. The fact that 80% or more of all Louisiana, Mississippi, and Alabama stranded sea turtles in the past 5 years were Kemp's ridleys is notable; however, this could simply be a function of the species' preference for shallow, inshore waters coupled with increased population abundance, as reflected in recent Kemp's ridley nesting increases.

In response to these strandings, and due to speculation that fishery interactions may be the cause, fishery observer effort was shifted to evaluate the inshore skimmer trawl fishery during the summer of 2012. During May-July of that year, observers reported 24 sea turtle interactions in the skimmer trawl fishery. All but a single sea turtle were identified as Kemp's ridleys (1 sea turtle was an unidentified hardshell turtle). Encountered sea turtles were all very small juvenile specimens, ranging from 7.6-19.0 in (19.4-48.3 cm) curved carapace length (CCL). All sea turtles were released alive. The small average size of encountered Kemp's ridleys introduces a potential conservation issue, as over 50% of these reported sea turtles could potentially pass through the maximum 4-in bar spacing of TEDs currently required in the shrimp fishery. Due to this issue, a Proposed 2012 Rule to require TEDs in the skimmer trawl fishery (77 FR 27411) was not implemented. Based on anecdotal information, these interactions were a relatively new issue for the inshore skimmer trawl fishery. Given the nesting trends and habitat utilization of Kemp's ridley sea turtles, it is likely that fishery interactions in the Northern Gulf of Mexico may continue to be an issue of concern for the species, and one that may potentially slow the rate of recovery for Kemp's ridley sea turtles.

While oil spill impacts are discussed generally for all species in Section 3.2.2, specific impacts of the DWH oil spill event on Kemp's ridley sea turtles are considered here. Kemp's ridleys experienced the greatest negative impact stemming from the DWH oil spill event of any sea turtle species. Impacts to Kemp's ridley sea turtles occurred to offshore small juveniles, as well as large juveniles and adults. Loss of hatchling production resulting from injury to adult turtles was also estimated for this species. Injuries to adult turtles of other species, such as loggerheads, certainly would have resulted in unrealized nests and hatchlings to those species as well. Yet, the calculation of unrealized nests and hatchlings was limited to Kemp's ridleys for several reasons. All Kemp's ridleys in the Gulf belong to the same population (NMFS et al. 2011b), so total population abundance could be calculated based on numbers of hatchlings because all individuals that enter the population could reasonably be expected to inhabit the northern Gulf of Mexico throughout their lives (DWH Trustees 2015).

A total of 217,000 small juvenile Kemp's ridleys (51.5% of the total small juvenile sea turtle exposures to oil from the spill) were estimated to have been exposed to oil. That means approximately half of all small juvenile Kemp's ridleys from the total population estimate of 430,000 oceanic small juveniles were exposed to oil. Furthermore, a large number of small juveniles were removed from the population, as up to 90,300 small juveniles Kemp's ridleys are estimated to have died as a direct result of the exposure. Therefore, as much as 20% of the small oceanic juveniles of this species were killed during that year. Impacts to large juveniles (>3 years old) and adults were also high. An estimated 21,990 such individuals were exposed to oil (about 22% of the total estimated population for those age classes); of those, 3,110 mortalities were estimated (or 3% of the population for those age classes). The loss of near-reproductive and reproductive-stage females would have contributed to some extent to the decline in total nesting abundance observed between 2011 and 2014. The estimated number of unrealized Kemp's ridley nests is between 1,300 and 2,000, which translates to between approximately 65,000 and 95,000 unrealized hatchlings (DWH Trustees 2015). This is a minimum estimate, however, because the sublethal effects of the DWH oil spill event on turtles, their prey, and their habitats might have delayed or reduced reproduction in subsequent years, which may have contributed substantially to additional nesting deficits observed following the DWH oil spill event. These sublethal effects could have slowed growth and maturation rates, increased remigration intervals, and decreased clutch frequency (number of nests per female per nesting season). The nature of the DWH oil spill event effect on reduced Kemp's ridley nesting abundance and associated hatchling production after 2010 requires further evaluation. It is clear that the DWH oil spill event resulted in large losses to the Kemp's ridley population across various age classes, and likely had an important population-level effect on the species. Still, we do not have a clear understanding of those impacts on the population trajectory for the species into the future.

3.2.6 Green Sea Turtles

Information Relevant to All DPSs

The green sea turtle was originally 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. On April 6, 2016, the original listing was replaced with the listing of 11 distinct population segments (DPSs) (81 FR 20057). The Mediterranean, Central West Pacific, and Central South Pacific DPSs were listed as endangered. The North Atlantic, South Atlantic, Southwest Indian, North Indian, East Indian-West Pacific, Southwest Pacific, Central North Pacific, and East Pacific were listed as threatened. For the purposes of this consultation, only the South Atlantic DPS (SA DPS) and North Atlantic DPS (NA DPS) will be considered, as they are the only two DPSs with individuals occurring in the Atlantic and Gulf of Mexico waters of the United States.

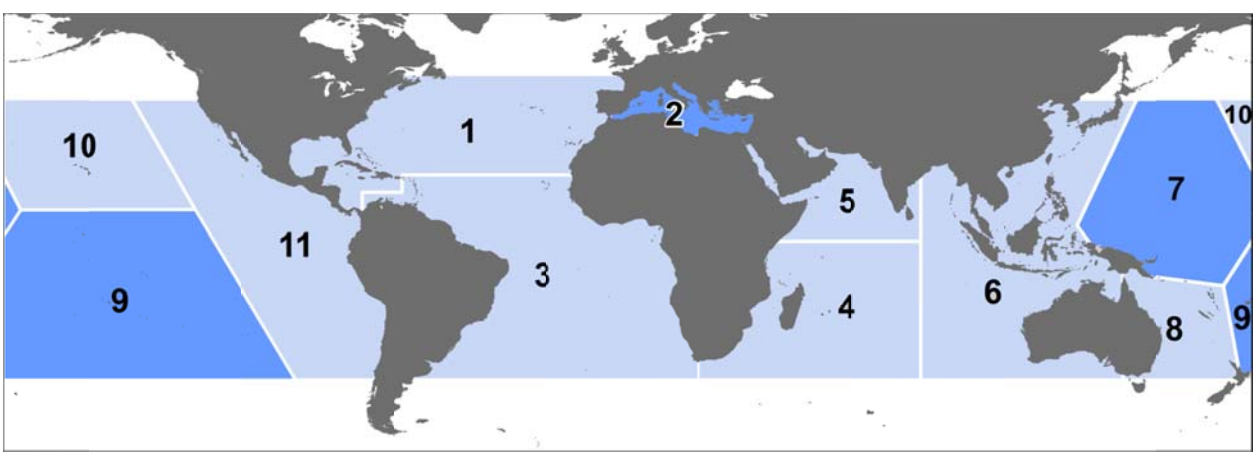

Figure 3.6. Threatened (light) and endangered (dark) green turtle DPSs: 1. North Atlantic, 2. Mediterranean, 3. South Atlantic, 4. Southwest Indian, 5. North Indian, 6. East Indian-West Pacific, 7. Central West Pacific, 8. Southwest Pacific, 9. Central South Pacific, 10. Central North Pacific, and 11. East Pacific.

Species Description and Distribution
The green sea turtle is the largest of the hardshell marine turtles, growing to a weight of 350 lb (159 kg) with a straight carapace length of greater than 3.3 ft (1 m). Green sea turtles have a smooth carapace with 4 pairs of lateral (or costal) scutes and a single pair of elongated prefrontal scales between the eyes. They typically have a black dorsal surface and a white ventral surface, although the carapace of green sea turtles in the Atlantic Ocean has been known to change in color from solid black to a variety of shades of grey, green, or brown and black in starburst or irregular patterns (Lagueux 2001).

With the exception of post-hatchlings, green sea turtles live in nearshore tropical and subtropical waters where they generally feed on marine algae and seagrasses. They have specific foraging grounds and may make large migrations between these forage sites and natal beaches for nesting (Hays et al. 2001). Green sea turtles nest on sandy beaches of mainland shores, barrier islands, coral islands, and volcanic islands in more than 80 countries worldwide (Hirth 1997). The 2 largest nesting populations are found at Tortuguero, on the Caribbean coast of Costa Rica (part of the NA DPS), and Raine Island, on the Pacific coast of Australia along the Great Barrier Reef.

Differences in mitochondrial DNA properties of green sea turtles from different nesting regions indicate there are genetic subpopulations (Bowen et al. 1992; FitzSimmons et al. 2006). Despite the genetic differences, sea turtles from separate nesting origins are commonly found mixed together on foraging grounds throughout the species' range. Within U.S. waters individuals from both the NA and SA DPSs can be found on foraging grounds. While there are currently no in-depth studies available to determine the percent of NA and SA DPS individuals in any given location, two small-scale studies provide an insight into the degree of mixing on the foraging grounds. An analysis of cold-stunned green turtles in St. Joseph Bay, Florida (northern Gulf of Mexico) found approximately 4% of individuals came from nesting stocks in the SA DPS (specifically Suriname, Aves Island, Brazil, Ascension Island, and Guinea Bissau) (Foley et al. 2007a). On the Atlantic coast of Florida, a study on the foraging grounds off Hutchinson Island found that approximately 5% of the turtles sampled came from the Aves Island/Suriname nesting assemblage, which is part of the SA DPS (Bass and Witzell 2000). All of the individuals in both studies were benthic juveniles. Available information on green turtle migratory behavior indicates that long distance dispersal is only seen for juvenile turtles. This suggests that larger adult-sized turtles return to forage within the region of their natal rookeries, thereby limiting the potential for gene flow across larger scales (Monzón-Argüello et al. 2010). While all of the mainland U.S. nesting individuals are part of the NA DPS, the U.S. Caribbean nesting assemblages are split between the NA and SA DPS. Nesters in Puerto Rico are part of the NA DPS, while those in the U.S. Virgin Islands are part of the SA DPS. We do not currently have information on what percent of individuals of the U.S. Caribbean foraging grounds come from which DPS.

<u>North Atlantic DPS Distribution</u>

The NA DPS boundary is illustrated in Figure 1. Four regions support nesting concentrations of particular interest in the NA DPS: Costa Rica (Tortuguero), Mexico

(Campeche, Yucatan, and Quintana Roo), U.S. (Florida), and Cuba. By far the most important nesting concentration for green turtles in this DPS is Tortuguero, Costa Rica. Nesting also occurs in The Bahamas, Belize, Cayman Islands, Dominican Republic, Haiti, Honduras, Jamaica, Nicaragua, Panama, Puerto Rico, Turks and Caicos Islands, and North Carolina, South Carolina, Georgia, and Texas, U.S.A. In the eastern North Atlantic, nesting has been reported in Mauritania (Fretey 2001).

The complete nesting range of NA DPS green sea turtles within the southeastern United States includes sandy beaches between Texas and North Carolina, as well as Puerto Rico (Dow et al. 2007; NMFS and USFWS 1991). The vast majority of green sea turtle nesting within the southeastern United States occurs in Florida (Johnson and Ehrhart 1994; Meylan et al. 1995). Principal U.S. nesting areas for green sea turtles are in eastern Florida, predominantly Brevard south through Broward counties.

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

South Atlantic DPS Distribution

The SA DPS boundary is shown in Figure 3.6, and includes the U.S. Virgin Islands in the Caribbean. The SA DPS nesting sites can be roughly divided into four regions: western Africa, Ascension Island, Brazil, and the South Atlantic Caribbean (including Colombia, the Guianas, and Aves Island in addition to the numerous small, island nesting sites).

The in-water range of the SA DPS is widespread. In the eastern South Atlantic, significant sea turtle habitats have been identified, including green turtle feeding grounds in Corisco Bay, Equatorial Guinea/Gabon (Formia 1999); Congo; Mussulo Bay, Angola (Carr and Carr 1991); as well as Principe Island. Juvenile and adult green turtles utilize foraging areas throughout the Caribbean areas of the South Atlantic, often resulting in interactions with fisheries occurring in those same waters (Dow et al. 2007). Juvenile green turtles from multiple rookeries also frequently utilize the nearshore waters off Brazil as foraging grounds as evidenced from the frequent captures by fisheries (Lima et al. 2010; López-Barrera et al. 2012; Marcovaldi et al. 2009). Genetic analysis of green turtles on the foraging grounds off Ubatuba and Almofala, Brazil show mixed stocks coming primarily from Ascension, Suriname and Trindade as a secondary source, but also Aves, and even sometimes Costa Rica (North Atlantic DPS)(Naro-Maciel et al. 2007; Naro-Maciel et al. 2012). While no nesting occurs as far south as Uruguay and Argentina, both have important foraging grounds for South Atlantic green turtles (Gonzalez Carman et al. 2011; Lezama 2009; López-Mendilaharsu et al. 2006; Prosdocimi et al. 2012; Rivas-Zinno 2012).

Life History Information
Green sea turtles reproduce sexually, and mating occurs in the waters off nesting beaches and along migratory routes. Mature females return to their natal beaches (i.e., the same beaches where they were born) to lay eggs (Balazs 1982; Frazer and Ehrhart 1985) every 2-4 years while males are known to reproduce every year (Balazs 1983). In the southeastern United States, females generally nest between June and September, and peak nesting occurs in June and July (Witherington and Ehrhart 1989b). During the nesting season, females nest at approximately 2-week intervals, laying an average of 3-4 clutches (Johnson and Ehrhart 1996). Clutch size often varies among subpopulations, but mean clutch size is approximately 110-115 eggs. In Florida, green sea turtle nests contain an average of 136 eggs (Witherington and Ehrhart 1989b). Eggs incubate for approximately 2 months before hatching. Hatchling green sea turtles are approximately 2 inches (5 cm) in length and weigh approximately 0.9 ounces (25 grams). Survivorship at any particular nesting site is greatly influenced by the level of man-made stressors, with the more pristine and less disturbed nesting sites (e.g., along the Great Barrier Reef in Australia) showing higher survivorship values than nesting sites known to be highly disturbed (e.g., Nicaragua) (Campell and Lagueux 2005; Chaloupka and Limpus 2005).

After emerging from the nest, hatchlings swim to offshore areas and go through a post-hatchling pelagic stage where they are believed to live for several years. During this life stage, green sea turtles feed close to the surface on a variety of marine algae and other life associated with drift lines and debris. This early oceanic phase remains one of the most poorly understood aspects of green sea turtle life history (NMFS and USFWS 2007a). Green sea turtles exhibit particularly slow growth rates of about 0.4-2 inches (1-5 cm) per year (Green 1993), which may be attributed to their largely herbivorous, low-net energy diet (Bjorndal 1982). At approximately 8-10 inches (20-25 cm) carapace length, juveniles leave the pelagic environment and enter nearshore developmental habitats such as protected lagoons and open coastal areas rich in sea grass and marine algae. Growth studies using skeletochronology indicate that green sea turtles in the western Atlantic shift from the oceanic phase to nearshore developmental habitats after approximately 5-6 years (Bresette et al. 2006; Zug and Glor 1998). Within the developmental habitats, juveniles begin the switch to a more herbivorous diet, and by adulthood feed almost exclusively on seagrasses and algae (Rebel 1974), although some populations are known to also feed heavily on invertebrates (Carballo et al. 2002). Green sea turtles mature slowly, requiring 20-50 years to reach sexual maturity (Chaloupka and Musick 1997; Hirth 1997).

While in coastal habitats, green sea turtles exhibit site fidelity to specific foraging and nesting grounds, and it is clear they are capable of “homing in” on these sites if displaced (McMichael et al. 2003). Reproductive migrations of Florida green sea turtles have been identified through flipper tagging and/or satellite telemetry. Based on these studies, the majority of adult female Florida green sea turtles are believed to reside in nearshore foraging areas throughout the Florida Keys and in the waters southwest of Cape Sable. Some post-nesting turtles also reside in Bahamian waters as well (NMFS and USFWS 2007a).

Status and Population Dynamics

Accurate population estimates for marine turtles do not exist because of the difficulty in sampling turtles over their geographic ranges and within their marine environments. Nonetheless, researchers have used nesting data to study trends in reproducing sea turtles over time. A summary of nesting trends and nester abundance is provided in the most recent status review for the species (Seminoff et al. 2015), with information for each of the DPSs.

<u>North Atlantic DPS</u>

The NA DPS is the largest of the 11 green turtle DPSs, with an estimated nester abundance of over 167,000 adult females from 73 nesting sites. Overall this DPS is also the most data rich. Eight of the sites have high levels of abundance (i.e., < 1000 nesters), located in Costa Rica, Cuba, Mexico, and Florida. All major nesting populations demonstrate long-term increases in abundance (Seminoff et al. 2015).

Tortuguero, Costa Rica is by far the predominant nesting site, accounting for an estimated 79% of nesting for the DPS (Seminoff et al. 2015). Nesting at Tortuguero appears to have been increasing since the 1970's, when monitoring began. For instance, from 1971-1975 there were approximately 41,250 average annual emergences documented and this number increased to an average of 72,200 emergences from 1992-1996 (Bjorndal et al. 1999). Troëng and Rankin (2005) collected nest counts from 1999-2003 and also reported increasing trends in the population consistent with the earlier studies, with nest count data suggesting 17,402-37,290 nesting females per year (NMFS and USFWS 2007a). Modeling by Chaloupka et al. (2008) using data sets of 25 years or more resulted in an estimate of the Tortuguero, Costa Rica population's growing at 4.9% annually.

In the continental United States, green sea turtle nesting occurs along the Atlantic coast, primarily along the central and southeast coast of Florida where an estimated 200-1,100 females nest each year (Meylan et al. 1994; Weishampel et al. 2003). Occasional nesting has also been documented along the Gulf Coast of Florida (Meylan et al. 1995). Green sea turtle nesting is documented annually on beaches of North Carolina, South Carolina, and Georgia, though nesting is found in low quantities (nesting databases maintained on www.seaturtle.org).

In Florida, index beaches were established to standardize data collection methods and effort on key nesting beaches. Since establishment of the index beaches in 1989, the pattern of green sea turtle nesting has generally shown biennial peaks in abundance with a positive trend during the 10 years of regular monitoring (Figure 3.7). According to data collected from Florida's index nesting beach survey from 1989-2015, green sea turtle nest counts across Florida have increased approximately ten-fold from a low of 267 in the early

1990s to a high of 27,975 in 2015. Two consecutive years of nesting declines in 2008 and 2009 caused some concern, but this was followed by increases in 2010 and 2011, and a return to the trend of biennial peaks in abundance thereafter (Figure 3.7). Modeling by Chaloupka et al. (2008) using data sets of 25 years or more has resulted in an estimate of the Florida nesting stock at the Archie Carr National Wildlife Refuge growing at an annual rate of 13.9%.

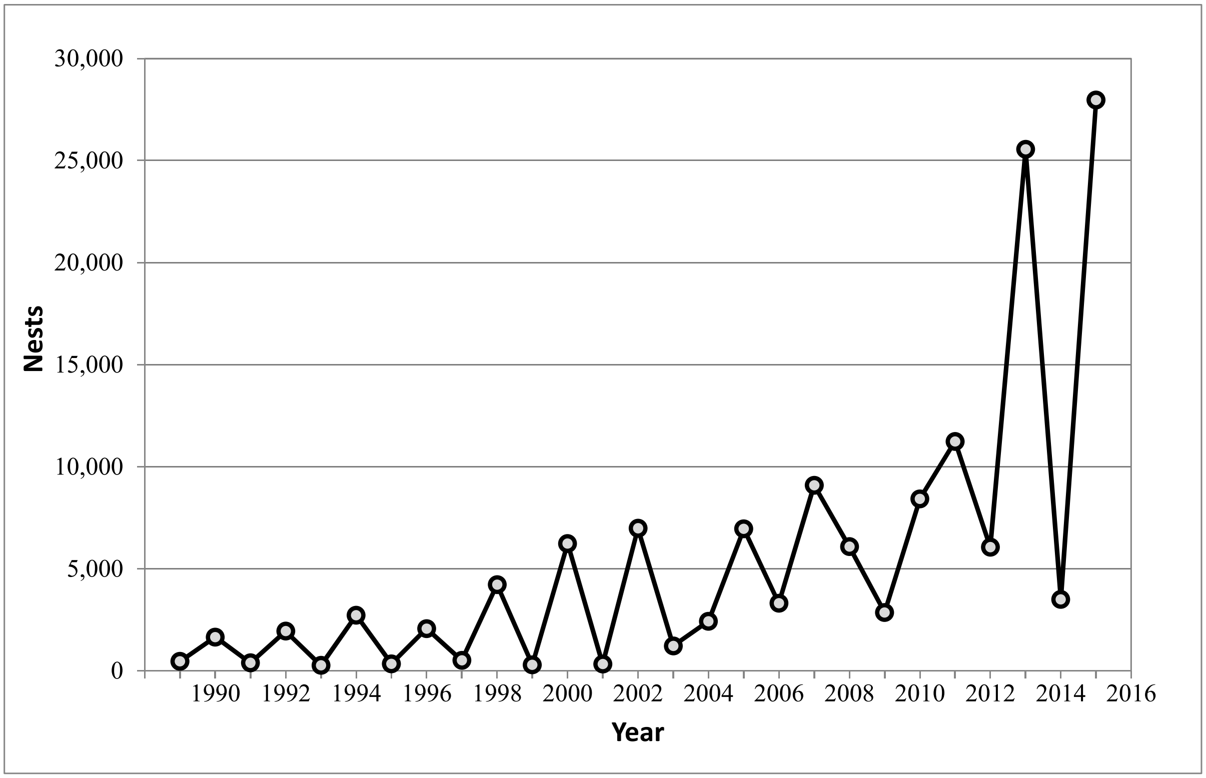

Figure 3.7. Green sea turtle nesting at Florida index beaches since 1989

Similar to the nesting trend found in Florida, in-water studies in Florida have also recorded increases in green turtle captures at the Indian River Lagoon site, with a 661% increase over 24 years (Ehrhart et al. 2007), and the St. Lucie Power Plant site, with a significant increase in the annual rate of capture of immature green turtles (SCL < 90 cm) from 1977 to 2002 or 26 years –
3,557 green turtles total (M. Bressette, Inwater Research Group, unpubl. data; (Witherington et al. 2006).

South Atlantic DPS

The SA DPS is large, estimated at over 63,000 nesters, but data availability is poor. More than half of the 51 identified nesting sites (37) did not have sufficient data to estimate number of nesters or trends (Seminoff et al. 2015). This includes some sites, such as beaches in French Guiana, which are suspected to have large numbers of nesters. Therefore, while the estimated number of nesters may be substantially underestimated, we also do not know the population trends at those data-poor beaches. However, while the lack of data was a concern due to increased uncertainty, the overall trend of the SA DPS was not considered to be a major concern as some of the largest nesting beaches such as Ascension Island, Aves Island (Venezuela), and Galibi (Suriname) appear to be increasing. Others such as Trindade (Brazil), Atol das Rocas (Brazil), and Poilão and the rest of Guinea-Bissau seem to be stable or do not have sufficient data to make a determination. Bioko (Equatorial Guinea) appears to be in decline but has less nesting than the other primary sites (Seminoff et al. 2015).

In the U.S., nesting of SA DPS green turtles occurs on the beaches of the U.S. Virgin Islands, primarily on Buck Island. There is insufficient data to determine a trend for Buck Island nesting, and it is a smaller rookery, with approximately 63 total nesters utilizing the beach (Seminoff et al. 2015).

Threats

The principal cause of past declines and extirpations of green sea turtle assemblages has been the overexploitation of the species for food and other products. Although intentional take of green sea turtles and their eggs is not extensive within the southeastern United States, green sea turtles that nest and forage in the region may spend large portions of their life history outside the region and outside U.S. jurisdiction, where exploitation is still a threat. Green sea turtles also face many of the same threats as other sea turtle species, including destruction of nesting habitat from storm events, oceanic events such as cold-stunning, pollution (e.g., plastics, petroleum products, petrochemicals), ecosystem alterations (e.g., nesting beach development, beach nourishment and shoreline stabilization, vegetation changes), poaching, global climate change, fisheries interactions, natural predation, and disease. A discussion on general sea turtle threats can be found in Section 3.2.2.

In addition to general threats, green sea turtles are susceptible to natural mortality from Fibropapillomatosis (FP) disease. FP results in the growth of tumors on soft external tissues (flippers, neck, tail, etc.), the carapace, the eyes, the mouth, and internal organs (gastrointestinal tract, heart, lungs, etc.) of turtles (Aguirre et al. 2002; Herbst 1994; Jacobson et al. 1989). These tumors range in size from 0.04 inches (0.1 cm) to greater than 11.81 inches (30 cm) in diameter and may affect swimming, vision, feeding, and organ function (Aguirre et al. 2002; Herbst 1994; Jacobson et al. 1989). Presently, scientists are unsure of the exact mechanism causing this disease, though it is believed to be related to both an infectious agent, such as a virus (Herbst et al. 1995), and environmental conditions (e.g., habitat degradation, pollution, low wave energy, and shallow water (Foley et al. 2005). FP is cosmopolitan, but it has been found to affect large numbers of animals in specific areas, including Hawaii and Florida (Herbst 1994; Jacobson 1990; Jacobson et al. 1991).

Cold-stunning is another natural threat to green sea turtles. Although it is not considered a major source of mortality in most cases, as temperatures fall below 46.4°-50°F (8°-10°C) turtles may lose their ability to swim and dive, often floating to the surface. The rate of cooling that precipitates cold-stunning appears to be the primary threat, rather than the water temperature itself (Milton and Lutz 2003). Sea turtles that overwinter in inshore waters are most susceptible to cold-stunning because temperature changes are most rapid in shallow water (Witherington and Ehrhart 1989a). During January 2010, an unusually large cold-stunning event in the southeastern United States resulted in around 4,600 sea turtles, mostly greens, found cold-stunned, and hundreds found dead or dying. A large cold-stunning event occurred in the western Gulf of Mexico in February 2011, resulting in approximately 1,650 green sea turtles found cold-stunned in Texas. Of these, approximately 620 were found dead or died after stranding, while approximately 1,030 turtles were rehabilitated and released. During this same time frame, approximately 340 green sea turtles were found cold-stunned in Mexico, though approximately 300 of those were subsequently rehabilitated and released.

Whereas oil spill impacts are discussed generally for all species in Section 3.2.2, specific impacts of the DWH spill on green sea turtles are considered here. Impacts to green sea turtles occurred to offshore small juveniles only. A total of 154,000 small juvenile greens (36.6% of the total small juvenile sea turtle exposures to oil from the spill) were estimated to have been exposed to oil. A large number of small juveniles were removed from the population, as 57,300 small juveniles greens are estimated to have died as a result of the exposure. A total of 4 nests (580 eggs) were also translocated during response efforts, with 455 hatchlings released (the fate of which is unknown) (DWH Trustees 2015). Additional unquantified effects may have included inhalation of volatile compounds, disruption of foraging or migratory movements due to surface or subsurface oil, ingestion of prey species contaminated with oil and/or dispersants, and loss of foraging resources which could lead to compromised growth and/or reproductive potential. There is no information currently available to determine the extent of those impacts, if they occurred.

While green turtles regularly use the northern Gulf of Mexico, they have a widespread distribution throughout the entire Gulf of Mexico, Caribbean, and Atlantic, and the proportion of the population using the northern Gulf of Mexico at any given time is relatively low. Although it is known that adverse impacts occurred and numbers of animals in the Gulf of Mexico were reduced as a result of the Deepwater Horizon oil spill of 2010 (DWH), the relative proportion of the population that is expected to have been exposed to and directly impacted by the DWH event, as well as the impacts being primarily to smaller juveniles (lower reproductive value than adults and large juveniles), reduces the impact to the overall population. It is unclear what impact these losses may have caused on a population level, but it is not expected to have had a large impact on the population trajectory moving forward. However, recovery of green turtle numbers equivalent to what was lost in the northern Gulf of Mexico as a result of the spill will likely take decades of sustained efforts to reduce the existing threats and enhance survivorship of multiple life stages (DWH Trustees 2015).

3.2.7 Hawksbill Sea Turtle

The hawksbill 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, a precursor to the ESA. Critical habitat was designated on June 2, 1998, in coastal waters surrounding Mona and Monito Islands in Puerto Rico (63 FR 46693).

Species Description and Distribution

Hawksbill sea turtles are small- to medium-sized (99-150 lb on average [45-68 kg]) although females nesting in the Caribbean are known to weigh up to 176 lb (80 kg) (Pritchard et al. 1983). The carapace is usually serrated and has a "tortoise-shell" coloring, ranging from dark to golden brown, with streaks of orange, red, and/or black. The plastron of a hawksbill turtle is typically yellow. The head is elongated and tapers to a point, with a beak-like mouth that gives the species its name. The shape of the mouth allows the hawksbill turtle to reach into holes and crevices of coral reefs to find sponges, their primary adult food source, and other invertebrates. The shells of hatchlings are 1.7 in (42 mm) long, are mostly brown, and are somewhat heart-shaped (Eckert 1995; Hillis and Mackay 1989; van Dam and Sarti 1989).

Hawksbill sea turtles have a circumtropical distribution and usually occur between latitudes 30°N and 30°S in the Atlantic, Pacific, and Indian Oceans. In the western Atlantic, hawksbills are widely distributed throughout the Caribbean Sea, off the coasts of Florida and Texas in the continental United States, in the Greater and Lesser Antilles, and along the mainland of Central America south to Brazil (Amos 1989; Groombridge and Luxmoore 1989; Lund 1985; Meylan and Donnelly 1999; NMFS and USFWS 1998a; Plotkin and Amos 1990; Plotkin and Amos 1988). They are highly migratory and use a wide range of habitats during their lifetimes (Musick and Limpus 1997; Plotkin 2003). Adult hawksbill sea turtles are capable of migrating long distances between nesting beaches and foraging areas. For instance, a female hawksbill sea turtle tagged at Buck Island Reef National Monument (BIRNM) in St. Croix was later identified 1,160 miles (1,866 km) away in the Miskito Cays in Nicaragua (Spotila 2004).

Hawksbill sea turtles nest on sandy beaches throughout the tropics and subtropics. Nesting occurs in at least 70 countries, although much of it now only occurs at low densities compared to that of other sea turtle species (NMFS and USFWS 2007b). Meylan and Donnelly (1999) believe that the widely dispersed nesting areas and low nest densities is likely a result of overexploitation of previously large colonies that have since been depleted over time. The most significant nesting within the United States occurs in Puerto Rico and the U.S. Virgin Islands, specifically on Mona Island and BIRNM, respectively. Although nesting within the continental United States is typically rare, it can occur along the southeast coast of Florida and the Florida Keys. The largest hawksbill nesting population in the western Atlantic occurs in the Yucatán Peninsula of Mexico, where several thousand nests are recorded annually in the states of Campeche, Yucatán, and Quintana Roo (Garduño-Andrade et al. 1999; Spotila 2004). In the U.S. Pacific, hawksbills nest on main island beaches in Hawaii, primarily along the east coast of the island. Hawksbill nesting has also been documented in American Samoa and Guam. More information on nesting in other ocean basins may be found in the 5-year status review for the species (NMFS and USFWS 2007b).

Mitochondrial DNA studies show that reproductive populations are effectively isolated over ecological time scales (Bass et al. 1996). Substantial efforts have been made to determine the nesting population origins of hawksbill sea turtles assembled in foraging grounds, and genetic research has shown that hawksbills of multiple nesting origins commonly mix in foraging areas (Bowen and Witzell 1996). Since hawksbill sea turtles nest primarily on the beaches where they were born, if a nesting population is decimated, it might not be replenished by sea turtles from other nesting rookeries (Bass et al. 1996).

Life History Information

Hawksbill sea turtles exhibit slow growth rates although they are known to vary within and among populations from a low of 0.4-1.2 in (1-3 cm) per year, measured in the Indo-Pacific (Chaloupka and Limpus 1997; Mortimer et al. 2003; Mortimer et al. 2002; Whiting 2000), to a high of 2 in (5 cm) or more per year, measured at some sites in the Caribbean (Diez and Van Dam 2002; León and Diez 1999). Differences in growth rates are likely due to differences in diet and/or density of sea turtles at foraging sites and overall time spent foraging (Bjorndal and Bolten 2002; Chaloupka et al. 2004). Consistent with slow growth, age to maturity for the species is also long, taking between 20 and 40 years, depending on the region (Chaloupka and Musick 1997; Limpus and Miller 2000). Hawksbills in the western Atlantic are known to mature faster (i.e., 20 or more years) than sea turtles found in the Indo-Pacific (i.e., 30-40 years) (Boulan 1983; Boulon Jr. 1994; Diez and Van Dam 2002; Limpus and Miller 2000). Males are typically mature when their length reaches 27 in (69 cm), while females are typically mature at 30 in (75 cm) (Eckert et al. 1992; Limpus 1992).

Female hawksbills return to the beaches where they were born (natal beaches) every 2-3 years to nest (Van Dam et al. 1991; Witzell 1983) and generally lay 3-5 nests per season (Richardson et al. 1999). Compared with other sea turtles, the number of eggs per nest (clutch) for hawksbills can be quite high. The largest clutches recorded for any sea turtle belong to hawksbills (approximately 250 eggs per nest) ((Hirth and Latif 1980), though nests in the U.S. Caribbean and Florida more typically contain approximately 140 eggs (USFWS hawksbill fact sheet, http://www.fws.gov/northflorida/SeaTurtles/Turtle%20Factsheets/hawksbill-sea-turtle.htm). Eggs incubate for approximately 60 days before hatching (USFWS hawksbill fact sheet). Hatchling hawksbill sea turtles typically measure 1-2 in (2.5-5 cm) in length and weigh approximately 0.5 oz (15 g).

Hawksbills may undertake developmental migrations (migrations as immatures) and reproductive migrations that involve travel over many tens to thousands of miles (Meylan 1999a). Post-hatchlings (oceanic stage juveniles) are believed to live in the open ocean, taking shelter in floating algal mats and drift lines of flotsam and jetsam in the Atlantic and Pacific oceans (Musick and Limpus 1997) before returning to more coastal foraging grounds. In the Caribbean, hawksbills are known to almost exclusively feed on sponges (Meylan 1988; Van Dam and Diez 1997), although at times they have been seen foraging on other food items, notably corallimorphs and zooanthids (León and Diez 2000; Mayor et al. 1998; Van Dam and Diez 1997).

Reproductive females undertake periodic (usually non-annual) migrations to their natal beaches to nest and exhibit a high degree of fidelity to their nest sites. Movements of reproductive males are less certain, but are presumed to involve migrations to nesting beaches or to courtship stations along the migratory corridor. Hawksbills show a high fidelity to their foraging areas as well (Van Dam and Diez 1998). Foraging sites are typically areas associated with coral reefs, although hawksbills are also found around rocky outcrops and high energy shoals which are optimum sites for sponge growth. They can also inhabit seagrass pastures in mangrove-fringed bays and estuaries, particularly along the eastern shore of continents where coral reefs are absent (Bjorndal 1997; Van Dam and Diez 1998).

Status and Population Dynamics

There are currently no reliable estimates of population abundance and trends for non-nesting hawksbills at the time of this consultation; therefore, nesting beach data is currently the primary information source for evaluating trends in global abundance. Most hawksbill populations around the globe are either declining, depleted, and/or remnants of larger aggregations (NMFS and USFWS 2007b). The largest nesting population of hawksbills occurs in Australia where approximately 2,000 hawksbills nest off the northwest coast and about 6,000-8,000 nest off the Great Barrier Reef each year (Spotila 2004). Additionally, about 2,000 hawksbills nest each year in Indonesia and 1,000 nest in the Republic of Seychelles (Spotila 2004). In the United States, hawksbills typically laid about 500-1,000 nests on Mona Island, Puerto Rico in the past (Diez and Van Dam 2007), but the numbers appear to be increasing, as the Puerto Rico Department of Natural and Environmental Resources counted nearly 1,600 nests in 2010 (PRDNER nesting data). Another 56-150 nests are typically laid on Buck Island off St. Croix (Meylan 1999b; Mortimer and Donnelly 2008). Nesting also occurs to a lesser extent on beaches on Culebra Island and Vieques Island in Puerto Rico, the mainland of Puerto Rico, and additional beaches on St. Croix, St. John, and St. Thomas, U.S. Virgin Islands.

Mortimer and Donnelly (2008) reviewed nesting data for 83 nesting concentrations organized among 10 different ocean regions (i.e., Insular Caribbean, Western Caribbean Mainland, Southwestern Atlantic Ocean, Eastern Atlantic Ocean, Southwestern Indian Ocean, Northwestern Indian Ocean, Central Indian Ocean, Eastern Indian Ocean, Western Pacific Ocean, Central Pacific Ocean, and Eastern Pacific Ocean). They determined historic trends (i.e., 20-100 years ago) for 58 of the 83 sites, and also determined recent abundance trends (i.e., within the past 20 years) for 42 of the 83 sites. Among the 58 sites where historic trends could be determined, all showed a declining trend during the long-term period. Among the 42 sites where recent (past 20 years) trend data were available, 10 appeared to be increasing, 3 appeared to be stable, and 29 appeared to be decreasing. With respect to regional trends, nesting populations in the Atlantic (especially in the Insular Caribbean and Western Caribbean Mainland) are generally doing better than those in the Indo-Pacific regions. For instance, 9 of the 10 sites that showed recent increases are located in the Caribbean. Buck Island and St. Croix's East End beaches support 2 remnant populations of between 17-30 nesting females per season (Hillis and Mackay 1989; Mackay 2006). While the proportion of hawksbills nesting on Buck Island represents a small proportion of the total hawksbill nesting occurring in the greater Caribbean region, Mortimer and Donnelly (2008) report an increasing trend in nesting at that site based on data collected from 2001-2006. .

Nesting concentrations in the Pacific Ocean appear to be performing the worst of all regions despite the fact that the region currently supports more nesting hawksbills than either the Atlantic or Indian Oceans (Mortimer and Donnelly 2008). While still critically low in numbers, sightings of hawksbills in the eastern Pacific appear to have been increasing since 2007, though some of that increase may be attributable to better observations (Gaos et al. 2010). More information about site-specific trends can be found in the most recent 5-year status review for the species (NMFS and USFWS 2007b).

Threats

Hawksbills are currently subjected to the same suite of threats on both nesting beaches and in the marine environment that affect other sea turtles (e.g., interaction with federal and state fisheries, coastal construction, oil spills, climate change affecting sex ratios) as discussed in Section 3.2.2. There are also specific threats that are of special emphasis, or are unique, for hawksbill sea turtles discussed in further detail below.

While oil spill impacts are discussed generally for all species in Section 3.2.2, specific impacts of the DWH spill on hawksbill turtles have been estimated. Hawksbills made up 2.2% (8,850) of small juvenile sea turtle (of those that could be identified to species) exposures to oil in offshore areas, with an estimate of 615 to 3,090 individuals dying as a result of the direct exposure (DWH Trustees 2015). No quantification of large benthic juveniles or adults was made. Additional unquantified effects may have included inhalation of volatile compounds, disruption of foraging or migratory movements due to surface or subsurface oil, ingestion of prey species contaminated with oil and/or dispersants, and loss of foraging resources which could lead to compromised growth and/or reproductive potential. There is no information currently available to determine the extent of those impacts, if they occurred. Although adverse impacts occurred to hawksbills, the relative proportion of the population that is expected to have been exposed to and directly impacted by the DWH event is relatively low, and thus a population-level impact is not believed to have occurred due to the widespread distribution and nesting location outside of the Gulf of Mexico for this species.

The historical decline of the species is primarily attributed to centuries of exploitation for the beautifully patterned shell, which made it a highly attractive species to target (Parsons 1972). The fact that reproductive females exhibit a high fidelity for nest sites and the tendency of hawksbills to nest at regular intervals within a season made them an easy target for capture on nesting beaches. The shells from hundreds of thousands of sea turtles in the western Caribbean region were imported into the United Kingdom and France during the nineteenth and early twentieth centuries (Parsons 1972). Additionally, hundreds of thousands of sea turtles contributed to the region's trade with Japan prior to 1993 when a zero quota was imposed (Milliken and Tokunaga 1987), as cited in Brautigam and Eckert (2006).

The continuing demand for the hawksbills' shells as well as other products derived from the species (e.g., leather, oil, perfume, and cosmetics) represents an ongoing threat to its recovery. The British Virgin Islands, Cayman Islands, Cuba, Haiti, and the Turks and Caicos Islands (United Kingdom) all permit some form of legal take of hawksbill sea turtles. In the northern Caribbean, hawksbills continue to be harvested for their shells, which are often carved into hair clips, combs, jewelry, and other trinkets (Márquez M. 1990; Stapleton and Stapleton 2006). Additionally, hawksbills are harvested for their eggs and meat, while whole, stuffed sea turtles are sold as curios in the tourist trade. Hawksbill sea turtle products are openly available in the Dominican Republic and Jamaica, despite a prohibition on harvesting hawksbills and their eggs (Fleming 2001). Up to 500 hawksbills per year from 2 harvest sites within Cuba were legally captured each year until 2008 when the Cuban government placed a voluntary moratorium on the sea-turtle fishery (Carillo et al. 1999; Mortimer and Donnelly 2008). While current nesting trends are unknown, the number of nesting females is suspected to be declining in some areas (Carillo et al. 1999; Moncada et al. 1999). International trade in the shell of this species is prohibited between countries that have signed the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES), but illegal trade still occurs and remains an ongoing threat to hawksbill survival and recovery throughout its range.

Due to their preference to feed on sponges associated with coral reefs, hawksbill sea turtles are particularly sensitive to losses of coral reef communities. Coral reefs are vulnerable to destruction and degradation caused by human activities (e.g., nutrient pollution, sedimentation, contaminant spills, vessel groundings and anchoring, recreational uses) and are also highly sensitive to the effects of climate change (e.g., higher incidences of disease and coral bleaching) (Crabbe 2008; Wilkinson 2004). Because continued loss of coral reef communities (especially in the greater Caribbean region) is expected to impact hawksbill foraging, it represents a major threat to the recovery of the species.

3.2.8 Smalltooth Sawfish

The U.S. DPS of smalltooth sawfish was listed as endangered under the ESA effective May 1, 2003 (68 FR 15674; April 1, 2003).

Species Description and Distribution

The smalltooth sawfish is a tropical marine and estuarine elasmobranch. It has an extended snout with a long, narrow, flattened, rostral blade (rostrum) with a series of transverse teeth along either edge. In general, smalltooth sawfish inhabit shallow coastal waters of warm seas throughout the world and feed on a variety of small fish (e.g., mullet, jacks, and ladyfish) (Simpfendorfer 2001), and crustaceans (e.g., shrimp and crabs) (Bigelow and Schroeder 1953; Norman and Fraser 1937).

Although this species is reported to have a circumtropical distribution, NMFS identified smalltooth sawfish from the Southeast United States as a distinct population segment (DPS), due to the physical isolation of this population from others, the differences in international management of the species, and the significance of the U.S. population in relation to the global range of the species (see 68 FR15674). Within the United States, smalltooth sawfish have been captured in estuarine and coastal waters from New York southward through Texas, although peninsular Florida has historically been the region of the United States with the largest number of recorded captures (NMFS 2000). Recent records indicate there is a resident reproducing population of smalltooth sawfish in south and southwest Florida from Charlotte Harbor through the Dry Tortugas, which is also the last U.S. stronghold for the species (Poulakis and Seitz 2004a; Seitz and Poulakis 2002; Simpfendorfer and Wiley 2005a). Water temperatures (no lower than 16-18°C) and the availability of appropriate coastal habitat (shallow, euryhaline waters and red mangroves) are the major environmental constraints limiting the northern movements of smalltooth sawfish in the western North Atlantic. Most specimens captured along the Atlantic coast north of Florida are large adults (over 10 ft) that likely represent seasonal migrants, wanderers, or colonizers from a historic Florida core population(s) to the south, rather than being members of a continuous, even-density population (Bigelow and Schroeder 1953).

Life History Information
Smalltooth sawfish fertilization is internal and females give birth to live young. The brood size, gestation period, and frequency of reproduction are unknown for smalltooth sawfish. Therefore, data from the closely related (in terms of size and body morphology) largetooth sawfish represent our best estimates of these parameters. The largetooth sawfish likely reproduces every other year, has a gestation period of approximately 5 months, and produces a mean of 7.3 offspring per brood, with a range of 1-13 offspring (Thorson 1976). Smalltooth sawfish are approximately 31 in (80 cm) at birth and may grow to a length of 18 ft (548 cm) or greater during their lifetime (Bigelow and Schroeder 1953; Simpfendorfer 2002). Simpfendorfer et al. (2008) report rapid juvenile growth for smalltooth sawfish for the first 2 years after birth, with stretched total length increasing by an average of 25-33 in (65-85 cm) in the first year and an average of 19-27 in (48-68 cm) in the second year. By contrast, very little information exists on size classes other than juveniles, which make up the majority of sawfish encounters; therefore, much uncertainty remains in estimating life history parameters for smalltooth sawfish, especially as it relates to age at maturity and post-juvenile growth rates. Based on age and growth studies of the largetooth sawfish (Thorson 1982) and research by Simpfendorfer (2000), the smalltooth sawfish is likely a slow-growing (with the exception of early juveniles), late-maturing (10-20 years) species with a long lifespan (30-60 years). Juvenile growth rates presented by Simpfendorfer et al. (2008) suggest smalltooth sawfish are growing faster than previously thought and therefore may reach sexual maturity at an earlier age.

There are distinct differences in habitat use based on life history stage. Juvenile smalltooth sawfish, those up to 3 years of age or approximately 8 ft in length (Simpfendorfer et al. 2008), inhabit the shallow waters of estuaries and can be found in sheltered bays, dredged canals, along banks and sandbars, and in rivers (NMFS 2000). Juvenile smalltooth sawfish occur in euryhaline waters (i.e., waters with a wide range of salinities) and are often closely associated with muddy or sandy substrates, and shorelines containing red mangroves, *Rhizophora mangle* (Simpfendorfer 2001; Simpfendorfer 2003). Tracking data from the Caloosahatchee River in Florida indicate very shallow depths and salinity are important abiotic factors influencing juvenile smalltooth sawfish movement patterns, habitat use, and distribution (Simpfendorfer et al. 2011). Another recent acoustic tagging study in a developed region of Charlotte Harbor, Florida, identified the importance of mangroves in close proximity to shallow water habitat for juvenile smalltooth sawfish, stating that juveniles generally occur in shallow water within 328 ft (100 m) of mangrove shorelines, generally red mangroves (Simpfendorfer et al. 2010). Juvenile smalltooth sawfish spend the majority of their time in waters less than 13 ft (4 m) in depth (Simpfendorfer et al.

2010) and are seldom found in depths greater than 32 ft (10 m) (Poulakis and Seitz 2004a). Simpfendorfer et al. (2010) also indicated developmental differences in habitat use: the smallest juveniles (young-of-the-year juveniles measuring < 100 cm in length) generally used water depths less than 0.5 m (1.64 ft), had small home ranges (4,264-4,557 m^2), and exhibited high levels of site fidelity. Although small juveniles exhibit high levels of site fidelity for specific nursery habitats for periods of time lasting up to 3 months (Wiley and Simpfendorfer 2007), they do undergo small movements coinciding with changing tidal stages. These movements often involve moving from shallow sandbars at low tide to within red mangrove prop roots at higher tides (Simpfendorfer et al. 2010), behavior likely to reduce the risk of predation (Simpfendorfer 2006). As juveniles increase in size, they begin to expand their home ranges (Simpfendorfer et al. 2010; Simpfendorfer et al. 2011), eventually moving to more offshore habitats where they likely feed on larger prey and eventually reach sexual maturity.

Researchers have identified several areas within the Charlotte Harbor Estuary that are disproportionately more important to juvenile smalltooth sawfish, based on intra- or inter-annual (within or between year) capture rates during random sampling events within the estuary (Poulakis 2012; Poulakis et al. 2011). These areas were termed “hotspots” and also correspond with areas where public encounters are most frequently reported. Use of these “hotspots” can vary within and among years based on the amount and timing of freshwater inflow. Smalltooth sawfish use hotspots further upriver during high salinity conditions (drought) and areas closer to the mouth of the Caloosahatchee River during times of high freshwater inflow (Poulakis et al. 2011). At this time, researchers are unsure what specific biotic or abiotic factors influence this habitat use, but they believe a variety of conditions in addition to salinity, such as temperature, dissolved oxygen, water depth, shoreline vegetation, and food availability, may influence habitat selection (Poulakis et al. 2011).

While adult smalltooth sawfish may also use the estuarine habitats used by juveniles, they are commonly observed in deeper waters along the coasts. Poulakis and Seitz (2004a) noted that nearly half of the encounters with adult-sized smalltooth sawfish in Florida Bay and the Florida Keys occurred in depths from 200-400 ft (70-122 m) of water. Similarly, Simpfendorfer and Wiley (2005a) reported encounters in deeper waters off the Florida Keys, and observations from both commercial longline fishing vessels and fishery-independent sampling in the Florida Straits report large smalltooth sawfish in depths up to 130 ft (~ 40 m) (ISED 2014). Even so, NMFS believes adult smalltooth sawfish use shallow estuarine habitats during parturition (when adult females return to shallow estuaries to pup) because very young juveniles still containing rostral sheaths are captured in these areas. Since very young juveniles have high site fidelities, we hypothesize that they are birthed nearby or in their nursery habitats.

Status and Population Dynamics

Few long-term abundance data exist for the smalltooth sawfish, making it very difficult to estimate the current population size. Simpfendorfer (2001) estimated that the U.S. population may number less than 5% of historic levels, based on anecdotal data and the fact that the species’ range has contracted by nearly 90%, with south and southwest Florida the only areas known to support a reproducing population. Since actual abundance data are limited, researchers have begun to compile capture and sightings data (collectively referred to as encounter data) in the International Sawfish Encounter Database (ISED) that was developed in 2000. Although this data cannot be used to assess the population because of the opportunistic nature in which they are collected (i.e., encounter data are a series of random occurrences rather than an evenly distributed search over a defined period of time), researchers can use this database to assess the spatial and temporal distribution of smalltooth sawfish. We expect that as the population grows, the geographic range of encounters will also increase. Since the conception of the ISED, over 3,000 smalltooth sawfish encounters have been reported and compiled in the encounter database (ISED 2014).

Despite the lack of scientific data on abundance, recent encounters with young-of-the-year, older juveniles, and sexually mature smalltooth sawfish indicate that the U.S. population is currently reproducing (Seitz and Poulakis 2002; Simpfendorfer 2003). The abundance of juveniles encountered, including very small individuals, suggests that the population remains viable (Simpfendorfer and Wiley 2004b), and data analyzed from Everglades National Park as part of an established fisheries-dependent monitoring program (angler interviews) indicate a slightly increasing trend in abundance within the park over the past decade (Carlson and Osborne 2012; Carlson et al. 2007). Using a demographic approach and life history data for smalltooth sawfish and similar species from the literature, Simpfendorfer (2000) estimated intrinsic rates of natural population increase for the species at 0.08-0.13 per year and population doubling times from 5.4-8.5 years. These low intrinsic rates[15] of population increase, suggest that the species is particularly vulnerable to excessive mortality and rapid population declines, after which recovery may take decades.

Threats

Past literature indicates smalltooth sawfish were once abundant along both coasts of Florida and quite common along the shores of Texas and the northern Gulf coast (NMFS 2010c) and citations therein). Based on recent comparisons with these historical reports, the U.S. DPS of smalltooth sawfish has declined over the past century (Simpfendorfer 2001; Simpfendorfer 2002). The decline in smalltooth sawfish abundance has been attributed to several factors including bycatch mortality in fisheries, habitat loss, and life history limitations of the species (NMFS 2010c).

<u>Bycatch Mortality</u>

Bycatch mortality is cited as the primary cause for the decline in smalltooth sawfish in the United States (NMFS 2010c). While there has never been a large-scale directed fishery, smalltooth sawfish easily become entangled in fishing gears (gill nets, otter trawls, trammel nets, and seines) directed at other commercial species, often resulting in serious injury or death (NMFS 2009b). This has historically been reported in Florida (Snelson and Williams 1981), Louisiana (Simpfendorfer 2002), and Texas (Baughman 1943). For instance, 1 fisherman interviewed by Evermann and Bean (1897) reported taking an estimated 300 smalltooth sawfish in just a single netting season in the Indian River Lagoon, Florida. In another example, smalltooth sawfish landings data gathered by Louisiana shrimp trawlers

[15] The rate at which a population increases in size if there are no density-dependent forces regulating the population

from 1945-1978, which contained both landings data and crude information on effort (number of vessels, vessel tonnage, number of gear units), indicated declines in smalltooth sawfish landings from a high of 34,900 lb in 1949 to less than 1,500 lb in most years after 1967. The Florida net ban passed in 1995 has led to a reduction in the number of smalltooth sawfish incidentally captured, "…by prohibiting the use of gill and other entangling nets in all Florida waters, and prohibiting the use of other nets larger than 500 square feet in mesh area in nearshore and inshore Florida waters"[16] (FLA. CONST. art. X, § 16). However, the threat of bycatch currently remains in commercial fisheries (e.g., South Atlantic shrimp fishery, Gulf of Mexico shrimp fishery, federal shark fisheries of the South Atlantic, and the Gulf of Mexico reef fish fishery), though anecdotal information collected by NMFS port agents suggest smalltooth sawfish captures are now rare.

In addition to incidental bycatch in commercial fisheries, smalltooth sawfish have historically been and continue to be captured by recreational fishers. Encounter data (ISED 2014) and past research (Caldwell 1990) document that rostrums are sometimes removed from smalltooth sawfish caught by recreational fishers, thereby reducing their chances of survival. While the current threat of mortality associated with recreational fisheries is expected to be low given that possession of the species in Florida has been prohibited since 1992, bycatch in recreational fisheries remains a potential threat to the species.

<u>Habitat Loss</u>

Modification and loss of smalltooth sawfish habitat, especially nursery habitat, is another contributing factor in the decline of the species. Activities such as agricultural and urban development, commercial activities, dredge-and-fill operations, boating, erosion, and diversions of freshwater runoff contribute to these losses (SAFMC 1998). Large areas of coastal habitat were modified or lost between the mid-1970s and mid-1980s within the United States (Dahl and Johnson 1991). Since then, rates of loss have decreased, but habitat loss continues. From 1998-2004, approximately 64,560 acres of coastal wetlands were lost along the Atlantic and Gulf coasts of the United States, of which approximately 2,450 acres were intertidal wetlands consisting of mangroves or other estuarine shrubs (Stedman and Dahl 2008). Further, Orlando et al. (1994) analyzed 18 major southeastern estuaries and recorded over 703 mi of navigation channels and 9,844 mi of shoreline with modifications. In Florida, coastal development often involves the removal of mangroves and the armoring of shorelines through seawall construction. Changes to the natural freshwater flows into estuarine and marine waters through construction of canals and other water control devices have had other impacts: altered the temperature, salinity, and nutrient regimes; reduced both wetlands and submerged aquatic vegetation; and degraded vast areas of coastal habitat utilized by smalltooth sawfish (Gilmore 1995; Reddering 1988; Whitfield and Bruton 1989). While these modifications of habitat are not the primary reason for the decline of smalltooth sawfish abundance, it is likely a contributing factor and almost certainly hampers the recovery of the species. Juvenile sawfish and their nursery habitats are particularly likely to be affected by these kinds of habitat losses or alternations, due to their affinity for shallow, estuarine systems. Although many forms of habitat modification

[16] "nearshore and inshore Florida waters" means all Florida waters inside a line 3 mi seaward of the coastline along the Gulf of Mexico and inside a line 1 mi seaward of the coastline along the Atlantic Ocean.

are currently regulated, some permitted direct and/or indirect damage to habitat from increased urbanization still occurs and is expected to continue to threaten survival and recovery of the species in the future.

Life History Limitations

The smalltooth sawfish is also limited by its life history characteristics as a slow-growing, relatively late-maturing, and long-lived species. Animals using this life history strategy are usually successful in maintaining small, persistent population sizes in constant environments, but are particularly vulnerable to increases in mortality or rapid environmental change (NMFS 2000). The combined characteristics of this life history strategy result in a very low intrinsic rate of population increase (Musick 1999) that make it slow to recover from any significant population decline (Simpfendorfer 2000). More recent data suggest smalltooth sawfish may mature earlier than previously thought, meaning rates of population increase could be higher and recovery times shorter than those currently reported (Simpfendorfer et al. 2008).

Current Threats

The 3 major factors that led to the current status of the U.S. DPS of smalltooth sawfish – bycatch mortality, habitat loss, and life history limitations – continue to be the greatest threats today. All the same, other threats such as the illegal commercial trade of smalltooth sawfish or their body parts, predation, and marine pollution and debris may also affect the population and recovery of smalltooth sawfish on smaller scales (NMFS 2010c). We anticipate that all of these threats will continue to affect the rate of recovery for the U.S. DPS of smalltooth sawfish.

In addition to the man-made effects mentioned previously, changes to the global climate are likely to be a threat to smalltooth sawfish and the habitats they use. The Intergovernmental Panel on Climate Change has stated that global climate change is unequivocal (IPCC 2007) and its impacts to coastal resources may be significant. Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events, changes in the amount and timing of precipitation, and changes in air and water temperatures (EPA 2012; NOAA 2012). The impacts to smalltooth sawfish cannot, for the most part, currently be predicted with any degree of certainty, but we can project some effects to the coastal habitats where they reside. We know that the coastal habitats that contain red mangroves and shallow, euryhaline waters will be directly impacted by climate change through sea level rise, which is expected to exceed 1 meter globally by 2100 according to Meehl et al. (2007), Pfeffer et al. (2008), and Vermeer and Rahmstorf (2009). Sea level rise will impact mangrove resources, as sediment surface elevations for mangroves will not keep pace with conservative projected rates of elevation in sea level (Gilman et al. 2008). Sea level increases will also affect the amount of shallow water available for juvenile smalltooth sawfish nursery habitat, especially in areas where there is shoreline armoring (e.g., seawalls). Further, the changes in precipitation coupled with sea level rise may also alter salinities of coastal habitats, reducing the amount of available smalltooth sawfish nursery habitat.

3.2.9 Nassau Grouper

NMFS listed the Nassau grouper as threatened under the ESA effective July 29, 2016 (81 FR 42268, June 29, 2016). This section provides a summary of key biological information as presented in the June 29, 2016, listing rule as well as the Biological Report (Hill and Sadovy de Mitcheson 2013).

Species Description and Life History
The Nassau grouper, *Epinephelus striatus* (Bloch 1792), is a moderate-sized serranid fish with large eyes and a robust body. Coloration is variable, but adult fish are generally buff, with five dark brown vertical bars, a large black saddle blotch on top of the base of the tail, and a row of black spots below and behind each eye. Color pattern can also change within minutes from almost white to bicolored to uniformly dark brown, according to the behavioral state of the fish (Carter et al. 1994; Colin 1992; Heemstra and Randall 1993; Longley 1917). A distinctive bicolor pattern is seen when two adults or an adult and large juvenile meet and is frequently observed at spawning aggregations (Heemstra). There is also a distinctive dark tuning-fork mark that begins at the front of the upper jaw, extends back between the eyes, and then divides into two branches on top of the head behind the eyes. Another dark band runs from the tip of the snout through the eye and then curves upward to meet its corresponding band from the opposite side just in front of the dorsal fin. Juveniles exhibit a color pattern similar to adults (Silva et al. 2002).

As with many serranids, the Nassau grouper is slow-growing and long-lived; estimates range up to a maximum of 29 years (Bush et al. 1996). Using length-frequency analysis, which tends to exclude younger animals, a theoretical maximum age at 95% asymptotic size is 16 years. Individuals of more than 12 years of age are not common in fisheries, with more heavily fished areas yielding much younger fish on average. Most studies indicate a rapid growth rate for juveniles, which has been estimated to be about 10 mm/month total length (TL) for small juveniles, and 8.4-11.7 mm/month TL for larger juveniles (Beets and Hixon 1994) (Eggleston 1995). Maximum size is about 122 cm TL and maximum weight is about 25 kg (Heemstra and Randall 1993; (Humann and DeLoach 2002); (Froese 2010). Generation time (the interval between the birth of an individual and the subsequent birth of its first offspring) is estimated as 9-10 years (Sadovy and Eklund 1999). Data from scales and otoliths indicate that fish reach sexual maturity in approximately 4-7 years (Hill and Sadovy de Mitcheson 2013).

Distribution
The Nassau grouper's confirmed distribution currently includes "Bermuda and Florida (USA), throughout the Bahamas and Caribbean Sea" (e.g., (Heemstra 1993)). The occurrence of Nassau grouper from the Brazilian coast south of the equator as reported in Heemstra (1993) is "unsubstantiated" (Craig et al. 2011). The Nassau grouper has been documented in the Gulf of Mexico, at Arrecife Alacranes (north of Progreso) to the west off the Yucatan Peninsula, Mexico (Hildebrand et al. 1964). Nassau grouper is generally replaced ecologically in the eastern Gulf by red grouper (*E. morio*) in areas north of Key West or the Tortugas (Smith 1971). They are considered a rare or transient species off Texas in the northwestern Gulf of Mexico (Gunter and Knapp 1951) in (Hoese and Moore 1998). The first confirmed sighting of Nassau grouper in the Flower Garden Banks

National Marine Sanctuary, which is located in the northwest Gulf of Mexico approximately 180 km southeast of Galveston, Texas, was reported by (Foley et al. 2007b). Many earlier reports of Nassau grouper up the Atlantic coast to North Carolina have not been confirmed. The Biological Report (Hill and Sadovy de Mitcheson 2013) provides a detailed description of the distribution, summarized in Figure 3.8.

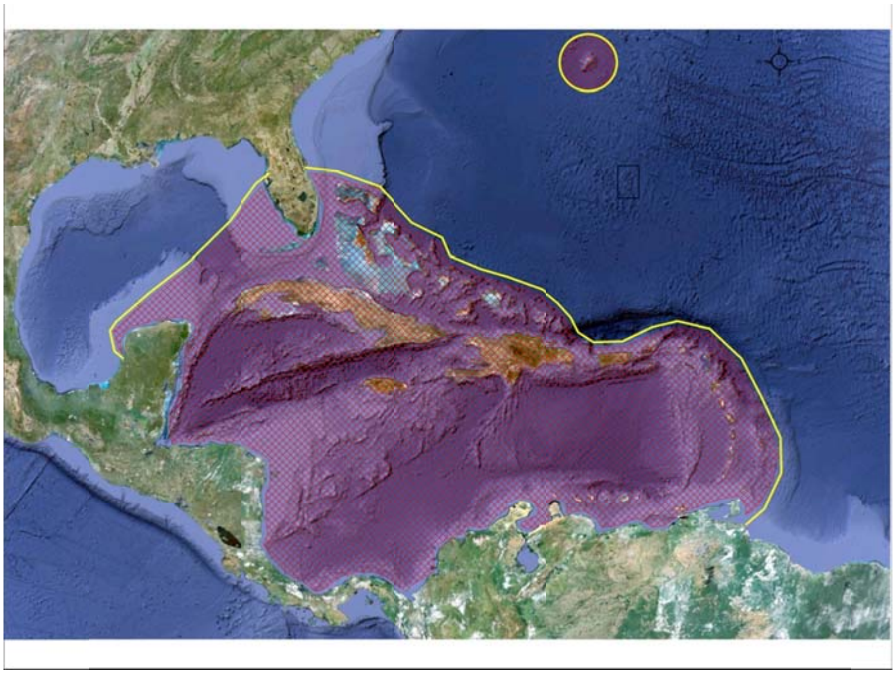

Figure 3.8. Range of Nassau grouper (*Epinephelus striatus*). Habitat zones include shoreline to insular or continental shelf throughout the indicated range.
(Hill and Sadovy de Mitcheson, 2013)

Basic Biology

Habitat and Depth Use Information

The Nassau grouper is primarily a shallow-water, insular fish species that has long been valued as a major fishery resource throughout the wider Caribbean, South Florida, Bermuda, and the Bahamas (Carter et al. 1994). This species is considered a reef fish, but it transitions through a series of developmental habitats. As larvae, the Nassau grouper is planktonic. After an average of 35-40 days and at an average size of 32 mm TL, larvae recruit from an oceanic environment into demersal habitats (Colin 1992); (Eggleston 1995). Following settlement, juvenile Nassau grouper inhabit macroalgae (primarily *Laurencia* spp.), coral clumps (*Porites* spp.), and seagrass beds (Dahlgren 1998; Eggleston 1995). Recently-settled Nassau grouper have also been collected from rubble mounds at 18 m depth (Colin et al. 1997). Post-settlement, small Nassau grouper have been reported with discarded queen conch shells (*Strombus gigas*) and other debris around Thalassia beds (Eggleston 1995; Randall 1983).

Juvenile Nassau grouper (12-15 cm TL) are relatively solitary and remain in specific areas for months (Bardach 1958). Juveniles of this size class are associated with macroalgae, and both natural and artificial reef structure. As juveniles grow, they move progressively to deeper areas and offshore reefs (Colin et al. 1997; Tucker et al. 1993). Schools of 30-40 juveniles (25-35 cm TL) were observed at 8-10 m depths in the Cayman Islands (Tucker et al. 1993). No clear distinction can be made between types of adult and juvenile habitats, although a general size segregation with depth occurs; smaller Nassau grouper in shallower inshore waters (3.7-16.5 m) and larger individuals more common near deeper (18.3-54.9 m) offshore banks (Bardach 1958; Bardach et al. 1958; Cervigón 1994; Radakov et al. 1975; Silva Lee 1974; Thompson and Munro 1978).

Adult Nassau grouper tend to be relatively sedentary and are generally associated with high-relief coral reefs or rocky substrate in clear waters to depths of 130 m. Generally, adults are most common at depths less than 100 m (Hill and Sadovy de Mitcheson 2013) except when at spawning aggregations where they are known to descend to depths of 255 m (Starr et al. 2007).

Foraging Information

Adult Nassau grouper are unspecialized, bottom-dwelling, ambush-suction predators (Randall 1965; Thompson and Munro 1978). Numerous studies describe adult Nassau grouper as piscivorous (Carter et al. 1994; Eggleston et al. 1998; Randall 1965; Randall 1967; Randall and Brock 1960). Feeding can take place around the clock although most fresh food is found in stomachs collected in the early morning and at dusk (Randall 1967). Young Nassau grouper (20.2-27.2 mm standard length [SL]) feed on a variety of plankton, including pteropods, amphipods, and copepods (Greenwood 1991; Grover et al. 1998).

Spawning Behavior and Habitat

The effects of fishing in relation to spawning behavior is an important issue for this species (please refer to the Population Dynamics and Status and the Threats sections that follow).

Nassau grouper form spawning aggregations
V.I.; however, many of these may no longer form. Recent evidence suggests that spawning is occurring at what may be reconstituted or novel spawning sites in both Puerto Rico and the U.S.V.I. (Hill and Sadovy de Mitcheson 2013). Suspected or anecdotal evidence also identifies spawning aggregations in Los Roques, Venezuela (Boomhower et al. 2010) and Old Providence in Colombia's San Andrés Archipelago (Prada et al. 2004). Spawning aggregation sites have not been reported in the Lesser Antilles, Central America south of Honduras, or Florida.
at predictable locations around the winter full moons, or between full and new moons (Aguilar-Perera 1994; Carter et al. 1994; Colin 1992; P.L. 1992; Smith 1971; Tucker et al. 1993; Tucker and Woodward 1994). Aggregations consist of hundreds, thousands, or, historically, tens of thousands of individuals. Some aggregations have persisted at known locations for periods of 90 years or more (see references in Hill and Sadovy de Mitcheson 2013). Pair spawning has not been observed.

About 50 individual spawning aggregation sites have been recorded, mostly from insular areas in the Bahamas, Belize, Bermuda, British Virgin Islands, Cayman Islands, Cuba, Honduras, Jamaica, Mexico, Puerto Rico, Turks and Caicos, and the U.S.
"Spawning runs," or movements of adult Nassau grouper from coral reefs to spawning aggregation sites, were first described in Cuba in 1884 by Vilaro Diaz, and later by

(Guitart-Manday and Juárez-Fernandez 1966). Nassau grouper migrate to aggregation sites in groups numbering between 25 and 500, moving parallel to the coast or along shelf edges or even inshore reefs (Aguilar-Perera and Aguilar-Davila 1996; Carter et al. 1994; Colin 1992; Nemeth et al. 2009). Distance traveled by Nassau grouper to aggregation sites is highly variable; some fish move only a few kilometers, while others move up to several hundred kilometers (Bolden 2000; Carter et al. 1994; Colin 1992). Ongoing research in the Exuma Sound, Bahamas has tracked migrating Nassau grouper up to 200 km, with likely estimates of up to 330 km, as they move to aggregation sites (Hill and Sadovy de Mitcheson 2013).

Observations suggest that individuals can return to their original home reef following spawning. Bolden (2001) reported 2 out of 22 tagged fish returning to home reefs in the Bahamas one year after spawning. Sonic tracking studies around Little Cayman Island have demonstrated that spawners may return to the aggregation site in successive months with returns to their residential reefs in between (Semmens et al. 2007). Larger fish are more likely to return to aggregation sites and spawn in successive months than smaller fish (Semmens et al. 2007). It is not known how Nassau grouper select and locate aggregation sites or why they aggregate to spawn. Spawning aggregation sites are typically located near significant geomorphological features, such as projections (promontories) of the reef as little as 50 m from the shore, and close to a drop-off into deep water over a wide (6-60 m) depth range (Aguilar-Perera 1994; Beets and Friedlander 1999; Burnett-Herkes 1975; Carter 1989; Colin 1992; Colin et al. 1987; Craig 1966; Fine 1990; Olsen and LaPlace 1979; Smith 1972). Sites are characteristically small, highly circumscribed areas, measuring several hundred meters in diameter, with soft corals, sponges, stony coral outcrops, and sandy depressions (Aguilar-Perera 1994; Beets and Friedlander 1999; Burnett-Herkes 1975; Carter 1989; Colin 1992; Colin et al. 1987; Craig 1966; Fine 1990; Olsen and LaPlace 1979; Smith 1972).

The link between spawning sites and settlement sites is also not well understood. Spawning aggregations form around the full moon between December and March (reviewed in Sadovy and Eklund (1999)), though this may occur later (May-August) in more northerly latitudes (Bardach 1958; Burnett-Herkes 1975; Gorce and (eds.) 1939; Smith 1971). The formation of spawning aggregations is triggered by a very narrow range of water temperatures between 25-26°C. While day length has also been considered as a trigger for aggregation formation (Carter et al. 1994; Colin 1992; Tucker et al. 1993), temperature is evidently a more important stimulus (Hill and Sadovy de Mitcheson 2013). Spawning occurs for up to 1.5 hours around sunset for several days (Whaylen et al. 2007). At spawning aggregation sites, Nassau grouper tend to mill around for a 1-2 days in a "staging area" adjacent to the core area where spawning activity later occurs (Colin 1992; Kadison et al. 2010; Nemeth 2012). Courtship is indicated by 2 behaviors that occur late in the afternoon: "following" and "circling" (Colin 1992). The aggregation then moves into deeper water shortly before spawning (Carter et al. 1994; Colin 1992; Tucker et al. 1993). Progression from courtship to spawning may depend on aggregation size, but generally fish move up into the water column, with an increasing number exhibiting the bicolor phase (Carter et al. 1994; Colin 1992).

Repeated spawning occurs at the same site for up to 3 consecutive months generally around the full moon or between the full and new moons (Aguilar-Perera 1994; Carter et al. 1994; Colin 1992; Smith 1971; Tucker et al. 1993; Tucker and Woodward 1994). Participation by individual fish across the months is unknown. It is unknown whether a single, mature female will spawn continuously throughout the spawning season or just once per year.

Population Dynamics and Status

Few formal stock assessments have been conducted for the Nassau grouper, likely because of limited data. The most recent published assessment, conducted in The Bahamas, suggests that fishing effort in The Bahamas needs to be reduced from the 1998 to 2001 level in order to avoid overexploitation of stocks relative to biological reference points (Cheung et al. 2013).

During the first U.S. survey of the fishery resources of Puerto Rico, the Nassau grouper was noted as a common and very important food fish, reaching a weight of 50 lb (22.7 kg) or more ((Evermann 1900). By 1970, Nassau grouper was still the fourth most common shallow-water species landed in Puerto Rico ((Thompson 1978), and it was common in the reef fish fishery of the Virgin Islands, where an aggregation in the 1970s contained an estimated 2,000-3,000 individuals (Olsen and LaPlace 1979) (Olsen and LaPlace 1979). During the 1980s, port sampling in the U.S.V.I. showed that Nassau grouper accounted for 22% of grouper landings with 85% of the Nassau grouper catch coming from spawning aggregations (D. Olsen, Chief Scientist – St. Thomas Fishermen's Association, pers. comm. to J. Rueter, NMFS SERO PRD, October, 2013). By 1981, "the Nassau grouper ha(d) practically disappeared from the local catches and the ones that d(id) appear (were)-small compared with previous years" (CFMC and NMFS 1985) and by 1986, the Nassau grouper was considered commercially extinct in the U.S. Virgin Islands/Puerto Rico region (Bohnsack et al. 1986). About 1,000 kg were landed from the Reef Fish fishery during the latter half of the 1980s in Puerto Rico, most of them were less than 500 mm, indicating they were likely sexually immature (Sadovy 1997).

Although there are few data on historic abundance of Nassau grouper off the U.S. mainland, it appears that abundance was once high in southern Florida (Springer and McErlean 1962). Anecdotal reports from spearfishers noted large daily catches in the 1950s (Bohnsack 1990). Interviews of Florida Keys' residents suggested that Nassau grouper were once caught in much greater numbers from the upper Florida Keys and the Bahamas (Sadovy and Eklund 1999). Starck (1968) reported Nassau grouper frequently at Alligator Reef in the Florida Keys.

Historically, Nassau grouper was a component of the grouper fishery in Florida, suggesting once healthy (sub)population(s) in southeastern U.S. mainland waters (Sadovy and Eklund 1999). In contrast, now the species is rarely encountered (Sadovy and Eklund 1999). In the Dry Tortugas, where Nassau grouper were once abundant, only one individual was recorded in 1994 out of 183 point censuses and none in 37 predator censuses (Sluka et al. 1998). On Elbow Reef, Florida Keys, mean Nassau grouper densities were 0.01- 0.04 fish per 100 m^2 in 1993-94 (Sluka et al. 1998), with few seen on census dives through the Florida Keys. Censuses comparing areas protected and unprotected from fishing indicated that Nassau grouper, where protected, had a higher density and were one of the dominant grouper species observed (Sluka et al. 1997). Despite 10-20 years of no-take protection of the Nassau grouper in the Florida Keys, Nassau grouper has made no appreciable recovery and numbers remain extremely low (Semmens et al. 2007, Don DeMaria pers. comm. 2012 *In* Hill and Sadovy de Mitcheson 2013).

Little is known about the dynamics of unexploited stocks of Nassau grouper, although some of the data from the 1980s give us some insight (Carter et al. 1994). Spawning stock biomass per recruit has not been quantified for the species, but landings data clearly show a chronological trend from abundance to rarity in many areas (e.g., (Sadovy 1997). Of particular concern has been the rapid and extreme decline in numbers taken from traditional aggregation sites (Sala et al. 2001). In general, slow-growing, long-lived species (such as snappers and groupers) with limited spawning periods and, possibly, with only a narrow recruitment window are susceptible to overexploitation ((Bannerot et al. 1987; Polovina and Ralston 1987). Hodgson and Liebeler (2002) noted that Nassau grouper were absent from 82% of shallow Caribbean reefs (3–10 m) during a 5-year period (1997-2001) of underwater surveys for the ReefCheck project. This is derived from underwater surveys in most countries in the range of the species.

Because insufficient stock assessments or population estimates exist, NMFS (81 FR 42268, June 29, 2016) considered the changes in spawning aggregations as a proxy for the status of the current population. NMFS believes the status of spawning aggregations is likely to be reflective of the overall population because adults migrate to spawning aggregations for the only known reproductive events. Historically, 50 spawning aggregation sites had been identified throughout the Caribbean (Sadovy De Mitcheson et al. 2008). Of these 50, less than 20 probably still remain (Sadovy De Mitcheson et al. 2008). Numbers of fish at aggregation sites once numbered in the tens of thousands (30,000 – 100,000 fish; Smith 1972), however they have now been reduced to less than 3,000 at those sites where counts have been made (Sadovy De Mitcheson et al. 2008). In many areas of its range, the species is now considered commercially extinct and numerous spawning aggregations have been extirpated with no signs of recovery (81 FR 42268, June 29, 2016). Based on the size and number of current spawning aggregations, the Nassau grouper population appears to be significantly reduced from its historical size.

Threats

The most serious threats to Nassau grouper are fishing at spawning aggregations and inadequate law enforcement. These threats are considered high risk threats to the species, and are currently affecting the status of Nassau grouper, putting it at a heightened risk of extinction. Nassau grouper are fished commercially and recreationally throughout the year by handline, longline, fish traps, spear guns, and gillnets (NMFS General Canvas Landing System). Aggregations are mainly exploited by handlines or by fish traps, although gillnets were being used in Mexico in the early to mid-1990s (Aguilar-Perera 2004). Sadovy and Eklund (1999) show declines in landings, catch per unit effort (CPUE) and, by implication, abundance in the late 1980's and early 1990's throughout its range, which has led Nassau grouper to now be considered commercially extinct in a number of areas (Sadovy and Eklund 1999). Recent reports from throughout the Nassau grouper's range document continued population declines and loss of aggregations (Sadovy de Mitcheson 2012). The aggregative reproduction style - gathering at predictable sites in large concentrations to spawn during a few weeks (over a few months) each year - makes the Nassau grouper vulnerable as a target of fishing like many other reef species that form large aggregations to spawn. In many places, aggregation-fishing once produced most of the annual landings of the species (e.g.,(Claro 1990)). Because Nassau grouper are only known to reproduce in spawning aggregations, removing ripe individuals during spawning has the potential to greatly influence population dynamics and future fishery yields (Shapiro 1987). The fact that much of the catch in many countries historically came from spawning aggregations (Aguilar-Perera 1994; Olsen and LaPlace 1979; Sadovy and Eklund 1999) likely magnified the effects to the extent that targeted aggregations have collapsed in many countries (Sadovy de Mitcheson 2012). Its declines have compromised the ecological function of a major top predator in the reef ecosystem (Mumby et al. 2006; Mumby et al. 2012; Randall 1967). Law enforcement in many foreign countries is less than adequate, thus rendering the regulations ineffective; although many countries have taken regulatory measures to conserve Nassau grouper, the species faces an ongoing threat due to the inadequacy of regulatory mechanisms to prevent or remediate the impacts of other threats that are elevating the species' extinction risk, particularly fishing of spawning aggregations. Overutilization in the form of historical harvest has reduced population size and led to the collapse of spawning aggregations in many locations. While some countries have made efforts to curb harvest, fishing at spawning aggregation sites remains a "high risk" threat, and this risk is exacerbated by the inadequacy of regulatory control and law enforcement, which leads to continued overutilization (low abundance), reduced reproductive output, and reduced recruitment (more details found in 81 FR 42268, June 29, 2016).

There is currently no fishery for Nassau grouper in the United States, and possession is prohibited (for additional details of the history, see Sadovy and Eklund (1999)). Nassau grouper may show up as bycatch in various fisheries around south Florida. Barotrauma from rapid decompression, increased time in warm surface waters, and increased exposure to predation threats may result in species mortality in the absence of a directed fishery (Bartholomew and Bohnsck 2005).

Other factors also pose a threat to the status of this species. Poor spatial population structure/connectivity is an increasing risk for Nassau grouper and is due, in part, to the declining number and size of spawning aggregations, which affects population structure. Population growth rate/productivity issues also present an increasing risk for the species. The nature of these factors could contribute to the species becoming endangered over the foreseeable future.

Abundance of Nassau grouper has diminished dramatically over the past several decades. This decline is a direct impact of historical harvest and the overfishing of spawning aggregations. The current reduced population abundance of Nassau grouper is a threat to the status of the species over the foreseeable future if abundance continues to decline.

In the final rule listing Nassau grouper (81 FR 42268, June 29, 2016), NMFS considered climate change as a threat to Nassau grouper including global warming, sea level rise, and ocean acidification. Although Nassau grouper occur across a range of temperatures, spawning occurs when sea surface temperatures range between 25°C-26°C (Colin 1992; Tucker and Woodward 1996). Because Nassau grouper spawn in a narrow window of temperatures, a rise in sea surface temperature outside that range could impact spawning or shift the geographic range of the species to overlap with waters within the required temperature parameters. Increased sea surface temperatures have also been linked to coral habitat loss through bleaching and disease, as well as possible negative effects to coral and coral reefs due to sea level rise (Munday et al. 2008). Further, increased global temperatures are also predicted to change parasite-host relationships and may present additional unknown concerns (Harvell et al. 2002; Marcogliese 2001). Another potential effect of climate change could be the loss of structural habitat in coral reef ecosystems as ocean acidification is anticipated to affect the integrity of coral reefs (Munday et al. 2008). While climate change has the potential to pose a threat to this species there is currently insufficient information to determine how it is affecting the extinction risk of the Nassau grouper now or in the foreseeable future.

4.0 Environmental Baseline

This section describes the effects of past and ongoing human and natural factors contributing to the current status of the species, their habitats (including designated critical habitat), and ecosystem within the action area, without the additional effects of the proposed action. In the case of ongoing actions, this section includes the effects that may contribute to the projected future status of the species, their habitats and ecosystems. The environmental baseline describes a species' and habitat's health based on information available at the time of this consultation.

By regulation (50 CFR 402.02), environmental baselines for Biological Opinions include the past and present impacts of all state, federal, or private actions and other human activities in or having effects in, the action area. We identify the anticipated impacts of all proposed federal projects in the specific action area of the consultation at issue, that have already undergone formal or early Section 7 consultation (as defined in 50 CFR 402.11), as well as the impact of state or private actions, or the impacts of natural phenomena, which are concurrent with the consultation in process (50 CFR 402.02).

Focusing on the impacts of the activities in the action area specifically, allows us to assess the prior experience and state (or condition) of the endangered and threatened individuals, and areas of designated critical habitat that occur in an action area, and that will be exposed to effects from the action under consultation. This is important because, in some states or life history stages, or areas of their ranges, listed individuals or critical habitat features will commonly exhibit, or be more susceptible to, adverse responses to stressors than they would be in other states, stages, or areas within their distributions. These localized stress responses or stressed baseline conditions may increase the severity of the adverse effects expected from the proposed action.

4.1 Status of Species in the Action Area

As stated in Section 2.3 (Action Area), the proposed action occurs in the U.S. South Atlantic states' EEZ's, which extends from 3 nmi seaward of Florida, Georgia, South Carolina, and North Carolina to 200 nmi (except that the EEZ off of southern Florida does not extend all the way out 200 nmi due to the close proximity of The Bahamas).

NARW
Right whales can be found in winter months in their only known calving area in the warm, calm coastal waters off the Southeast Atlantic Bight (SAB) which extends roughly from Cape Hatteras, North Carolina, to West Palm Beach, Florida. The whales start migrating back north during the spring. Sightings off the Southeast Atlantic Coast include primarily adult females and calves, but juveniles and adult males are also commonly observed. The status of species in the action area, as well as the threats to this species, is supported by the species account in Section 3 (Status of the Species).

Sea Turtles
The 5 species of sea turtles that occur in the action area are all highly migratory. Given the large size of the action area, all sea turtle life stages, and associated behaviors occur in the action area. Therefore, the status of the 5 species (or DPS where applicable) of sea turtles in the action area, as well as the threats to these species, are best reflected in their range-wide statuses and supported by the species accounts in Section 3 (Status of Species).

Smalltooth Sawfish
Smalltooth sawfish greater than 200 cm TL may be found in the southern portion (primarily off Florida) of the action area throughout the year. The status of smalltooth sawfish in the action area, as well as the threats to this species, is supported by the species account in Section 3 (Status of the Species).

Nassau Grouper
Nassau grouper that could potentially interact with the proposed action may be found in the southern portion of the action area (e.g., off the coast of Florida and south). The status of species in the action area, as well as the threats to this species, is supported by the species account in Section 3 (Status of the Species).

4.2 Factors Affecting NARWs in the Action Area

Right whales can be found year round from Cape Cod to Nova Scotia, an area the whales use for feeding and mating. Each fall, pregnant females and others travel from this area to their only known calving area in the warm, calm coastal waters off the Southeast Atlantic Bight (SAB) which extends roughly from Cape Hatteras, North Carolina, to West Palm Beach, Florida. Non-calving whales are moving between habitats continuously during the calving season (Brown and Marx 2000). The whales start migrating back north during the spring. Sightings off the Southeast Atlantic Coast include primarily adult females and calves, but juveniles and adult males are also commonly observed. Animals are impacted by a number of factors as described in this section as they feed, migrate, and breed.

4.2.1 Federal Actions

4.2.1.1 Federal Vessel Operations

Watercraft are great contributors to overall noise in the sea and have the potential to interact with whales though direct impacts by ship hulls or propellers. Collisions with ships is one of the primary causes of the right whale's failure to recover (NMFS 2005c). Sound levels and tones produced are generally related to vessel size and speed. Larger vessels generally emit more sound than smaller vessels, and vessels underway with a full load, or those pushing or towing a load, are noisier than unladen vessels. Vessels operating at high speeds have the potential to strike whales. Potential sources of adverse effects from federal vessels in the action area include operations of the United States Navy (USN) and the USCG, which maintain the largest federal vessel fleets, the EPA, NOAA, BOEM/BSEE, FERC, NOAA, and the USACE. An average of approximately 2 *known* vessel (federal and non-federal) collision-related right whale deaths have occurred annually over the last decade (Henry et al. 2012; Waring et al. 2012) and an average of 1.2 known vessel-strike related fatalities occurred in the period 2006–2010 (Waring et al. 2012). NOAA believes the actual number of deaths can possibly be higher than those documented, as some deaths likely go undetected or unreported. Through the Section 7 process, where applicable, NMFS has and will continue to establish conservation measures for all federal agency vessel operations to avoid adverse effects to listed species.

4.2.1.2 Military Activities

Potential sources of adverse effects in the action area include operations of the U.S. Department of Defense (DoD).

The USN conducts military readiness activities, which can be categorized as either training or testing exercises, throughout the action area. During training, existing and established weapon systems and tactics are used in realistic situations to simulate and prepare for combat. Activities include: routine gunnery, missile, surface fire support, amphibious assault and landing, bombing, sinking, torpedo, tracking, and mine exercises. Testing activities are conducted for different purposes and include at-sea research, development, evaluation, and experimentation. USN performs testing activities to ensure that its military forces have the latest technologies and techniques available to them. USN activities are likely to produce noise and harass protected species throughout the action area. Consultations on overall USN activities in the Atlantic have been completed, including USN Joint Logistics Over-the-Shore Training in Virginia and North Carolina (JLOTS) 2014 (NMFS 2014); USN Atlantic Fleet Training and Testing (AFTT) Activities (2013-2018) (NMFS 2013a); U.S. Navy East Coast Range Complex (NMFS 2012a); USN's Activities in East Coast Training Ranges (NMFS 2011a); USN Atlantic Fleet Sonar Training Activities (AFAST) (NMFS 2011b); Navy AFAST LOA 2012-2014: U.S. Navy active sonar training along the Atlantic Coast and Gulf of Mexico (NMFS 2011d); and Navy's East Coast Training Ranges (Virginia Capes, Cherry Point, and Jacksonville) (NMFS 2010a).

4.2.1.3 Federal Fisheries

Northern Atlantic Right whales are at risk from entanglement in fishing gear when in the action area.

Atlantic Shark Fisheries (via the Consolidated HMS Fishery Management Plan)
This fishery targets Atlantic shark and smoothhound species using bottom longline and gillnet gear. The range of most bottom longline sets runs from northwestern Florida in the Gulf of Mexico to northern North Carolina in the Atlantic, with concentrations of activity around the Florida Keys, Cape Canaveral, and North Carolina. Gillnet fishing effort has concentrations northwest of the Florida Keys and along the central and east coast of Florida.

The 2012 Opinion (NMFS 2012b) for the fishery anticipated future annual take of 0.017 non-serious injury/mortality (SI/M) entanglements with net gear, and 0.015 entanglements causing SI/M for a total of 0.032 total entanglements annually. The Opinion concluded that NMFS did not believe the fishery was appreciably reducing the likelihood of the species' survival in the wild.

Other Fisheries
As discussed in the Status of the Species, entanglement in fixed fishing gear is a leading cause of NARW mortality. The types of fishing gear with which this species is known to interact includes gillnet gear, lobster gear, other pot/trap gear, bottom longline, and much fishing gear that must be assigned to the "unknown gear" category; these interactions can result in serious injury and possible mortality (NMFS 2010b). Table 4.1 shows the types of fishing gear with which this species is known to interact. The table shows documented entanglements (by gear) from 1999 to 2009. Other large whale species are included in the table to emphasize how much is unknown in terms of gear interactions and to show that gear identification isn't just a NARW issue.

Table 4.1. Documented Annual Large Whale Entanglements 1999-2009

Gear	**Documented Entanglements (Percent of Total Entanglements)**			**Documented Entanglements Causing SI/M (Percent of Total SI/M Entanglements)**		
	NARW	Humpback	Fin	NARW	Humpback	Fin
Sink Gillnet	1 (2%)	11 (6%)	0	1 (9%)	2 (5%)	0
Unspecified Gillnet	1 (2%)	14 (8%)	0	1 (9%)	3 (8%)	0
American Lobster Gear	7 (12%)	15 (8%)	0	1 (9%)	2 (5%)	0
Other pot/trap gear	1 (2%)	4 (2%)	0	1 (9%)	0	0
Hook and Line	0	7 (4%)	0	0	0	0
Bottom Longline	1 (2%)	0	0	0	0	0
Purse Seine	0	1 (1%)	0	0	0	0
Unknown Gear	47 (81%)	128 (71%)	24 (100%)	7 (64%)	30 (81%)	8 (100%)
Total	58	180	24	11	37	8
Mean Annual Total	5.27	16.36	2.18	1.00	3.36	0.73

(Adapted from: (Morin et al. 2011; NMFS 2010b))

Entanglement records from 1990 through 2010 maintained by NMFS Northeast Regional Office (NMFS, unpublished data) included 74 confirmed NARW entanglements, including right whales in weirs, gillnets, and trailing line and buoys. Information from an entanglement event rarely includes the detail necessary to assign the entanglements to a particular fishery or location. In their study, Johnson et al. (2005) found that when gear type was identified, pot gear and gillnet gear represented 71% and 14% of entanglements, respectively. The authors pointed out that buoy lines were involved in 51% of entanglements and suggested that entanglement risk is elevated by any line that rises in the water column. Entanglement mortality from fishing operations and its effects on the NARW population are likely underestimated because fishers may not report entanglements, and it is likely that carcasses from offshore are not detected or recovered (Cole et al. 2006). NARWs are under threat from fishing gear in the action area, although assigning gear threat to specific fisheries (e.g., federal or state) is often not currently possible.

Additionally, it is important to note that right whales may not die immediately as the result of a vessel strike or entanglement from fishing gear but may gradually weaken or otherwise be affected so that further injury or death is likely (Waring et al. 2014). Vessel and fishing operation may also result in nonlethal takes of listed species (through harassment). Effects of harassment or disturbance which may be caused by such vessel activities are currently unknown. Recent federal efforts regarding mitigating impacts of the whale watch and shipping industries on endangered whales are discussed below.

4.2.2 State or Private Actions

4.2.2.1 Private and Commercial Vessel Operations

These activities have the potential to result in lethal (through entanglement or boat strike) interactions. As introduced in the previous "Federal Actions" section, vessel strikes have been identified as a significant issue for whales, are a source of mortality to the NARW population (Kraus 1990), and could prevent or slow the species' recovery. An unknown number of commercial and private recreational boaters frequent coastal waters; some of these are engaged in pleasure cruising or sport fishing activities. As right whales may be in the area where high vessel traffic occurs, the potential exists for collisions with vessels transiting from within and out of the action area. As discussed in the Federal Vessel Operations section, an average of approximately 2 *known* vessel collision-related right whale deaths have occurred annually over the last decade and an average of 1.2 known vessel-strike related fatalities occurred in the period 2006–2010. NOAA believes that these numbers are likely an underestimate, as some deaths likely go undetected or unreported.

4.2.3 Man-Made Noise

A number of activities (including those mentioned in this section) currently generate noise in the marine environment and affect whale species As discussed in the Status of the Species section of this Opinion, several investigators have argued that man-made sources of noise have increased ambient noise levels in the ocean over the last 50 years. Anthropogenic noises in the action area that could affect ambient noise arise from the following general types of activities in and near the sea, any combination of which can contribute to the total noise at any one place and time. Examples include maritime activities, mineral exploration in offshore areas; geophysical (seismic) surveys; sonars;

explosions; and ocean research activities. Much of the increase in ambient noise is due to increased shipping as ships become more numerous and of larger tonnage and seismic exploration. Commercial fishing vessels, cruise ships, transport boats, airplanes, helicopters and recreational boats all contribute sound into the ocean. Sound affects whale communication (e.g., finding mates), potentially increases stress in individual animals, and can change behavior. The long-term implications of these effects are unclear.

4.2.4 Climate Change

As discussed earlier in this Opinion, there is a large and growing body of literature on past, present, and future impacts of global climate change. Potential effects commonly mentioned include changes in sea temperatures and salinity (due to melting ice and increased rainfall), ocean currents, storm frequency and weather patterns, and ocean acidification.

NARWs currently have a range of sub-polar to sub-tropical waters. An increase in water temperature could result in a northward shift of range, with both the northern and southern limits moving north. It is possible that the northern limit could shift to a greater extent than the southern limit (which requires ideal temperature and water depth for calving). If so, the whales could experience an unfavorable effect of increasing in the length of migrations, or a favorable effect by allowing them to expand their range. But a northward shift in the suitable calving grounds off the southeast United States (including areas currently in the action area) based on optimal temperatures would involve calving in waters that are generally rougher, and thus more hazardous, for newborn calves.

An increase in atmospheric carbon dioxide may also affect the marine plankton species –a vital food source of NARWs. This species potentially feeds in the northern portion of the action area (e.g., off the coast of North Carolina). The ocean will absorb most atmospheric carbon dioxide released by burning fossil fuels. Any decline in the marine plankton could have serious consequences for the marine food web upon which NARWs rely.

Additional discussion of climate change can be found in the Status of the Species. To summarize, global climate change may affect the timing and extent of whale population movements and their range, distribution, and species composition of prey relative to the action area. Changes in distribution including displacement from ideal habitats, decline in fitness of individuals, population size due to the potential loss of foraging opportunities, abundance, migration, community structure, susceptibility to disease and contaminants, and reproductive success are all possible impacts that may occur as the result of climate change. Global climate change may also result in changes to the range and abundance of competitors and predators, which could also indirectly affect this whale species. Still, more information is needed to better determine the full and entire suite of impacts of climate change on NARWs and specific predictions regarding impacts in the action area are not currently possible.

4.2.5 Conservation and Recovery Actions Reducing Threats to Listed Whales

A number of activities are in progress that may ameliorate some of the threat that activities (summarized in the Environmental Baseline) pose to NARWs in the action area of this consultation. These include education/outreach activities, as well as specific measures to reduce the adverse effects of entanglement in fishing gear, including: gear modifications, fishing gear time area closures, and whale disentanglement. In addition measures exist to reduce ship and other vessel impacts to whale species. Many of these measures have been implemented to reduce risk to critically endangered NARW. Despite the focus on NARW, other cetaceans and some sea turtles will likely benefit from the measures as well.

Atlantic Large Whale Take Reduction Plan

The Atlantic Large Whale Take Reduction Plan (ALWTRP) seeks to reduce serious injury or mortality of large whales due to incidental entanglement in U.S. commercial fishing gear. The ALWTRP focuses on the critically endangered NARW, but is also intended to reduce entanglement of endangered humpback and fin whales. The plan is required by the Marine Mammal Protection Act (MMPA) and has been developed by NMFS. The ALWTRP covers the EEZ from Maine through Florida. The requirements are year-round in the Northeast, and seasonal in the Mid- and South Atlantic.

Regulatory actions are directed at reducing serious entanglement injuries and mortality of right, humpback, and fin whales from fixed gear fisheries (i.e., trap and gillnet fisheries). The non-regulatory component of the ALWTRP is composed of four principal parts: (1) gear research and development, (2) disentanglement, (3) the Sighting Advisory System (SAS), and (4) education/outreach. The first ALWTRP went into effect in 1997. For more information, see the ALWTRP (available online at http://www.nero.noaa.gov/whaletrp/).

Ship Strike Reduction Program

The Ship Strike Reduction Program is currently focused on protecting the NARW, but the operational measures are expected to reduce the incidence of ship strike on other large whales to some degree. The program consists of 5 basic elements and includes both regulatory and non-regulatory components: (1) operational measures for the shipping industry, including speed restrictions and routing measures, (2) Section 7 consultations with federal agencies that maintain vessel fleets, (3) education and outreach programs, (4) a bilateral conservation agreement with Canada, and (5) ongoing measures to reduce ship strikes of right whales (e.g., SAS, ongoing research into the factors that contribute to ship strikes, and research to identify new technologies that can help mariners and whales avoid each other).

Regulatory Measures to Reduce Vessel Strikes to Large Whales Restricting Vessel Approach to Right Whales

In one recovery action aimed at reducing vessel-related impacts, including disturbance, NMFS published an interim Final Rule in February 1997 that prohibits, except in limited circumstances, both boats and aircraft from approaching any right whale closer than 500 yards.

Mandatory Ship Reporting System (MSRS)
Established in July 1999, the MSRS requires all commercial ships 300 gross tons or greater to report into a shore-based station when entering 2 key NARW aggregation areas, 1each in waters off the U.S. northeastern and southeastern coasts. The U.S. northeast system operates year round; the U.S. southeast system is in effect from November 15 to April 15, when NARW aggregate in these waters. The MSRS requires mariners to report such things as entry location, destination, and ship speed. Reporting prompts an automated return message providing NARW sighting locations and information on how collisions can be avoided, thereby providing information on NARW directly to mariners as they enter NARW habitat.

Vessel Speed Restrictions
A key component of NOAA's right whale ship strike reduction program is the implementation of speed restrictions for vessels transiting the U.S. Atlantic in areas and seasons where NARW predictably occur in high concentrations. NOAA published regulations on October 10, 2008 to implement a 10-knot speed restriction for all vessels 65 ft (19.8 m) or longer in Seasonal Management Areas (SMAs) along the east coast of the U.S. Atlantic seaboard at certain times of the year (73 FR 60173; October 10, 2008). SMAs are supplemented by Dynamic Management Areas (DMAs) that are implemented for 15 day periods in areas in which right whales are sighted outside of SMA boundaries. When NOAA aerial surveys or other reliable sources report aggregations of 3 or more right whales in a density that indicates the whales are likely to persist in the area, NOAA calculates a buffer zone around the aggregation and announces the boundaries of the zone to mariners via various mariner communication outlets, including NOAA Weather Radio, USCG Broadcast Notice to Mariners, MSR return messages, email distribution lists, and the Right Whale SAS. NOAA requests mariners to route around these zones or transit through them at 10-kt/hr or less. Compliance with DMAs is voluntary. The rule was set to expire 5 years from the date of effectiveness. NOAA has analyzed data on compliance with the rule and the effectiveness of the rule since its implementation and published a Final Rule (78 FR 73726: December 9, 2013) to eliminate the planned December 2013 expiration date of the 2008 Rule.

Vessel Routing Measures to Reduce Co-occurrence of Ships and Whales
Another critical, non-regulatory component of NOAA's NARW ship-strike reduction program involves the development and implementation of routing measures that reduce the co-occurrence of vessels and NARW, thus reducing the risk of vessel collisions. Recommended routes were developed for the Cape Cod Bay feeding grounds and Southeast calving grounds by overlaying NARW sightings data on existing vessel tracks, and plotting alternative routes where vessels could expect to encounter fewer right whales. Full implementation of these routes was completed at the end of November 2006. The routes are now charted on all NOAA electronic and printed charts, published in U.S. Coast Pilots, and mariners have been notified through USCG Notices to Mariners.

Sighting Advisory System
The right whale Sighting Advisory System (SAS) was initiated in early 1997 as a partnership among several federal and state agencies and other organizations to conduct

aerial and ship board surveys to locate NARW and to alert mariners to right whale sighting locations in a near real time manner. The SAS surveys and opportunistic sightings reports document the presence of right whales and are provided to mariners via fax, email, NAVTEX, Broadcast Notice to Mariners, NOAA Weather Radio, and several websites. Fishers and other vessel operators can obtain SAS sighting reports, and make necessary adjustments in operations to decrease the potential for interactions with NARW.

Updating Navigational Aids and Publications
The *U.S. Coast Pilot* is a set of regionally specific references on marine environmental conditions, navigation hazards, and regulations. Currently, captains of commercial vessels 1600 gross tons and above are required to carry the *Coast Pilot* when operating in U.S. waters. Since 1997, NMFS has provided updated information for U.S. eastern seaboard *Coast Pilot* guides, including information on the status of right whales, times and areas that they occur, threats posed by ships, the MSRS, and advice on measures mariners can take to reduce the likelihood of hitting NARW.

Right Whale Recovery Plan Implementation Teams
Following completion of the 1991 Right Whale Recovery Plan, NMFS established Recovery Plan Implementation Teams, comprised of federal and state agencies and other organizations, to advise NMFS on actions to aid in the recovery of the species. Many of the Teams' activities have centered on reducing ship strikes. Both the Northeast and Southeast Implementation Teams were instrumental in developing and operating the aircraft survey programs described above. In addition, the Teams have developed and disseminated NARW material to mariners including brochures, placards, and training videos. The Teams have also funded various studies and have been an important conduit for information to and from the shipping industry and between federal agencies.

4.3 Factors Affecting Sea Turtles in the Action Area

The following analysis examines actions that may affect these species or their environments specifically within the action area. Sea turtles found in the immediate project area may travel widely throughout the Atlantic, Gulf of Mexico, and Caribbean Sea, and individuals found in the action area can potentially be affected by activities anywhere within this wide range. These impacts outside of the action area are discussed and incorporated as part of the overall status of the species as detailed in Status of Species section, above. The activities that shape the environmental baseline for sea turtles in the action area of this consultation are primarily federal fisheries, vessel operations, military activities, permits allowing take under the ESA for scientific research or incidental to non-federal activities, and private vessel traffic.

4.3.1 Federal Actions

NMFS has undertaken a number of Section 7 consultations to address the effects of federally permitted fisheries and other federal actions on threatened and endangered sea turtle species, and when appropriate, has authorized the incidental taking of these species.

Each of those consultations sought to minimize the adverse impacts of the action on sea turtles. Similarly, NMFS has undertaken recovery actions under the ESA to address sea turtle captures/interactions resulting from federal activities. The summary below of federal actions and the effects these actions have had on sea turtles includes only those federal actions in the action area that have already concluded or are currently undergoing formal Section 7 consultation.

4.3.1.1 Fisheries

Threatened and endangered sea turtles are adversely affected by several types of fishing gears used throughout the action area. Gillnet, longline, other types of hook-and-line gear, trawl gear, and pot fisheries have all been documented as interacting with sea turtles. Available information suggests sea turtles can be captured in any of these gear types when the operation of the gear overlaps with the distribution of sea turtles. For all fisheries for which there is an FMP or for which any federal action is taken to manage that fishery, impacts have been evaluated under Section 7. Formal Section 7 consultations have been conducted on the following fisheries, occurring at least in part within the action area, found likely to adversely affect threatened and endangered sea turtles. An Incidental Take Statement (ITS) has been issued for the take of sea turtles in each of these fisheries (Appendix 2). A brief summary of each fishery is provided below, but more detailed information can be found in the respective Biological Opinions.

Atlantic Bluefish Fishery

The fishery has been operating in the U.S. Atlantic (from Maine to Florida) for at least the last half century, although its popularity did not heighten until the late 1970s and early 1980s (MAFMC and ASMFC 1998). The majority of commercial fishing activity in the North Atlantic and mid-Atlantic occurs in the late spring to early fall, when bluefish (and sea turtles) are most abundant in these areas (NEFSC 2005). This fishery is known to interact with loggerhead sea turtles, given the time and locations where the fishery occurs. Gillnets account for the vast majority of bluefish landed by commercial harvesters. In 2011, gillnets accounted for 93.4% of the directed catch of bluefish, while hook gear accounted for 4.5% and other gear categories caught the remaining 2.1% (MAFMC 2013). Aside from gillnets, gear types authorized for use in the commercial harvest of bluefishinclude trawl, longline, handline, bandit, rod and reel, pot, trap, seine, and dredge gear (50 CFR 600.725(v)).

Consultations on the fishery have been conducted in 1999, 2010, and most recently in 2013. The 2013 consultation included an evaluation of the effects of the fishery on ESA-listed whales, sea turtles, and the newly listed Atlantic sturgeon. The bluefish fishery was considered as part of a larger “batched” consultation that evaluated the effects of: (1) Northeast multispecies, (2) monkfish, (3) spiny dogfish, (4) Atlantic bluefish, (5) Northeast skate complex, (6) Atlantic mackerel/squid/butterfish, and (7) summer flounder/scup/black sea bass fisheries. The consultation concluded that the continued operation of the Atlantic bluefish fishery was likely to adversely affect, but not jeopardize, the continued existence of any species of sea turtle; incidental take was authorized. Appendix 2 reports the takes currently authorized by gear type for the fisheries analyzed in the batched consultation.

Coastal Migratory Pelagics Fishery
In 2007, NMFS completed a Section 7 consultation on the continued authorization of the coastal migratory pelagics fishery in the Gulf of Mexico and South Atlantic (NMFS 2007). In the Gulf of Mexico, vertical line, gillnet, and cast net gears are used. Gillnets are the primary gear type used by commercial fishers in the south Atlantic regions as well, while the recreational sector uses hook-and-line gear. The vertical line effort is primarily trolling. The Opinion concluded that green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles may be adversely affected by operation of the fishery. In November 2012, NMFS requested reinitiation of consultation to evaluate the potential impact of this fishery on the recently listed 5 distinct population segments of Atlantic sturgeon and an Opinion was issued on June 18, 2015. The proposed action was not expected to jeopardize the continued existence of any of sea turtle species, and an ITS was provided. Appendix 2 reports the takes currently authorized for the fishery.

Dolphin/Wahoo Fishery
The South Atlantic FMP for the dolphin/wahoo fishery was approved in December 2003. The stated purpose of the Dolphin and Wahoo FMP is to adopt precautionary management strategies to maintain the current harvest level and historical allocations of dolphin (90% recreational) and ensure no new fisheries develop. NMFS conducted a formal Section 7 consultation to consider the effects on sea turtles of authorizing fishing under the FMP (NMFS 2003b). The August 27, 2003, Opinion concluded that green, hawksbill, Kemp’s ridley, leatherback, and loggerhead sea turtles may be adversely affected by the longline component of the fishery, but it was not expected to jeopardize their continued existence. An ITS for sea turtles was provided with the Opinion. In addition, pelagic longline vessels can no longer target dolphin/wahoo with smaller hooks because of hook size requirements in the pelagic longline fishery. Appendix 2 reports the takes currently authorized for the fishery.

HMS-Atlantic Pelagic Fisheries for Swordfish, Tuna, and Billfish
Atlantic pelagic fisheries for swordfish, tuna, and billfish are known to incidentally capture large numbers of sea turtles, particularly in the pelagic longline component. Pelagic longline, pelagic driftnet, bottom longline, and/or purse seine gear have all been documented taking sea turtles. The Northeast swordfish driftnet portion of the fishery was prohibited during an emergency closure that began in December 1996, and was subsequently extended. A permanent prohibition on the use of driftnet gear in the swordfish fishery was published in 1999. NMFS reinitiated consultation on the pelagic longline component of this fishery (NMFS 2004) because the authorized number of incidental takes for loggerheads and leatherbacks sea turtles were exceeded. The resulting Biological Opinion stated the long-term continued operation this sector of the fishery was likely to jeopardize the continued existence of leatherback sea turtles, but reasonable and prudent alternatives were identified allowing for the continued authorization of the pelagic longline fishing that would not jeopardize leatherback sea turtles. Appendix 2 reports the takes currently authorized for the fishery.

HMS Atlantic Shark and Smoothhound Fisheries
These fisheries include commercial shark bottom longline and gillnet fisheries and recreational shark fisheries under the FMP for Atlantic Tunas, Swordfish, and Sharks (HMS FMP). NMFS has formally consulted 3 times on the effects of HMS shark fisheries on sea turtles (i.e., (NMFS 2003a; NMFS 2008b; NMFS 2012b). NMFS also began authorizing a federal smoothhound fishery that will be managed as part of the HMS shark fisheries. (NMFS 2012b) analyzed the potential adverse effects from the smoothhound fishery on sea turtles for the first time. Both bottom longline and gillnet are known to adversely affect sea turtles. From 2007-2011, the sandbar shark research fishery had 100% observer coverage, with 4-6% observer coverage in the remaining shark fisheries. During that period, 10 sea turtle (all loggerheads) takes were observed on bottom longline gear in the sandbar shark research fishery, and 5 were taken outside the research fishery. The 5 non-research fishery takes were extrapolated to the entire fishery, providing an estimate of 45.6 sea turtle takes (all loggerheads) for non-sandbar shark research fishery from 2007-2010 (Carlson and Richards 2011). No sea turtle takes were observed in the non-research fishery in 2011 (NMFS unpublished data). Since the research fishery has a 100% observer coverage requirement those observed takes were not extrapolated (Carlson and Richards 2011). Because few smoothhound trips were observed, no sea turtle captures were documented in the smoothhound fishery.

The most recent ESA Section 7 consultation was completed on December 12, 2012, on the continued operation of those fisheries and Amendments 3 and 4 to the Consolidated HMS FMP (NMFS 2012b). The consultation concluded the proposed action was not likely to jeopardize the continued existence of sea turtles. An ITS was provided authorizing takes. Appendix 2 reports the takes currently authorized for the fishery.

South Atlantic Snapper-Grouper Fishery
This fishery is the subject of this consultation. As discussed in this Opinion, the fishery uses spear and powerheads, BSB pot, and hook-and-line gear. Hook-and-line gear used in the fishery includes commercial bottom longline gear and commercial and recreational vertical line gear (e.g., handline, bandit gear, and rod-and-reel). The fishery has impacted sea turtle species in the past and is mentioned here to acknowledge the effects it has had on sea turtle species up to this point. The previous consultation concluded the continued authorization of the fishery was not likely to jeopardize the continued existence of any of these species. Appendix 2 reports the takes authorized for the fishery prior to completion of this consultation.

Southeastern Shrimp Trawl Fisheries
NMFS has prepared Opinions on the Gulf of Mexico shrimp trawling numerous times over the years (most recently 2002 and 2012). The consultation history is closely tied to the lengthy regulatory history governing the use of TEDs and a series of regulations aimed at reducing potential for incidental mortality of sea turtles in commercial shrimp trawl fisheries. The level of annual mortality described in (NRC 1990) is believed to have continued until 1992-1994, when U.S. law required all shrimp trawlers in the Atlantic and Gulf of Mexico to use TEDs, allowing at least some sea turtles to escape nets before

drowning (NMFS 2002a).[17] TEDs approved for use have had to demonstrate 97% effectiveness in excluding sea turtles from trawls in controlled testing. These regulations have been refined over the years to ensure that TED effectiveness is maximized through proper placement and installation, configuration (e.g., width of bar spacing), flotation, and more widespread use.

Despite the apparent success of TEDs for some species of sea turtles (e.g., Kemp's ridleys), it was later discovered that TEDs were not adequately protecting all species and size classes of sea turtles. Analyses by Epperly and Teas (2002) indicated that the minimum requirements for the escape opening dimension in TEDs in use at that time were too small for some sea turtles and that as many as 47% of the loggerheads stranding annually along the Atlantic and Gulf of Mexico were too large to fit the existing openings. On December 2, 2002, NMFS completed an Opinion on shrimp trawling in the southeastern United States (NMFS 2002a) under proposed revisions to the TED regulations requiring larger escape openings (68 FR 8456, February 21, 2003). This Opinion determined that the shrimp trawl fishery under the revised TED regulations would not jeopardize the continued existence of any sea turtle species. The determination was based in part on the Opinion's analysis that shows the revised TED regulations are expected to reduce shrimp trawl related mortality by 94% for loggerheads and 97% for leatherbacks. In February 2003, NMFS implemented the revisions to the TED regulations.

On May 9, 2012, NMFS completed a Biological Opinion that analyzed the continued implementation of the sea turtle conservation regulations and the continued authorization of the Southeast U.S. shrimp fisheries in federal waters under the Magnuson-Stevens Act (NMFS 2012c). The Opinion also considered a proposed amendment to the sea turtle conservation regulations to withdraw the alternative tow time restriction at 50 CFR 223.206(d)(2)(ii)(A)(3) for skimmer trawls, pusher-head trawls, and wing nets (butterfly trawls) and instead require all of those vessels to use TEDs. The Opinion concluded that the proposed action was not likely to jeopardize the continued existence of any sea turtle species. An ITS was provided that used anticipated trawl effort and fleet TED compliance (i.e., compliance resulting in overall average sea turtle catch rates in the shrimp otter trawl fleet at or below 12%) as surrogates for sea turtle takes. On November 21, 2012, NMFS determined that a Final Rule requiring TEDs in skimmer trawls, pusher-head trawls, and wing nets was not warranted and withdrew the proposal. The decision to not implement the Final Rule created a change to the proposed action analyzed in the 2012 Opinion and triggered the need to reinitiate consultation. Consequently, NMFS reinitiated consultation on November 26, 2012. Consultation was completed in April 2014 and determined the continued implementation of the sea turtle conservation regulations and the continued authorization of the Southeast U.S. shrimp fisheries in federal waters under the Magnuson-Stevens Act was not likely jeopardize the continued existence of any sea turtle species. The ITS maintained the use of anticipated trawl effort and fleet TED compliance as surrogates for numerical sea turtle takes. Appendix 2 reports the takes currently authorized for the fishery

[17] TEDs were mandatory on all shrimping vessels; however, certain shrimpers (e.g., fishers using skimmer trawls or targeting bait shrimp) could operate without TEDs if they agreed to follow specific tow time restrictions.

Spiny Dogfish Fishery
The primary gear types for the spiny dogfish fishery are sink gillnets, otter trawls, bottom longline, and driftnet gear (NEFSC 2003). The predominance of any 1 gear type has varied over time (NEFSC 2003). In 2005, 62.1% of landings were taken by sink gillnet gear, followed by 18.4% in otter trawl gear, 2.3% in line gear, and 17.1% in gear defined as "other" (excludes drift gillnet gear) (NEFSC 2006). More recently, data from fish dealer reports in Fiscal Year 2008 indicate that spiny dogfish landings came mostly from sink gill nets (68.2%), and hook gear (15.2%), bottom otter trawls (4.9%), as well as unspecified (7.7%) or other gear (3.9%) (MAFMC 2010). Sea turtles can be incidentally captured in spiny dogfish gear, which can lead to injury and death as a result of forced submergence in the gear.

Biological Opinions on the continued operation of the fishery were completed in 2008, 2010, and most recently in December 2013. The 2013 consultation included an evaluation of the effects of the fishery on ESA-listed considered as part of a larger "batched" consultation which evaluated the effects of the (1) Northeast multispecies, (2) monkfish, (3) spiny dogfish, (4) Atlantic bluefish, (5) Northeast skate complex, (6) Atlantic mackerel/squid/butterfish, and (7) summer flounder/scup/BSB fisheries. The consultation concluded that the continued operation of the fishery was likely to adversely affect but not jeopardize the continued existence of any species of sea turtle. Incidental take was authorized. Appendix 2 reports the takes currently authorized for the fishery.

Monkfish Fishery
The federal monkfish fishery occurs from Maine to the North Carolina/South Carolina border and is jointly managed by the New England Fishery Management Council (NEFMC) and mid-Atlantic Fishery Management Council, under the Monkfish FMP (NMFS 2005b). Monkfish are harvested commercially primarily from the deeper waters of the Gulf of Maine, Georges Bank, and southern New England, and in the mid-Atlantic. Monkfish have been found in depths ranging from the tide line to 900 m with concentrations between 70 and 100 m and at 190 m. The directed monkfish fishery uses several gear types that may entangle protected species, including gillnet and trawl gear.

Gillnet gear used in the monkfish fishery is known to capture ESA-listed sea turtles. Two unusually large stranding events occurred in April and May 2000 during which 280 sea turtles (275 loggerheads and 5 Kemp's ridleys) washed ashore on ocean facing beaches in North Carolina. Although there was not enough information to specifically determine the cause of the sea turtle deaths, there was information to suggest that the turtles died as a result of entanglement with large-mesh gillnet gear. The monkfish gillnet fishery, which uses a large-mesh gillnet, was known to be operating in waters off North Carolina at the time the stranded turtles would have died. As a result, in March 2002, NMFS published new restrictions for the use of gillnets with larger than 8-in (20.3 cm) stretched mesh, in federal waters (3-200 nmi) off of North Carolina and Virginia. These restrictions were published in an Interim Final Rule under the authority of the ESA (67 FR 13098; March 21, 2002) and were implemented to reduce the impact of the monkfish and other large-mesh gillnet fisheries on endangered and threatened species of sea turtles in areas where sea turtles are known to concentrate. Following review of public comments submitted on the Interim Final Rule, NMFS published a Final Rule on December 3, 2002, that established the restrictions on an annual basis.

Biological Opinions on the fishery were completed in 2001, 2003, 2010, and most recently, in December 2013. The 2013 consultation included an evaluation of the effects of the fishery on ESA-listed whales, sea turtles, and the newly listed Atlantic sturgeon. The monkfish fishery was considered as part of a larger "batched" consultation which evaluated the effects of the (1) Northeast multispecies, (2) monkfish, (3) spiny dogfish, (4) Atlantic bluefish, (5) Northeast skate complex, (6) Atlantic mackerel/squid/butterfish, and (7) summer flounder/scup/black sea bass fisheries. The consultation concluded that the continued operation of the fishery was likely to adversely affect but not jeopardize the continued existence of any species of sea turtle; incidental take was authorized. Appendix 2 reports the takes currently authorized by gear type for the fisheries analyzed in the batched consultation.

Other Fisheries

Several fisheries are promulgated primarily in the mid-Atlantic to northern Atlantic of the United States and marginally overlap with the action area of the proposed action (just the northern portion of North Carolina). These fisheries are not likely to impact the proposed action baseline to the extent other fisheries listed in this Opinion may. They are listed here to provide a complete acknowledgement of the activities potentially impacting the baseline. They are the Atlantic Sea Scallop Fishery, the Summer Flounder/Scup/Black Sea Bass, Mackerel/Squid/Butterfish Fisheries, Red Crab Fishery, and Skate Fishery. The consultation for these fisheries concluded that the continued operation of the fisheries were likely to adversely affect, but not jeopardize, the continued existence of any species of sea turtle. Appendix 2 reports the takes currently authorized by gear type for the fisheries analyzed in the batched consultation.

Atlantic Sea Scallop Fishery

The Atlantic sea scallop fishery has a long history of operation in mid-Atlantic, as well as New England waters (NEFMC 1982 ; NEFMC 2003). The fishery operates in areas and at times that it has traditionally operated and uses traditionally fished gear (NEFMC 1982 ; NEFMC 2003). Landings from Georges Bank and the mid-Atlantic dominate the fishery (NEFSC 2007a). On Georges Bank and in the mid-Atlantic, sea scallops are harvested primarily at depths of 30-100 m, while the bulk of landings from the Gulf of Maine are from relatively shallow nearshore waters (< 40 m) (NEFSC 2007a). Effort (in terms of days fished) in the mid-Atlantic is about half of what it was prior to implementation of Amendment 4 to the Scallop FMP in the 1990s (NEFSC 2007a).

NMFS completed a Section 7 consultation on the Atlantic sea scallop fishery (NMFS 2008a). The Opinion concluded that the continued authorization of the fishery was likely to adversely affect green, Kemp's ridley, leatherback, and loggerhead sea turtles, but was not likely to jeopardize their continued existence; an ITS was issued. The sea scallop fishery has a long history of operation in the mid-Atlantic, as well as in New England waters (NEFMC 1982 ; NEFMC 2003). Effort in the mid-Atlantic is about half of what it was prior to implementation of the Scallop FMP in the 1990s (NEFSC 2007a). Green, Kemp's ridley, and loggerhead sea turtles have been reported by NMFS-trained observers as being captured in scallop dredges and trawl gear. Methods used to detect any sea turtle interactions with scallop fishing gear (dredge or trawl gear) were insufficient prior to increased observation coverage in 2001, which now documents that this fishery results in many loggerhead mortalities on an annual basis. Although NMFS was not aware until 2001 of sea turtle interactions with scallop fishing gear, there is no information to suggest that they are new or occurring at a greater rate than what has likely occurred in the past. Therefore, it is likely that the effect of the scallop fishery on sea turtles has been present for decades.

Formal Section 7 consultation on the continued operation of the scallop fishery was completed by NMFS on March 14, 2008; the ITS was amended on February 4, 2009. NMFS determined that the continued operation of the fishery (including the seasonal use of chain-mat modified scallop dredge gear in mid-Atlantic waters) may adversely affect but was not likely to jeopardize the continued existence of loggerhead, leatherback, Kemp's ridley, and green sea turtles.

Consultation was reinitiated to address the listing of 5 DPSs of Atlantic sturgeon in April 2012, as well as additional information available since the last Opinion on the fishery's effects on sea turtles. Reports by Murray (2011) and Warden and Murray (2011) provide new information on the annual number of sea turtle interactions in both the dredge and trawl components of the fishery. In addition, a workshop convened by NMFS to refine methods to determine the levels of serious injury/mortality to sea turtles interacting with Northeast fisheries, and papers by Milliken et al. (2007), Smolowitz et al. (2010) and the Scallop Plan Development Team, provided new information on the levels of serious injury/mortality to sea turtles in the fishery. Additionally, new management measures meant to reduce the impacts of the fishery on sea turtles were implemented since the completion of the last Opinion. Appendix 2 reports the takes currently authorized for the Atlantic scallop trawl and dredge fisheries.

Summer Flounder, Scup, and Black Sea Bass Fisheries

In the mid-Atlantic, summer flounder, scup, and BSB are managed under a single FMP since these species occupy similar habitat and are often caught at the same time. Bottom otter and beam trawl gear are used most frequently in the commercial fisheries for all 3 species (MAFMC 2007b). Gillnets, handlines, dredges, and pots/traps are also occasionally used (MAFMC 2007b).

Significant measures have been developed to reduce the incidental take of sea turtles in summer flounder trawls and trawls that meet the definition of a summer flounder trawl (which includes gear used in fisheries for other species like scup and BSB). TEDs are required throughout the year for trawl nets fished from the North Carolina/South Carolina border to Oregon Inlet, North Carolina, and seasonally (March 16-January 14) for trawl vessels fishing between Oregon Inlet, North Carolina, and Cape Charles, Virginia. Effort in the summer flounder, scup, and BSB fisheries has also declined since the 1980s and since each species became managed under the FMP. Therefore, effects to sea turtles are expected, in general, to have declined as a result of the decline in fishing effort.

Nevertheless, the fisheries primarily operate in mid-Atlantic waters in areas and times when sea turtles occur. Thus, there is a continued risk of sea turtle captures causing injury and death in summer flounder, scup, and BSB fishing gear.

Biological Opinions on the continued operation of the fishery under the Summer Flounder, Scup and Black Sea Bass FMP were completed in 2008, 2010, and most recently in December 2013. The 2013 consultation included an evaluation of the effects of the fishery on ESA-listed whales, sea turtles, and the newly listed Atlantic sturgeon. The monkfish fishery was considered as part of a larger "batched" consultation which evaluated the effects of the (1) Northeast multispecies, (2) monkfish, (3) spiny dogfish, (4) Atlantic bluefish, (5) Northeast skate complex, (6) Atlantic mackerel/squid/butterfish, and (7) summer flounder/scup/black sea bass fisheries. The consultation concluded that the continued operation of the fishery was likely to adversely affect but not jeopardize the continued existence of any species of sea turtle. Incidental take was authorized. Appendix 2 reports the takes currently authorized as part of the batched consultation.

Mackerel/Squid/Butterfish Fisheries
Atlantic mackerel/squid/butterfish fisheries are managed under a single FMP, which was first implemented on April 1, 1983. Bottom otter trawl gear is the primary gear type used to land *Loligo* and *Illex* squid. Based on NMFS dealer reports, the majority of *Loligo* and *Illex* squid are fished in the mid-Atlantic including waters within the action area of this consultation where loggerheads also occur. While squid landings occur year round, the majority of *Loligo* squid landings occur in the fall through winter months while the majority of *Illex* landings occur from June through October (MAFMC 2007a); time periods that overlap in whole or in part with the distribution of loggerhead sea turtles in mid-Atlantic waters. Gillnets account for a small amount of landings in the mackerel fishery, and all gillnet gear use by this fishery is subject to the requirements of the Atlantic Large Whale Take Reduction Plan.

Loggerhead sea turtles are captured in bottom-otter trawl gear used in the *Loligo* and *Illex* squid fisheries, and gillnet gear used by the mackerel fishery and may be injured or killed as a result of forced submergence in the gear. The most recent Biological Opinion completed on these federal fisheries was completed in December 2013. The 2013 consultation included an evaluation of the effects of the fishery on ESA-listed whales, sea turtles, and the newly listed Atlantic sturgeon. The mackerel/squid/butterfish fisheries were considered as part of a larger "batched" consultation which evaluated the effects of the (1) Northeast multispecies, (2) monkfish, (3) spiny dogfish, (4) Atlantic bluefish, (5) Northeast skate complex, (6) Atlantic mackerel/squid/butterfish, and (7) summer flounder/scup/black sea bass fisheries. The consultation concluded that the continued operation of the fisheries were likely to adversely affect but not jeopardize the continued existence of any species of sea turtle. Incidental take was authorized. Appendix 2 reports the takes currently authorized by gear type for the fisheries analyzed in the batched consultation.

Red Crab Fishery
Section 7 consultation was completed on the deep-sea red crab fishery during the proposed implementation of the Red Crab FMP (NMFS 2002b). The fishery is a pot/trap fishery that occurs in deep waters along the continental slope. The primary fishing zone for red crab, as reported by the fishing industry, is at a depth of 1,300-2,600 ft along the continental shelf in the Northeast Region and is limited to waters north of 35°15.3'N (Cape Hatteras, North Carolina) and south of the Hague Line. The Opinion concluded that the action was not likely to result in jeopardy to any ESA-listed species under NMFS's jurisdiction. An ITS was provided for leatherback and loggerhead sea turtles. Appendix 2 reports the takes currently authorized for fishery.

Skate Fishery
The skate fishery has typically been composed of both a directed fishery and an indirect fishery. Otter trawls are the primary gear used to land skates in the United States, with some landings also coming from sink gillnet, longline, and other gear (NEFSC 2007b). Bottom trawl gear accounted for 94.5% of directed skate landings. Gillnet gear is the next most common gear type, accounting for 3.5% of skate landings.

For Section 7 purposes, NMFS considers the effects to ESA-listed species of the directed skate fishery. Fishing effort that contributes to landings of skate for the indirect fishery is considered during Section 7 consultation on the directed fishery in which skate bycatch occurs. Biological Opinions on the skate FMP were completed in 2003 (NMFS 2003b), 2010, and most recently, in December 2013, as one of the fisheries analyzed in the aforementioned batch consultation. Appendix 2 reports the takes currently authorized by gear type for the fisheries analyzed in the batched consultation.

4.3.1.2 Vessel Activities

Watercraft are the greatest contributors to overall noise in the sea and have the potential to interact with sea turtles though direct impacts or propellers. Sound levels and tones produced are generally related to vessel size and speed. Larger vessels generally emit more sound than smaller vessels, and vessels underway with a full load, or those pushing or towing a load, are noisier than unladen vessels. Vessels operating at high speeds have the potential to strike sea turtles. Potential sources of adverse effects from federal vessel operations in the action area include operations of the United States Department of Defense (DOD), Bureau of Ocean Energy Management/Bureau of Safety and Environmental Enforcement (BOEM/BSEE), Federal Energy Regulatory Commission (FERC), United States Coast Guard (USCG), NOAA, and USACE.

4.3.1.3 Federal Military Activities

Potential sources of adverse effects in the action area include operations of the U.S. Department of Defense (DoD).

The United States Navy (USN) conducts military readiness activities, which can be categorized as either training or testing exercises, throughout the action area. During training, existing and established weapon systems and tactics are used in realistic situations to simulate and prepare for combat. Activities include: routine gunnery, missile, surface fire support, amphibious assault and landing, bombing, sinking, torpedo, tracking, and mine exercises. Testing activities are conducted for different purposes and include at-sea research, development, evaluation, and experimentation. USN performs testing activities to ensure that its military forces have the latest technologies and techniques available to them. USN activities are likely to produce noise and harass sea turtles throughout the action area. Formal consultations on overall USN activities in the Atlantic have been completed, including USN Joint Logistics Over-the-Shore Training in Virginia and North Carolina (JLOTS) 2014, [Opinion issued to USN in 2014 (NMFS 2014)]; USN Atlantic Fleet Training and Testing (AFTT) Activities (2013-2018), [Opinion issued to USN in 2013 (NMFS 2013)]; U.S. Navy East Coast Range Complex, [Opinion issued to USN in 2012 (NMFS 2012)]; USN's Activities in East Coast Training Ranges [Opinion issued to USN in 2011 (NMFS June 1, 2011)]; USN Atlantic Fleet Sonar Training Activities (AFAST) [Opinion issued to USN in 2011 (January 20, 2011)]; Navy AFAST LOA 2012-2014: U.S. Navy active sonar training along the Atlantic Coast and Gulf of Mexico [Opinion issued to USN in 2011 (December 19, 2011)]; and Navy's East Coast Training Ranges (Virginia Capes, Cherry Point, and Jacksonville) [Opinion issued to USN in 2010 (June 2010)]. These Opinions concluded that although there is a potential from some USN activities to affect sea turtles, those effects were not expected to impact any species on a population level. Therefore, the activities were determined to be not likely to jeopardize the continued existence of any ESA-listed sea turtle species, or destroy or adversely modify critical habitat of any listed species.

4.3.1.4 ESA Section 10 Permits

The ESA allows for the issuance of permits authorizing take of certain ESA-listed species for the purposes of scientific research or enhancement (Section 10(a)(1)(A)). NMFS consults with itself to ensure that issuance of such permits can be done in compliance with Section 7 of the ESA.

Sea turtles are the focus of research activities in the action area for which take is authorized by Section 10 permits under the ESA. As of July 2016, there were 11 active scientific research permits directed toward sea turtles that are applicable to the action area of this Biological Opinion. Authorized activities range from photographing, weighing, and tagging sea turtles incidentally taken in fisheries, to blood sampling, tissue sampling (biopsy), and performing laparoscopy on intentionally captured sea turtles. The number of authorized takes varies widely depending on the research and species involved but may involve the taking of hundreds of sea turtles annually. Most takes authorized under these permits are expected to be nonlethal. Before any research permit is issued, the proposal must be reviewed under the permit regulations (i.e., must show a benefit to the species). In addition, since issuance of the permit is a federal activity, Section 7 analysis is also required to ensure the issuance of the permit is not likely to result in jeopardy to the species.

4.3.2 State or Private Actions

4.3.2.1 Private and Commercial Vessel Operations

Private and commercial vessels, including fishing vessels, operating in the action area of this consultation also have the potential to interact with ESA-listed species. The effects of fishing vessels, recreational vessels, or other types of commercial vessels on listed species may involve disturbance or injury/mortality due to collisions or entanglement in anchor lines. Commercial traffic and recreational pursuits can also adversely affect sea turtles through propeller- and boat strikes. The STSSN includes many records of vessel interaction (propeller injury) with sea turtles off south Atlantic coastal states such as Florida, where there are high levels of vessel traffic. The extent of the problem is difficult to assess because of not knowing whether the majority of sea turtles are struck pre- or post-mortem. Private vessels in the action area participating in high-speed marine events (e.g., boat races) are a particular threat to sea turtles. It is important to note that although minor vessel collisions may not kill an animal directly, they may weaken or otherwise affect an animal, which makes it more likely to become vulnerable to effects such as entanglements. NMFS and the USCG have completed several formal consultations on individual marine events that may affect sea turtles.

4.3.3 Climate Change

As discussed earlier in this Opinion, there is a large and growing body of literature on past, present, and future impacts of global climate change. Potential effects commonly mentioned include changes in sea temperatures and salinity (due to melting ice and increased rainfall), ocean currents, storm frequency and weather patterns, and ocean acidification. These changes have the potential to affect species behavior and ecology including migration, foraging, reproduction (e.g., success), and distribution. For example, sea turtles currently range from temperate to tropical waters. A change in water temperature could result in a shift or modification of range. Climate change may also affect marine forage species, either negatively or positively (the exact effects for the marine food web upon which sea turtles rely is unclear, and may vary between species). It may also affect migratory behavior (e.g., timing, length of stay at certain locations). These types of changes could have implications for sea turtle recovery.

Additional discussion of climate change can be found in the Status of the Species. However, to summarize with regards to the action area, global climate change may affect the timing and extent of population movements and their range, distribution, species composition of prey, and the range and abundance of competitors and predators. Changes in distribution including displacement from ideal habitats, decline in fitness of individuals, population size due to the potential loss of foraging opportunities, abundance, migration, community structure, susceptibility to disease and contaminants, and reproductive success are all possible impacts that may occur as the result of climate change. Still, more information is needed to better determine the full and entire suite of impacts of climate change on sea turtles and specific predictions regarding impacts in the action area are not currently possible.

4.3.4 Marine Pollution

While some sources of marine pollution are difficult to attribute to a specific federal, state, local or private action, they may indirectly affect sea turtles in the action area. Sources of pollutants include atmospheric loading of pollutants such as PCBs and stormwater runoff from coastal towns and cities into rivers and canals emptying into bays and the ocean (e.g., Mississippi River). There are studies on organic contaminants and trace metal accumulation in green, leatherback, and loggerhead sea turtles (Aguirre et al. 1994; Caurant et al. 1999; Corsolini et al. 2000). McKenzie et al. (1999) measured concentrations of chlorobiphenyls and organochlorine pesticides in sea turtles tissues collected from the Mediterranean (Cyprus, Greece) and European Atlantic waters (Scotland) between 1994 and 1996. Omnivorous loggerhead turtles had the highest organochlorine contaminant concentrations in all the tissues sampled, including those from green and leatherback turtles (Storelli et al. 2008b). It is thought that dietary preferences were likely to be the main differentiating factor among species. Decreasing lipid contaminant burdens with sea turtle size were observed in green turtles, most likely attributable to a change in diet with age. (Sakai et al. 1995) documented the presence of metal residues occurring in loggerhead sea turtle organs and eggs. Storelli et al. (1998) analyzed tissues from 12 loggerhead sea turtles stranded along the Adriatic Sea (Italy) and found that characteristically, mercury accumulates in sea turtle livers while cadmium accumulates in their kidneys, as has been reported for other marine organisms like dolphins, seals, and porpoises (Law et al. 1991a). No information on detrimental threshold concentrations is available and little is known about the consequences of exposure of organochlorine compounds to sea turtles. Research is needed into how chlorobiphenyl, organochlorine, and heavy-metal accumulation effect the short- and long-term health of sea turtles and what effect those chemicals have on the number of eggs laid by females. More information is needed to understand the potential impacts of marine pollution in the action area.

Nutrient loading from land-based sources, such as coastal communities and agricultural operations, stimulate plankton blooms in closed or semi-closed estuarine systems. Oxygen depletion, referred to as hypoxia, can negatively impact sea turtles' habitats, prey availability, and survival and reproductive fitness. But the effects of nutrient loading on larger embayments (and the pelagic environment of the action area) are unknown.

Fuel oil spills could affect animals directly or indirectly through the food chain. Fuel spills involving fishing vessels are common events, although these spills typically involve small amounts of material. Larger oil spills may result from accidents, although these events would be rare. No direct adverse effects on listed species resulting from fishing vessel fuel spills have been documented.

4.3.5 Conservation and Recovery Actions Benefiting Sea Turtles in the Action Area

NMFS has implemented a series of regulations aimed at reducing potential for incidental mortality of sea turtles from commercial fisheries in the action area. These include sea turtle release gear requirements for the Atlantic HMS, South Atlantic snapper-grouper fisheries, TED requirements for the Southeast shrimp trawl and North Carolina flynet fisheries, mesh size restrictions in the North Carolina gillnet fishery and Virginia's gillnet fisheries, and area closures in the North Carolina gillnet fishery. In addition to regulations, outreach programs have been established and data on sea turtle interactions with recreational fisheries has been collected through the Marine Recreational Fishery Statistical Survey (MRFSS)/Marine Recreational Information Program. The summaries below discuss all of these measures in more detail.

Reducing Threats from Pelagic Longline and Other Hook-and-Line Fisheries
On July 6, 2004, NMFS published a Final Rule to implement management measures to reduce bycatch and bycatch mortality of Atlantic sea turtles in the Atlantic pelagic longline fishery (69 FR 40734). The management measures include mandatory circle hook and bait requirements, and mandatory possession and use of sea turtle release equipment to reduce bycatch mortality.

NMFS published Final Rules to implement sea turtle release gear requirements and sea turtle careful release protocols in the South Atlantic snapper-grouper fishery (November 8, 2011; 76 FR 69230). These measures require owners and operators of vessels with federal commercial or charter vessel/headboat permits for South Atlantic snapper-grouper to comply with sea turtle (and smalltooth sawfish) release protocols and have on board specific sea turtle-release gear.

Revised Use of Turtle Excluder Devices in Trawl Fisheries
NMFS has also implemented a series of regulations aimed at reducing potential for incidental mortality of sea turtles in commercial shrimp trawl fisheries. In particular, NMFS has required the use of TEDs in southeast United States shrimp trawls since 1989 and in summer flounder trawls in the mid-Atlantic area (south of Cape Charles, Virginia) since 1992. It has been estimated that TEDs exclude 97% of the sea turtles caught in such trawls. These regulations have been refined over the years to ensure that TED effectiveness is maximized through more widespread use, and proper placement, installation, configuration (e.g., width of bar spacing), and floatation.

Significant measures have been developed to reduce sea turtle interactions in summer flounder trawls and trawls that meet the definition of a summer flounder trawl (which would include fisheries for other species like scup and BSB) by requiring TEDs in trawl nets fished from the North Carolina/South Carolina border to Cape Charles, Virginia. However, the TED requirements for the summer flounder trawl fishery do not require the use of the larger TEDs that are used in the shrimp trawl fisheries to exclude leatherbacks, as well as large benthic-immature and sexually mature loggerheads and green sea turtles.

In 1998, the SEFSC began developing a TED for flynets. In 2007, the Flexible Flatbar Flynet TED was developed and catch retention trials and usability testing was completed (Gearhart 2010). Experiments are still ongoing to certify a bottom-opening flynet TED.

Placement of Fisheries Observers to Monitor Sea Turtle Captures
On August 3, 2007, NMFS published a Final Rule that required selected fishing vessels to carry observers on board to collect data on sea turtle interactions with fishing operations, to evaluate existing measures to reduce sea turtle captures, and to determine whether additional measures to address prohibited sea turtle captures may be necessary (72 FR 43176). This Rule also extended the number of days NMFS observers could be placed aboard vessels, for 30-180 days, in response to a determination by the Assistant Administrator that the unauthorized take of sea turtles may be likely to jeopardize their continued existence under existing regulations.

Final Rules for Large-Mesh Gillnets
In March 2002, NMFS published new restrictions for the use of gillnets with larger than 8-in-stretched mesh, in federal waters (3-200 nmi) off North Carolina and Virginia. These restrictions were published in an interim Final Rule under the authority of the ESA (67 FR 13098) and were implemented to reduce the impact of the monkfish and other large-mesh gillnet fisheries on ESA-listed sea turtles in areas where sea turtles are known to concentrate. Following review of public comments submitted on the interim Final Rule, NMFS published a Final Rule on December 3, 2002, that established the restrictions on an annual basis. As a result, gillnets with larger than 8-in-stretched mesh were not allowed in federal waters (3-200 nmi) in the areas described as follows: (1) north of the North Carolina/South Carolina border at the coast to Oregon Inlet at all times; (2) north of Oregon Inlet to Currituck Beach Light, North Carolina, from March 16-January 14; (3) north of Currituck Beach Light, North Carolina, to Wachapreague Inlet, Virginia, from April 1-January 14; and (4) north of Wachapreague Inlet, Virginia, to Chincoteague, Virginia, from April 16-January 14. On April 26, 2006, NMFS published a Final Rule (71 FR 24776) that included modifications to the large-mesh gillnet restrictions. The new Final Rule revised the gillnet restrictions to apply to stretched mesh that is greater than or equal to 7 inches. Federal waters north of Chincoteague, Virginia, remain unaffected by the large-mesh gillnet restrictions.

Sea Turtle Handling and Resuscitation Techniques
NMFS published a Final Rule (66 FR 67495, December 31, 2001) detailing handling and resuscitation techniques for sea turtles that are incidentally caught during scientific research or fishing activities. Persons participating in fishing activities or scientific research are required to handle and resuscitate (as necessary) sea turtles as prescribed in the Final Rule. These measures help to prevent mortality of hardshell turtles caught in fishing or scientific research gear.

Outreach and Education, Sea Turtle Rescue and Rehabilitation
There is an extensive network of SSTSSN participants along the Atlantic coast who not only collect data on dead sea turtles, but also rescue and rehabilitate any live stranded sea turtles.

A Final Rule (70 FR 42508) published on July 25, 2005, allows any agent or employee of NMFS, the USFWS, the USCG, or any other federal land or water management agency, or any agent or employee of a state agency responsible for fish and wildlife, when acting in the course of his or her official duties, to take endangered sea turtles encountered in the marine environment if such taking is necessary to aid a sick, injured, or entangled endangered sea turtle, or dispose of a dead endangered sea turtle, or salvage a dead endangered sea turtle that may be useful for scientific or educational purposes. NMFS already affords the same protection to sea turtles listed as threatened under the ESA [50 CFR 223.206(b)].

4.4 Factors Affecting Smalltooth Sawfish within the Action Area

The following analysis examines actions that may affect this species and its environment specifically within the action area. The activities that shape the environmental baseline in the action area of this consultation are primarily federal fisheries. Other environmental impacts include effects of permits allowing take under the ESA and marine pollution.

4.4.1 Federal Actions

In recent years, NMFS has undertaken Section 7 consultations to address the effects of federally permitted fisheries and other federal actions on smalltooth sawfish, and when appropriate, has authorized the incidental taking of this species. Each of those consultations sought to minimize the adverse impacts of the action on smalltooth sawfish. The following sections summarize anticipated sources of incidental take of smalltooth sawfish in the action area that have already concluded formal Section 7 consultation.

4.4.1.1 Federal Fisheries

HMS Shark and Smoothhound Fisheries

These fisheries include commercial shark bottom longline and gillnet fisheries and recreational shark fisheries under the FMP for Atlantic Tunas, Swordfish, and Sharks (HMS FMP). NMFS has formally consulted 3 times on the effects of HMS shark fisheries on smalltooth sawfish (NMFS 2003a; NMFS 2008c; NMFS 2012b). NMFS also began authorizing a federal smoothhound fishery that will be managed as part of the HMS shark fisheries. NMFS (2012b) considered the potential adverse effects from the smoothhound fishery on smalltooth sawfish for the first time. Both bottom longline and gillnet are known to adversely affect smalltooth sawfish. From 2007-2011, the sandbar shark research fishery had 100% observer coverage and with 4-6% observer coverage in the remaining shark fisheries. During that period, smalltooth sawfish were only observed taken in bottom longline gear. Sixteen smalltooth sawfish captures were observed in the sandbar shark research fishery and 6 were taken outside the research fishery (Carlson and Richards 2011); 1 take in the shark bottom longline fishery resulted in mortality. The 6 non-research fishery captures were extrapolated to the entire fishery, providing an estimate of 17.3 total smalltooth sawfish captures for non-sandbar shark research fishery. Since the research fishery has a 100% observer-coverage requirement those observed captures were not extrapolated (Carlson and Richards 2011). No captured smalltooth sawfish have been observed in the smoothhound fishery.

The most recent ESA Section 7 consultation was completed on December 12, 2012, on the continued operation of HMS shark fisheries and Amendments 3 and 4 to the Consolidated HMS FMP (NMFS 2012b). The consultation concluded the proposed action was not likely to jeopardize the continued existence of the smalltooth sawfish. Appendix 2 reports the smalltooth sawfish incidental takes authorized for this fishery.

South Atlantic U.S. Shrimp Fishery

NMFS has also conducted Section 7 consultations on the impacts to smalltooth sawfish from the shrimp fishery in the South Atlantic (NMFS 2005a). This consultation found this fishery likely to adversely affect smalltooth sawfish, but not likely to jeopardize its continued existence. The ITS provided in the Biological Opinion anticipated the lethal take of up to 1 smalltooth sawfish annually in the fishery. Between May 2009 and March 2010, NMFS requested reinitiation of Section 7 consultation on the South Atlantic and Gulf of Mexico shrimp fisheries to analyze their effects on smalltooth sawfish, because new observer data indicated that the incidental take statements of the respective Biological Opinions had been exceeded. On May 9, 2012, NMFS completed the new Opinion which analyzed the continued implementation of the Southeast U.S. shrimp fisheries in federal waters under the Magnuson-Stevens Fisheries Conservation and Management Act. The Opinion also considered a proposed amendment to the sea turtle conservation regulations that would withdraw the alternative tow time restriction at 50 CFR 223.206(d)(2)(ii)(A)(3) for skimmer trawls, pusher-head trawls, and wing nets (butterfly trawls) and instead require all of these vessels to use TEDs. The Opinion concluded that the proposed action was not likely to jeopardize the continued existence of smalltooth sawfish. An ITS was provided.

On November 21, 2012, NMFS determined that a Final Rule requiring TEDs in skimmer trawls, pusher-head trawls, and wing nets was not warranted and withdrew the proposal. The decision to not implement the Final Rule created a change to the proposed action analyzed in the 2012 Opinion and triggered the need to reinitiate consultation. Consequently, NMFS reinitiated consultation on November 26, 2012. Consultation was completed in April 2014, and NMFS determined the continued implementation of the sea turtle conservation regulations and the continued authorization of the southeast U.S. shrimp fisheries in federal waters under the Magnuson-Stevens Act was not likely to jeopardize the continued existence smalltooth sawfish. An ITS was issued and Appendix 2 reports the smalltooth sawfish incidental takes authorized for this fishery.

Coastal Migratory Pelagic Fishery

NMFS recently completed a Section 7 consultation on the continued authorization of the coastal migratory pelagic fishery in the Atlantic and Gulf of Mexico (NMFS 2015a). Gillnets are the primary gear type used by commercial fishers in the South Atlantic, while the recreational sector uses hook-and-line gear. The Biological Opinion concluded that smalltooth sawfish may be adversely affected by operation of the fishery; however, the proposed (NMFS 2015b)action was not expected to jeopardize its continued existence, and an ITS was provided. Appendix 2 reports the smalltooth sawfish incidental takes authorized for this fishery.

South Atlantic Snapper-Grouper Fishery
This fishery is the subject of this consultation. As discussed in this Opinion, the fishery uses spear and powerheads, black sea bass pot, and hook-and-line gear. Hook-and-line gear used in the fishery includes commercial bottom longline gear and commercial and recreational vertical line gear (e.g., handline, bandit gear, and rod-and-reel). The fishery has impacted sea turtle species in the past and is mentioned here to acknowledge the effects it has had on sea turtle species up to this point. The previous consultation concluded the proposed action was not likely to jeopardize the continued existence of any of these species. Appendix 2 reports the takes authorized for the fishery prior to completion of this consultation.

4.4.1.2 ESA Section 10 Permits

Section 10(a)(1)(A) of the ESA allows NMFS to issue permits for the taking of ESA-listed species for scientific research or enhancement purposes. NMFS consults with itself to ensure that its issuance of these permits can be done in compliance with Section 7 of the ESA. There are currently 3 active research permits issued for smalltooth sawfish. The permit allows researchers to capture, handle, collect tissue and blood samples, and tag smalltooth sawfish. Although the research may result in disturbance and minor injury of smalltooth sawfish, the activities are not expected to affect the reproduction of the individuals that are caught, nor result in mortality. No Section 10 (a)(1)(B) have ever been issued for the capture of smalltooth sawfish.

4.4.2 State or Private Actions

Entanglement in state trap/pot fisheries is another potential route of effect to smalltooth sawfish. The State of Florida's stone crab fishery is an example of a state trap fishery that may interact with smalltooth sawfish. On October 15, 2011, NMFS repealed the federal FMP for stone crab. Prior to the repeal, NMFS prepared a Biological Opinion on the continued authorization of the federal fishery. The Opinion concluded the federal stone crab fishery was likely to adversely affect smalltooth sawfish, but it was not likely to jeopardize their continued existence. The State of Florida now exclusively manages the stone crab fishery, even vessels fishing in the EEZ (which includes the action area). The State of Florida has actively managed the fishery since 1929; the federal FMP was implemented in 1979 to address gear conflicts. The federal fishery was managed primarily by issuing regulations complimentary to those promulgated by the State of Florida. Since the State of Florida has essentially been the lead management agency for the state and federal fishery for some time, little change in how the fishery operates or amount of the effort occurring in the fishery is expected because of the repeal of the federal FMP. Therefore, the anticipated adverse effects described in the Biological Opinion completed before the repeal of the federal FMP are expected to continue to occur to smalltooth sawfish.

Additionally, lost fishing gear, or discarded hooks and line, can also pose an entanglement threat to smalltooth sawfish.

4.4.3 Climate Change

As discussed earlier in this Opinion, there is a large and growing body of literature on past, present, and future impacts of global climate change. Potential effects to the environment commonly mentioned include changes in sea temperatures and salinity (due to melting ice and increased rainfall), ocean currents, storm frequency and weather patterns, and ocean acidification. These changes have the potential to affect species behavior and ecology including migration, foraging, reproduction (e.g., success), and distribution.

Additional discussion of climate change can be found in the Status of the Species. However, more information is needed to better determine the full and entire suite of impacts of climate change on this species and specific predictions regarding impacts in the action area are not currently possible.

4.4.4 Other Potential Sources of Impacts in the Environmental Baseline

Marine Pollution
Smalltooth sawfish have been encountered with polyvinyl pipes and fishing gear entangled on their toothed rostrum (Seitz and Poulakis 2006). The same sources of pollutants described previously for sea turtles (see Section 4.3.4) may also adversely affect smalltooth sawfish.

4.4.5 Conservation and Recovery Actions Shaping the Environmental Baseline

Regulations restricting the use of gear known to incidentally catch smalltooth sawfish may benefit the species by reducing their incidental capture and/or mortality in fishing gear. In 1994, entangling nets (including gillnets, trammel nets, and purse seines) were banned in Florida state waters. Although intended to restore the populations of inshore gamefish, this action removed possibly the greatest source of fishing mortality on smalltooth sawfish (Simpfendorfer 2002).

Public Outreach
Public outreach efforts are also helping to educate the public on smalltooth sawfish status and proper handling techniques and helping to minimize interaction, injury, and mortality of encountered smalltooth sawfish. Information regarding the status of smalltooth sawfish and what the public can do to help the species is available on the websites of the Florida Museum of Natural History,[18] NMFS,[19] and the Ocean Conservancy.[20] Reliable information is also available at websites maintained by noted sawfish expert Matthew

[18] http://www.flmnh.ufl.edu/fish/Sharks/Sawfish/SRT/srt.htm
[19] http://www.sero.nmfs.noaa.gov/pr/SmalltoothSawfish.htm
[20] http://www.oceanconservancy.org/site/PageServer?pagename=fw_sawfish

McDavitt.[21] These organizations and individuals also educate the public about sawfish status and conservation through regular presentations at various public meetings.

Smalltooth Sawfish Recovery Plan
In September 2003, NMFS convened a smalltooth sawfish recovery team. Under Section 4(f)(1) of the ESA, NMFS is required to develop and implement recovery plans for the conservation and survival of endangered and threatened species. The final smalltooth sawfish recovery plan published on January 21, 2009 (74 FR 3566). The recovery plan is available at http://sero.nmfs.noaa.gov/pr/SmalltoothSawfish.htm.

4.5 Factors Affecting Nassau Grouper within the Action Area

The following analysis examines actions that may affect this species and its environment specifically within the action area. The activities that shape the environmental baseline in the action area of this consultation are primarily federal fisheries. The Nassau grouper is a recently listed species (effective July 26, 2016) and information for this species is somewhat limited. The most recent information can be found in the status review (Hill and Sadovy de Mitcheson 2013) and the Final Listing Rule (81 FR 42268, June 29, 2016).

4.5.1 Federal Actions

There is less historic information and analysis (e.g., bycatch discussed in previous biological opinions for various fisheries) available for the Nassau grouper than what exists for sea turtles and other species discussed in this Opinion.

Federal Fisheries
The Nassau grouper is found only in the southernmost portion of the action area (mid-Florida and south), which means some of the fisheries (e.g., Atlantic Sea Scallop Fishery, the Summer Flounder/Scup/Black Sea Bass, Mackerel/Squid/Butterfish Fisheries, Red Crab Fishery, and Skate Fishery) that could potentially affect other species in this opinion do not affect (e.g., bycatch) the Nassau grouper.

There is currently no fishery for Nassau grouper in the United States and possession is prohibited (for additional details of the history, see Sadovy and Eklund (1999)). Nassau grouper may show up as bycatch in various fisheries around south Florida in the action area. Barotrauma from rapid decompression, increased time in warm surface waters, and increased exposure to predation threats may result in species mortality in the absence of a directed fishery (Bartholomew and Bohnsack 2005). However, insufficient data and information exist to specify how many animals are taken in various federal fisheries (beyond the Snapper-Grouper fishery analyzed in this Opinion).

ESA Section 10 Permits
No permits are currently needed for this species.

[21] http://hometown.aol.com/nokogiri/

4.5.2 State or Private Actions

Fisheries

Snapper-grouper Amendment 35 delegated management authority in federal waters to the state of Florida for black snapper, dog snapper, mahogany snapper, and schoolmaster. Fishing trips pursuing these species could interact with Nassau grouper in the action area.

4.5.3 Other Potential Sources of Impacts in the Environmental Baseline

Marine Pollution

The same sources of pollutants described previously for other species in this Opinion (see Section 4.3.4 as an example) may also adversely affect Nassau grouper.

4.5.4 Climate Change

As discussed earlier in this Opinion, there is a large and growing body of literature on past, present, and future impacts of global climate change. Potential effects commonly mentioned include changes in sea temperatures and salinity (due to melting ice and increased rainfall), ocean currents, storm frequency and weather patterns, and ocean acidification. These changes have the potential to affect species behavior and ecology including migration, foraging, reproduction (e.g., success), and distribution.

For example, a rise in sea surface temperature outside spawning temperature range could impact spawning or shift the geographic range to waters that accommodate the temperatures necessary to spawn. Climate change may also affect the marine habitat and forage species, as well as parasite-host relationships. Additional discussion of climate change can be found in the Status of the Species section. Still, more information is needed to better determine the full and entire suite of impacts of climate change on this species and specific predictions regarding impacts in the action area are not currently possible.

4.5.5 Conservation and Recovery Actions Shaping the Environmental Baseline

NMFS (2016) notes that general (throughout the species range) conservation efforts with the potential to address identified threats to Nassau grouper include, but are not limited to, fisheries management plans, education about overfishing and fishing of spawning aggregations, and projects addressing the health of coral reef ecosystems. While these can potentially benefit the species, many of these efforts are conducted outside the action area.

In the United States (including the action area), take and possession of Nassau grouper have been prohibited in federal waters since 1990. A ban on fishing/possessing Nassau grouper has been in effect in the state of Florida since 1993 and has been enacted in all U.S. state waters. The species is protected in Dry Tortugas Marine Reserve and Florida Keys National Marine Sanctuary. Information on import of the species into the U.S. is needed to understand implications of international trade on regional Nassau grouper populations.

As mentioned earlier, this species is newly listed under the ESA. No recovery plan currently exists for the Nassau grouper. NMFS will develop and implement a plan (hereinafter in this subsection referred to as "recovery plans") unless such a plan will not promote the conservation of the species.

5.0 Effects of the Action

In this section of our Opinion, we assess the direct and indirect effects of the continued authorization of the South Atlantic snapper-grouper fishery on listed species that are likely to be adversely affected. The analysis in this section forms the foundation for our jeopardy analysis in Section 7.0. The quantitative and qualitative analyses in this section are based upon the best available commercial and scientific data on species biology and the effects of the action. Data are limited, so we are often forced to make assumptions to overcome the limits in our knowledge. Sometimes, the best available information may include a range of values for a particular aspect under consideration, or different analytical approaches may be applied to the same data set. In those cases, the uncertainty is resolved in favor of the species (House of Representatives Conference Report No. 697, 96th Congress, Second Session, 12 (1979)). NMFS generally selects the value that would lead to conclusions of higher, rather than lower, risk to endangered or threatened species. This approach provides the "benefit of the doubt" to threatened and endangered species.

There are no indirect effects associated with the proposed action that are likely to adversely affect listed species. Indirect effects are caused by or result from the proposed action, are later in time, and are reasonably certain to occur. Indirect effects include aspects such as habitat degradation, reduction of prey/foraging base, etc. The continued authorization of the South Atlantic snapper-grouper fishery (i.e., vessel operations, gear deployment and retrieval) is not expected to impact the water column or benthic habitat in any appreciable way. Unlike mobile trawls and dredges that physically disturb habitat as they are dragged along the bottom, the gears used in the South Atlantic snapper-grouper fishery are suspended in the water column or essentially stationary on the bottom and do not affect water column or benthic habitat characteristics. The fishery's target and bycatch species are not foraged on or a primary prey species for NARWs, sea turtles, or smalltooth sawfish (Perry et al. 1999, Hopkins et al. 2003, Simpfendorfer 2001). Nassau grouper diet is varied and includes shrimps, crabs, snails/slugs, molluscs, and numerous fish species including, but not limited to, tangs, old world silversides, filefish, wrasse, soldierfish, damselfish, parrotfish, grunts, and snapper ((Carter et al. 1994; Randall 1967). While they do feed on snapper, it is one of many prey species rather than a dominant prey species on which they depend. Prey competition is not expected to be a factor for any of the protected species discussed in this Opinion. Therefore, all analyses will be based on direct effects.

Approach to Assessment

We began our analysis of the effects of the action by first reviewing what activities (e.g., gear types and techniques) associated with the proposed action are likely to adversely affect NARWs, sea turtles, smalltooth sawfish, and Nassau grouper in the action area (i.e., what the proposed action stressors are). We next reviewed the range of responses to an individual's exposure to that stressor, and the factors affecting the likelihood, frequency, and severity of exposure. Afterwards, our focus shifted to evaluating and quantifying exposure. We estimated the number of individuals of each species likely to be exposed and the likely fate of those animals.

Effects of the continued authorization of the South Atlantic snapper-grouper fishery on threatened and endangered species stem primarily from interactions with the fishery's fishing gear which results in the capture, injury, or death of an individual, listed species. Our analysis, therefore, assumed listed species are not likely to be adversely affected by a gear type unless they come in physical contact with fishing gear. We also assumed the potential effects of each gear type are proportional to the number of interactions between the gear and each species. There are 3 basic types of fishing gear authorized for use in the South Atlantic snapper-grouper fishery: spear/powerheads, pot/traps (targeting BSB exclusively), and hook-and-line gear. Hook-and-line gear can be further divided into vertical line gear (i.e., handline, bandit gear, and rod and reel) and bottom longline gear. Section 2.0 describes these fishing gears and how commercial and recreational fishers may use them to target snapper-grouper.

The other potential route of direct effects of the proposed action on listed species is via vessel interactions resulting in injury, and/or death of an individual. Fishing vessels actively fishing either operate at relatively slow speeds, drift, or remain idle, when setting, soaking and hauling gear. Thus, any listed species in the path of a fishing vessel would be more likely to have time to move away before being struck. However, fishing vessels transiting to and from port or between fishing areas can travel at greater speeds, particularly recreational vessels, and thus do have more potential to strike a vulnerable species than during active fishing.

Smalltooth sawfish and Nassau grouper spend the vast majority of their time at or near the seafloor, where they are not vulnerable and subject to vessel interactions. Their benthic habits make it extremely unlikely that these species would be struck by a vessel. Thus, the continued operation of fishing vessels used in the South Atlantic Snapper-grouper fishery will have discountable effects on these species. Based on our understanding of the effects of the proposed action on these species, direct effects of the proposed action are expected to result only when these listed species interact with the fishing gear.

NARWS and sea turtles, both of which surface to breath air are more vulnerable to vessel interactions. Given the rarity of NARW vessel strikes when considering (1) the large amount of vessel traffic in the action area, (2) that all fishing vessels represents only a portion of marine vessel activity and (3) that just snapper-grouper fishing vessels represent an even smaller portion of marine activity, it seems extremely unlikely and discountable that a snapper-grouper vessel would strike a NARW, even during transiting. Based on this information, it is our judgment that NARW are also not likely to be adversely affected by vessels fishing as authorized under the Snapper-Grouper FMP unless they interact with their gear. However, given NMFS' STSSN data indicate that vessel interactions are believed to be responsible for a large number of sea turtles stranding within the action area each year, it seems reasonable that the snapper-grouper fishery may be responsible for at least a few interactions.

For gear analysis purposes, we generally evaluated the South Atlantic Snapper-Grouper fishery by looking at spear and powerhead gear (both commercial and recreational), commercial BSB pots, commercial hook-and-line (i.e., bottom longline and vertical line gear) and recreational vertical line separately. The likelihood, frequency, and severity of gear interactions is different for different species groups (i.e., for NARW, sea turtles, smalltooth sawfish, and Nassau grouper). Also the type of fishing gear, area fished, and the manner/technique in which the gear is used all affect the potential likelihood, frequency, and severity of listed species interactions. We therefore organized our Effects section first by species group and then by gear type and/or user group to the extent the effects were different and we had data to distinguish them. For sea turtles, we also included a vessel strike analysis.

5.1 Effects on NARWs

Commercial and recreational fishers in the South Atlantic snapper-grouper fishery use hook-and-line gear, spear/powerheads, and pot/traps to target BSB, but only pots may adversely affect NARWs. Divers spearfish or use powerheads by visually detecting and shooting BSB at close proximity. The maximum operational range of a spear is about 9-13 ft (about 3 to 4 m) -less than that if the spear is fitted with a powerhead. It is highly unlikely that divers would be within 13 ft of a NARW or that they would accidentally shoot a NARW while in such close proximity. On extremely rare occasions, divers may encounter NARWs at a moderate- to long-distance while diving. In these instances, there may be potential behavioral effects to the whales (e.g., change in swim speed or direction, curious approaches); however, these effects are expected to be temporary and insignificant.

The South Atlantic snapper-grouper fishery is only permitted to use longlines in 50 fathoms (300 ft or 91 m) or greater depth (50 CFR 622.182(b)) and the vertical line sector of the fishery typically fishes in water depths of at least 13 fathoms (78 ft or 24 m). The vast majority of NARWs are expected to occur well shallower, in depths of up to 50 ft, although a few NARW individuals may occur in depths exceeding 60 ft (Gowan and Ortega-Ortiz 2014). Therefore, snapper-grouper longline gear will not spatially overlap with NARWs, and the vertical line sector of the fishery may overlap only slightly. Further, vertical lines are generally actively fished or soaked for very short soak times, making interactions with NARWs even more unlikely to occur. Based on this information, we believe the effects of the snapper-grouper hook-and-line fishery on NARWs are discountable. Consequently, we focus the remainder of this section on BSB pots.

5.1.1 Types of Interactions and General Effects from BSB Pots

Any line rising into the water column has the potential to entangle a whale (Johnson et al. 2005), and the longer the line remains vertically extended through the water column, the greater the probability of encountering a whale becomes. The general scenario that leads to a whale becoming entangled in gear begins with a whale encountering a line. It may then move along that line until it comes up against something such as a buoy. The buoy can then be caught in the whale's baleen, against a pectoral fin, or on some other body part. When the animal feels the resistance of the gear, it is likely to thrash, which may cause it to become further entangled in the lines associated with trap gear. There are generally 3 attachment points for gear to attach to large whales: the gape of the mouth, around the flippers, and around the tail stock. NARWs are often entangled through the mouth (Johnson et al. 2005). Once attached, lines can wrap around various portions of the whale.

If the gear attached to the line is too heavy for the whale, drowning may result. But many whales have been observed swimming with portions of the line, with or without additional fishing gear, wrapped around a pectoral fin, the tail stock, the neck, or the mouth. Entangled animals may travel for extended periods of time and over long distances before freeing themselves, being disentangled by humans, or dying as a result of the entanglement (Angliss and Demaster 1998; Waring et al. 2013b).

Entanglement may lead to exhaustion and starvation due to increased drag (Wallace 1985). Entanglements may also result in systemic infection or debilitation from tissue damage. Additionally, any injury or entanglement that restricts a NARW from rotating its jaw while feeding, prevents it from forming a hydrostatic oral seal, compromises the integrity of its baleen, or prevents it from swimming at speeds necessary to capture prey will reduce its foraging capabilities and may lead to starvation (Cassoff et al. 2011; van der Hoop et al. 2012). A sustained stress response, such as repeated or prolonged entanglement in gear, makes marine mammals less able to fight infection or disease, and may make them more prone to ship strikes.

5.1.2 Factors affecting the Likelihood of NARW Entanglement in BSB Pots

Gear Characteristics and Fishing Techniques (soak times)
The length of time gear is left in the water is an important consideration. This is because the longer the soak time, the greater likelihood that NARWs may encounter the gear and become entangled. Snapper-grouper Amendment 18A included a requirement that BSB pots be brought back to shore after each trip, thus limiting the amount of time they can soak. Since the implementation of Amendment 18A, the 32-pot gear endorsement holders have averaged 2,122 ± 653 pots/month (range 1,503–3,148) during months completely open to pot gear fishing (Farmer et al. 2016). In the 2013–2014 season, the number of pots per trip was 24.9 ± 9.7, with 52.3 ± 36.4 hauls per trip (Farmer et al. 2016). Trip length was 1.4 ± 0.6 days. Soak time was 4.4 ± 4.0 hours per trap (range, 0.33–28.0) (Farmer et al. 2016).

Spatial Overlap of Fishing Effort and NARWs
The spatial and temporal overlap of NARWs and fishing effort is a factor influencing the likelihood that gear entanglement will occur. NARWs are in the SAFMC's jurisdiction from November 1 through April 30 (73 FR 60173, November 8, 2008). As described in detail in Section 3.2 (Status of Species), NARWs follow a general annual pattern of migration between low latitude winter calving grounds and high latitude summer foraging grounds (Kenney 2002; Perry et al. 1999). The coastal waters of the southeastern United States are the only known calving area for NARWs. From 2009 through 2013, the number of NARWs detected in the calving area ranged from 60 in 2013 to 250 in 2009 (median = 165) (Right Whale Consortium 2014, FWRI unpublished data).

NARW concentrations are highest in the core calving area off Florida and Georgia from November 15 through April 15, but they may occur from North Carolina to Florida from November 1 through April 30 (73 FR 60173, 8 November 2008). Systematic surveys conducted off the coast of North Carolina during the winters of 2001 and 2002 sighted 8 calves, suggesting the calving grounds may actually extend as far north as Cape Fear, North Carolina (McLellan et al. 2004). The amount of time non-calving NARWs spend in the southeastern United States is typically less than 1 month (A. Krzystan, June 2014 SEIT meeting) indicating a steady stream of NARWs travel between habitats in the northeastern and southeastern United States during fall, winter, and spring.

On rare occasions, NARWs have been spotted as early as September and as late as July in the southeastern United States (Taylor et al. 2010). Hodge et al. (2015) acoustically detected right whale calls off Georgia during summer months in 2012. Those authors acknowledged that the occurrence of calls in summer months in that area indicate a rare occurrence although they did not rule out an unknown presence not previously documented. Regardless, Hodge et al. (2015) stated more studies were necessary before conclusions could be drawn. It is suspected that right whale presence off Florida through South Carolina during the summer months is an abnormal event because water temperatures during that time of year are warmer than water temperatures typically selected by right whales. Gowan and Ortega-Ortiz (2014) found that sea surface temperature (as well as water depth and survey year) were predictors of right whale abundance in the Southeast U.S. during winter and right whales were more likely to occur in water 12 to 16°. Average monthly water temperatures off Savannah, Georgia range between 26 and 29° from June to September (taken from http://www.ndbc.noaa.gov/view_climplot.php?station=41008&meas=st on September 15, 2016) which is similar to average monthly water temperatures off Edisto Beach, South Carolina (see http://www.ndbc.noaa.gov/view_climplot.php?station=41004&meas=st).

Right whales have been detected in Southeast waters by acoustic monitoring that was deeper than expected based on visual sightings (Oswald et al. 2016). For example, Oswald et al. (2016) recorded data from 2009-2010 in an area ~48 to 67 nmi offshore of Jacksonville Beach, Florida, for approximately one month in the fall and winter. Right whale calls were detected at all sites during both deployments but were slightly more common during the winter (Oswald et al. 2016). However, Oswald et al. (2016) suggested that this detection of whales farther offshore than previously thought may be explained one of two ways: (1), the distribution of the species does indeed extend farther offshore or (2), the propagation of right whale vocalizations allows them to be detected at long distances and may have been produced in nearshore waters. In addition, Stanistreet et al. (2015) and Stanistreet et al. (2016), recording off the coast of North Carolina near Cape Hatteras in December 2013 detected the majority of right whale calls from acoustic buoys 10 and 15 nmi from the shoreline. Fewer calls were detected 20 nmi from the shoreline and even fewer were detected 25 nmi from the shoreline. From October 2014 through February 2015, the majority of right whale calls were again detected at buoys 5 and 10 nmi from the shoreline (the buoy ~15 nmi from the shoreline was offline from December 2014 through February 2015). Fewer right whale calls were detected 20 and 25 nmi from shore. The authors did not correlate the number of calls to the number of whales nor did they specify the detection range of the buoys. Given that the location of these calling whales and the range detection of the buoys is unknown in both studies, the most comprehensive and peer-reviewed literature currently available on right whale distribution and spatial use in southeast waters appears to be from modeling work conducted by Gowan and Ortega-Ortiz (2014) and Farmer et al. (2016).

Right whale sightings data and search effort can be biased depending on areas surveyed and frequency. Consequently, in considering right whale occurrence, we relied on predicted right whale occurrence derived from two spatial distribution models: for right whale distribution between Florida and South Carolina, we considered Gowan and Ortega-Ortiz (2014) and for right whale distribution off North Carolina, we used an additional model developed by FWC/FWRI following methods outlined in Gowan and Ortega-Ortiz (2014) and Farmer et al. (2016). We used these models because they were based on a robust data set (sightings data for Florida - South Carolina during the calving season from 2003/2004 to 2012/2013 (Gowan and Ortega-Ortiz 2014) and surveys off North Carolina from October 2005-April 2006, December 2006-April 2007, and February 2008-April 2008 (Farmer et al. 2016). The models allowed us to extrapolate predicted right whale occurrence in areas that were not surveyed (i.e. the models controlled for bias created by shore-based search effort). There are other studies available on right whale distribution in the Southeast, such as Knowlton et al. (2002) and Schick et al. (2009); however, we do not believe they are the best available information. Knowlton et al. (2002) summarized sightings data in the mid-Atlantic, but did not correct those sightings for survey effort. Schick et al. (2009) modeled right whale spatial distribution in the Mid-Atlantic, but they only used data from two female right whales -one tagged in 1996 and the other tagged in 2000.

Prior to 2010, the bulk of the BSB pot sector effort operated from November to April. Since 2010, fishing with BSB pots was prohibited during this time period due to commercial ACL closures (2010, 2011, and 2012) or by regulation (2013 to present). Regulatory Amendment 19 has prohibited commercial BSB pot fishing from November 1 through April 30 upon its implementation in 2013.

Species morphology, Behavior, and Life Stage

Body configuration and behavior are also likely contributing factors in entanglement risk. NARWs spend a substantial amount of time feeding at, just below the water's surface, and at depth. To feed, NARWs swim slowly forward with mouths open. They also roll and lift their flippers about the water's surface; behaviors that may add to entanglement risk, especially from vertical buoy lines and surface system lines. Thus, all body parts are at risk of entanglement.

The probability that a marine mammal will become entangled and initially survive an entanglement in fishing gear depends on the age of the NARW involved. Calves and juveniles become entangled more frequently than adults and are more likely to suffer deep wounds (> 8 cm) from entanglement. Younger animals are particularly at risk if the entangling gear is tightly wrapped, because the gear will become more constricting as they grow. The majority of large cetaceans that become entangled are juveniles (Angliss and Demaster 1998). Furthermore, if a mother with a dependent calf becomes entangled and dies as a result, the dependent calf will most likely not survive either. The death of the mother and her dependent calf results in two takes attributed to a single entanglement.

(Knowlton et al. 2011) studied ropes that were removed from entangled NARWs (dead and alive) and suggested that a whale's ability to break free of entangling gear is related to its age. Breaking strength of rope also influences a whale's ability to break free of entangling gear. Adults appear to be able to break free of ropes with a breaking strength of less than 3,300 lb, but calves and juveniles cannot and are more prone to drowning (Cassoff et al. 2011; Knowlton et al. 2011). NARW calves would likely need a line breaking strength of 600 lb or lighter in order to have some chance of breaking free (Knowlton et al. 2015).

5.1.3 Estimating Interactions and Mortality

Although entanglements incidental to commercial fishing are the primary threat to NARWs, it is often difficult to identify the source of entanglements (e.g., fishery) or their geographic origin. In a study of 31 entanglements, Johnson et al. (2005) found only 14 cases for which gear could be identified; 10 (71%) of these were determined to be pot gear. In the annual marine mammal stock assessment reports (SAR), using data from 2009–2013, 18 whales were documented as seriously injured or killed by entanglements or fishery interactions, but none of these entanglements could be attributed to a specific fishery (Waring et al. 2016). Furthermore, scarring studies suggest that the vast majority of entanglements are not observed (Knowlton et al. 2012). Consequently, while BSB gear has not been definitively identified in an entanglement case, it cannot be ruled out as a fishery that has previously entangled a NARW. Any vertical line that rises in the water column poses some entanglement risk to NARWs (Johnson et al. 2005) and line with higher breaking strength is likely more harmful to right whales than line with a lower breaking strength (Knowlton et al 2015).

The proposed action will reintroduce commercial BSB pot fishing at certain times when NARWs are present in the action area. The potential for serious injury or mortality to NARWs from entanglements in BSB pot gear exists from November 1 through April 30, when whales co-occur with fisheries that fall within the Council's jurisdiction (73 FR 60173, 8 November 2008). In the past, the bulk of the BSB pot sector effort has operated from November to April. Since 2010, the BSB pot sector has not opened during this time period due to commercial ACL closures (2010, 2011, and 2012) or by regulation (2013 to present). A regulatory closure of the BSB pot sector from November 1 through April 30 was implemented in 2013, via Regulatory Amendment 19. We therefore had determined risk to NARWs to be discountable given that the closure removed the temporal and spatial overlap between the BSB pot fishery and NARWs, essentially eliminating entanglement risk.

In Section 2, we presented both the November 1 through November 30 and April 1 through April 30 proposed time-area BSB pot closure (See Figure 2.1) and the December 1 through March 31 BSB pot time-area closure (See Figure 2.2). From November 1 through November 30 and from April 1 through April 30 each year, the boundaries of the proposed closure off Florida and Georgia are generally based on NARW calving habitat modeling work of Garrison (2007) and Keller et al. (2012). These authors found that right whale spatial distribution could be predicted based on water temperature and depth and that there was good agreement in the spatial distribution of predicted and observed right whales. Off North Carolina and South Carolina, the BSB pot proposed closure applies in the EEZ in waters shallower than 25 m. From December 1 through March 31, the proposed closure area generally represents waters 25 m or shallower from 28°21'N (approximately Cape Canaveral, Florida) to Savannah, Georgia; from the Georgia/South Carolina border to Cape

Hatteras, North Carolina, the closure applies to waters under Council management that are 30 m or shallower.

Because allowing BSB pot gear fishing during NARW calving season would reintroduce some level of entanglement risk not present since 2010, we must evaluate the potential increased risk of NARW interactions in terms of potential entanglements and mortalities under the proposed action. To do so, we broke our methodology and calculations for estimating the risk of NARW entanglements and mortalities under the proposed action into 3 parts. In the following sections, we review how we conducted each part and present the results.

5.1.3.1 Estimating How Many NARWs Are Potentially Entangled in BSB Pot Gear in the Action Area Annually

In Part 1, we estimated the number of NARWs potentially entangled in BSB pot gear in the action area annually. We based our estimate on the median number of NARWs expected to occur in the action area during a calving season and the annual percentage of the population expected to become entangled in fishing gear each year. We then estimated the number of NARWs that could potentially become entangled in BSB trap/pot gear.

Based on preliminary photo-identification analysis of NARW photographs collected in the southeastern United States, the median number of NARWs (including calves, but excluding reported or assumed calf mortalities) documented in the southeastern United States from the 2009-2013 calving seasons is 165 (Right Whale Consortium 2014; K. Jackson, FWC, pers. comm. to B. Zoodsma, NMFS SERO PRD, July 21, 2016; Waring et al. 2016). While there are other data sources indicating that whales are present at times and in areas not identified from the areal sightings data, we relied on sightings data for this exercise because models of right whale distribution (Gowan and Ortega-Ortiz 2014; Farmer et al. 2016) provide spatial distribution information based on environmental parameters but do not provide estimated numbers of whales that are needed for this analysis. We therefore believe 165 is based on the best available information and represents a reasonable estimate for the number of NARWs expected to be present in the Southeast during any single calving season. Knowlton et al. (2012) found that, on average, 25.9% of adequately photographed NARWs became entangled each year. Applying Knowlton et al. (2012), we estimated that 25.9 % of the 165 NARWs in the action area (i.e., 25.9% x 165) or 42.74 NARWs become entangled annually. This number likely overestimates the annual entanglement rate because Knowlton et al. (2012) examined the entanglement rate for the entire population across its year-round range, rather than a subset of the population that occurs in the action area during a limited time period. Therefore, since we are applying the entanglement rate to only Southeast waters during the calving season, 42.74 animals per year overestimates the number of entangled whales in the action area. However, this calculation does not account for any additional deaths of dependent calves that may result from a mother that was entangled and subsequently died.

Next, we estimated the number of NARWs that could potentially become entangled in BSB pot gear, specifically. Johnson et al. (2005) assigned gear to particular fisheries, when possible. The assignment included gear recovered and gear identified but not recovered from NARWs. Of the 31 NARW entanglements examined, 20 entanglements had gear that was either recovered or identifiable but not recovered. From these 20 entanglements, 10 were found to have entangling gear from trap/pot fisheries: 8 lobster pots, 1 crab pot, and 1 unknown pot fishery. To err on the side of conservation for this analysis, we assumed that this unknown pot (1/20 or 5%) was from the SAFMC BSB trap/pot fishery. We then applied this percentage to the number of NARWs that may be entangled annually in the action area, which yielded 2.14 whales (42.74 x 0.05). This number, 2.14, represents the number of whales potentially entangled in BSB trap/pot gear annually. As mentioned previously, the majority of gear that is recovered from NARWs is not identifiable. There are numerous trap/pot fisheries along the East Coast that spatially and temporally co-occur with NARWs, and all vertical lines rising in the water column (e.g., buoy lines from pot gear) present an entanglement risk to whales.

Table 5.1 Summary of Part 1 Results

Maximum Number of NARWs that may be present in action area during 1 calving season	Proportion expected to be entangled annually	Number of NARWs that may be present in action area and entangled annually	Number of NARWs that may potentially be entangled in BSB trap/pot gear annually
165	0.259	42.74	2.14

*****When feasible, we used scientific notation and only present the first two significant digits for each value.

5.1.3.2 Estimating Past and Future Trap Entanglement Rates

In Part 2, we examined the past reduction in the number of whales that may potentially be entangled in BSB trap/pot gear given the measures presented in the previous Snapper-Grouper Amendment 18A (18A), and the potential increase in entanglements as the result of the proposed action, Regulatory Amendment 16.

Trap Entanglement Rates under Snapper-Grouper Amendment 18A

The Knowlton et al. (2012) study that provided the average annual entanglement rate of 25.9% was based on NARW entanglement data through 2009. Snapper-Grouper Amendment 18A, implemented on July 1, 2012, reduced trap/pot effort by requiring trap/pots be returned to shore at the conclusion of each fishing trip (i.e., reducing trap/pot soak time) and by limiting the number of pots per fisher and restricting the number of fishing endorsements. These regulations will remain in effect through the implementation of Regulatory Amendment 16. Two models were developed to overlay NARW population distributions and projected BSB fishing effort; 1 for Florida through South Carolina and 1 for North Carolina (Farmer et al. 2016). Gowan and Ortega-Ortiz (2014) predicts right whale distribution in coastal waters from Florida to South Carolina, so an additional model was developed for North Carolina waters using aerial survey data collected by the University of North Carolina—Wilmington (Farmer et al. 2016). Because Amendment 18A reduced fishing effort for BSB following the Knowlton et al. (2012) study period, we compared the mean (2006-2009) reported fishing effort and modeled NARW relative risk by area to the projected fishing effort and associated NARW relative risk for the same period under simulated Amendment 18A regulations, following methods described in Farmer et al. (2016). Amendment 18A regulations were estimated to reduce NARW relative risk from November 1 through April 30 by 37% (i.e., 100%-37%= 63% risk remaining) for North Carolina and 47% (i.e., 100%-47%= 53% risk remaining) for Florida through South Carolina. Thus, relative risk of entanglement during the Knowlton et al. (2012) study period was scaled by 63% off North Carolina (i.e., "NC 18A scalar") and 53% off Florida through South Carolina (i.e., "FL-SC 18A scalar").

We considered dividing the number of NARWs that may potentially be entangled in BSB trap/pot gear between the 2 regions of North Carolina and South Carolina through Florida; however, that would require knowledge of whale residency times well as detailed whale movements within those regions, and that information is lacking. Without any such information to establish residency, any attempt to apportion the number of potential NARW entanglements by region would be arbitrary, so we conservatively applied 2.14 to both the NC and the FL-SC regions.

Furthermore, the regional models (NC and FL-SC) cannot be combined. The predicted values from the North Carolina model did not have the same scale or interpretation as the predictions from the Florida–South Carolina model (Gowan and Ortega-Ortiz 2014) and were not directly comparable due to differences in survey design, quantification of survey effort, temporal components in the model, model framework (the probability of presence versus relative abundance), and, potentially, whale behavior (e.g., a sighting availability bias in the migratory corridor off North Carolina versus the wintering grounds off Florida–South Carolina) (Farmer et al. 2016). Using the NC 18A scalar (0.63) and the FL-SC scalar (0.53) multiplied by the number of NARWs that may potentially be entangled in BSB trap/pot gear annually (2.14), we arrived at 1.35 and 1.13 potentially BSB trap/pot gear entangled NARWs off NC and FL-SC, respectively (NC: (2.14)*(0.63)=1.35; FL-SC: (2.14)*(0.53)=1.13). These estimates suggest that the implementation of Regulatory Amendment 18A reduced entanglements in BSB trap/pot gear within a range of 0.79 to 1.01 whales, annually.

Trap entanglement rates under the proposed action

Overlaying distributions of NARWs with different threats (fisheries, ships, etc.) is an established way of evaluating risk from activities of interest (NMFS 2015b,) (Redfern et al. 2013). Farmer et al. (2016) used this general approach to model the relative risk of NARW entanglement for each time-area closure alternative considered in Regulatory Amendment 16. Below, we first provide a brief summary of Farmer et al. (2016) basic methodology and then explain how we applied it in our effects analysis of the proposed action. Farmer et al (2016) is included in this Opinion as Appendix 3.

Farmer et al. (2016)

Farmer et al. (2016) had 3 major outputs: (1) projected potential landings by BSB pot endorsement holders during a winter season under each of the time-area closure alternatives, (2) predicted date that the BSB ACL would be met (i.e., the fishery closed) under each time-area alternative and under various scenarios of fishing effort and catch rates, and (3) estimated relative risk of NARW entanglement in BSB pot gear under each of the time-area closure alternatives by evaluating the spatio-temporal overlap of pot gear and modeled NARW occurrence. The authors used historical catch data to predict the spatial distribution of commercial BSB catches and historical NARW survey data to predict relative NARW abundance (see Appendix 3 for detailed information on data sources). Farmer et al. (2016) then overlaid both sets of data to predict relative entanglement risk to NARWs, expressed in relative risk units (RRU), for each time-area closure alternative considered in Regulatory Amendment 16. Model outputs included total catch relative to the ACL, closure date, total days open, and cumulative relative risk of NARW entanglement. Outputs were generated for 3 different fishing effort projection scenarios, 4 different catch rate projection scenarios, and 3 different environmental condition scenarios. Due to differences in NARW data sets with different sampling protocols, separate models that overlaid NARW and BSB fishing effort were generated for 2 regions: North Carolina, and South Carolina to Florida. Since the risk cannot be added together and must be considered separately, because of differences in sampling protocols and data sets, the resulting analysis estimated the relative risk of entanglement for each alternative in those 2 regions.

The measure of risk assumed that given a uniform distribution of pot gear, the areas from which whale encounter rates from aerial surveys are predicted to be greatest would also have the greatest risk of entanglement (Fonnesbeck et al. 2008) and that the co-occurrence of NARWs and pot gear represents a true (but unknown) entanglement risk greater than zero (Johnson et al. 2005). Farmer et al. (2016) further assumed that: (1) detectability of NARWs and its effects on predicted encounter rates is equivalent across the study area, (2) recent fishing pressure is predictive of future behavior (i.e., that effort would not shift into open areas during November through April), and (3) that endorsement holders' pot gear soak times would be consistent with their observed spatially explicit soak times from summer 2013-2014. Farmer et al. (2016) discusses potential implications of these assumptions.

The comparison of Regulatory Amendment 16 time-area closure alternatives ranged from 0 RRUs under the status quo complete closure from November to April and no increased risk to whales from regulations to 100 RRUs if no closure was implemented posing the maximum risk to whales. The proposed action was projected to result in a relatively low increase in risk to NARWs from the status quo. Depending on the fishing effort projection scenario, catch rate projection scenario, and environmental condition scenarios, the increases in RRUs under the proposed closure ranged from 3-15 RRUs off North Carolina and 1-12 RRUs off Florida–South Carolina (See Farmer et al. [2016], Table 1 for more information).

<u>Application of Farmer et al. (2016) to the Proposed Action</u>
The proposed action increases BSB trap/pot gear in times and areas where NARWs occur. The Farmer et al. (2016) RRU analysis allows us to estimate the effects of this increase on NARW in terms of minimum, maximum, and median RRUs. We then produced RRU-adjusted entanglement rates based on the minimum, maximum, and median values. To estimate the number of NARW entanglements for each scenario, we multiplied the RRU-adjusted entanglement rate by the number of Amendment 18A-adjusted potential entanglements in BSB trap/pot gear to produce the estimated number of NARWs entangled in BSB trap/pot gear under the different minimum, maximum, and median values for the proposed action (e.g., for NC Min: 1.35*0.03=0.04).

Table 5.2. Step 2 Results Summary

NC	**0.63**	**1.35**	**Min.**	**3.00**	**97.00**	**0.03**	**0.04**
			Max.	**15.00**	**85.00**	**0.15**	**0.20**
			Median	**7.00**	**93.00**	**0.07**	**0.09**
FL/SC	**0.53**	**1.13**	**Min.**	**1.00**	**99.00**	**0.01**	**0.01**
			Max.	**12.00**	**88.00**	**0.12**	**0.14**
			Median	**5.00**	**95.00**	**0.05**	**0.06**

*****When feasible, we used scientific notation and only present the first two significant digits for each value.

5.1.3.3 Estimating BSB Pot Entanglements Resulting in Mortality

In Part 3, we estimated the proportion of BSB pot entanglements resulting in mortality. We based our estimate on the number of serious injury and mortality events documented in Henry et al. (2015) and Waring et al. (2016) that were potentially associated with trap/pot gear.

Henry et al. (2015) presented the total number of reported injury events and the number of events determined to be serious injuries for baleen whale stocks along the Gulf of Mexico, United States East Coast, and Canadian Atlantic Provinces, for 2009-2013. A serious injury is one that is more likely than not to result in mortality. Because Henry et al. (2015) assessed serious injuries from all gear types (gillnet, trap/pot, weirs, etc.), we mined only the serious injury entanglement records from trap/pot or unknown gears that had not been confirmed as Canadian gear. We included unknown gear entanglements because the vast majority of gear is not identified. Johnson et al. (2005) found that at least 71% of gear from entangled whales is typically trap/pot gear, so it is not unreasonable to assume that most of the unknown gear entangling large whales is from a trap/pot related fishery. NARWs entangled in gillnet gear, entrapped in fishing weirs, or entangled in Canadian gear were removed from the dataset.

There were 30 records of NARWs entangled in unknown gear and 3 records of NARWs entangled in trap/pot gear. Each record was assigned a Serious Injury (SI) value of 1 for serious injury or 0 for non-serious injury by Henry et al. (2015). In some cases, records are assigned a portion (e.g., 0.75) of an SI value rather than a 1 or a 0 (Henry et al. 2015). SI values for poorly documented injury events are prorated based on observed ratios of mortality to survival in similar entanglement cases from the past (Henry et al.2015;

http://www.nmfs.noaa.gov/op/pds/documents/02/238/02-238-01.pdf). Overall, 10.25 records were assigned as serious injuries.

Henry et al. (2015) also reported that there were 6 confirmed NARW mortalities between 2009-2013 resulting from entanglements. Using additional details about these mortality events from the 2015 SAR, we determined that all of the 6 NARW entanglement mortalities were attributable to trap/pot or unknown gear sources (Waring et al. 2016).

In total, we tallied 16.25 (10.25 SI + 6 mortalities) NARWs (of a total of 39 records) that were seriously injured or killed by unknown or trap/pot gear entanglements between 2009-2013. This is calculated as a mortality rate of 0.42 (=16.25/39). To calculate the number of lethal takes in each region under the different minimum, maximum, and median scenarios, we then multiplied the mortality rate by the number of expected NARWs entangled annually. For example, the number of annual lethal takes under the NC min scenario is 0.04*0.42=0.02. The number of annual total takes is the same number as the number of estimated interactions. To put these numbers in a yearly context, we then calculated the number of years per 1 NARW entanglement (e.g., for the NC min scenario: 1/0.02=59.43).

Table 5.3 Part 3 Results Summary

Region	Scenario	Estimated Interactions	Mortality Rate	Annual Lethal Takes	Annual Total Takes	1 lethal take per every X years	1 take per every X years
NC	Min	0.04	0.42	0.02	0.04	59.43	24.76
	Max	0.20		0.08	0.20	11.89	4.95
	Median	0.09		0.04	0.09	25.47	10.61
FL/SC	Min	0.01		0.005	0.01	211.92	88.30
	Max	0.14		0.06	0.14	17.66	7.36
	Median	0.06		0.02	0.06	42.38	17.66

*When feasible, we used scientific notation and only present the first two significant digits for each value.

5.1.4 Effects of Additional Measures Regulatory Amendment 16

The proposed action also provides a mechanism to potentially identify whether a line entangling a whale belongs to the BSB pot sector. There are no direct biological benefits from Action 2, Preferred Alternative 4; however, any information gained from entangled whales on fishery type, entanglement location, and entanglement date is important to assess the impacts of a fishery and better understand and possibly work towards reducing future entanglements. Not all gear remains on the individual whale after an interaction occurs, and if gear does remain, it is rare to recover the portion of the line that is marked (or in which the mark has not already deteriorated). Furthermore, many entangled NARWs are never seen nor is gear recovered.[22] For line markings to be effective, the gear must be recovered and the recovered gear must retain the marks. Line markings do improve the chances of identifying recovered gear, particularly as the number and size of the marks increases. This alternative provides a mechanism to potentially identify the BSB pot sector if an interaction occurs and if the gear remains entangled on the whale and marks are intact. The gear marking would be in addition to the gear marking required in the Atlantic Large Whale Take Reduction Plan (50 CFR 229.32) (http://www.greateratlantic.fisheries.noaa.gov/protected/whaletrp/docs/2015-12869.pdf).

5.2 Effects on Sea Turtles

Of the 3 basic types of gear used in the South Atlantic snapper-grouper fishery by commercial and/or recreational fishers (i.e., hook-and-line gear, spear/powerheads, and BSB pots), we believe only snapper-grouper hook-and-line gear may adversely affect sea turtles. Below, we explain why we believe potential effects from the other gear types are discountable. The remainder of Section 5.2 focuses on evaluating the effects of snapper-grouper hook-and-line fishing (Section 5.2.1-5.2.6) and vessel interactions (5.2.7).

Spearfishing
In our 2006 Opinion, we determined spear and power head gear used in the South Atlantic snapper-grouper fishery were not likely to adversely affect sea turtles, and we still believe this to be true. Commercial and recreational divers (either free diving, or more typically with SCUBA) fishing with these gears do occasionally encounter sea turtles. However, given the selectivity of the gear and the careful aim divers exercise to strike a fish, divers spearfishing are able to easily avoid aiming in any direction where sea turtles are within striking range. Therefore, we believe that incidental spearing of sea turtles is extremely unlikely and discountable. We also expect any effects on sea turtles from the presence of divers fishing to be insignificant (e.g., have a negligible impacts on feeding or other normal activities, result in minimal metabolic costs or stress to sea turtles). Anecdotal information from divers encountering sea turtles indicates that most sea turtles either change their route to avoid coming in close proximity to divers or appear unaware of the presence of divers. There are also a few anecdotal reports of sea turtles swimming directly at and into divers, and/or trying to bite them. One diver reported to the SDDP having 3 sea turtle interactions in 2009 on 3 different dive trips. Through follow-up with the fisher, SDDP staff clarified that the reported were of sea turtle "attacks" and not of interaction involving spear gear (spear).

BSB Pots
Sea turtles are known to occasionally interact with trap/pot gear via entanglement in the buoy lines that are typically attached to traps/pots. Yet, in our 2006 Opinion, we discounted these potential effects. Our determination that such effects were highly unlikely was based on (1) most BSB pot effort in the action area is limited to the Carolinas (i.e., relatively small fishery) and there is very little off Florida (i.e., doesn't take place

[22] While it is known that some entanglements are never documented, we have no way of estimating the number of potential undocumented entanglements or evaluating how those entanglements may have impacted the entangled animals. Thus, the above estimates of the number of entanglements and the associated mortality were not adjusted upwards to account for these potential undocumented interactions.

where sea turtles are most abundant in the action area), and (2) the absence of any buoy line entanglement reports that may have been attributed to the South Atlantic BSB fishery in the NEFSC observer data, SDDP, or STSSN database. These sets of data collectively represented the best available data on BSB pot entanglements in the action area.

In our 2006 Opinion, we considered the effects of the BSB fishery as managed under the SGFMP, including all amendments implemented prior to 2006 and Amendment 13C, which was proposed at that time. The snapper-grouper fishery as managed then was limited access fishery, but the BSB component was not subject to any time-area closures or other effort-limiting regulations other than a BSB quota. Subsequently, additional amendments were implemented, placing greater restrictions on the BSB fishing (e.g., SGFMP Amendment 18A). Thus, sea turtle BSB pot gear entanglements are even more unlikely under the proposed action than they were in the historical fishery analyzed in the 2006 Opinion. For example, sea turtles become entangled in commercial trap gear with long soak times (e.g., 1+ days) likely because longer soak times increase the likelihood that invertebrate animals will grow on trap lines, attracting sea turtles. SGFMP Amendment 18A required all BSB pots to be returned to land overnight, and the average soak time is now estimated to be 4.4 hours (Farmer et al. 2016). There are still no reports of buoy line entanglements that may have been attributed to the South Atlantic BSB fishery in the NEFSC observer data, SDDP, or STSSN database. Records of entanglements in spiny lobster and stone crabs, both prey species of loggerhead sea turtles, indicate that sea turtle entanglement is associated with fisheries that either target or bait with sea turtle prey items. BSB are not a sea turtle prey species nor are the traps baited with prey species. Based on this information, we believe effects from BSB pots are extremely unlikely to occur and discountable.

5.2.1 Types of Interactions and General Effects from all Types of Hook and Line Gear (i.e., commercial bottom longline and commercial and recreational vertical line gear)

Hook-and-line gear is known to adversely affect sea turtles via hooking, entanglement, trailing line, and/or forced submergence. Upon retrieval of the gear, captured sea turtles may be found and released alive or found dead because of forced submergence. Sea turtles released alive may later succumb to injuries sustained at the time of capture or from exacerbated trauma from ingested fishing hooks and/or entangling lines or lines otherwise still attached when they were released. Of the sea turtles hooked or entangled that do not die from their wounds, some may suffer impaired swimming or foraging abilities.

The following discussion summarizes in greater detail the available information on how individual sea turtles are likely to respond to interactions with all types of hook-and-line fishing gear.

Entanglement
Sea turtles are particularly prone to entanglement because of their body configuration and behavior. Records of stranded or entangled sea turtles reveal that hook-and-line gear can wrap around the neck, flippers (particularly front flippers), or body of a sea turtle and severely restrict swimming or feeding. Entangling gear can interfere with a sea turtle's

ability to swim or impair its feeding, breeding, or migration and prevent its surfacing if the line gets caught on an object below the surface, causing it to drown. If the sea turtle is entangled when young, the fishing line becomes tighter and more constricting as the sea turtle grows, cutting off blood flow and causing deep gashes, some severe enough to remove an appendage.

Entanglements are expected to be more common on vertical line because it is generally lighter, more flexible gear; however, sea turtles have been found entangled in branchlines (gangions), mainlines, and float lines of longline gear as well. Observer data from the shark bottom longline fishery indicate sea turtles entangled in longline are most often entangled around the neck and fore flippers (NMFS unpublished data).

Hooking

Sea turtles are also injured and sometimes killed by being hooked. Sea turtles are either hooked externally in the flippers, head, shoulders, armpits, or beak (i.e., foul-hooked) or internally inside the mouth or when the animal has swallowed the bait, in the gastro-intestinal tract (Balazs et al. 1995). Observer data from the pelagic and shark bottom longline fishery indicates entanglement and foul-hooking are the primary forms of interaction between leatherback sea turtles and longline gear, whereas beak and internal hooking is much more prevalent in hardshell sea turtles, especially loggerheads (NMFS unpublished data). Internal hooking of leatherback sea turtles is much rarer. Almost all interactions with loggerheads result from taking the bait and hook; only a very small percentage of loggerheads are foul-hooked externally or entangled.

Hooks swallowed by sea turtles are of the greatest concern. Their throats are lined with strong cone-shaped papillae directed towards the stomach (White 1994). The presence of these papillae in combination with an S-shaped bend in the throat makes it difficult to see swallowed hooks when looking through a sea turtle's mouth. Because of the shape of a sea turtle's digestive tract, deeply swallowed hooks are also very difficult to remove without seriously injuring the turtle. A sea turtle's throat is attached firmly to underlying tissue; thus, if a sea turtle swallows a hook and tries to free itself or is hauled on board a vessel, the hook can pierce the sea turtle's throat or stomach and can pull organs from their connective tissue. These injuries can cause internal bleeding or infections, both of which can kill the sea turtle.

If a hook does not lodge into, or pierce, a sea turtle's digestive organs, it can pass through the sea turtle entirely (Aguilar et al. 1995; Balazs et al. 1995) with little damage (Work 2000). For example, a study of loggerheads deeply hooked by the Spanish Mediterranean pelagic longline fleet found ingested hooks could be expelled after 53-285 days (average 118 days) (Aguilar et al. 1995). If a hook passes through a sea turtle's digestive tract without getting lodged, the hook probably has not harmed the turtle.

Trailing Line

Trailing line (i.e., line left on a sea turtle after it has been captured and released), particularly line from a swallowed hook, poses a serious risk to sea turtles. Line trailing from an ingested hook is also likely to be ingested, which may irritate the lining of the digestive tract. The line may cause the intestine to twist upon itself until it twists closed, creating a blockage ("torsion"), or it may cause a part of the intestine to slide into another part of intestine like a telescopic rod ("intussusception") also leading to blockage. In both cases, death is a likely outcome (Watson et al. 2005). It may also prevent or hamper foraging, eventually leading to death. Trailing line may also become snagged on a floating or fixed object, further entangling a turtle and potentially slicing its appendages and affecting its ability to swim, feed, avoid predators, or reproduce. Sea turtles have been found with trailing gear that has been snagged on the bottom, or has the potential to snag, thus anchoring them in place (Balazs 1985b). Long lengths of trailing gear are likely to entangle the sea turtle, eventually leading to impaired movement, constriction wounds, and potentially death.

Forced Submergence

Generally, when sea turtles dive, their bodies create energy for their cells in a process that uses oxygen from their lungs. Sea turtles that are stressed from being forcibly submerged due to entanglement, eventually use up all their oxygen stores. When their oxygen stores are used up, they begin to create energy via a process that does not require oxygen (i.e., anaerobic glycolysis). This process can significantly increase the level of a certain type of lactic acid in a sea turtle's blood (Lutcavage and Lutz 1997); if the level gets too high, it can cause death.

Numerous factors affect the survival rate of forcibly submerged sea turtles. It is likely that the speed at which physiological changes occur and how long they last are related to the intensity of struggling and how long the animal is underwater (Lutcavage and Lutz 1997). The size, activity level, and condition of the sea turtle; the ambient water temperature; and if multiple forced submergences have recently occurred all affect how badly an animal may be injured by forced submergence. Disease factors and hormonal status may also influence survival during forced submergence. Larger sea turtles are capable of longer voluntary dives than small sea turtles, so young sea turtles may be more vulnerable to the stress from forced submergence. The normal process for creating cellular energy happens more quickly during the warmer months. Because this process takes place more quickly, oxygen stores are also used more quickly, and anaerobic glycolysis may begin sooner. Subsequently, the negative effects from forced submergence may occur more quickly during warm months. With each forced submergence event, the level of lactic acid in the blood increases and can require a long (up to 20 hours) time to return to normal levels. Sea turtles are probably more susceptible to dying from high levels of lactic acid if they experience multiple forced submergence events in a short period of time. Recurring submergence does not allow sea turtles to reduce high levels of lactic acid (Lutcavage and Lutz 1997). Stabenau and Vietti (2003) illustrated that sea turtles given time to stabilize their pH level after being forcibly submerged have a higher survival rate. How quickly this happens depends on the overall health, age, size, etc., of the sea turtle, time of last breath, time of submergence, environmental conditions (e.g., sea surface temperature, wave action), and the nature of any sustained injuries at the time of submergence (NRC 1990).

Effects from forced submergence are expected to sometimes result from bottom longline gear interactions. Although there may be some stress associated with capture on vertical line gear, forced submergence and its effects on sea turtles are generally not expected to occur because of short soak times and because sea turtles likely are able to swim and reach the surface to breath despite having gear attached. Forced submergence is not expected to occur when fishing with vertical line unless entangling lines are caught on an object below the surface and result in the sea turtle's inability to reach the surface and breathe.

5.2.2 Factors Affecting the Likelihood of Exposure of Sea Turtles to Hook-and-Line Gear

A variety of factors may affect the likelihood and frequency of listed sea turtle species interacting with hook-and-line gear. The spatial and temporal overlap between fishing effort and sea turtle abundance and sea turtle behavior may be the most evident variable involved in anticipating interactions. Other fishing related-factors that may influence the likelihood and frequency of hooking, entanglement, and forced submergence effects include gear characteristics (e.g., hook sizes, bait) and fishing techniques employed (e.g., soak times). Each of these factors and its potential influence is discussed briefly below.

Spatial/Temporal Overlap of Fishing Effort and Sea Turtles and Sea Turtle Diving Depths
The likelihood and rate of sea turtle hookings and/or entanglements in snapper-grouper hook-and-line gear is at least in part a function of the spatial and temporal overlap of sea turtle species and fishing effort. The more abundant sea turtles are in a given area where and when fishing occurs, and the more fishing effort in that given area, the greater the probability a sea turtle will interact with gear. Environmental conditions may play a large part in both where sea turtles are located in the action area and whether or not a sea turtle interacts with hook-and-line gear.

Based on what we know about where snapper-grouper longline and vertical line fishing occurs in the action area, the likelihood and rate of sea turtle hookings and/or entanglements is much greater for vertical lines. Longlines targeting snapper-grouper are only permitted in depths greater than 50 fathoms and only north of St. Lucie Inlet, Florida (27 10'N), thus substantially restricting the area overlap between longline gear and sea turtles in the action area. Also longline vessels may only possess 4 species of grouper (snowy, warsaw, yellow edge, and misty grouper) and 3 species of tilefish (golden, blueline, and sand tilefish). The primary species targeted with bottom longline is golden tilefish, so most bottom longlines for snapper-grouper species are set at depths ranging from 190-300 m (i.e., the depth range in which golden tilefish most commonly occur). Leatherback sea turtles routinely dive to far greater depths than other sea turtle species and spend the majority of their time submerged; thus, they are expected to occur in the deep waters where the gear is allowed. In contrast, most hardshell sea turtles would likely be less abundant or possibly not present in longline fishing areas given what we know about their feeding and diving behavior (P. Richards, NMFS SEFSC pers. comm. to J. Lee, NMFS SERO PRD, July 22, 2016). The vertical line is typically fished in mid-shelf waters 13-50 fathoms (78-300 ft) deep where hardshell sea turtles are more common.

Hook Type
The type of hook (size and shape) used in fisheries likely plays a role in the probability and severity of interactions with sea turtles. Experiments in pelagic longline fisheries demonstrate the best hook for avoiding sea turtle takes is a circle hook. The configuration of a circle hook reduces the likelihood of foul-hooking interactions because the point of the hook is less likely to accidentally become embedded in a sea turtle's appendage or shell. In some fisheries, circle hooks are wide enough to actually prevent hooking of some sea

turtles if the sea turtle cannot get its mouth around the hook (Gilman et al. 2006). Circle hook configuration also reduces the severity of interactions with sea turtles because it has a tendency to hook in the animal's mouth instead of its pharynx, esophagus, or stomach (Prince et al. 2002; Skomal et al. 2002).

Stainless steel circle hooks are required to be used when fishing for snapper-grouper with any type of hook-and-line gear and natural baits north of 28°N. The South Atlantic snapper-grouper longline fishery only uses circle hooks. South Atlantic snapper-grouper vertical line fishers historically have used and currently still use both circle hooks and J-hooks, where allowed. All hooks used in the South Atlantic snapper-grouper fishery are relatively small in size compared to those used in pelagic longline fisheries. Also, snapper-grouper hook-and-line fishers catch larger benthic sea turtles whereas pelagic longline fisheries typically interaction with smaller pelagic juvenile sea turtles. Thus, we suspect that the width of the circle hook's used do not prevent any hookings in the snapper-grouper fishery (i.e., any sea turtle encountered could get its mouth around the hook). Still, the circle hooks that are used do reduce the likelihood of any caught sea turtle getting hooked internally.

Soak Time/Number of Hooks
Hook-and-line gear interactions with sea turtles may be affected by both soak time and the number of hooks fished, independent of overall fishing effort. The longer the soak time, the greater the chances a foraging sea turtle may encounter the gear ,and the longer a sea turtle may be exposed to the entanglement or hooking threat, increasing the likelihood of such an event's occurrence. Likewise, as the number of hooks in the water in a given area increases, so may the likelihood of an incidental hooking event.

Longline soak times in the snapper-grouper vary depending on the success of fishing, but gear is rarely in the water for more than 2 hours. Snapper-grouper vertical lines typically have short soak times and a limited number of hooks per line. In Section 2, Proposed Action, we describe how vertical lines targeting snapper-grouper species can either be constantly tended or left to soak anywhere from 15 minutes to 1 hour with 2-3-hook rigs.

Bait Type and Sea Turtle Feeding Habits
Sea turtles, particularly loggerhead sea turtles, may be attracted to and bite baited hooks. Sub-adult and adult loggerheads are primarily coastal dwelling and typically prey on benthic invertebrates such as mollusks and decapod crustaceans in hard bottom habitats. Kemp's ridley sea turtles also feed on these species. As such, loggerhead and Kemp's ridley sea turtles may be the species attracted to gear baited with these prey items. Green, hawksbill, and leatherback turtles may still also be attracted to fishing bait and have been caught on fishing hooks, but their feeding habits make it less likely. Green sea turtles become herbivorous as they mature, feeding on algae and sea grasses, but also occasionally consume jellyfish and sponges. The hawksbill's diet is highly specialized and consists primarily of sponges ((Meylan 1988). Leatherbacks feed primarily on cnidarians (medusae, siphonophores) and tunicates, so they are less likely to pursue bottom longline gear bait.

Bait characteristics (e.g., the type, size, and texture of the bait) may also influence the likelihood and frequency of certain sea turtle species becoming incidentally hooked. For example, in pelagic longline fisheries there has been considerable success in reducing leatherback sea turtles captures by modifying bait usage, particularly replacing squid baits with mackerel (Watson et al. 2005). There are laboratory studies on the effect different bait characteristics have on loggerhead sea turtles' feeding behavior and preferences (Kiyota et al. 2004; Stokes et al. 2006). Because of significant differences between the pelagic longline and bottom and vertical line fisheries in the size of sea turtles (i.e., small versus large) caught, the sizes of the hooks (i.e., large versus small) and the baits (i.e., whole versus cut), we do not believe the results of these studies are applicable to the snapper-grouper hook-and-line gear without further study in the snapper-grouper fishery.

5.2.3 Estimating Sea Turtle Captures and Mortalities in Commercial Bottom Longline Gear

In our 2006 Opinion, we presented the first quantitative evaluation of the effects of the bottom longline component of the South Atlantic snapper-grouper fishery on sea turtle species. The evaluation was based on commercial self-reported fishing effort from the CFLP and sea turtle capture data from the SDDP, which we determined was the best available information on sea turtle bycatch on bottom longlines targeting snapper-grouper. From August 2001 through July 2004, fishers selected to report in the SDDP (representing between approximately 5% and 14% of all South Atlantic snapper-grouper CFLP fishing effort) had reported catching 1 loggerhead sea turtle and 1 leatherback sea turtle on bottom longlines. Based on extrapolation of that data to commercial bottom longline effort in the entire South Atlantic snapper-grouper fishery, we estimated 23 loggerhead and 23 leatherback sea turtles would be captured on a triennial basis.

In conducting this consultation, we first searched for any new snapper-grouper bycatch data on which to update our 2006 analysis for the bottom longline component of the South Atlantic snapper-grouper fishery. We found that very little snapper-grouper sea turtle bycatch data had become available over the past 10 years. There is still no observer program for the South Atlantic snapper-grouper fishery, and the only pilot observer projects to date have been in the vertical line component. Fishers with shark permits that are observed by the Shark Bottom Longline Observer Program (SBLOP) were sometimes observed targeting tilefish under the SGFMP, so we did have some limited coverage of at least a portion of South Atlantic snapper-grouper bottom longline component. We also found an EFP project during which NCDMF observed some commercial snapper-grouper fishers using bottom longlines to target blueline tilefish off North Carolina. Both the SBLOP and the EFP project did not detect any sea turtle bycatch on bottom longlines targeting tilefish, but they did provide some fishery characterization data specific as well as context for evaluating the potential rarity of sea turtle captures on snapper-grouper bottom longlines.

We also re-evaluated logbook data. To assist us in our evaluation, Farmer (2016a) analyzed sea turtle captures reported to the SDDP on commercial snapper-grouper trips, including the old and new reported captures, and CFLP effort data. However, Farmer (2016a) did not generate any new sea turtle capture estimates for bottom longlines. The new analysis indicated that our 2006 Opinion sea turtle capture estimates for bottom longlines were based on 2 SDDP reports that were not actually snapper-grouper bottom longline sea turtle captures. Farmer (2016a) clarified that the 1 loggerhead sea turtle sea turtle capture record for bottom longline was targeting dolphin-wahoo and not snapper-grouper; the other leatherback record appears to also have been misidentified as a snapper-grouper bottom longline capture.

Finally, because Farmer (2016a) invalidated our 2006 bottom longline gear sea turtle capture estimate and we could not simply assume the same rates and number of captures in the absence of new data, we looked at sea turtle capture data from other bottom longline fisheries in the Southeast Region. We considered what might be the best proxy, based on their differences and similarities to snapper-grouper bottom longlines relative to the factors that may affect capture rates (e.g., fishing locations, gear and fishing techniques). Bottom longlines are used in 2 other fisheries in the Southeast Region: the Atlantic HMS shark fishery which occurs in both the Gulf of Mexico and South Atlantic Region, and the reef fish fishery in the Gulf of Mexico. The Gulf of Mexico reef fish fishery uses essentially the same bottom longline gear, has similar soak times, and targets mid-water and deep-water reef fish species, essentially the same bottom species as, the South Atlantic snapper-grouper fishery. Since 1990, longline gear has been prohibited for the harvest of reef fish inside of 50 fathoms west of Cape San Blas. East of Cape San Blas, longline gear has been prohibited for harvest of reef fish inside of 20 fathoms also since 1990, with a seasonal shift in the longline boundary to 35 fathoms during June through August implemented (along with other measures) in 2010. In contrast, the Atlantic HMS shark fishery typically uses heavier longlines with larger hooks, for longer soak times. Also, even though the Atlantic HMS shark fishery occurs in part in the South Atlantic region, its bottom longlines are fished much closer to shore than both the Gulf of Mexico reef fishery and the South Atlantic snapper-grouper fishery. Thus, even though the Gulf of Mexico reef fishery is not in our action area, we still believe recent observer data from its bottom longline sector is likely the best source of information to infer sea turtle bycatch rates in South Atlantic snapper-grouper longline gear.

In Section 5.2.3.1, we present a summary of the primary observer data sources considered. These include the SBLOP observed tilefish sets, the EFP project, and Gulf of Mexico reef fish bottom longline observed sea turtle bycatch data from 2011 through 2014, which is the most recent data available since the additional seasonal closure pushing longlines out to 35 fathoms from June through August and other regulations impacting the longline sector went in effect. In Section 5.2.3.2, we discuss that information and what we believe are the best estimates of sea turtle captures on commercial bottom longlines targeting snapper-grouper species under the proposed action. Finally, in 5.2.3.3, we estimate mortality, both on the line prior to retrieval and post-release mortality and present our overall mortality estimates for the bottom longline component of the South Atlantic snapper-grouper fishery.

5.2.3.1 Review of the Primary Data Sources Considered For Estimating Sea Turtle Capture Rates Bottom Longlines Targeting Snapper-Grouper Species

SBLOP Observed Sets Targeting Tilefish

From 2005 through 2007, there were a total of 40 hauls on 7 trips observed targeting tilefish exclusively off the southern U.S. Atlantic states from North Carolina to Florida. Mainline length ranged from 5.5 to 14.8 km with an average of 8.7 km. Average bottom depths fished was 225.5 m for 2005-2006 and 211.5 m in 2007. The most commonly used hooks were 12.0 J hooks and 14.0 circle hooks, and on some hauls a mixture of both of these were used. The average soak duration was 0.6 hr ((Hale and Carlson 2007; Hale et al. 2007).

There were 18 hauls on four (4) trips observed targeting tilefish in the U.S. Atlantic Ocean. The mainline length ranged from 6.1 to 11.3 km with an average of 8.6 km. The average bottom depth fished was 115.6 fathoms (211.5 m) and the number of hooks ranged from 323 to 900 hooks with an average of 800 hooks fished. The most commonly used hooks were 12.0 J hooks and 14.0 circle hooks (77.8% of hauls). Seven (7) hauls (38.9% of hauls) employed two different types of hooks, with 12.0 J hooks and 14.0 circle hooks used each time.

North Carolina Division of Marine Fisheries Blueline Tilefish Bottom Longline EFP Project

In August 2011, SERO issued an EFP allowing 11 commercial vessels with federal commercial snapper-grouper permits to harvest and land South Atlantic snapper-grouper species that were either prohibited (speckled hind and warsaw grouper) or prohibited (at that time) beyond a depth of 240 ft (73.2 meters) (blueline tilefish, misty grouper, queen snapper, silk snapper, snowy grouper, and yellowedge grouper). Authorized vessels were eligible to harvest these prohibited species in federal waters from a depth of 240 ft seaward to the EEZ limit, between Cape Hatteras (35°15.03' N latitude) north to the North Carolina/Virginia state line (36°3 3.02' N latitude). To participate in the EFP, each vessel's 2009 commercial landings must have exceeded 500 lb (226.8 kilograms) of blueline tilefish in the EEZ waters off North Carolina, north of Cape Hatteras. The vessels were required to have an NCDMF observer onboard for 20% of all trips taken under the authority of the EFP. The EFP exempted designated project participants from regulations regarding the harvest and possession prohibition for speckled hind and warsaw grouper (622.32 (b)(3)(vii)), the area closure for deep-water snapper-grouper species (622.35 (o)), queen snapper, and silk snapper commercial size limits (622.37 (e)(1)(iii)), and the snowy grouper commercial trip limit (622.44 (c)(3)).

Between August and May 4, 2012, 100 trips (max of 3 days per trip) were conducted, 20 of which carried observers. Observers collected information on area/time fished, gear configuration, target/non-target species caught and released, general comments on the fishery, and trip ticket information by market. Based on the data collected, the blueline tilefish fishery north of Cape Hatteras is prosecuted during daylight hours (due to sea lice eating bait) and occurs anywhere from 28-38 nautical miles east to east-northeast of Oregon Inlet. Depths fished ranged from 234-438 ft (39-73 fathoms). The gear used was predominantly longline (#12 circle hook), with an average length of mainline of 2 miles and a range of 0.75-3 miles (1 vessel employed bandit gear when its mainline broke). The average number of hooks used was 400, with a range of 180-1,200. The average number of sets was 8, with a range from 1-20, depending on conditions, with an average soak time of 1 hour (range: 0.8-1.5 hours). No listed species were caught.

Sea Turtle Bycatch Data from Observed Gulf of Mexico Reef Bottom Longlines

Two ongoing observer programs provide data on sea turtle bycatch from bottom longlines in the Gulf of Mexico, the Reef Fish Observer Program and the SBLOP. Each program was independently designed and implemented sampling regimes for different, but overlapping, fisheries employing bottom longlines in the Gulf of Mexico. The Reef Fish Observer Program for the commercial reef fish fishery was established in July 2006 under Amendment 22 to the FMP to provide quantitative biological, vessel, and gear-selectivity information on the directed reef fish fishery. The second program is the SBLOP. Although this program targets the bottom longline component of the HMS shark fishery, since mid-2006, this program not only requires observers to record all catches, including that of protected resources, but also records the target species group. Thus, because some fishers participate in both fisheries, information on trips targeting reef fish is also collected and used for analyses of the reef fish fishery.

As stated previously, since May 26, 2010, the Gulf of Mexico reef fish fishery has been restricted to fishing longlines in waters off the western Florida shelf greater than 35 fathoms from June through August. Gulf of Mexico Reef Fish Opinion annual reports for 2011-2014 indicate that from 2011 through 2014, the SBLOP and the (ROP observed 12 sea turtle captures, all loggerheads, on bottom longlines targeting reef fish in the Gulf of Mexico. Of those, only 1 was caught in waters greater than 50 fathoms. Also of note is that the sea turtles were all caught in the eastern Gulf of Mexico, where the shelf is particularly wide (i.e., more so than anywhere else on the eastern coast of the United States), despite the fishery's also occurring in the western Gulf, which has a relatively narrow shelf. Because observer coverage is only half that of the western Gulf, the absence of observed sea turtle captures in that region may be, at least in part, because the smaller sample size was insufficient to capture such a rare event. In general, we would expect the eastern Gulf to have higher CPUEs of sea turtles than the western Gulf due to the shelf habitat differences (P. Richards, SEFSC to J. Lee, NMFS SERO August 5, 2016).

Gulf of Mexico Reef Fish Opinion annual reports for 2011-2014 included observed loggerhead CPUEs (i.e., the only observed species in this fishing component to date) and extrapolated captures estimates for the Gulf of Mexico by year, season, and observer program in the bottom longline portion of the Gulf of Mexico reef fish fishery. In Table 5.4, we present the annual loggerhead CPUEs, the observer program source(s), and extrapolated capture estimates from these reports. As noted previously, the RFOP samples the entire reef fish bottom longline fishery, and the SBLOP samples the portion of the fishery that also has directed shark permits. In cases where sea turtles were caught in both programs, relative weighting was used to produce an overall CPUE. Weightings were determined by multiplying approximated logbook effort (in sets) by the proportion of the fishery from which either the RFOP or the SBLOP were presumed to have selected.

Table 5.4. 2011-2014 Gulf of Mexico Bottom Longline Loggerhead CPUEs and Estimated Captures

Year	Loggerhead CPUE (captures per 1,000 hooks)	Observer Program Source	Estimated Captures (95% CI, CV)
2011	0.006297	RFOP/SBLOP	30.8 (6.8-139.5, 0.90)
2012	0.0024	RFOP/SBLOP	12.5 (2.3-68.6, 1.06)
2013	0.00096	RFOP	11.9 (3.4-41.4), 0.70)
2014	0	NA	NA

5.2.3.2 Estimating Future Bottom Longline Effort Levels Based On Recent Effort Data

In Table 5.5, we present 2012-2015 annual effort levels for the bottom longline component of the South Atlantic snapper-grouper fishery. Over the past 4 years (2012-2015), 4,910,080 hooks have been fished, with an overall average of 1,227,520 hooks fished annually. In our experience monitoring fishing effort we have found that typically the most recent past is reflective of the most recent fishery conditions, fuel prices, and other economic factors that influence effort and also is most predictive of future effort levels. We have no information to indicate that average bottom longline effort levels may increase in the future. These data are the most recent data and, by using the average over this 4-year period, should be reflective of effort we expect the near future.

Table 5.5. 2012-2015 Hooks Fished in Bottom Longlines Targeting Snapper-Grouper Species (D. Gloeckner, SEFSC commercial coastal logbook program pers. comm. to J. Lee, SERO, August 10, 2016)

Year(s)	Effort (in 1,000 hooks)
2012	1053.385
2013	1342.355
2014	1459.59
2015	1054.75
2012-2015 total	4910.08
2012-2015 average	1227.52

5.2.3.3 Sea Turtle Capture Estimates

Sea turtle capture estimates are calculated essentially by multiplying a capture rate per unit of effort by total effort. Thus, in this section, we calculate sea turtle capture estimates based what we determined in the previous sections to be our best sea capture rate estimate and our best estimate of future effort levels for each sea turtle species.

Loggerhead and Other Hardshell Sea Turtle Species
The 2011-2014 average Gulf of Mexico bottom longline loggerhead CPUE is 0.00241425. Applying this average CPUE as a proxy for sea turtle captures in the snapper-grouper fishery to our proxy for future effort, the 2012-2015 average 1,000-hooks effort (0.00241425*1227.52), we estimate only 3 loggerhead sea turtles would be captured in the

entire fishery component. Although using the Gulf of Mexico sea turtle CPUE as a proxy is conservative, (i.e., given no captures have actually been documented in the bottom longline component of the snapper-grouper fishery and the sea turtles captured in the Gulf of Mexico were all from shallower waters of the west Florida shelf that are important loggerhead feeding grounds) we believe, based on the best available data, it is reasonable to assume that up to 3 loggerhead sea turtles could be captured annually. Our estimate is based on 2012-2015 average effort, which as explained above we believe best represents future effort levels in this gear type. With no indication that effort will increase in the future, we believe that is a reasonable assumption for future annual loggerhead sea turtle captures in bottom longlines targeting snapper-grouper FMU species.

The Gulf CPUE we used in estimating potential capture levels in the South Atlantic snapper-grouper fishery is specific to loggerhead sea turtles; thus, our estimate is specific to loggerhead sea turtles. We expect loggerheads comprise the vast majority of sea turtles caught because they are the most abundance sea turtle species found in the action area and also comprise the vast majority of sea turtle captured in other offshore hook and-line fisheries. Based on what we know about green, hawksbill, and Kemp's ridley diet, foraging habitats, and depth preferences, we believe captures of these other species are unlikely. Still, because captures of these other hardshell species in HMS fisheries have been observed (in some years sporadically), we estimate that 1 additional capture of a Kemp's ridley, green, or hawksbill sea turtle may occur every 3 years. This approach is consistent with our treatment of this information in the 2006 Opinion,

Leatherbacks

The leatherback bottom longline captures in the last Opinion were invalidated by Farmer (2016a), thus we no longer have direct evidence of them being captured in equal proportion to loggerhead sea turtles; in fact, under the new approach (i.e., using the observed Gulf CPUE) we do not have a leatherback capture estimate at all. Given that leatherbacks are more common at the depths at which South Atlantic snapper-grouper are targeted with bottom longlines relative to other bottom longline fisheries, we are concerned that our new approach results in no estimated leatherback captures.

While leatherback entanglements have not been observed in Gulf reef fish bottom longlines, only 3-6% of fishing effort is observed in that fishery, and there have been a few leatherbacks captured in Atlantic HMS shark bottom longlines. The Florida Museum of Natural History, University of Florida, in Gainesville, Florida coordinated a voluntary observer program of the bottom longline sector of the Atlantic HMS shark fishery from 1994 through 2001. Over that time, 4 leatherbacks and 31 loggerheads (i.e., 1 leatherback every 2 years, with overall captures 11% leatherbacks and 89% loggerheads) were observed captured. Observer coverage became mandatory in 2002, but the SEFSC-run SBLOP was initiated in 2005. Since that time (i.e. 2005) through 2015, observers documented an additional 25 loggerhead sea turtle captures, but only 1 leatherback sea turtle capture.

After reviewing the above information, we believe 1 leatherback capture annually in bottom longlines targeting snapper-grouper is a reasonable estimate. This is the result of the greater depths at which South Atlantic snapper-grouper are targeted with bottom longlines relative to where Gulf of Mexico reef fish bottom longlines and Atlantic HMS shark bottom longlines are set. We expect more leatherback sea turtles to present near where gear is set and more leatherbacks to possibly be caught than in those fisheries.

5.2.3.4 Estimating Mortalities

As discussed in Section 5.2.1, sea turtle mortality can occur prior to gear retrieval (i.e., immediate mortality) or later in time, when individuals released alive die later from related injuries (i.e., post-release mortality).

In the 2006 Opinion, we first considered the observed immediate mortality rates of all sea turtles caught on Atlantic HMS shark bottom longline and Gulf of Mexico reef fish bottom longlines (i.e., 23% and 27%, respectively, based on NMFS 2003a and NMFS 2005b) and applied the most conservative estimated rate (i.e., 27%) to estimate immediate mortality in bottom longlines targeting snapper-grouper FMU species. We applied that rate to our estimated sea turtles captures by species for bottom longline over a three-year period (i.e., 22 loggerheads, 1 green, hawksbill or Kemp's ridley; and 23 leatherbacks every 3 years) and rounded the products up to the nearest whole number, yielding 7 (6.21) loggerheads and7 (6.21) leatherbacks. Since we assumed that only one green, hawksbill, or Kemp's ridley would be taken every 3 years, applying this method assumed that one capture would lead to mortality. Although that method inflated the mortality rate, we did so to allow for a more conservative estimate of impacts. We then moved on to estimating post-release mortality. In January 2004, NMFS had developed new criteria for estimating post-release mortality of sea turtles, based on the best available information on the subject, to set standard guidelines for assessing post-release mortality from pelagic longline interactions. Under that criteria, overall mortality ratios are dependent upon the type of interaction (i.e., hooking; entanglement, etc.) and the amount of gear left following the release (i.e., hook remaining, amount of line remaining, entangled or not). The new criteria also took into account differences in post-release mortality between hardshell sea turtles and leatherback sea turtles, with slightly higher rates of post-release mortality assigned to leatherbacks. Because we saw no reason why the same factors affecting post-release mortality of sea turtles hooked on pelagic longlines (interaction type and amount of gear remaining) would not apply, we used the draft criteria to estimate post-release mortality associated with snapper-grouper hook-and-line gear. We did not have empirical data describing sea turtle interaction types and sea turtle release conditions for the snapper-grouper fishery. Consequently, following the guidance provided in Epperly and Boggs (2004) we assigned the most conservative likely post-release category, based on what we knew about the fishery. Given the bottom longline sector's use of circle hooks and anecdotal information indicating fishers typically just cut the line when sea turtles are caught, we assumed sea turtles would be hooked in the jaw and released still hooked and with trailing line. Based on these assumed conditions and the January 2004 post-release criteria, we estimated post-release mortality rates of 30% for hardshell sea turtles released alive and 40% for leatherbacks released alive.

For this opinion, we considered whether there was any new data on which to revise our 2006 mortality estimates. More recent data on and analyses of immediate mortality in the

Atlantic HMS shark bottom longline and Gulf of Mexico reef fish bottom longline continue to support the same 23% and 27% observed immediate mortality rates (NMFS 2011c; NMFS 2012b). Again, we have no way of determining which mortality estimate is more appropriate to apply to the South Atlantic snapper-grouper bottom longline sector, so we chose to use the more conservative rate of 27 % as our best estimate of immediate mortality in this opinion. In 2006, the post–release mortality criteria used in our 2006 opinion were revised and finalized (Ryder et al. 2006). The final criteria slightly modified the injury and release condition criteria to be more specific, but the changes had no impact on our assessment of the snapper-grouper fishery. Aside from the criteria, we have no new information pertaining to our analysis of post-release mortality. Thus, following the same methods as specifically stated above for estimating post-release mortality, except for using the final criteria in Ryder et al. (2006) rather than the 2004 draft criteria, still resulted in an estimated post-release mortality rates of 30% for hardshell sea turtles released alive and 40% for leatherbacks alive.

In the previous section, we concluded that 3 loggerhead sea turtles and 1 leatherback sea turtle may be captured annually, along with 1 additional species of hardshell sea turtle every 3 years. Thus, every 3 years we expect 9 loggerhead sea turtles, 3 leatherback sea turtles; and 1 hawksbill, Kemp's ridley or green sea turtle will be captured. To avoid rounding our estimates multiple times and the numerical consequences that rounding can create, we calculated overall mortality rates for hardshell sea turtles and leatherback sea turtles, rather than apply immediate and post-release mortality sequentially to our capture estimates. Using the immediate and post-release mortality rates (i.e., (1.0 - 0.27)*0.30+.27) = .489*100 = 48.9% for hardshells and (1.0-.27)*0.40+.27) = .562*100 = 56.2% for leatherbacks) we applied the overall rates to our 3-year capture estimates. Therefore, of the 9 loggerhead sea turtles, 3 leatherback sea turtles, and 1 hawksbill, Kemp's ridley or green sea turtles expected to be captured every 3-years, 4.4 (9*0.489) loggerheads, 1.686 (3*.562) leatherbacks, and an additional 0.489 (1*.489) hardshell sea turtles are estimated to result in mortality. Conservatively rounding to the nearest whole number (and because it is not possible to kill a fraction of an animal), we estimate that up to 5 loggerheads, 2 leatherbacks and then 1 Kemp's ridley, green, or hawksbill may be killed every 3 years

In conducting this consultation, we noted that the current criteria used to estimate post-release mortality do not consider any decompression sickness (DCS) effects on sea turtles. This is because DCS has only been recently recognized as a new pathological condition that can compromise post-release survivorship of incidentally captured sea turtles. Garcia-Parraga et al. (2014) documented for the first time DCS, a previously undescribed condition, in sea turtles incidentally captured by trawl and gillnet fisheries of the Valencian Community region of Spain. Because the bottom longline component of the South Atlantic snapper-grouper fishery is conducted entirely in such deep water and much deeper water than the other two longline fisheries, we believe this could be a mortality factor specific to this component. However, in the absence of data, we believe that in rounding up all of our mortality estimates as we have done, we have already inflated our mortality estimates and thus provided a sufficient buffer for any additional mortality risk associated with DCS..

5.2.4 Estimating Sea Turtle Captures and Mortalities in Commercial Vertical Line Gear

In our 2006 Opinion, we presented the first quantitative evaluation of the effects of the commercial vertical line component of the South Atlantic snapper-grouper fishery on sea turtle species. We used the same SDDP and CLP extrapolation methodology for estimating sea turtle captures for vertical lines as we did for bottom longlines (see Summary Description in 5.2.3). We estimated 54 hardshell sea turtles would be captured every 3 years, based on extrapolation of 6 hardshell sea turtles caught on vertical lines targeting snapper-grouper that were reported to the SDDP.

In conducting this consultation, we searched for new data on which to update our previous estimated sea turtle capture rates and number of sea turtle captures attributed to commercial vertical lines targeting snapper-grouper. As noted previously, very little new snapper-grouper bycatch data have become available over the past 10 years. We did find and review information from 2 new vertical line observer projects: 1 conducted by the Gulf and South Atlantic Fisheries Foundation, and 1 by the SEFSC. Although these projects did not detect any sea turtle bycatch, they did provide some fishery characterization data as well as context for evaluating the potential rarity of sea turtle captures on snapper-grouper vertical lines. The SDDP data remained the only source of snapper-grouper vertical line gear sea turtle capture records, and there were only 7 new sea turtle capture records. To assist our evaluation, Farmer (2016a) analyzed sea turtle captures reported to the SDDP on commercial snapper-grouper vertical line trips, including the old and new reported captures, and CFLP effort data. Summaries of the observer projects and the logbook data, including Farmer's (2016a) analysis of the logbook data, are presented in Section 5.2.4.1. We then discuss and present what we believe is the best estimate of sea turtle captures and mortalities on commercial vertical lines targeting snapper-grouper FMU species under the proposed action in Section 5.2.4.2 and 5.2.4.3.

5.2.4.1 Review of the Primary Data Sources Considered

2007-2011 Pilot Observer Projects

The Gulf and South Atlantic Fisheries Foundation observed South Atlantic snapper-grouper vertical line fishing from 2007-2011 via soliciting vessels and captains to participate in voluntary observer coverage. The objective was to characterize catch and discards within the vertical line component of the fishery. Only vessels with valid South Atlantic snapper-grouper unlimited permits, exclusively fishing bandit reels, were asked to participate in the program. Cooperating vessels carrying an observer were asked to fish under "normal" conditions and were not instructed on when, where, or how to fish. Observed trips covered 4 statistical zones ranging from the southern part of North Carolina to the northern part of Florida. Sampling was continuous within each of 3 distinct periods: January 2007-February 2008, August 2008-July 2009, and November 2010-December 2011.

Because commercial fishing practices on individual vessels were variable, in events when the observer could not sample the total catch brought aboard by all bandit reels (e.g., too many reels per vessel to allow the observer to accurately record all data), the observer subsampled the total catch by focusing efforts on individual reels chosen at random. Even if a reel was not "sampled" (data collected on caught fish), all sets were accounted for as effort data and were labeled as an "unsampled" set. This became necessary when a vessel encountered a large number of biting fish at one time, and all of the reels were catching multiple fish. A set was defined as a single deployment and retrieval of a reel (rig). The sampled reel was randomly chosen by the observer to decrease the likelihood of side or gear bias. After a set was sampled, a new reel was randomly selected.

In total, the Gulf and Fisheries Foundation sampled a total of 59 trips on 27 vessels and conducted 316 observer days, representing 12,695 hook-hours, as defined above. These hook-hours represented only 2,056 hours of actual fishing time because there were on average 6 hook-hours for every hour fished due to multiple reels' being fished with 2 or 3 hooks per reel. No listed species bycatch was observed in that effort.

2014/2015 SEFSC Mandatory Observer Coverage Pilot (Enzenauer et al. 2015)
From February 2014 through January 2015, the SEFSC conducted a pilot mandatory observer project in southeastern U.S. Atlantic mid-shelf and deep-water reef fisheries with vertical line gear (Enzenauer et al. 2015). The U.S. Southeast coast was divided into 3 fishing regions for the purposes of vessel selection: the Carolinas, Georgia/Florida (Cape Canaveral) and southern Florida (Cape Canaveral to Key West). Vessels were randomly selected from all 3 fishing regions based on SEFSC standard vessel selection methodology, and observer coverage was divided based on the fishing effort and landings reported from the previous year. Observers recorded gear characteristics, fishing effort (i.e., hauls) environmental parameters, species caught, condition (e.g., alive, dead, damaged, unknown), and final disposition (kept, released alive, discarded dead, etc.) and collected biological samples. A haul was defined as the time the first line dropped into the water to the time the last line left the water.

The SEFSC observed a total of 27 trips, with an average of 2.1 sea days per trip, on 15 vessels over which a total of 408 vertical line and trolling hauls were observed. Enzenauer et al. (2015) grouped the vertical line and trolling data by target and gear type into 5 groups: (1) trolling (powered and unpowered combined) hauls targeting mixed species, (2) unpowered hauls targeting coastal pelagics, (3) unpowered hauls targeting reef fish (i.e., snapper grouper FMU species), (4) powered hauls targeting coastal pelagic and (5) powered hauls targeting reef fish (Table 5.6). (Enzenauer et al. 2015) excluded 6 hauls that did not fall into these categories (i.e., 3 that targeted bait fish, 2 that were mixed between powered and unpowered gear, and 1 that was a pole spear haul) due to confidentiality concerns.

Table 5.6. Number of Vessels, Trips, Hauls, and Hook-hours by Gear and Target Type Observed in the Southeastern U.S. Atlantic Ocean for All Target Species (with the total number of unique vessels and trips reported in brackets) (Enzenauer et al. 2015)

Gear/Target Group	Vessels Observed	Trips Observed	Hauls Observed	Hook Hours
Trolling/mixed species	3	7	16	82.3
Unpowered gear/coastal pelagics	4	6	36	74.5
Unpowered gear/reef fish	6	10	53	170.9
Powered gear/coastal pelagics	6	10	54	63.3
Powered gear/reef fish	9	11	249	613.3
Total	22(15)	44 (27)	408	1004.3

No interactions with listed species were observed on vertical or trolling hauls during the study period. In total, of the 27 total observed trips, only 21 trips representing 302 hauls, were targeting snapper-grouper species and were fishing under the SGFMP. The "trolling/mixed species" hauls were not considered to be snapper-grouper fishing because this fishing technique (i.e., trolling) is rarely if ever used to target reef fish and is instead a common coastal pelagic species fishing technique for which sea turtle effects are discountable (NMFS 2015a).

Farmer (2016a)

Farmer's (2016a) analysis of the entire SDDP dataset, (i.e., 2001 through 2015) indicated that 13 sea turtle captures on South Atlantic commercial snapper-grouper vertical line trips were reported to the SEFSC SDDP since its inception (Table 5.7). Only 3 sea turtles were identified to species, and all of those were reported as loggerhead sea turtles. Farmer (2016a) assumed that (1) all turtles caught were sea turtles because the unclassified turtles were reported on trips that caught oceanic snapper-grouper species, and (2) that all sea turtles caught were hardshell species because leatherbacks are easily identifiable.

Table 5.7. Sea Turtle Captures as Reported to the SDDP (Farmer 2016)

Year	Month	Logbook Statistical Grid Area	Species Caught	Number Caught	Discard Condition
2001	11	3377	Loggerhead	1	Alive
2002	4	2482	Anapsid-unclassified	1	Alive
2002	11	3474	Loggerhead	1	Alive
2002	11	3476	Anapsid-unclassified	1	Alive
2002	12	3476	Anapsid-unclassified	1	Alive
2003	2	2780	Loggerhead	1	Alive
2005	6	3476	Anapsid-unclassified	1	Alive
2008	3	3378	Anapsid-unclassified	1	Alive
2008	7	3279	Anapsid-unclassified	1	Alive
2012	4	2481	Anapsid-unclassified	4	Some Dead

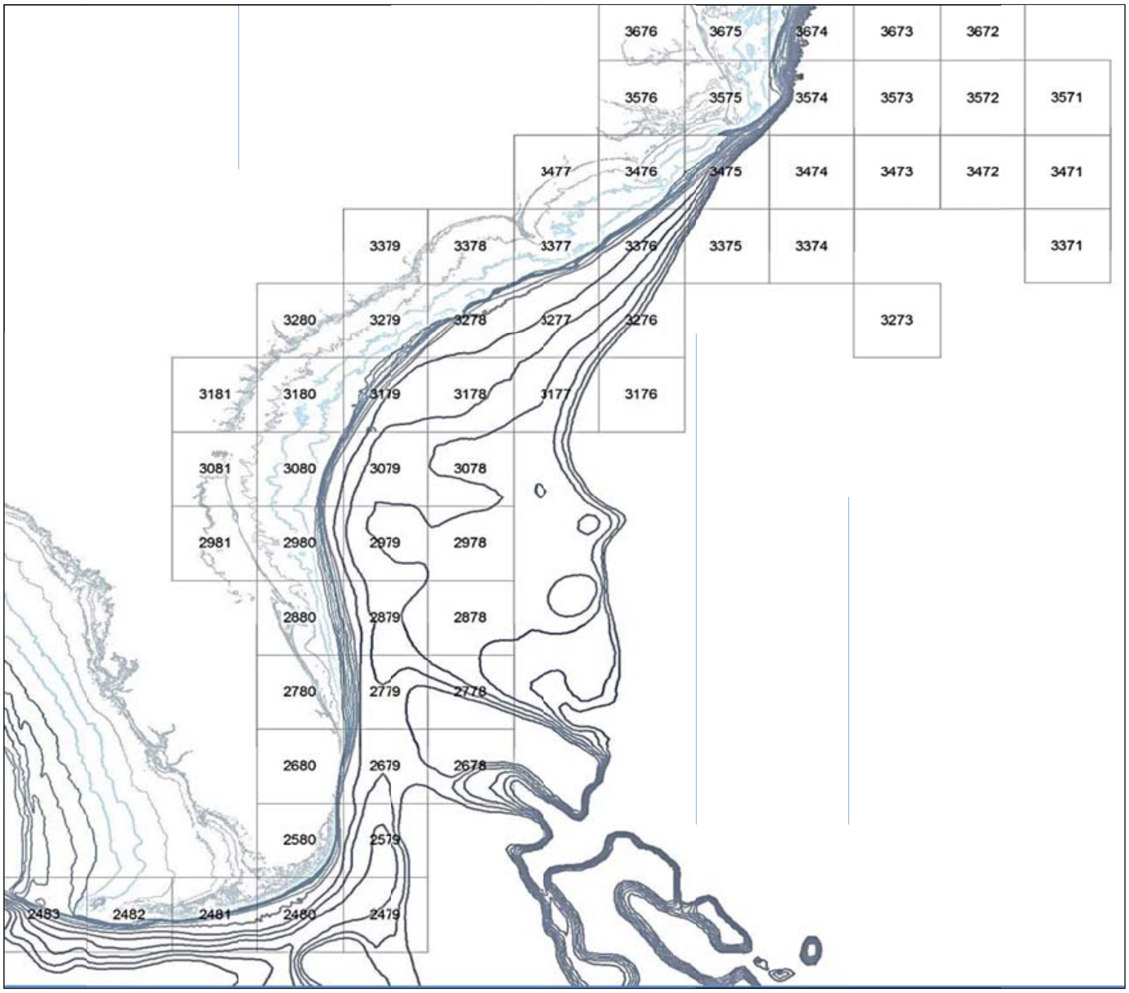

Figure 5.3. Statistical fishing zones in the South Atlantic Region (SAFMC 206)

Farmer (2016a) analyzed the 3 reported loggerhead sea turtles as hardshell sea turtles rather than relying on the species identification. Hardshell sea turtle species can be difficult to tell apart from each other. NMFS did not validate any of the reported species' identifications recorded, and we cannot attest to the knowledge of fishers regarding the identity of various species. It is very likely that some, if not the majority or all, of the unidentified to species records were loggerhead sea turtles, given they are most abundant sea turtle species in the action area as well as the sea turtles species most attracted to baited hooks. Also, while loggerhead sea turtles are the species most expected to be encountered, it is still possible that 1 or more loggerheads were falsely identified as another species.

In Table 5.8, we present the 2001-2015 annual effort levels for the vertical line component of the South Atlantic snapper-grouper fishery from Farmer et al. (2016a). South Atlantic snapper-grouper vertical line trips were defined by Farmer (2016a) as any commercial trip that fished vertical line gear and landed at least 1 pound of a species in the snapper-grouper fishery management unit.

Table 5.8. 2001-2015 Hook-Hours Fished in Vertical Lines Targeting Snapper-Grouper Species

Year(s)	Effort (in hook-hours)
2001	927,262
2002	1,018,242
2003	868,646
2004	753,687
2005	687,291
2006	733,301
2007	818,288
2008	811,519
2009	846,351
2010	702,162
2011	662,386
2012	603,033
2013	621,700
2014	654,387
2015	612,473

Farmer (2016a) calculated hardshell sea turtle discards[23] per hook-hour by year (2001-2015), based on all available data from the SDDP (accessed April 2016) for South Atlantic snapper-grouper vertical line trips. Those sea turtle discards per hook-hour estimates were then expanded by the total effort in South Atlantic snapper-grouper vertical lines, based on 2001-2015 information from the CFLP (April 2016). Uncertainty in results was expressed as 95% confidence intervals.

In Table 5.9, we present the annual estimates of hardshell sea turtle captures from Farmer (2016a). The broad 95% confidence limits and many years with 0 (zero) estimates indicate hardshell sea turtle discards may be a rare event. The empirical estimates are relatively high (~ 100 discards) during years with reported interactions; it is reasonable to assume that there are unreported interactions during years with 0 estimates, either because fishers with sea turtle discards were not selected for the SDDP or chose not to report sea turtle discards on their form. The 95% lower confidence limits typically cross 0, indicating high uncertainty and a rare event.

[23] Note “sea turtle discards” and “sea turtle captures” are used synonymously and interchangeably in this section as all sea turtles captured must be released (i.e., discarded).

Table 5.9. Estimated Annual Hardshell Sea Turtle Captures on Vertical Lines

Year	Number of Sea Turtle Captured	95% LCL	95% UCL
2001	0.27	-0.26	0.81
2002	101.33	-31.96	234.61
2003	3.21	-3.08	9.49
2004	0.00	0.00	0.00
2005	2.26	-2.18	6.70
2006	0.00	0.00	0.00
2007	0.00	0.00	0.00
2008	2.18	-0.85	5.20
2009	0.00	0.00	0.00
2010	0.00	0.00	0.00
2011	0.00	0.00	0.00
2012	77.52	-74.49	229.54
2013	0.00	0.00	0.00
2014	0.00	0.00	0.00
2015	0.00	0.00	0.00

Due to the substantial inter-annual variability in reported discards, Farmer (2016a) suggested a multi-year averaging approach, both for the discard rate and the effort rate, to better capture uncertainty in the data when determining interaction risk. Farmer (2016a) applied the average hardshell discard rate for 2012-2015 (.00004.86 turtles/hook-hour) to the mean 2012-2015 South Atlantic snapper-grouper vertical line hook-hour effort (i.e., 622,898 hook-hours) and estimated 30 hardshell sea turtle captures per year (95% CI: -29 to 89 turtle discards per year).

5.2.4.2 Sea Turtle Capture Estimates

Although the two observer projects did not reveal any sea turtle captures on snapper-grouper vertical line trips, we know at least a small number sea turtles were caught in that component of the South Atlantic snapper-grouper fishery in past years based on the SDDP data. Thus, the observer data indicate that sea turtle interactions in the snapper grouper vertical line component are likely too rare to be detected at the level of sampling conducted during this limited study.

Based on our knowledge of under-reporting in logbook programs, fishers selected for the SDDP may have caught additional sea turtles but not reported them. Also, because only 20% of commercial fishers are selected for the SDDP, it is reasonable to assume that sea turtles were also caught during the other approximately 80% of snapper-grouper vertical line trips. Thus, we continue to believe that the total number of sea turtles that are captured by South Atlantic snapper-grouper vertical line gear are greater than reported, and may be much greater. We therefore relied on Farmer (2016a) in our estimating of total sea turtle commercial vertical line captures.

As discussed above, Farmer et al (2016a) first presented annual capture estimates for 2001-2015 and then suggested a multiple year estimate (i.e.,2012-2015) We believe using the most recent 4-year average discard rate, as Farmer (2016a) suggested and calculated, adequately accounts for the substantial inter-annual variability in sea turtle captures. Also, the most recent 4 years are likely most reflective of the current overlap between fishing and sea turtles and sea turtle abundance in the area, and therefore, they are likely to be most reflective of future interactions between the fishery and sea turtles. With respect to fishing effort, we believe that 2012-2015 average vertical line effort best represents future effort in vertical lines targeting snapper-grouper. This is because we believe the most recent 4 years of effort data should best reflect effort in the near future. As explained in our bottom longline analysis, in our experience monitoring fishing effort we have found that typically the most recent past is reflective of the most recent fishery conditions, fuel prices, and other economic factors that influence effort and also is most predictive of future effort levels. We have no information to indicate that average commercial vertical line effort levels may increase in the future. In Regulatory Amendment 16, NMFS and the SAFMC do discuss potential effects of the proposed new regulations, including potential effort shifts from black sea bass pots to vertical line gear during the proposed closures resulting in a potential increase in the likelihood of hook-and line gear sea turtle captures. However, the discussion does not seem to consider that the proposed BSB pot time-area closure is replacing a longer seasonal time area closure that has been in effect since 2010. While recent increases in BSB quota could still lead to potential effort shifts and potentially increased vertical line effort, we believe this is highly uncertain and speculative, and the extent of the potential increase unknown. Consequently, we believe using 2012-2015 average effort in our analysis is appropriate. Therefore, we adopted Farmer (2016a)'s estimate of 30 hardshell sea turtles will be captured annually (95% CI: -29 to 89 sea turtles) by commercial vertical lines targeting snapper –grouper FMU species under the proposed action.

Estimated Hardshell Sea Turtle Captures By Species
To effectively assess the proposed action's effects on each sea turtle species, we need to apportion our estimate of 30 hardshell sea turtle captures by species.

All 5 species of sea turtles present in the action area have been found entangled in line and with embedded hooks, but how prone they are to such situations varies by species. Differences in interactions with vertical lines would be expected because of distribution and feeding behavioral differences among the species. Loggerhead and Kemp's ridley sea turtles are expected to be most affected based on their feeding behavior. These species comprise the most frequently reported sea turtle species caught incidentally on vertical line gear. Leatherback and green sea turtles may be affected by vertical line capture. Given their diets and preferred habitats, though, these species of sea turtles are not as likely to be caught as loggerhead sea turtles. Leatherbacks are the most pelagic of the sea turtles, entering coastal waters on a seasonal basis to feed in areas where jellyfish are concentrated. Leatherbacks feed primarily on cnidarians (medusae, siphonophores) and tunicates. Given leatherback sea turtles' preferred habitat and diet, they are likely to be relatively rare in areas where shallow-water snapper-grouper FMS species are targeted with vertical lines, but are known to be quite vulnerable to entanglements when gear is encountered. Subadult and adult green sea turtles are primarily herbivorous, feeding on algae and sea grasses.

Green sea turtles' diet and preference for habitat rich in seagrasses and algae may result in that species' presence less common in the hard bottom areas where snapper-grouper FMU species are typically targeted. Also, if present, they are not likely to be as attracted to baited hooks as loggerhead and Kemp's ridley sea turtle, so we would expect them to be captured much less frequently. Hawksbills are the most tropical sea turtle species, ranging from approximately 30°N latitude to 30°S latitude. Adult foraging habitat is typically coral reefs, although other hard bottom communities and occasionally mangrove-fringed bays may be occupied. Thus, hawksbill sea turtles are likely to be present in vertical line fishing areas off South Florida and the Florida Keys. However, because the hawksbill's diet is highly specialized, consisting primarily of sponges, this species is still the least likely sea turtle species to be caught.

In the 2006 Opinion, we evaluated sea turtle observations by species and relative species compositions in several datasets to try and estimate the hardshell species composition of our estimated captures. The datasets reviewed included Atlantic HMS Atlantic shark and pelagic longline observed captures (1992-2002), Ocean Biogeographic Information System (OBIS)-SEAMAP sea turtle records (1992-2002), and STSSN strandings (1998-2005). We used what we knew about each gear component of the South Atlantic snapper-grouper fishery and sea turtle diet, foraging habits, and depth preferences to evaluate which dataset, and ultimately which species compositions, were most appropriate to use. First, we discussed how the vertical line sector of the fishery operated over a wider depth range than the bottom longline sector (78-660 ft) (SAFMC 2006); consequently, the likelihood of encountering hardshell sea turtles other than just loggerhead sea turtles was increased. Second, we discussed how what we knew about the diet, foraging habits, and depth preferences for green, hawksbill, and Kemp's ridleys suggested that the likelihood of the vertical line sector incidentally capturing these species would still be relatively low for most of the species. We chose not to apply the species composition estimates suggested by STSSN data because we believed (1) that this sector of the fishery operates too far from shore for that dataset to be the most accurate, and (2) that it did not reflect our understanding based on sea turtle feeding habits. Ultimately, we looked at all the non-strandings data and selected the highest species composition percentage available to give us the most conservative estimate of take of greens, hawksbills, and Kemp's ridleys. The OBIS-SEAMAP data gave us the highest species composition percentage (2.2%) for greens, while the highest species composition percentage for the hawksbills and Kemp's ridleys (0.3% each) were from the HMS pelagic longline data set. We then applied those percentages to our estimates of hardshell sea turtles.

Since completing our 2006 Opinion, we have faced the same challenge of estimating sea turtles by species in our recent Gulf of Mexico Reef Fish Opinions (i.e., NMFS 2009a; NMFS 2011c). For those Opinions, we used Epperly et al. (2002) as the best source of data for the relative abundance of loggerhead sea turtles in the Gulf of Mexico; they estimated 67.7% of sea turtles would be loggerheads. However, although other species were examined in that study, differences in interactions with vertical lines would be expected because of distribution and behavioral differences among the other species that would alter the likelihood of interacting with a baited hook, as described above. Therefore, for the remaining sea turtle species, we looked at the relative occurrence in offshore sea turtle strandings that had evidence of vertical line interactions rather than considering all stranding data as done for our 2006 Opinion. Of those, 60.9% were Kemp's ridley sea turtles, 36.9% were green sea turtles, 1.3% were hawksbill sea turtles, and 0.8% were leatherback sea turtles. Although the percentages stemmed from what we believed to be recreational vertical line interactions with no data specific to commercial vertical line, we believed they represent the best available information on which to quantify different vertical line capture rates by species. Therefore, we then applied the percentages above to the 32.3 percent sea turtle captures left after estimating 67.7 percent loggerhead sea turtle captures (i.e., 100-67.7=32.3 percent non-loggerheads multiplied by 36.9 percent green, 60.9 percent Kemp's ridley, and 1.3 percent hawksbill, and 0.8 percent leatherback). Thus, overall,, in the 2006 opinion we estimated approximately 67.7% would be loggerhead sea turtles, 19.7% [(100-67.7)*.609] would be Kemp's ridley sea turtles, 11.9% [(100-67.7)*.369] would be green sea turtles, 0.42% [(100-67.7)*.013] would be hawksbill sea turtles, and 0.3% would be leatherbacks.

In reviewing our 2006 Opinion analysis, we noted the rationale and application of OBIS was a bit questionable, given our current understanding of OBIS SEAMAP data as well as its data use policy. The dataset is actually a collection of many datasets, made possible by contributions from data providers all over the world. The relative species composition of OBIS-SEAMAP data in our action area would be more reflective of the relative amount of research on each species in the action area. We also noted that the dataset was selected ultimately because it was the closest fit to our basic understanding and expert opinion of what the relative species composition our expert opinion.

Although the species composition percentages used in our recent Gulf of Mexico Reef Fish Opinions are based on Gulf of Mexico data sources, the percentages (1) reflect the vertical line sea turtle capture rates by species we would expect to be present in the South Atlantic Region and (2) are consistent with the best available information and our expert opinion. Considering loggerhead sea turtles seem to be most attracted to baited hooks as well as their greater abundance throughout the action area relative to other species, 67.8% of captures being loggerhead sea turtles seems reasonable. Similarly, the species percentage estimates drawn from strandings with evidence of vertical line interactions reflect our expectation that Kemp's ridley sea turtles would be caught second-most frequently, then green sea turtles, and then, on an extremely infrequent basis, hawksbill sea turtles and lastly leatherback sea turtles. For these reasons, we apportioned our annual estimate of 30 hardshell sea turtles based approximately on these percentages from the strandings analysis[24] (i.e., 67.89% loggerhead, 11.93% green, 19.76% Kemp's ridley, 0.42% hawksbill sea turtles) and estimated 20.367 (30*0.6789) loggerheads sea turtle captures, 5.928 (30*0.1976) Kemps' ridley sea turtle captures, 3.579 (30*0.1193) green sea turtle captures, and 0.126 (30*0.0042) hawksbill sea turtle capture annually. Because the proposed action is a long-term action and the annual hawksbill estimate was so tiny (less than half a percent), we also calculated and considered 3-year capture estimates. Applying

[24] Because we considered leatherbacks in a separate analysis from that of hardshells, we reapportioned the relative species percentages to reflect only the hardshell species (e.g., 67.7+19.7+11.9+0.42=99.72; then 67.7/99.72=67.89% loggerheads, 19.7/99.72=19.76% Kemp's ridleys; 11.9/99.72=11.93% greens, and 0.42/99.72=0.42%.

the same percentages to 3-year hardshell captures (i.e., 30*3=90), we estimated 61.101 (90*0.6789) loggerheads sea turtle captures, 17.784 (90*0.1976) Kemp's ridley sea turtle captures, 10.737 (90*0.1193) green sea turtle captures, and 0.378 (90*0.0042) hawksbill sea turtle captures every 3 years. In both cases (i.e., annual and 3-year capture sea turtle species estimates), (1) rounding up all of our estimates to the nearest whole number added 2 more captures than we actually anticipated (i.e., 21+ 6+4+1=32; 62+18+11+1=92), and (2) rounding following standard mathematical rounding rules resulted in no hawksbill sea turtles being estimated. To resolve this issue, we chose to estimate captures on a 3-year basis and structured our capture estimate as no more than 90 hardshell sea turtles in total, of which up to 62 may be loggerheads, up to 18 may be Kemp's ridleys, up to 11 may be greens, and up to 1 may be a hawksbill. In structuring our estimate this way we are able to maintain our overall estimate of hardshell sea turtles while allowing for some flexibility in our species composition and recognizing that we do expect a hawksbill capture to occur occasionally.

Consideration of Leatherback Sea Turtles
There continue to be no documented captures of leatherbacks in the SDDP data for the vertical line sector. As acknowledged in our 2006 Opinion, this may be a result of leatherback captures occurring infrequently enough that they are not picked up by the existing reporting schemes, or because they are indeed not captured. In the 2006 Opinion, we acted with precaution and anticipated the capture of 1 leatherback every 3 years by the commercial vertical line sector. We based that decision on interactions between this gear type and leatherbacks that have occurred in the other fisheries' in the past and our belief they are likely to occur again in the future. In this Opinion, we adopt the same precautionary approach and again estimated 1 leatherback every 3 years by the commercial vertical line sector.

5.2.4.3 Sea Turtle Mortalities

As discussed in 5.2.1, sea turtle mortality can occur prior to release (i.e., immediate mortality) or later in time (i.e. post-release mortality). Below, we review both types of mortality are reviewed and estimated for bottom longline and vertical lines.

Immediate Mortality
In our 2006 Opinion, we explained how we believed all sea turtles caught during commercial vertical fishing are released alive because: (1) commercial snapper-grouper fishers typically retrieve vertical lines within 15 minutes of their deployment, and sea turtles can very likely breath-hold longer than typical soak times, even under stress; (2) observed and reported captures on vertical lines have all been released alive; and (3) forcible submergence is extremely unlikely to occur as, except in cases of extreme entanglement (such as hooking late in a sea turtle's dive, combined with bottom-fouling or extremely heavy sinkers with very small sea turtles), hooked sea turtles will be able to surface and breathe. Based on that information, we believed it was highly unlikely that a sea turtle caught on a vertical line would be dead upon retrieval of the line, and we assumed no immediate mortality.

Of the 10 trips for which fishers reported catching sea turtles since 2001 (all vertical line trips, see Table 5.7 above), mortalities were reported only by one fisher on 1 trip, so based on this approximately 10% of all trips reporting sea turtle captures may have mortalities. The discard condition of the 4 sea turtles that were reported as caught on vertical lines on that single trip (in 2012) was “some dead;” all other reported sea turtle captures on vertical lines (i.e., n=9) were reported to have been released alive. We assume “some dead” to mean either 2 or 3 of the 4 sea turtles caught on that trip were dead. Thus, of the 13 sea turtles reported caught, 15.4-23.1% ([2÷13] – [3÷13]%) of them were reported to have died prior to release. It seems highly unlikely that a fisher would report “some dead” when there were none; thus, we believe these moralities did occur. Still, we find it very hard to believe that immediate mortality would be experienced fleet-wide at that level and suspect that the circumstances that led to immediate mortality were likely unusual or rare. This trip was also the only reported trip with multiple captures; all other records were of a single sea turtle. Thus, we believe applying the most conservative assumption and rate (23.1%) uniformly would very likely substantially overestimate the number of mortalities attributed to hook-and-line. Consequently, we chose 15.4% to represent the percentage of sea turtle mortality that occurs prior to a sea turtle’s release.

Post-release Mortality

Post-release mortality criteria specific to sea turtles caught on vertical line interactions do not exist. We presume that sea turtles caught on vertical line gear and released alive would be in better overall health than if released alive from bottom longline gear because of the much shorter soak times and the animals’ likely ability to reach the surface of the water to breathe. However, we see no reason why the same factors affecting post-release mortality of sea turtles hooked on bottom longlines (interaction type and amount of gear remaining) would not apply. In our 2006 Opinion, we assumed sea turtles were, and would continue to be, hooked in the jaw and released still hooked and with trailing line. We based this assumption on mainly circle hook use and anecdotal information that indicated fishers typically just cut the line when sea turtles are caught. With these same hook-and-trail line assumptions made for commercial bottom longline captures, in the absence of other quantitative data, we conservatively applied the same post-release mortality rates (i.e., 30% for hardshell and 40% for leatherback sea turtles) to the commercial vertical line component of the snapper-grouper fishery, just as we applied to the commercial bottom longline component of the fishery.

Since February 16, 2010, vessels with commercial (and for-hire snapper-grouper) vessel permits have been required to have sea turtle release gear be onboard when fishing to facilitate the safe release of any sea turtles caught. They are also required to possess specific documents (i.e., NMFS’s *Sea Turtle Careful Release and Safe Handling Protocols*) providing instruction on the safe release of any sea turtle caught. Depending on the level of compliance with these regulations and the skill of fishers in following these protocols, it is possible that these regulations have reduced post-release mortality in this fishery component. Still, these new regulations do not reduce the likelihood of some line break-offs’ occurring, with sea turtles escaping still hooked and with varying amounts of trailing line. Also, the aforementioned requirements were also implemented in the bottom longline component of the Gulf of Mexico reef fish fishery, yet analysis of recent observer data still documented a 30% post-release mortality rate (NMFS 2009a; NMFS 2011c). Thus, we have no data to support revising our previous post-release mortality rate, and we again assumed these rates (i.e., 30% for hardshells, 40% for leatherbacks).

Overall Mortalities

Combining our estimated immediate and post-release mortality rates, we estimated overall mortality on commercial vertical lines to be 40.78% for hardshell species ([1-0.154]*0.30+0.154) and 49.24% for leatherback sea turtles ([1-0.154]*0.40+0.154). In the previous section, we concluded that there would no more than 90 hardshell sea turtle captures every 3 years, comprised of up to 62 loggerhead sea turtle captures, 18 Kemps ridley sea turtle captures, 11 green sea turtle captures, and 1 hawksbill sea turtle capture. Applying our overall mortality rates and conservatively rounding up the final numbers, we estimated that up to 26 (61* 0.4078=25.2836) loggerhead sea turtles, 8 (18*0.4078=7.3404) Kemp's ridley sea turtles, 5 (11*0.4078=4.4868) green sea turtles, 1 hawksbill sea turtles (1*0.4078=0.4078), and 1 (1*0.4924=0.4924) leatherback sea turtle would be killed, every 3 years.

5.2.5 Estimating Sea Turtle Captures and Mortalities in Recreational Vertical Line Gear

Estimating the number of sea turtle captures and mortalities in recreational vertical line fisheries is particularly challenging, especially in the offshore waters of our action area.

In our 2006 Opinion, absent snapper-grouper vertical line sea turtle bycatch data, we quantified the effects of the recreational snapper-grouper vertical lines by assuming they would have the same sea turtle CPUEs as we had estimated for commercial vertical lines via SDDP data. We reviewed differences between commercial versus recreational vertical line fishing (e.g., number of hooks fished per line, fishing depth and geographic area). Some differences suggested recreational sea turtle capture rates might be higher (e.g., more recreational fishing effort concentrated offshore reef habitats at depths where sea turtles are likely more abundant), while others indicated they could be lower (e.g., only 1 or 2 hooks per recreational line versus 5-20+ per line with commercial bandit gear). Ultimately, we reasoned that differences would result in overall negligible differences in hardshell sea turtle CPUE estimates and slightly biased high leatherback CPUE estimates. We then multiplied our CPUE estimates by estimated 16.5 million (16,578,988) hook-hours of fishing effort every 3 years, which resulted in an estimated total capture of 185 hardshell sea turtles caught every 3 years. We made no attempt to quantify the precision or variance associated with the CPUEs or our final estimates.

Prior to conducting this consultation, we reviewed new data on recreational vertical line interactions through 2009 as well as considered additional methods to estimate recreational sea turtle captures for our 2009 Opinion on the Gulf of Mexico reef fish fishery (i.e., NMFS 2009). In the 2009 Opinion, we first analyzed a 2006 MRFSS dockside private vessel intercept pilot study. The study had been implemented in response to a NMFS (2005a) requirement, intended to collect improved data on sea turtle captures in the recreational sector of Gulf of Mexico reef fish fishery. Next, we updated our NMFS (2005a) recreational sea turtle capture analysis to reflect the observed commercial recreational sea turtle capture CPUE from a new Reef Fish Observer Program (RFOP), instead of the SDDP CPUE used previously. Last, because of the large spread in numbers between the results of these approaches, we analyzed Gulf of Mexico stranding data associated with vertical line gear to get a general understanding of the scope of impact from all recreational vertical gear Gulf-wide (and because it was not possible to parse the data out to anything less than a Gulf-wide analysis of all types of recreational vertical line fishing). None of the data and methods considered to calculate estimates provided much certainty and as a whole, they clearly demonstrated the lack of information available regarding recreational captures of sea turtles, particularly for a specific recreational fishery. Thus, in the end we concluded that our capture estimate produced by using the NMFS (2005a) approach-only with the new observer-based CPUE, was the most reasonable estimate of sea turtle captures in the recreational vertical line component of the Gulf reef fish fishery. The 2011 Reef Fish Opinion (NMFS 2011c) found no new information and thus took the same approach.

Over the past 5 years, we have been collaborating with other NMFS's offices to improve the data available on which we can estimate and monitor sea turtle captures in the South Atlantic snapper-grouper fishery and the Gulf of Mexico reef fish fishery. In January 2010, the NMFS Office of Science and Technology (OST) agreed to lead a SERO and SEFSC team to develop possible survey designs and evaluate their effectiveness. To ensure that all appropriate survey approaches for the estimation of rare events were considered, 2 expert survey design consultants were hired by contract to work with the team to develop appropriate survey designs for use in monitoring the fishing interactions with sea turtles that occur in different modes of recreational fishing. The team (named RECTURTLE) was later expanded to include additional NOAA Fisheries representatives interested in developing survey designs that could be used to monitor recreational fishing interactions with sea turtles and other protected species. The project team recognized that separate independent surveys were likely needed to provide the data and statistics needed for fishing on headboats, charter boats, private or rental boats, man-made shore structures, and natural shoreline beaches or banks. To date, the team has developed and piloted 2 surveys: a supplemental mail survey for private vessels surveyed via MRIP, and a charter headboat survey. Both surveys were conducted in North Carolina. At this time, further analysis of these studies needs to be completed to better understand how to move forward to collect data that can be expanded to a wider universe than sampled.

In summary, additional recreational sea turtle interaction surveys conducted since our 2006 Opinion are too limited in scope, and STSSN stranding data associated with vertical line are too broad (i.e., a Gulf-wide analysis of all types of recreational vertical line fishing) to produce estimates of the number of sea turtle hookings or entanglements by recreational snapper-grouper fishers fishing in federal waters. Based on (1) our experience considering different analysis methods for the 2009 Opinion on the Gulf of Mexico reef fish fishery as summarized above, and (2) our knowledge and experience as a member of the RECTURTLE team (also described above), we have no better way of estimating sea turtle captures in the recreational vertical line component of the South Atlantic snapper-grouper fishery at this time. Thus, in this Opinion, we applied the same basic method as previously used in NMFS (2006) to estimate sea turtle interactions in the various recreational snapper-grouper vertical line sectors. Specifically, we assumed recreational vertical fishing would have the same sea turtle CPUEs as we had estimated for commercial vertical lines via SDDP data and extrapolated our commercial vertical hook-and-line discard rate (i.e., the 2012-2015 SDDP sea turtle rate documented by SDDP vessels) to fishing effort of the recreational snapper-grouper vertical line component

Estimating Sea Turtle Captures in the Private Angler and Charter Vessel Sector
For our private angler and charter vessel (non-headboat) analysis, we sought data and analysis assistance from the NMFS OST, MRIP. The MRIP survey provides estimates of recreational landings and effort by state and area fished (e.g., state waters and EEZ). Snapper-grouper trips were defined as any trip using vertical line gear where a species in the snapper-grouper FMU was targeted or caught. We used 2012-2015 effort data to represent future effort levels for the same reasons as described in Section 5.2.3.2. For each fishing mode, state, and year, we multiplied the total estimated directed snapper-grouper vertical line angler-trips in the EEZ by the average reported hours fished on snapper-grouper directed vertical line trips to estimate angler hours. In Table 5.10 we present the number of trips and angler hours data as well as our calculated angler hours. We then (1) summed across states within years to get annual totals of angler hours, and (2) averaged across 2012-2015 to get mean angler hours. Next, we estimated the number of hooks fished per angler. Anecdotal information indicated that some private anglers fishing for snapper-grouper stocks use 1 hook per line, while others use 2 per line. On charter trips, 1 hook per angler is probably the most common; however, some anglers use 2 hooks (R. Zales, Gulf of Mexico Charter Captain, pers. comm. to J. Lee, NMFS 2004). To be precautionary, 1.5 hooks per angler were assumed for both modes. We multiplied the estimate for mean (2012-2015) snapper-grouper angler-hours in the EEZ for each mode (i.e., 260,285 private hours and 1,638,491 charter hook-hours) by 1.5, resulting in 390,428 hook-hours for the charter mode and 2,457,736 hook-hours for the private mode. In Table 5.11 we present our calculated annual and mean 2012-2015 angler hours and hook-hours for the directed snapper-grouper charter and private sectors. The 2012-2015 mean commercial vertical hook-and-line discard rate for snapper-grouper trips in the EEZ was 0.0000486 turtles per hook-hour (95% CI: -0.0000474 to 0.000144 sea turtles per hook-hour). (which we used for the same reasons as noted previously for the effort estimates; (see Section 5.2.4.2) Applied to the MRIP snapper-grouper EEZ hook-hours by mode (presented above and also in Table 5.11 below), this resulted in mean take estimates of 18 sea turtles per year on charter trips (95% CI: -18 to 56 turtles per year) and 119 sea turtles per year on private/rental trips (95% CI: -115 to 353 sea turtles per year) targeting snapper-grouper FMU stocks in the EEZ.

Table 5.10 Directed Snapper Grouper 2012-2015 Effort in the Charter and Private Sector By State

YEAR	STATE	CHARTER			PRIVATE		
		Number of Trips	Average Hours Fished	Angler Hours	Number of Trips	Average Hours Fished	Angler Hours
2012	Florida	13,818	4.93	68,123	179,577	4.97	892,498
	Georgia	2,001	3.91	7,824	7,067	4.35	30,741
	North Carolina	17,204	5.69	97,891	52,432	5.02	263,209
	South Carolina	3,445	4.16	14,331	51,753	5.65	292,404
2013	Florida	13,283	5.19	68,939	205,614	5.00	1,028,070
	Georgia	2,762	3.64	10,054	20,796	5.06	105,228
	North Carolina	6,279	5.40	33,907	53,366	5.36	286,042
	South Carolina	1,666	2.33	3,882	14,511	4.47	64,864
2014	Florida	29,545	4.21	124,384	300,827	4.85	1,459,011
	Georgia	5,373	4.39	23,587	19,504	4.56	88,938
	North Carolina	9,076	4.99	45,289	39,091	5.22	204,055
	South Carolina	31,658	4.44	140,562	36,108	3.82	137,933
2015	Florida	43,662	4.47	195,169	257,773	5.06	1,304,331
	Georgia	5,072	4.40	22,317	12,523	6.04	75,639
	North Carolina	6,740	5.64	38,014	55,800	4.66	260,028
	South Carolina	28,353	5.18	146,869	17,224	3.54	60,973

Source. NMFS OST, unpublished data, July 27, 2106

Table 5.11 Annual and Mean 2012-2015 Angler Hours and Hook-Hours for the Directed Snapper Grouper Charter and Private Sector

YEAR	Charter		Private/Rental	
	Angler Hours	**Hook-Hours**	**Angler Hours**	**Hook-Hours**
2012	188,169	282,253	1,478,852	2,218,278
2013	116,781	175,171	1,484,204	2,226,306
2014	333,823	500,734	1,889,937	2,834,905
2015	402,368	603,552	1,700,971	2,551,457
MEAN	260,285	390,428	1,638,491	2,457,736

Source. NMFS OST, unpublished data, July 27, 2016

Estimating Sea Turtle Captures on Snapper-Grouper Headboats

For headboat effort, we analyzed data from the SEFSC's Southeast Region Headboat Survey. Effort is reported by captains in the Headboat Survey as number of anglers and trip duration. Headboats take both half-day and full-day trips, each of which includes a portion of time in transit to and from offshore fishing grounds. Trip duration in hours is reported in bins. For this analysis, using Statistical Analysis System software, angler-hours were calculated as the number of anglers on the trip times the mid-point of each trip duration (i.e., trip) bin. We used 2012-2015 effort data to represent future effort levels for the same reasons as described in Section 5.2.3.2. For 2013-2015 we did not have data to partition effort between state and federal. Therefore, the percentage of angler-hours expended towards species in the snapper-grouper FMU in the EEZ for these years was calculated using the 'distance-from-shore' variable (reported 2004-2012). The mean percentage of snapper-grouper EEZ effort (2004-2012) relative to total effort (i.e., 22%) was then used to partition total effort into snapper-grouper EEZ effort for the years 2013-2015. In some cases, participants in the headboat census failed to report their catch in a timely manner for trips that have been verified as taken; expansion factors are used to approximate unreported catch and effort from reported catch and effort, using proxies of similar vessels operating out of the same or nearby ports during the same period. The reported effort was expanded for non-reporting in this manner following Headboat Survey protocols. The expanded estimates for snapper-grouper EEZ angler-hours were converted to snapper-grouper EEZ hook-hours by multiplying by 2, as the number of hooks per line typically used by headboat anglers is 2 (R. Dixon, NMFS SEFSC pers. comm. to J. Lee, NMFS SERO PRD 2004). In Table 5.12 we present 2003-2015 total headboat effort and angler-hours and hook-hours for headboats targeting snapper-grouper FMU species. The mean snapper-grouper EEZ hook-hours estimate for 2012-2015 was 2,683,015 hook-hours on headboats reporting to the Headboat Survey. The mean commercial vertical hook-and-line discard rate (2012-2015) for snapper-grouper trips in the EEZ was 0.0000486 turtles/hook-hour (95% CI: -0000470 to 0.000144 turtles/hook-hour). Applied to the headboat hook-hours, this resulted in a mean take estimate of 130 sea turtles per year on headboat trips that targeted snapper-grouper FMU stocks in the EEZ (95% CI: -126 to 386 sea turtles per year).

Table 5.12. 2003-2015 Total Headboat Effort and Angler-Hours and Hook-Hours for Headboats Targeting Snapper-grouper FMU Species

YEAR	Total Headboat Effort Targeting the Snapper-grouper FMU	Angler Hours Targeting the Snapper-grouper in the EEZ	Hook-Hours Targeting the Snapper-grouper FMUin the EEZ
2003	6680094	1455246	2910491
2004	7714615	938750	1877500
2005	7413791	948042	1896085
2006	7573338	996869	1993738
2007	6791592	856224	1712448
2008	5588369	1197643	2395286
2009	4633172	1358096	2716192
2010	5059405	1496844	2993687
2011	4935268	1515324	3030647
2012	4877740	1673284	3346567
2013	5550122	1209083	2418167
2014	5398707	1176098	2352196
2015	6002184	1307564	2615129

Source: NMFS SERO LAPPS Branch, unpublished data, July 27, 2016

Overall Estimates of Sea Turtle Captures on Recreational Vertica Line Gear
In Table 5.13, we present our estimated sea turtle captures for all recreational fishing modes in the South Atlantic snapper-grouper fishery, along with 2012-2015 average hook-hours and the mean commercial vertical line capture rate that were used in calculating them. There is great uncertainty in these estimates due to: (1) extrapolation from a different component of the South Atlantic snapper-grouper fishery, (2) a highly uncertain discard rate estimate, based only on self-reported hardshell sea turtle captures and (3) a 95% confidence interval overlapping zero (0). Still, these estimates represent the best available data on this fishery component.

Table 5.13. Average Hook-Hours, the Mean Commercial Vertical Line Capture Rate, and Annual Estimated Sea Turtle Captures By Recreational Fishing Mode

Recreational Fishing Mode	Mean Hook-Hours (2012-2015)	Mean Commercial Vertical Line Capture Rate (95% CI)	Annual Sea Turtle Captures (95% CI)
Private	2,457,736	0.0000486 sea turtles/hook-hour (-0000470 to 0001.)	119 (115-353)
Charter	390,428		18 (18 to 56)
Headboat	2,683,015		130 (126 to 386)
All Recreational Effort	5,531,179		267 (115 to 353)

There were no documented captures of leatherbacks in the SDDP data for the vertical line sector. Consequently, all of the estimates presented in this section thus far, summarized in Table 5.13, are specific only to hardshell sea turtle species. As noted in our commercial vertical line analysis, this may be a result of leatherback captures' occurring infrequently enough that they are not picked up by the existing reporting schemes, or because they are indeed not captured. Given that interactions between this gear type and leatherbacks that have occurred in the other fisheries in the past, and our belief that these kinds of interactions are likely to occur again in the future, we acted with precaution and anticipated the capture of 1 leatherback every 3 years by the commercial vertical line sector in the 2006 Opinion. In this Opinion, we adopt the same precautionary approach and again estimate 1 leatherback every 3 years by the commercial vertical line sector in addition to the estimated hardshell sea turtles above.

5.2.5.1 Hardshell Sea Turtle Takes by Species

The recreational vertical lines are fished for snapper-grouper FMU species over a wide range of depths, but generally are fished closer to shore than the commercial components of the fishery. In the 2006 Opinion, because of its relatively close proximity to shore, we applied the species composition estimates from 1998-2005 STSSN data to our recreational hardshell sea turtles estimates (i.e., 66.8% loggerhead, 19.6% green, 20% Kemp's ridley, 1.2% hawksbill). Still by applying the STSSN data, we assumed sea turtles species were equally likely to be caught proportional to their overall abundance as documented via the STSSN, which we know is not the case. Thus, in this Opinion, we followed the same approach and rationale we took in our commercial vertical line gear. That is, we used the same sea turtle relative occurrence rates based on offshore strandings with evidence of vertical line interactions rather than using all strandings to break down our hardshell sea turtle captures by species, i.e., 67.89 % loggerhead sea turtles, 19.76% Kemp's ridley sea turtles, 11.93 % green sea turtles, and 0.42% hawksbill sea turtles. Applying these species percentages to our overall annual capture estimate and conservatively rounding up the results to the nearest whole number, we estimate approximately 182 (267*0.6789=181.2663) loggerhead sea turtles, 53 (276*00.1973=52.6791) Kemp's ridley sea turtles, 32 (267*0.1193=31.8531) green sea turtles, and 2 (267* 0.0042=1.1214) hawksbill sea turtle would be captured annually. Because of the rounding, the resulting captures by species, add up to 2 more captures than we anticipated in the previous section (i.e., 182+ 53+32+2=269 versus 267). To resolve this issue, we chose to structure our capture estimate as no more than 267 hardshell sea turtles in total, of which up to 182 may be loggerheads, up to 53 may be Kemp's ridleys, up to 32 may be greens, and up to 2 may hawksbills. In structuring our estimate this way we were able to maintain our overall estimate while allowing for some flexibility in our species composition.

5.2.5.2 Estimated Mortalities

Although we do now have evidence of some sea turtle mortality prior to release on a commercial snapper-grouper vertical line trip, we do not believe immediate mortality is a concern for sea turtles captures on recreational vertical lines. Recreational fishers typically fish no more than 3 vertical lines at the same time, tend their lines, and retrieve their lines within only 15 minutes of their deployment. Sea turtle may swim to the surface and breathe, even though hooked or entangled in most cases. Regardless, sea turtles can easily breath-hold for periods in excess of an hour, thus should not run out of oxygen given such short deployment times.

As noted previously, there are still no criteria specifically for assessing sea turtle post-release mortality from recreational vertical line interactions. In our 2006 Opinion, we stated sea turtles caught on recreational vertical line gear and released alive would presumably be in better overall health than if released alive from bottom longline gear because of the shorter soak times and their ability to reach the surface of the water to breathe. Yet, we also saw no reason why the same factors affecting post-release mortality of sea turtles hooked on bottom longlines (interaction type, hooking location, and amount of gear remaining) would not apply. Therefore, we applied the same post-release mortality criteria and estimated mortality percentages (i.e., 30% for hardshell and 40% for leatherback sea turtles) as used for our commercial estimates to the recreational sector. With no new information on post-release mortality rates in vertical line fisheries, in this Opinion, we applied these same rates of mortality to our capture estimates. Consequently, conservatively rounding up to the nearest whole number, we estimated that a total of 55 (182*0.3=54.6) loggerhead sea turtles, 16 (53*0.3=15.9) Kemp's ridley sea turtles, 10 (32*0.3=9.6) green sea turtles, and 1 (2*0.3=0.6) hawksbill sea turtle would die annually, while 1 (1*0.4=0.4) leatherback sea turtle would die every 3 years as a result of their capture on recreational snapper-grouper vertical lines under the proposed action.

5.2.6 Summary of Estimated Sea Turtle Captures and Mortalities in the South Atlantic Snapper-Grouper Fishery

In Table 5.14, we present 3-year estimated captures and mortalities we anticipate under the proposed action based on the analyses we presented in the preceding sections. We chose to present all of the estimates in this manner primarily to help standardize our sea turtle capture estimates, but also to be consistent with the 3-year approach used in our ITS. For hardshell sea turtle species, we estimated most of them would occur on an annual basis, but we did have 1 additional sea turtle capture, either a Kemp's ridley, green, or hawksbill sea turtle, that we estimated would occur only every 3 years on commercial bottom longline. For leatherback sea turtle captures, we estimated 1 capture annually in the bottom longline component and then 1 in each other fishery component only every 3 years. By presenting the data in 3-year estimates, we able to consider all of the cumulative captures over time more easily. In addition, our annual capture estimates are based on averages, so the number of annual captures is likely to fluctuate above and below the number specified from year to year. Thus, we decided to consider all of our capture estimates in 3-year periods to incorporate annual variability.

Loggerhead sea turtles are the species most affected by the proposed action. The majority of estimated sea turtle captures are on recreational vertical lines targeting snapper-grouper FMU species. It is also important to recognize that our sea turtle capture estimates for the recreational vertical line are also likely the most uncertain.

Table 5.14. Estimated 3-Year Sea Turtle Total (T) and Mortalities (M) Estimates in South Atlantic Snapper-Grouper Fishery by Fishery Component and Overall

Fishery Component	Loggerhead		Kemp's ridley		Green		Hawksbill		Leatherback	
	T	M	T	M	T	M	T	M	T	M
Commercial Bottom Longline*	9	5	1	1	1	1	1	1	3	2
Commercial Vertical Line**	62	26	18	8	11	5	1	1	1	1
Recreational Vertical Line ***	546	165	159	48	96	30	2	1	1	1
All Components Combined	617	196	178	57	108	36	5	3	5	4

*Only 10 hardshell sea turtles combined are estimated to be captured every 3 years; only 1 hawksbill, Kemp's ridley **or** green sea turtle is expected to be captured and killed every 3 years in this component. **No more than 90 hardshell sea turtles combined are estimated for this component. ***No more than 801 hardshell sea turtle combined are estimated for this component.

5.2.7 Vessel Interactions

Snapper-Grouper vessels transiting to and from fishing areas and moving during fishing activity pose a potential threat to sea turtles. Based on recorded sizes of stranded sea turtles with propeller injuries, both juvenile and adult sea turtles are subject to vessel strikes. Young sea turtles are very alert and so less likely to be hit by a vessel. Sea turtles are susceptible to vessel collisions and propeller strikes because they regularly surface to breathe and may spend a considerable amount of time on or near the surface of the water. Activities such as basking, mating, and resting at the surface also make these animals susceptible to vessel strikes. For example, Sobin (2008) suggests loggerhead sea turtles are most vulnerable to boat strikes following a false crawl event, within 12 hours after nesting, and the night before returning to the beach to nest, during when they are closest to shore and also subject to high-traffic boat areas. Sea turtle stranding data also indicates sea turtle species may be more susceptible to being hit by boat propellers during movements associated with reproductive activity (Foley et al. 2008b). Sick and injured sea turtles typically float so are also particularly vulnerable to being struck by vessels.

5.2.7.1 Types of Interactions (Stressors and Individual Responses to Stressors if Exposed)

Vessel strikes may result in direct injury or death through collision (concussive) impacts or propeller wounds. Although sea turtles, with the exception of leatherback sea turtles, have hard carapaces, they are unable to withstand the strike of a rapidly moving vessel or the cut of a propeller. A sea turtle's spine and ribs are fused to the shell, which is a living part of their body that grows, sheds, and bleeds. Rapidly moving vessels may strike the head or carapace and result in fractures. Injuries to the carapace can involve fractures to the spinal column and buoyancy problems. A propeller can easily cut through the shell and sever or damage the spine and internal organs. Propeller injuries may range from mild to severe and include head lacerations, eye injury, injury to limbs, and carapace lacerations and fractures. Chronic and/or partially healed propeller wounds also may be associated with secondary problems such as emaciation and increased buoyancy (Jacobson et al. 1989). Abnormally buoyant sea turtles are unable to dive for food or escape predators or future vessel strikes. Seriously injured or dead turtles may be struck multiple times by vessels before they drift ashore.

The proportion of vessel-struck sea turtles that survive or die is unknown. In many cases, it is not possible to determine whether documented injuries on stranded animals resulted in death or were post-mortem injuries. Sea turtles found alive with concussive or propeller injuries are frequently brought to rehabilitation facilities; some are later released and others are deemed unfit to return to the wild and remain in captivity. Sea turtles in the wild are documented with healed injuries; thus, we know at least some sea turtles survive without human intervention.

5.2.7.2 Potential Factors Affecting the Likelihood and Frequency of Sea Turtle Exposure to Vessel Strikes

The threat posed by moving vessels is not constant and is influenced in part by vessel type (planing versus displacement hulls), vessel speed, and environmental conditions such as sea state and visibility. Seasonal and regional variance in vessel use and sea turtle distribution and densities also are expected to affect sea turtle vessel strike rates. Below we review how these factors may affect the likelihood and frequency of sea turtle vessel strikes.

Vessel Type and Speed

Generally, vessels typically possess either a planing hull or a (semi-)displacement hull. Planing hulls, typical of smaller (e.g., 18-27 feet in length) recreational vessels, are designed to run on top of the water (i.e., on plane) at high speeds. Conversely, displacement hulls push through the water, as they have no hydrodynamic lift, and the boat does not rise out of the water as speed increases. Because of how these two hulls function, they likely introduce differing threat risks to sea turtles. For example, because operational speeds of planing hulls are typically greater than displacement hulls, they possess greater kinetic energy to transfer to an impacted sea turtle. Additionally, because most of the hull is out of the water, the running gear (including the propeller and skeg of an outboard) of a planing hull running at speed becomes a significant cutting/slashing threat, in combination with the concussive effect of a collision. This risk would be compounded by twin or triple engines, which are fairly common in small- to medium-sized (e.g., 25-34 feet in length) recreational reef fish vessels. In comparison, displacement hulls, which include most large (e.g., > 65 feet in length) vessels comprising commercial traffic (e.g., tankers, freighters, tugs, etc.), while traveling slower extend deeper into the water column. The slower speed and greater size of these vessels suggests the risk to sea turtles is largely limited to a concussive impact from the hull. It is possible that a sea turtle may avoid significant impact altogether by being pushed away by the hydrodynamic bow wave of a large vessel, and, therefore, allowed to escape before incurring an injury.

Greater vessel speed is expected to increase the probability that a sea turtle would fail to have to time to flee the approaching vessel and that the vessel operator would fail to detect and avoid the sea turtle. A study on vessel speed and collisions with green sea turtles conducted in shallow water (<5 m) along the northeastern margin of Moreton Bay, Queensland, Australia, analyzed behavioral responses of benthic green sea turtles to an approaching 20-ft (6-m) aluminum vessel at slow (2 knot), moderate (6 knot), and fast (10 knot) speeds (Hazel et al. 2007). The proportion of turtles that fled to avoid the vessel decreased significantly as vessel speed increased, and turtles that fled from moderate and fast approaches did so at significantly shorter distances from the vessel than turtles that fled at slow approaches. Although vessel noise is within a green turtle's hearing range, there are several factors that may impede their recognition of the noise as a threat (e.g., directionality of the noise in the ocean and habituation to background vessel noise). The results implied that vessel operators could not rely on sea turtles to actively avoid being struck by a vessel if it exceeds 2 knots. On this basis, the authors determined that vessel speed was a significant factor in the likelihood of a strike and implied that mandatory vessel speed restrictions were necessary to reduce the risk of vessel strikes to sea turtles (Hazel et al. 2007).

Environmental Factors
Sea state and visibility will also influence the likelihood of an interaction between a vessel and a sea turtle. Typically, most vessel operators keep watch for potential obstructions or debris, which can seriously damage or potentially sink a boat. The calmer the sea state, the easier it is to see floating objects, including sea turtles. When the sea state increases and swells are introduced, observing floating obstructions gets increasingly difficult. However, increased sea state will also compel most vessels on the water to decrease speed, which would reduce the risk of a strike and potentially the severity of a strike. Also, generally fewer recreational vessels go on trips in rough conditions, in comparison with calm seas. Thus, there may be a seasonal component to the magnitude of vessel strike risks to sea turtles in some areas. Another factor is traveling east or west during a rising or setting sun; this can dramatically limit forward visibility and inhibit an operator from avoiding a floating sea turtle or other obstruction.

Vessel Traffic and Sea Turtle Abundance
Areas with high concentrations of vessel traffic and high concentrations of sea turtles are expected to have a higher probability and frequency of vessel strikes than areas where vessels and/or sea turtles are less abundant. Data on offshore vessel traffic is still largely absent, but several recent studies have explored the issue of vessel traffic for a few coastal counties in Florida (Sidman et al. 2007; Sidman et al. 2005; Sidman et al. 2009). The available information indicates that there is extensive traffic in inshore and nearshore waters, particularly around inlets. Additionally, there are latitudinal changes in peak use and average number of trips, with a longer peak season and higher number of monthly trips in southern counties when compared to northern counties.

5.2.7.2 Estimating Sea Turtle Vessel Strikes Attributed to Snapper Grouper Vessels

It is very difficult to definitively or even approximately evaluate the potential risk to sea turtles stemming from specific vessel traffic from any action because of the numerous variables discussed in Section 5.5.1.2 that may impact vessel strike rates. This difficulty is compounded by a general lack of information on vessel use trends, particularly in regard to offshore vessel traffic. Available data are insufficient to account for such differences in our analysis. However, the following analysis is intended to provide a gross estimate of the potential impact snapper grouper vessels may have on sea turtles, taking a reasoned approach to conservatively account for vessel impacts based on the best available information.

Foley et al. (2008b) evaluated distributions, relative abundances, and mortality factors, including vessel strikes, for sea turtles in Florida from 1980 through 2005 as determined from strandings. The analysis remains the best available comprehensive quantitative evaluation of vessel strike impacts to date. The Florida Sea Turtle Stranding and Salvage Network (FLSTSSN) has documented 25,290 Florida stranding records (all species and size classes) in their database from 1980 through 2005 (Foley et al. 2008b). Although the cause of death was not usually determined for stranded sea turtles because most carcasses (about 70 percent) were at least moderately decomposed, the most common readily observable potential mortality factor was propeller wounds. From 1980 through 2005, there were 3,586 sea turtle stranding records in Florida with definitive propeller injury (1,222 green, 92 leatherback, 2,056 loggerhead, 187 Kemp's ridley, and 29 hawksbill sea turtles). By species, the percent occurrence of propeller wounds was 34 percent green, 3 percent leatherback, 57 percent loggerhead, 5 percent Kemp's ridley, and 1 percent hawksbill sea turtles. Many of these specimens may have been dead, sick, or lethargic when struck by a vessel. Of the 3,586 sea turtles with propeller wounds, Foley et al. (2008) determined that 1,086 (30 percent) were wounded by a propeller prior to death, including: (1) 440 sea turtles that were alive when discovered, (2) 22 sea turtles that were determined via necropsy to have been hit prior to death because of the presence of clotted blood, infection, or healing, and (3) 624 sea turtles that were fresh dead when found. Therefore, based on the STSSN strandings data, there was an average of 43 sea turtles injured or killed per year due to propeller wounds (1,086 sea turtles/25 years). Foley et al. (2008) also noted 703 records of sea turtle strandings in Florida from 1980 through 2005 with major, crushing injuries evident, but no discernible propeller wounds. The sources of these crushing injuries were unknown, but could have been a result of collisions with vessel hulls or engines, fishing gear impacts (e.g., trawl doors), and/or dredging impacts.

In a January 12, 2009, memorandum from Michael Barnette, SERO fishery biologist, to David Bernhart, SERO Assistant Regional Administrator for Protected Resources, the potential threats on listed sea turtles from vessel traffic related to new dock and /or marina construction were analyzed. In doing so, several different estimates of vessel strike frequency on a by-vessel and by-trip basis with varying degrees of conservatism were presented by using Foley et al. (2008b)'s analysis of Florida sea turtle stranding data attributed to vessel impacts discussed above in combination with Florida vessel traffic and use trend data under various assumptions. The number of injured or killed sea turtles attributed to vessel strikes was estimated assuming that (1) only those strandings definitively known to have been hit pre-mortem were caused by vessels (i.e., 43 sea turtles injured or killed by vessel strikes a year); (2) all 3,586 stranding records with propeller injuries and the 703 stranding records with crushing injuries were pre-mortem and caused by vessels (i.e., 4,289 total potential vessel related sea turtle injuries so 171 sea turtles injured or killed a year [4,289 sea turtles / 25 years]); and (3) the 3,586 stranding records with propeller injuries and the 703 stranding records with crushing injuries were pre-mortem, caused by vessels, and based on Epperly et al. (1999), represented only 7-13 percent of total strandings (i.e., 1,315-2,443 sea turtles injured or killed a year). The minimum and maximum total number of potential vessel trips in Florida waters during the course of a year was estimated based the number of registered vessels in Florida coastal counties in 2007 and an extrapolation of the minimum and maximum average number of trips per vessel per month documented by several Florida county recreational vessel traffic studies (Sidman et al. 2005 and 2007). The total number of potential vessel trips in Florida ranged from 25.6 to 53.1 million trips. Assuming each vessel trip possesses the same likelihood of resulting in a sea turtle strike, based on the best available information, Barnette estimated a sea turtle vessel strike was to occur: (1) every 1,235,268 trips under the least conservative approach, (2) every 149,877 trips under a more conservative approach, and (3) every 10,491 to 19,490 trips under the "ultra-conservative" approach.

On April 18, 2013, Barnette updated the January 12, 2009, threats and effects analysis memorandum, but the information did not significantly change from the 2009 memorandum. The estimates of the number of trips per sea turtle vessel strike under the different scenarios remained the same thus are still best available.

In order to roughly gauge the potential impacts of vessel interactions on sea turtles, we very conservatively assumed all snapper-grouper vessel trips also possess the same likelihood of resulting in a sea turtle strike and applied the vessel strike trip rates from the Barnette memorandum. Keeping consistent with all of our gear analyses we used the 2012-2015 average number of trips from each sector and then summed them for our future effort proxy for the entire South Atlantic snapper-grouper fishery. In Section 5.2.5, Table 5.10 we had presented directed snapper-grouper 2012-2015 effort in the charter and private sectors by state, including the number of trips. However, the trips presented in that table do not take into account that multiple anglers fish from the same vessel. Thus, we first had to convert that data by dividing by the average number of anglers on a vessel per trip (Table 5.15). In Table 5.16, we then present the 2012-2015 average number of trips from each sector and sum them for our future effort proxy for the entire South Atlantic snapper-grouper fishery.

Table 5.15. 2012-2015 Annual Charter and Private Vessel Trip Data.

YEAR	STATE	CHARTER			PRIVATE		
		Number of Trips	Ave. Num. of Anglers per Fishing Party	Number of Vessel Trips	Number of Trips	Ave. Num. of Anglers per Fishing Party	Num. of Vessel Trips
2012	Florida	13,818	5.8	2382	179,577	3.04	59071
	Georgia	2,001	5.68	352	7,067	3.32	2129
	North Carolina	17,204	7.17	2399	52,432	2.95	17774
	South Carolina	3,445	5.35	644	51,753	3.12	16588
2013	Florida	13,283	6.14	2163	205,614	3.02	68084
	Georgia	2,762	3.67	753	20,796	2.99	6955
	North Carolina	6,279	5.02	1251	53,366	2.82	18924
	South Carolina	1,666	6	278	14,511	3.32	4371
2014	Florida	29,545	4.6	6423	300,827	3.59	83796
	Georgia	5,373	5.34	1006	19,504	3.5	5573
	North Carolina	9,076	5.31	1709	39,091	2.71	14425
	South Carolina	31,658	4.55	6958	36,108	3.45	10466
2015	Florida	43,662	4.23	10322	257,773	3.13	82356
	Georgia	5,072	4.19	1211	12,523	3.3	3795
	North Carolina	6,740	4.99	1351	55,800	2.66	20977
	South Carolina	28,353	4.67	6071	17,224	4.39	3923

Source: NMFS OST, unpublished data July 27, 2106, and November 10, 2016

Table 5.16. 2012-2015 Average Number of Snapper-Grouper vessel trips in the South Atlantic Region EEZ By Mode and All Sectors Combined

Vessel trips	Commercial	Private/Rental	Charter	Headboat	All Sectors Combined
2012-2015 Average	11,175	10,4801	11,318	6,297	133,592

Sources: Farmer, SEFSC's Commercial Logbook Data Program, unpublished data; April 2016; NMFS OST, unpublished data, MRIP and Southeast Headboat Survey Logbook Program, July 27, 2106, and November 10, 2016)

Based on the 2012-2015 average number of total trips in the fishery and the above vessel strike rates, estimated vessel strikes attributed to the South Atlantic snapper-grouper fishery could be none under the least conservative approach to 7 to 13 sea turtles under the most conservative approach.

Barnette did not consider his most conservative approach to be a realistic estimate for considering the potential vessel impact risk associated with typical dock and/or marine construction. He stated that due to the long string of extrapolations, estimates, and assumptions, as well as some other inherent issues with basing conclusions on Florida recreational vessel traffic patterns (i.e., largely nearshore/coastal) with a single, limited study conducted on a North Carolina commercial fishery operating further offshore, his most conservative approach was intended solely to help define the absolute edges of the envelope for his analysis.

For our purposes (i.e., estimating vessel strikes attributed to snapper-grouper vessels), extrapolating reported strandings using Epperly et al. (1996) in and of itself seems reasonable to us, considering other studies demonstrating similar levels of under-reporting in stranding records due to turtle carcasses not washing ashore (e.g., TEWG 1998). However, the preceding assumption that all stranding records were pre-mortem likely overestimates the number of reported strandings attributed to snapper-grouper vessels. This is because, although it is highly likely that more than 13 percent of records were pre-mortem and directly attributed to being vessel-struck, it is equally likely that at least some sea turtles struck were dead from other causes prior to being struck. Thus, to try and balance these considerations, we believe using our lower estimate of the most conservative method (i.e., 7 annually or 21 every 3 years) is the most reasonable approach. Based on the percent occurrence of strandings with propeller wounds by species (i.e., 34% green, 3% leatherback, 57% loggerhead, 5% Kemp's ridley, and 1% hawksbill) and rounding to the nearest whole number, we estimate that a combined total of 21 sea turtles may be struck and killed every 3 years, of which up to 12 (11.97) may be loggerhead sea turtles, 8 (7.14) may be green sea turtles , 2 (1.05) may be Kemp's ridley sea turtles, 1 (0.63) may be a leatherback sea turtle, and 1 may be (0.21) hawksbill sea turtle.

In reality, this crude assumption likely exaggerates the risk of vessel strikes the South Atlantic snapper-grouper fishery poses to sea turtles, given what we know about potential factors affecting the likelihood and frequency of sea turtle exposure to vessel strikes (see Section 5.2.7.2). For example, vessels strike rates off Florida are likely much higher given Florida waters typically have greatest amount of both fishing vessels and sea turtles. However, with the limited available information, we believe, while highly imprecise, this provides a reasoned approach to recognize and account for some potential vessel strike impacts attributed to the fishery's vessels rather than just blindly dismissing any connection the proposed action may have to vessel strike impacts in the action area.

5.3 Effects on Smalltooth Sawfish

Of the 3 basic types of gear used in the South Atlantic snapper-grouper fishery by commercial and/or recreational fishers (i.e., hook-and-line gear, spear/powerheads, and BSB pots), we believe only snapper-grouper hook-and-line gear may adversely affect smalltooth sawfish. Below, we explain why we believe potential effects from the other gear types are discountable. The remainder of Section 5.3 focuses on evaluating the effects of snapper-grouper hook-and-line fishing.

Spear/powerhead
In the 2006 Opinion, we determined spear and power head gear were not likely to adversely affect smalltooth sawfish, and we still believe this to be true. Commercial and recreational divers (either free diving or more typically, using SCUBA) fishing with these gears may occasionally encounter sawfish. Anecdotal information from diver encounters with smalltooth sawfish indicate some smalltooth sawfish may change their route to avoid coming in close proximity to divers, whereas others appear unaware of the presence of divers. Any behavioral effects on sawfish from the presence of divers fishing are expected to be insignificant. Given the selectivity of the gear and the careful aim divers exercise to strike a fish, divers spearfishing are easily be able to avoid aiming in any direction where smalltooth sawfish are within their striking range. We therefore believe that incidental spearing of smalltooth sawfish is extremely unlikely and discountable.

BSB pots
Consistent with our determination in the 2006 Opinion, we believe BSB pot fishing will not adversely affect smalltooth sawfish. This species may be present where BSB pots are authorized, but the majority of the fishing effort occurs well north of the species' core area (i.e., off the Carolinas). There are no historic or recent reports of smalltooth sawfish entangled in finfish pot/trap lines. A black sea bass pot/trap line consists of a single rope attached to a float at the surface. The rope is generally thicker than the space between individual teeth on a smalltooth sawfish's rostrum, so the rope is unlikely to become tangled in its teeth, as are other entanglement threats (e.g., gillnet). We have no information suggesting smalltooth sawfish attempt to feed on animals caught inside traps, which is how other animals such as sea turtles become entangled. Only 6 smalltooth sawfish have ever been documented in commercial stone crab or spiny lobster trap gear in the last 10 years. Given the much larger number of trap hours in those fisheries, which are concentrated with the range of smalltooth sawfish, we believe entanglement in commercial trap lines is a very rare occurrence. Because of the limited amount of fishing areas that might overlap the range of smalltooth sawfish, we further believe a smalltooth sawfish

becoming entangled in a BSB pot line is extremely unlikely to occur, and is, therefore, discountable.

5.3.1 Types of Interactions with Smalltooth Sawfish and Hook-and Line Gear

Hook-and-line gear is known to adversely affect smalltooth sawfish via hooking and/or entanglement. Hooking and entanglement can lead to cuts, puncture wounds, or lost rostral teeth. Hooked or entangled smalltooth sawfish may potentially also suffer impaired swimming or foraging abilities, altered migratory behavior, or altered breeding or reproductive patterns, though we have no actual evidence of such effects. However, observer data indicate that regardless of the type of interaction, the vast majority of incidentally captured smalltooth sawfish are released alive and in good condition. The following discussion summarizes in greater detail the available information on how individual smalltooth sawfish may to respond to interactions with hook-and-line gear.

Hooking

Based on hooking observation data from Mote Marine Laboratory bottom longline research surveys and reported recreational rod-and-reel fishing encounters, the vast majority of smalltooth sawfish are hooked in the mouth (ISED 2014). Foul-hooking reports are not nearly as frequent, but they do occasionally occur. There is only a single report of a smalltooth sawfish deeply hooked (ISED May 2009). Once hooked, the gangion or leader frequently gets wrapped around the animal's saw. This may result from slashing during the fight, spinning on the line as it is retrieved, or any other action bringing the rostrum in contact with the line.

Based on available data, all smalltooth sawfish caught on vertical lines and most smalltooth sawfish caught on bottom longline gear survive. All of these fish were alive upon capture and safely released with no apparent harm to the fish. Between 2007 and 2011, 22 smalltooth sawfish were observed caught in shark bottom longline gear in the Atlantic and Gulf of Mexico. One of the captured animals died from getting tangled in the gangion and mainline in 2007. The remaining captured animals were documented as very active when reaching the water's surface and were released in apparent good health good health (Carlson and Richards 2011). Soak times do not seem to be a factor for smalltooth sawfish mortality. It has been hypothesized that because the animal's natural habit consists of lying on the sea floor and using its spiracles to breathe that survivorship should be high (Simpfendorfer et al. 2010b). Thorson (1982) reported that largetooth sawfish caught by fishers at night or when no one was present to tag them were left tethered in the water with a line tied around the rostrum for several hours with no apparent harmful effects. Additional information on survivorship of smalltooth sawfish comes from research using bottom longline, nets, and rod and reel. From 2000-2008, over 130 individuals ranging in size from 62 cm to 496 cm were captured, 21 of which were caught on bottom longlines. All of these individuals were alive upon capture and safely released with no apparent harm to the fish (T. Wiley-Lescher, Haven Worth Consulting, pers. comm. to S. Norton, NMFS, July 2013).

There are no studies on the post-release mortality of smalltooth sawfish. Based on tag-recapture data, post-release mortality is expected to be low. Still, sublethal effects on smalltooth sawfish may occur, particularly if the animal is removed from the water. The weight of the sawfish on dry land (or aboard a vessel) may damage internal organs; moreover, the stress of being removed from the water may also cause sublethal effects. Because offshore snapper-grouper fishers are expected to only interact with larger animals, they are likely less apt to bring sawfish onboard for personal safety reasons.

5.3.2 Potential Factors Affecting the Likelihood and Frequency of Smalltooth Sawfish Interactions with Hook-and-Line Gear

A variety of factors may affect the likelihood of smalltooth sawfish interactions with hook-and-line gear. The spatial overlap between fishing effort and smalltooth sawfish abundance is the most noteworthy variable involved in anticipating interactions. Other important factors for determining the likelihood and frequency of interactions include the types of gear used (e.g., baits, hooks) and the fishing techniques employed.

Spatial/Temporal Overlap between Fishing Effort and Smalltooth Sawfish
The spatial distribution of smalltooth sawfish influences the rate of interaction with fishing gears. The more abundant smalltooth sawfish are in a given area where fishing occurs, the greater the probability a sawfish will interact with gear. The temporal distribution of fishing effort and smalltooth sawfish abundance is also a factor.

Different life stages of smalltooth sawfish are associated with different habitat types and water depths. Very small and small juvenile smalltooth sawfish are most commonly associated with shallow water areas of Florida, close to shore and typically associated with mangroves (Simpfendorfer and Wiley 2004a). Since larger (> 200 cm in length) size classes of the species are also observed in very shallow waters, it is believed that smaller (younger) animals are restricted to shallow waters, while larger animals roam over a much larger depth range (Simpfendorfer 2001). Poulakis and Seitz (2004b) observed that nearly half of the encounters with adult-sized sawfish in Florida Bay and the Florida Keys occurred in depths from 200-400 ft (70-122 m). Simpfendorfer and Wiley (2005b) also reported encounters in deeper water off the Florida Keys, noting that these were mostly reported during winter. Observations on commercial longline fishing vessels and fishery independent sampling in the Florida Straits report large sawfish in depths up to 130 ft (~ 40 m) (J. Carlson, NMFS SEFSC and G.Burgess, FMNH pers. comm.).

Large juveniles and adult smalltooth sawfish are known to occur in water depths of 100 m or more. Thus, snapper-grouper hook-and-line gears deployed in deeper water are more likely to encounter these 2 size classes.

Soak Time/Number of Hooks
Bottom longline gear interactions with smalltooth sawfish may be influenced by both soak time and the number of hooks fished. The longer the soak time, the longer a smalltooth sawfish may be exposed to an entanglement or hooking threat, increasing the likelihood of such an event occurring. Likewise, as the number of hooks fished increases, so does the likelihood of an incidental hooking event.

Hook Type
The type of hook (size and shape) may impact the probability and severity of interactions with smalltooth sawfish. The point of a circle hook is turned toward the shank, while the point of a J-hook is not. Thus, the configuration of a circle hook may reduce the likelihood of foul-hooking interactions because the point of the hook is less likely to accidentally become embedded in the smalltooth sawfish's mouth. Circle hooks make gut-hookings unlikely. Such interactions are believed to extremely rare and there is only a single known record of such despite hook-and-line's being the most common source of encounter records.

Bait
Smalltooth sawfish feed primarily on fish and crustaceans. Mullet, jacks, and ladyfish are believed to be their primary food sources (Simpfendorfer 2001). Smalltooth sawfish are reported to subsist on schooling fish such as mullet and clupeids (74 FR 45353, September 2, 2009). There are no directed studies on the attraction of smalltooth sawfish to bait used in the snapper-grouper fishery.

Environmental Conditions
Environmental conditions may also play a part in whether or not a smalltooth sawfish interacts with hook-and-line gear. Fishing gear can drift according to oceanographic conditions, including wind and waves, surface and subsurface currents, etc.; therefore, depending on these species' behavior, environmental conditions, and location of the set, smalltooth sawfish can become entangled in the gear.

5.3.3 Estimating Smalltooth Sawfish Interactions in Hook-and Line Gear

In the 2006 Opinion, we estimated 2 smalltooth sawfish would be captured in commercial bottom longlines, 2 smalltooth sawfish would be caught in commercial vertical lines, and 4 would be caught in recreational vertical line every 3 years. No interactions between any component of the South Atlantic snapper-grouper hook-and-line fishery (i.e., commercial bottom longline or commercial and recreational vertical line) and smalltooth sawfish had actually been documented. However, there were a limited number of interactions documented in the hook-and line component of the Gulf of Mexico reef fish fishery, which uses similar gear to target many of the same species. Our 2006 estimates were all from using smalltooth sawfish capture estimates established in the 2005 Gulf of Mexico reef fish fishery Opinion (NMFS 2005b) as a surrogate for those in the South Atlantic snapper-grouper commercial bottom longline and commercial and recreational vertical line fishing effort. Based on our knowledge of both fisheries and their potential for smalltooth sawfish interactions, we determined the Gulf of Mexico reef fish fishery was a reasonable proxy.

In conducting this consultation, we queried available databases (i.e., the SDDP and ISED), which now includes SEFSC fishery observations in addition to captures and sighting reported by the public, to see if there were any new records of interactions between snapper-grouper hook-and-line gear and smalltooth sawfish. We also reviewed the 2 most recent Opinions on the Gulf of Mexico reef fish fishery (i.e., NMFS 2009a; NMFS 2011c) to see if and how our effects analyses and estimates for the Gulf of Mexico reef fish fishery that we relied on may have changed.

In our query of available databases, we still did not identify any snapper-grouper hook-and-line records. Considering there has been almost no observation of the bottom longline component, only very limited pilot coverage in the vertical line component, and the self-reported nature of the SDDP and ISED, though, this was not surprising, especially considering the low level of expected interactions. It is very likely that the small number of anticipated smalltooth sawfish captures in the snapper-grouper fishery continue to occur undetected.

In the 2 more recent Opinions on the Gulf of Mexico reef fish fishery, we identified several new bottom longline and recreational reports of smalltooth sawfish caught on vertical lines targeting reef fish in the Gulf of Mexico; however, the 3-year estimates of 2 smalltooth sawfish captures on commercial bottom longline, 2 smalltooth sawfish captures on commercial vertical line, and 4 smalltooth sawfish captures on recreational vertical line all remained the same as in the 2005 Opinion.

Having found no new data on which to revise our effect analyses, we concluded there is no reason to change our previous estimates of 2 smalltooth sawfish in commercial bottom longlines, 2 smalltooth sawfish in commercial vertical lines, and 4 in recreational vertical line, every 3 years , and that they are still based on the best available data. Based on previous interaction observations, we believe all smalltooth sawfish captures in the future will be released alive with only short-term sublethal effects.

5.4 Effects on Nassau Grouper

There are 4 legal methods of harvest in the South Atlantic snapper-grouper fishery action area: vertical line (handline, hydraulic, or electric), longline, black sea bass pots, and powerheads or spears (except where prohibited in the EEZ). Of these basic types of gear used by commercial and/or recreational fishers, only hook-and-line gear may adversely affect Nassau grouper. The other gears will have no effect or are not likely to adversely affect Nassau grouper.

Pot gear is prohibited from Cape Canaveral south (map at http://sero.nmfs.noaa.gov/maps_gis_data/fisheries/s_atlantic/index.html), which means it will not overlap with the range of the Nassau grouper. It will have no interactions with, and no effect on, the species.

Divers spearfishing or using powerheads know it is illegal to fish for this species, so they would not target Nassau grouper. Only accidental spearing could lawfully occur under the proposed action, although estimating that number would be speculative. Divers could encounter Nassau grouper, and if so, this species could change its behavior to avoid coming in close proximity to divers. Any potential effects from the presence of divers spearfishing are expected to result in temporary stress and temporary behavioral modification, but the grouper would be expected to resume normal activities without injury or meaningful effects on foraging or metabolic costs. Any effects would be insignificant.

The use of bottom longlines is only permitted in depths greater than 50 fathoms and only north of St. Lucie Inlet, Florida (27°10’N). Both pelagic and bottom longline gears are authorized for use in the South Atlantic snapper-grouper fishery, but the behavior of the species targeted makes bottom longline the primary type of longline gear used in this fishery. Nassau grouper's range and where bottom longlines are permitted only overlap between St. Lucie Inlet and Cape Canaveral. While longline gear can be used, no discards (or landings) of Nassau grouper have been recorded with this gear in the commercial portion of the fishery (data on capture by gear type is not available for the recreational portion of the fishery). It is possible that the depth restriction eliminates most of the gear overlap with Nassau grouper, as the Nassau grouper tend to be a shallow-water grouper. It is also possible that the harvest restriction and disincentives for reporting discards may also factor into the lack of data, but we have no means by which to assess this issue. All estimated commercial discards are from hook-and-line gear (bandit, handline, and electric gear). Regardless of whether the Nassau grouper incidental take occurs in the commercial or recreational sector of the snapper grouper fishery, the fish are captured by some form of hook and line.

The remainder of this section is focused on the effects to the Nassau grouper that are from hook-and-line gear (i.e., gear that hooks the species).

5.4.1 Types of Interactions and General Effects from Hook-and-Line Gear

Nassau grouper are subject to hooking in snapper-grouper fishery hook-and-line gear. Animals take the bait and subsequently are hooked. After hooking, animals suffer from the stress of the capture and can be injured by the hooking (e.g., damage to the mouth or other tissues). Barotrauma from rapid decompression, increased time in warm surface waters, and increased exposure to predation may result in species mortality. While it is illegal to keep Nassau grouper and they must be returned to the sea, the most significant effect from the hooking is that a percentage of the animals that are captured die as a result of the interaction.

5.4.2 Factors Affecting the Likelihood of Nassau Grouper Hooking

Gear characteristics and fishing techniques (soak times)
The amount of fishing effort affects the landing of Nassau grouper that are accidentally captured by the snapper grouper fishery. Number of fishers, number of trips, and length of time gear is left in the water are all important considerations. More fishing increases the probability of hooking this species.

Spatial overlap of fishing effort and Nassau grouper
The location of the fishery in relation to the species is a factor influencing the likelihood that the snapper grouper fishery will interact with and hook a Nassau grouper. The range of the Nassau grouper in U.S. waters relevant to the proposed action extends from approximately Cape Canaveral, Florida to the southernmost part of the Florida Keys. Only that portion of the fishery that occurs in the federal waters of the species' range is subject to effects from the fishery's gear.

One of the greatest threats to the Nassau grouper is spawning aggregation overfishing (easily taking large numbers of reproducing fish). No spawning aggregations for this species have been documented in action area of the snapper grouper fishery. Yet, hooking of Nassau grouper does occur in the fishery off the coast of Florida.

5.4.3 Estimating Interactions and Mortality

Interactions

Farmer (2016b) calculated Nassau grouper landings and discards in the snapper-grouper fishery. Recreational landings for headboat, MRIP private angler, and MRIP charter mode were summarized from the Southeast Fisheries Science Center (SEFSC)'s MRIP-based Recreational Annual Catch Limit (ACL) Database (accessed March 2016). Recreational discards for MRIP private angler and charter mode were also summarized from the Recreational Annual Catch Limit (ACL) Database (accessed March 2016). Headboat discards were summarized based on captain reported releases from the Southeast Region Headboat Survey (SRHS) logbook program (accessed 2016). The recreational data is based on MRIP surveys which are expanded from intercepts to approximate the landings and discards across all recreational anglers. The Headboat data (SRHS) is based on captain's logbooks that are expanded for non-reporting to provide an estimate across all headboats. We believe that 100% of effort is covered by the estimation procedures. Commercial landings were summarized from the SEFSC Commercial ACL Database (accessed Dec 2015). Commercial discards per unit effort by were computed for Nassau grouper by year and gear from the SEFSC's Supplemental Discard Logbook Program (accessed April 2016). The Supplemental Discard Logbook Program began in 2001 and has provided approximately 20% random sampling coverage of the South Atlantic snapper-grouper fishery since 2002. Discard per unit effort estimates were expanded by the total effort in the snapper-grouper fishery south of 28°N, based on information from the SEFSC's CFLP (April 2016). The range for this analysis was truncated near Cape Canaveral to reflect the distribution of Nassau grouper. Uncertainty was expressed as 95% confidence intervals. Snapper-grouper trips were defined as any commercial trip landing at least 1 lb of a species in the snapper-grouper FMU. Effort was defined as hook-hours for hook-and-line gears (includes handline and electric/bandit rig), yard-hours for gillnet, number of traps for trap gear, total hooks fished on a trip for buoy gear and longline gear, and number of divers for spear and powerhead gear. The commercial landings are summarized from the ACL database, which incorporates all available dealer reports.

Farmer (2016b) reported that the annual average of Nassau grouper that were caught in the recreational component of the snapper-grouper fishery over the last 10 years was approximately 1,327. The annual average of Nassau grouper caught in the commercial component of the fishery over the last 10 years was 60. Over the last 10 years, a total of approximately 1,387 Nassau grouper have been captured annually in the fishery. This is the number of annual interactions we expect to occur in the future.

Mortality

No information exists on injury or post-release mortality for Nassau grouper captured in the snapper grouper fishery (Farmer 2016b). Estimates of Nassau grouper release mortality are probably best approximated in the snapper-grouper fishery by estimates for red grouper (*Epinephelus morio*), given their similarity with regards to appearance, behavior, and phylogeny (Farmer 2016b). The Southeast Data, Assessment, and Review

Stock Assessment Report of 2010 (SEDAR 2010) summarized release mortality estimates for red grouper. The Commercial and Recreational workgroups recommended discard mortality rates of 20%, and the Assessment Workshop supported this figure; however, the Review Panel was concerned with the lack of empirical data to support the discard mortality estimate of 20%. Sensitivity runs were performed that varied this estimate from 10-70%. These results support the high impact of this parameter. In the absence of any substantive empirical data, the panel did not see a strong basis to change the value from 20%. Still, it seems clear that attempts should be made to obtain a more accurate estimate of both immediate and delayed discard mortality. In this Opinion we adopt 20%.

Applying the 20% rate to the annual average number of expected Nassau groupers caught provides an annual average expected mortality of approximately 282 fish (269.4 recreational + 12 commercial) (Farmer 2016b). (NOTE: 1,322*0.2=264.4 (recreational mortalities); 5 (accidentally landed recreationally); 60*0.2=12 (commercial); Total 265.4+5+12=281.4).

6.0 Cumulative Effects

Cumulative effects include the effects of future state, tribal, local, or private actions that are reasonably certain to occur within the action area of this Opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA.

Human-induced mortality and/or injury of NARWs, sea turtles, smalltooth sawfish, and Nassau grouper occurring in the action area are reasonably certain to occur in the future. The sources of those effects include vessel interactions, ingestion of marine debris, pollution, and global climate change. While the combination of these activities may prevent or slow the recovery of populations of NARWs, sea turtles, smalltooth sawfish, and Nassau grouper, the magnitude of these effects is currently unknown.

6.1 Vessel Interactions

NMFS's STSSN data indicate that vessel interactions are responsible for a large number of sea turtles stranding within the action area each year. Such collisions are reasonably certain to continue into the future. Collisions with boats can stun or easily kill sea turtles, and many stranded sea turtles have obvious propeller or collision marks (Dwyer et al. 2003). Still, it is not always clear whether the collision occurred pre- or post-mortem. We believe that sea turtle injuries and mortalities by vessel interactions will continue in the future. An estimate of the number of sea turtles that will likely be killed by vessels is not available from data at this time.

Various types and sizes of vessels are involved in ship strikes with large whales, including container/cargo ships/freighters, tankers, steamships, U.S. Coast Guard vessels, U.S. Navy vessels, cruise ships, ferries, recreational vessels, fishing vessels, whale-watching vessels, and other vessels. As we outlined in Section 3.2.1, over the last decade, an average of approximately 2 *known* vessel collision-related NARW deaths have occurred annually. NMFS believes the actual number of deaths can possibly be higher than those documented, as some deaths likely go undetected or unreported. We expect that collisions that result in serious injury or mortality of NARWs are reasonably certain to continue into the future at approximately the same level that is currently occurring.

Because smalltooth sawfish and Nassau grouper are benthic species, vessel strikes are not considered a threat to them in the action area.

6.2 Pollution

Human activities in the action area causing pollution are reasonably certain to continue in the future, as are impacts from them on NARWs, sea turtles, smalltooth sawfish, and Nassau grouper. However, the level of impacts cannot be projected. Marine debris (e.g., discarded fishing line or lines from boats) can entangle sea turtles in the water and drown them. Sea turtles commonly ingest plastic or mistake debris for food. Excessive turbidity due to coastal development and/or construction sites could influence sea turtle foraging behavior. As mentioned previously, sea turtles are not very easily affected by changes in water quality or increased suspended sediments, but if these alterations make habitat less suitable for sea turtles and hinder their capability to forage, eventually they would tend to leave or avoid these areas (Ruben and Morreale 1999).

6.3 Global Climate Change

Global climate change is likely adversely, affecting NARWs, sea turtles, smalltooth sawfish, and Nassau grouper. Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events and fluctuation of precipitation levels, and change in air and water temperatures. The effects on ESA-listed species are unknown at this time. There are multiple hypothesized effects to NARWs, sea turtles, smalltooth sawfish, and Nassau grouper including changes in their range and distribution as well as prey distribution and/or abundance due to water temperature changes. Ocean acidification may also negatively affect marine life, particularly organisms with calcium carbonate shells that serve as important prey items for many species. Global climate change may also affect reproductive behavior in sea turtles, including earlier onset of nesting, shorter intervals between nesting, and a decrease in the length of nesting season. Sea level rise may also reduce the amount of nesting beach available. Changes in air temperature may also affect the sex ratio of sea turtle hatchlings. Water temperature is a main factor affecting the distribution of large whales, and it may affect the range of NARWs. A decline in reproductive fitness as a result of global climate change could have profound effects on the abundance and distribution of sea turtles in the Atlantic.

7.0 Jeopardy Analyses

The analyses conducted in the previous sections of this Opinion serve to provide a basis to determine whether the proposed action would be likely to jeopardize the continued existence of NARWS, sea turtles, smalltooth sawfish, or Nassau grouper. In Section 5, we outlined how the proposed action would affect these species at the individual level and the extent of those effects in terms of the number of associated interactions, captures, and mortalities of each species to the extent possible with the best available data. Now we assess each of these species' response to this impact, in terms of overall population effects, and whether those effects of the proposed action, in the context of the status of the species (Section 3), the environmental baseline (Section 4), and the cumulative effects (Section 6), are likely to jeopardize their continued existence in the wild.

To "jeopardize the continued existence of…" means to "engage in an action that reasonably would be expected, directly or indirectly to reduce appreciably the likelihood of both the survival and the recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). Thus, in making this determination for each species, we must look at whether the proposed actions directly or indirectly reduce the reproduction, numbers, or distribution of a listed species. Then if there is a reduction in 1 or more of these elements, we evaluate whether it would be expected to cause an appreciable reduction in the likelihood of both the survival and the recovery of the species.

The NMFS and USFWS's ESA Section 7 Handbook (USFWS and NMFS 1998) defines survival and recovery, as they apply to the ESA's jeopardy standard. Survival means "the species' persistence… beyond the conditions leading to its endangerment, with sufficient resilience to allow recovery from endangerment." Survival is the condition in which a species continues to exist into the future while retaining the potential for recovery. This condition is characterized by a sufficiently large population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, which exists in an environment providing all requirements for completion of the species' entire life cycle, including reproduction, sustenance, and shelter. Recovery means "improvement in the status of a listed species to the point at which listing is no longer appropriate under the criteria set out in Section 4(a)(1) of the Act." Recovery is the process by which species' ecosystems are restored and/or threats to the species are removed so self-sustaining and self-regulating populations of listed species can be supported as persistent members of native biotic communities.

The status of each listed species or DPS likely to be adversely affected by the continued operation of the South Atlantic snapper-grouper fishery is reviewed in Section 3. For any species listed globally, our jeopardy determination must find the proposed action will appreciably reduce the likelihood of survival and recovery at the global species range. For any species listed as DPSs; a jeopardy determination must find the proposed action will appreciably reduce the likelihood of survival and recovery of that DPS.

7.1 NARWs

As discussed in section 5, the proposed action could result in some nonlethal disturbance of NARW. For example, on extremely rare occasions, divers may encounter NARWs at a moderate- to long-distance while diving. In these types of instances, there may be potential behavioral effects to the whales (e.g., change in swim speed or direction, curious approaches); however, these effects are expected to be temporary and insignificant. The individuals suffering stress and nonlethal interactions are expected to recover such that the potential nonlethal interaction would not have any measurable impact on the reproduction, numbers, or distribution of these species.

As also discussed in section 5.1.3, we estimated that the number of annual lethal takes for NARWs from BSB trap/pot gear ranged from an estimated minimum of 0.005 to a maximum of 0.08. A number of our assumptions in building the model to estimate the number of lethal takes for NARWs from BSB trap/pot gear were based on a precautionary approach. The most conservative of our assumptions were (1) 25.9% of NARWs in the action area are entangled annually, (2) the number of NARWs estimated to be entangled in BSB trap/pot gear were applied to both regional models (NC and FL-SC), and (3) 5% of all estimated entangled whales within the action area were a result of BSB trap/pot gear. For a discussion of why these precautionary assumptions were applied, please see Section 5.1.3. The minimum, median, and maximum scenarios are based on risk assessments from different fishing catch rate scenarios and environmental variables that would effect NARW presence (a full discussion is available from Farmer et al. 2016). The maximum scenario assumes the most extreme cases in all aspects of the model whereas the minimum scenario assumes the most conservative case. The median is essentially the midpoint of these scenarios and therefore, we would anticipate being a more likely reflection of reality, especially given the conservative input that was used in the modeling. The median scenario for both regions indicates that lethal takes from black sea bass trap pot/gear is between 0.02-0.04. This equates to 1 estimated lethal entanglement approximately every 25 to 42 years.

A reduction in the distribution of NARWs is not expected from 1 estimated lethal entanglement every 25 to 42 years. Given the species' large geographic range and area used by NARWs, and negligible impact that the proposed action would have on the number of animals present off the southeast United States, this anticipated level of mortality is not expected to have any impact on the overall distribution of NARWs.

A potential entanglement could reduce the number of NARWs in the population, compared to their numbers in the absence of the proposed action. This would result in a reduction in future reproduction, assuming the individual was a female and would have survived otherwise to reproduce. If it was a male, the genetic contribution from that individual would be lost. Whether this reduction in numbers and reproduction would appreciably reduce the likelihood of survival of the NARWs depends on the probable effect the changes in numbers and reproduction would have relative to current population sizes and trends.

The current understanding of the NARW population trend is unclear. The 2015 SAR suggests that there is positive and slowly accelerating trend in population size for NARWs from 1990-2011 (Waring et al. 2016). These data reveal a significant increase in the number of catalogued whales with a geometric mean growth rate for this period of 2.8% (Waring et al. 2016). However, we have some concerns whether this trend will be maintained in the future based on other metrics and more recent events. For instance, the population growth rate for other well-studied right whale populations is between 6-7%, which is essentially double that of the NARW population (Best et al. 2001a). Kraus et al. (2016) states that NARW calving rates have dropped by nearly 40% since 2010. We also have concerns that the number of NARWs sighted in the Southeast United States during calving season has also declined since 2012, averaging 174 sighted whales from 2007-2011 to 40 sighted whales from 2012-2016 (representing a 77% decline in sighted whales) (Right Whale Consortium 2014; K. Jackson, personal communication, July 21, 2016). Newly published literature examining the health of the NARWs shows that health scores declined over the three decades examined (1980-2008), with significantly lower health scores for all demographic groups (except pregnant females) in the 2000s (Rolland et al. 2016). More analyses and research are needed before a discernable conclusion can be reached regarding the current NARW population trend. While uncertainty surrounds the population trend of this species, we must determine whether the takes under the proposed action are too high to allow survival and recovery given the current status of the species and uncertain population trajectory. We must evaluate whether the effects of the fishery as now proposed, considered in context of the environmental baseline and cumulative effects, are expected to appreciably reduce the likelihood of both the survival and the recovery of species in the wild. To try to answer this question, we examined the total population size relative to anticipated take levels, taking into account the period over which the take would occur.

The mortality of 1 NARW from the proposed action would represent approximately 0.22% (1/476) of the current minimum population estimate for 476 NARWs. This calculation does not account for any additional deaths of dependent calves that may result from mothers that were entangled and subsequently died. We did not have enough information on right whale demographics within the Southeast U.S. and their entanglement rates to make assumptions regarding dependent calf deaths in the calculations. However, the RRU analysis (please refer to Section 5.1) was based on calculations that used a conservative overestimate for overall NARW entanglement rates (e.g., 42.74 animals per year), as well as a conservative overestimation of apportionment of entanglements to the NC and SC/FL regions (2.14 to each). These conservative overestimates qualitatively provide some buffer to the impact of the action from the possible loss of a dependent calf. One NARW (adult, juvenile, or adult/with calf) mortality take would occur every 25 to 42 years, reducing the intensity of the impact (i.e., in contrast to if it were annually). This level of removal is very small and contributes only minimally to the overall mortality on the population. Additionally, we expect the proposed action would contribute approximately 1.2% (.04/3.4) up to 2.4% (if mother and calf were lost) to existing expected annual mortality and serious injury of 3.4 NARWs due to overall fishery entanglements. We believe that the incidental take and resulting mortality of NARW associated with the proposed action are not reasonably expected to cause an appreciable reduction in the likelihood of survival of the species over at least the next several decades, and we expect the NARW population to remain large enough and to retain the potential for recovery. We believe the threat from entanglement in fishing gear is still significant and efforts to reduce interactions are key to conservation of the species. The effects of the proposed action will most directly affect the overall size of the population, which we believe is currently sufficiently large to withstand this very low level of impact, and the proposed action will not cause the population to lose genetic heterogeneity, broad demographic representation, or successful reproduction, nor affect the species ability to meet its lifecycle requirements, including reproduction, sustenance, and shelter.

In addition to analyzing the effects of the action on survival of the species, NMFS is required to consider what impacts it will have on recovery. Recovery means: improvement in the status of a listed species to the point at which listing is no longer appropriate under the criteria set out in section 4(a)(1) of the Act. Said another way, recovery is the process by which species' ecosystems are restored and/or threats to the species are removed so self-sustaining and self-regulating populations of listed species can be supported as persistent members of native biotic communities.

The goal of the 2005 revised Recovery Plan for the NARW is to recover NARWs to a level sufficient to warrant their removal from the List of Endangered and Threatened Wildlife and Plants under the ESA. The intermediate goal is to reclassify the species from endangered to threatened. The revised Recovery Plan states that NARWs may be considered *reclassifying to threatened* when all of the following have been met:

1) *the population ecology (range, distribution, age structure, and gender ratios, etc.) and vital rates (age-specific survival, age-specific reproduction, and lifetime reproductive success) of right whales are indicative of an increasing population.*

2) *the population has increased for a period of 35 years at an average rate of increase equal to or greater than 2% per year..*

3) *none of the known threats to NARWs (summarized in the five listing factors) are known to limit the population's growth rate.*

All of these address the need for an increasing population growth rate. While the proposed action does not further the objectives to improve the rate, given the low level of removal of 1 NARW every 25 to 42 years, the effects of the action are not expected to appreciably impact the NARW population's ecology or vital rates. The impacts are sufficiently small as to have minimal impact on these aspects of the population. The removal of 1 NARW every 25 to 42 years is also not expected to appreciably impact the trend of the NARW population. While the proposed action does not increase the population growth rate, the small 0.22% reduction every 25 to 42 years is not expected to appreciably impact the average rate of increase of the NARW population.

The Recovery Plan also lists the objective that:

4) *given current and projected threats and environmental conditions, the right whale population has no more than a 1% chance of quasi-extinction in 100 years.* Above we determined that the mortality of NARW associated with the proposed action is not reasonably expected to cause an appreciable reduction in the likelihood of survival of the

species over at least the next several decades, and we expect the NARW population to remain large enough and to retain the potential for recovery. Therefore, we believe that the proposed action will not increase the chances of quasi-extinction in 100 years.

Conclusion

In conclusion, we believe that the lethal and nonlethal takes of NARWs associated with the proposed action are not expected to cause an appreciable reduction in the likelihood of both the survival and recovery of the species in the wild. Although any level of take and mortality theoretically has a negative effect on the overlying population, we believe the take and mortality associated with the proposed action, relative to the magnitude of other impacts, are not detectable. The impacts from the continued authorization of the fishery will not appreciably affect the population's persistence into the future or its potential for recovery.

7.2 Sea Turtles

Some sea turtle species are listed as a single species distributed globally; therefore, a jeopardy determination must find the proposed action will appreciably reduce the likelihood of such species' survival and recovery at the scale of its global range. Nine DPSs for loggerheads and 11 for green sea turtles have been identified. The loggerhead DPS potentially affected by the proposed action is the Northwest Atlantic DPS, listed as threatened. Two green sea turtle DPSs (North Atlantic DPS and South Atlantic DPS) may occur in the action area. Therefore, for loggerhead and green sea turtles, a jeopardy determination must find the proposed action will appreciably reduce the likelihood of survival and recovery of these DPSs.

7.2.1 Loggerhead Sea Turtles (NWA DPS)

The proposed action may result in up to 617 loggerhead sea turtle captures, 421 of which are expected to be nonlethal and 196 of which are expected to be lethal, and up to 12 lethal loggerhead sea turtle vessel strikes for a combined total of up to 629 takes, 421 of which are expected to be nonlethal and 208 of which are expected to be lethal, every 3 years. The potential nonlethal capture and release of 421 loggerhead sea turtles every 3 years is not expected to have a measurable impact on the reproduction, numbers, or distribution of this species. The individuals suffering nonlethal injuries are expected to fully recover such that no reductions in reproduction or numbers of loggerhead sea turtles are anticipated. The captures may occur anywhere in the action area, and the action area encompasses a tiny portion of the overall range/distribution of the NWA DPS of loggerhead sea turtles. Since any incidentally caught animal would be released within the general area where caught, no change in the distribution of loggerhead sea turtles is anticipated.

The estimated maximum of 208 lethal takes every 3 years associated with the proposed action represents a reduction in numbers. These lethal takes would also result in a future reduction in reproduction as a result of lost reproductive potential, as some of these individuals would be females who would have survived other threats and reproduced in the future, thus eliminating each female individual's contribution to future generations. For example, an adult female loggerhead sea turtle can lay 3 or 4 clutches of eggs every 2-4 years, with 100-130 eggs per clutch. Thus the loss of adult female sea turtles could preclude the production of thousands of eggs and hatchlings of which a small percentage would be expected to survive to sexual maturity. A reduction in the distribution of loggerhead sea turtles is not expected from lethal takes attributed to the proposed action. Because all the potential interactions are expected to occur at random throughout the proposed action area, which accounts for a tiny fraction of the species' overall range, the distribution of loggerhead sea turtles is expected to be unaffected.

Whether or not the reductions in loggerhead sea turtle numbers and reproduction attributed to the proposed action would appreciably reduce the likelihood of survival for loggerheads depends on what effect these reductions in numbers and reproduction would have on overall population sizes and trends, i.e., whether the estimated reductions, when viewed within the context of the environmental baseline, status of the species, and cumulative effects are of such an extent that adverse effects on population dynamics are appreciable. In Section 3.2.3, we reviewed the status of the species in terms of nesting and female population trends and several of the most recent assessments based on population modeling (i.e., (Conant et al. 2009; NMFS-SEFSC 2009). Below, we synthesize what that information means in general terms and in the more specific context of the proposed action.

Loggerhead sea turtles are a slow growing, late-maturing species. Because of their longevity, loggerhead sea turtles require high survival rates throughout their life to maintain a population. In other words, late-maturing species cannot tolerate much anthropogenic mortality without going into decline. Conant et al. (2009) concluded loggerhead natural growth rates are small, natural survival needs to be high, and even low to moderate mortality can drive the population into decline. Because recruitment to the adult population takes many years, population modeling studies suggest even small increased mortality rates in adults and subadults could substantially impact population numbers and viability (Chaloupka and Musick 1997; Crouse et al. 1987; Crowder et al. 1994).

SEFSC (2009) estimated the minimum adult female population size for the NW Atlantic DPS in the 2004-2008 timeframe to likely be between approximately 20,000-40,000 individuals (median 30,050), with a low likelihood of being as many as 70,000 individuals. Another estimate for the entire western North Atlantic population was a mean of 38,334 adult females using data from 2001-2010 (Richards et al. 2011). A much less robust estimate for total benthic females in the western North Atlantic was also obtained, with a likely range of approximately 30,000-300,000 individuals, up to less than 1 million.

NMFS-NEFSC (2011) preliminarily estimated the loggerhead population in the Northwestern Atlantic Ocean along the continental shelf of the Eastern Seaboard during the summer of 2010 at 588,439 individuals (estimate ranged from 381,941 to 817,023) based on positively identified individuals. The NMFS-NEFSC's point estimate increased to approximately 801,000 individuals when including data on unidentified sea turtles that were likely loggerheads. The NMFS-NEFSC (2011) underestimates the total population of loggerheads since it did not include Florida's east coast south of Cape Canaveral or the Gulf of Mexico, which are areas where large numbers of loggerheads are also expected. In other words, it provides an estimate of a subset of the entire population.

Florida accounts for more than 90% of U.S. loggerhead nesting. The Florida Fish and Wildlife Conservation Commission conducted a detailed analysis of Florida's long-term loggerhead nesting data (1989-2015). They indicated that following a 24% increase in nesting between 1989 and 1998, nest counts declined sharply from 1999 to 2007. However, annual nest counts showed a strong increase (74%) from 2008 to 2015. Examining only the period between the high-count nesting season in 1998 and the most recent nesting season (2015), researchers found a slight but nonsignificant increase, indicating a reversal of the post-1998 decline. The overall change in counts from 1989 to 2015 was significantly positive (38%); however, it should be noted that wide confidence intervals are associated with this complex data set (http://myfwc.com/research/wildlife/sea-turtles/nesting/loggerhead-trends/).

As described in the Status of Species section, we believe that the DWH oil spill event had an adverse impact on loggerhead sea turtles, and resulted in mortalities of individuals, along with lingering impacts resulting from nest relocations, nonlethal exposure, and foraging resource impacts. However, there is no information to indicate, or basis to believe, that a significant population-level impact has occurred that would have changed the species' status to an extent that the expected interactions with proposed action activities would result in a detectable change in the population status of the NWA DPS of loggerhead turtles. This is especially true given the size of the population and that, unlike Kemp's ridleys, the NWA DPS is proportionally much less intrinsically linked with the Gulf of Mexico.

It is possible that the DWH oil spill event reduced that survival rate of all age classes to varying degrees, and may continue to do so for some undetermined time into the future. However, there is no information at this time that it has, or should be expected to have, substantially altered the long-term survival rates in a manner that would significantly change the population dynamics compared to the conservative estimates used in this Opinion. Any impacts are not thought to alter the population status to a degree in which the number of mortalities from the proposed action could be seen as reducing the likelihood of survival and recovery of the species.

Abundance estimates accounting for only a subset of the entire loggerhead sea turtle population in the western North Atlantic indicate the population is large (i.e., several hundred thousand individuals). Nesting trends have been significantly increasing over several years. Additionally, our estimate of future takes is not a new source of impacts on the species. The same or a similar level of captures has occurred in the past, yet we have still seen positive trends in the status of this species.

The proposed action could remove up to 208 individuals every 3 years annually. These removed individuals represent approximately 0.054% every 3 years of the low end of the NMFS-SEFSC (2011) estimate that reflects a subset of the entire loggerhead population in the western North Atlantic Ocean. While the loss of 208 individuals every 3 years is an impact to the population, in the context of the overall population's size and current trend, it would not be expected to result in a detectable change to the population numbers or trend. The amount of loss is likely smaller than the error associated with estimating (through extrapolation) the overall population in the 2011 report. Consequently, we expect the western North Atlantic population to remain large (i.e., hundreds of thousands of individuals) and to retain the potential for recovery, and the proposed action to not cause the population to lose genetic heterogeneity, broad demographic representation, or successful reproduction, nor affect loggerheads' ability to meet their lifecycle requirements, including reproduction, sustenance, and shelter.

The loggerhead recovery plan defines the recovery goal as "…ensur[ing] that each recovery unit meets its Recovery Criteria alleviating threats to the species so that protection under the ESA is no longer necessary" (NMFS and USFWS 2008). The plan then identifies 13 recovery objectives needed to achieve that goal. Elements of the proposed action support or implement the specific actions needed to achieve a number of these recovery objectives. Thus, we do not believe the proposed action impedes the progress of the recovery program or achieving the overall recovery strategy.

The recovery plan for the Northwest Atlantic population of loggerhead sea turtles (NMFS and USFWS 2009) lists the following recovery objectives that are relevant to the effects of the proposed action:

Objective: Ensure that the number of nests in each recovery unit is increasing and that this increase corresponds to an increase in the number of nesting females

Objective: Ensure the in-water abundance of juveniles in both neritic and oceanic habitats is increasing and is increasing at a greater rate than strandings of similar age classes

Objective: Minimize bycatch in domestic and international commercial and artisanal fisheries

Objective: Minimize trophic changes from fishery harvest and habitat alteration

The recovery plan anticipates that, with implementation of the plan, the western North Atlantic population will recover within 50-150 years, but notes that reaching recovery in only 50 years would require a rapid reversal of the then-declining trends of the NRU, PFRU, and NGMRU. Recovery is the process of removing threats so self-sustaining populations persist in the wild. The proposed action would not impede progress on carrying out any aspect of the recovery program or achieving the overall recovery strategy. The recovery plan estimates that the population will reach recovery in 50-150 years following implementation of recovery actions. The minimum end of the range assumes a rapid reversal of the current declining trends; the higher end assumes that additional time will be needed for recovery actions to bring about population growth.

Recovery Objective No. 1, "Ensure that the number of nests in each recovery unit is increasing…," is the plan's overarching objective and has associated demographic criteria. Nesting trends have been significantly increasing over several years. As noted previously, we believe the future takes predicted will be similar to the levels of take that has occurred in the past and those past takes did not impede the positive trends we are currently seeing in nesting during that time. We also indicated that the potential lethal take of 208 loggerhead sea turtles over the future every 3 years is so small in relation to the overall population, that it would be hardly detectable. For these reasons, we do not believe the proposed action will impede achieving this recovery objective.

Continuation of the proposed action is not believed to be counter to the recovery plan's Objective No. 10: "minimize bycatch in domestic and international commercial and artisanal fisheries." While bycatch may still occur during fisheries independent monitoring, techniques are used to keep bycatch at levels far below bycatch occurring in commercial and recreational fisheries using similar gears, and to avoid or minimize lethal bycatch. For these reasons, we do not believe the proposed action will impede achieving this recovery objective.

Conclusion

The effects associated with the proposed action are not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of the NWA DPS of the loggerhead sea turtle in the wild.

7.2.2 Green Sea Turtles (NA and SA DPS)

Mixed-stock analyses of foraging grounds show that green sea turtles from multiple nesting beaches commonly mix at feeding areas across the Caribbean and Gulf of Mexico, with higher contributions from nearby large nesting sites and some contribution estimated from nesting populations outside the DPS (Bass et al. 1998; Bass and Witzell 2000; Bjorndal and Bolten 2008; Bolker et al. 2007). In other words, the proportion of animals on the foraging grounds from a given nesting beach is proportional to the overall importance of that nesting beach to entire DPS. For example, Tortuguero, Costa Rica, is largest nesting beach in the NA DPS and the number of animals from that nesting beach on foraging grounds were higher than from any other nesting beach. More specifically, Lahanas et al. (1998) showed that juvenile green sea turtles in the Bahamas originate mainly from western the Caribbean (Tortuguero, Costa Rica) (79.5%) (NA DPS) but that a significant proportion may be coming from the eastern Caribbean (Aves Island/Suriname; 12.9%) (SA DPS).

Flipper tagging studies provide additional information on the co-mingling of turtles from the NA DPS and SA DPS. Flipper tagging studies on foraging grounds and/or nesting beaches have been conducted in Bermuda (Meylan et al. 2011), Costa Rica (Troeng et al. 2005), Cuba (Moncada et al. 2006), Florida (Johnson and Ehrhart 1996; Kubis et al. 2009), Mexico (Zurita et al. 2003; Zurita et al. 1994), Panama (Meylan et al. 2011), Puerto Rico (Collazo et al. 1992; Patricio et al. 2011), and Texas (Shaver 1994; Shaver 2002). Nesters have been satellite tracked from Florida, Cuba, Cayman Islands, Mexico, and Costa Rica.

Troeng et al. (2005) report that while there is some crossover of adult female nesters from NA DPS into the SA DPS, particularly in the equatorial region where the DPS boundaries are in closer proximity to each other, NA DPS nesters primarily use the foraging grounds within the NA DPS.

As discussed in 3.2.6, within U.S. waters individuals from both the NA and SA DPSs can be found on foraging grounds. While there are currently no in-depth studies available to determine the percent of NA and SA DPS individuals in any given location, an analysis of cold-stunned green turtles in St. Joseph Bay, Florida (northern Gulf of Mexico) found approximately 4% of individuals came from nesting stocks in the SA DPS. On the Atlantic coast of Florida, a study on the foraging grounds off Hutchinson Island found that approximately 5% of the turtles sampled came from the SA DPS (Bass and Witzell 2000). All of the individuals in both studies were benthic juveniles.

Taken together, this information suggests that the vast majority of the anticipated captures in the Gulf of Mexico and South Atlantic regions are likely to come from the NA DPS. However, it is possible that animals from the SA DPS could be captured during the proposed action. For these reasons, we will act conservatively and conduct 2 jeopardy analyses, 1 for each DPS. The NA DPS analysis will assume, based on Bass and Witzell (2000) that 95% of animals captured during the proposed action are from that DPS. Our analysis of the SA DPS will consider that 5% of the green sea turtles affected by the proposed action are from the SA DPS. Applying these percentages to our estimated takes of 116 green sea turtles (72 nonlethal and 44 lethal) every 3 years and rounding in such a way as to conservatively assume the most lethal captures, resulted in estimate of up to 111 green sea turtles from the NA DPS (116*0.95=110.2, rounded up), of which 69 are expected to be nonlethal (72*0.95=68.4, rounded up) and 42 are expected to be lethal (44*0.95=41.8, rounded up) and up to 6 green sea turtles from the SA DPS (116*0.05= 5.8, rounded up), of which 3 are expected to be nonlethal [72*0.05=3.6, rounded down] and 3 are expected to be lethal [44*0.05=2.2]); no more than 116 green sea turtles combined during any 3 year period. We note rounding when splitting the take into the two DPSs results in a slightly higher combined total (i.e., 117 instead of 116) than the 3-year actual estimate.

7.2.2.1 NA DPS

The proposed action may result in 111 green sea turtle takes from the NA DPS (69 nonlethal, 42 lethal) every 3 years. The potential nonlethal capture of 69 green sea turtles from the NA DPS every 3 years is not expected to have any measurable impact on the reproduction, numbers, or distribution of these species. The individuals suffering nonlethal injuries are expected to fully recover such that no reductions in reproduction or numbers of green sea turtles are anticipated. The captures may occur anywhere in the action area, which encompasses only a tiny portion of green sea turtles' overall range/distribution within the NA DPS. Because any incidentally caught animal would be released within the general area where caught, no change in the distribution of NA DPS green sea turtles is anticipated.

The potential lethal take of 42 green sea turtles from the NA DPS every 3 years would reduce the number of NA green sea turtle DPS, compared to their numbers in the absence of the proposed action, assuming all other variables remained the same. Lethal takes would also result in a potential reduction in future reproduction, assuming some individuals would be females and would have survived otherwise to reproduce. For example, an adult green sea turtle can lay 1-7 clutches (usually 2-3) of eggs every 2-4 years, with 110-115 eggs/nest, of which a small percentage is expected to survive to sexual maturity. The anticipated lethal takes are expected to occur anywhere in the action area, and sea turtles generally have large ranges in which they disperse; thus, no reduction in the distribution of green sea turtles within the NA DPS is expected from these captures.

Whether the reductions in numbers and reproduction of this species would appreciably reduce its likelihood of survival depends on the probable effect the changes in numbers and reproduction would have relative to current population sizes and trends. In Section 3.2.5, we presented and discussed information on estimates of the number of nesting females and nesting trends at primary nesting beaches. We also presented the results of PVAs for Tortuguero, Costa Rica, and Florida, USA. Below we review the details of that information.

Seminoff et al. (2015) estimated that there are greater than 167,000 nesting females in the NA DPS. The nesting at Tortuguero, Costa Rica, accounts for approximately 79% of that estimate (approximately 131,000 nesters), with Quintana Roo, Mexico, (approximately 18,250 nesters; 11%), and Florida, USA, (approximately 8,400 nesters; 5%) also accounting for a large portion of the overall nesting (Seminoff et al. 2015).

At Tortuguero, Costa Rica, the number of nests laid per year from 1999 to 2003, was approximately 104,411 nests/year, which corresponds to approximately 17,402-37,290 nesting females each year (Troëng and Rankin 2005). That number increased to an estimated 180,310 nests during 2010; corresponding to 30,052-64,396 nesters. This increase has occurred despite substantial human impacts to the population at the nesting beach and at foraging areas (Campell and Lagueux 2005; Troëng 1998; Troëng and Rankin 2005).

Nesting locations in Mexico along the Yucatan Peninsula also indicate the number of nests laid each year has increased (Seminoff et al. 2015). In the early 1980s, approximately 875 nests/year were deposited, but by 2000 this increased to over 1,500 nests/year (NMFS and USFWS 2007a). By 2012, more than 26,000 nests were counted in Quintana Roo (J. Zurita, CIQROO, unpublished data, 2013, in Seminoff et al. 2015)

In Florida, most nesting occurs along the Atlantic coast of eastern central Florida, where a mean of 5,055 nests were deposited each year from 2001 to 2005 (Meylan et al. 2006) and 10,377 each year from 2008 to 2012 (B. Witherington, Florida Fish and Wildlife Conservation Commission, pers. comm., 2013). As described in the Section 3.3.3, nesting has increased substantially over the last 20 years and peaked in 2015 with 27,975 nests statewide in 2015. In-water studies conducted over 24 years in the Indian River Lagoon, Florida, suggest similar increasing trends, with green sea turtle captures up 661% (Ehrhart et al. 2007). Similar in-water work at the St Lucie Power Plant site revealed a significant increase in the annual rate of capture of immature green sea turtles over 26 years (Witherington et al. 2006).

Seminoff et al. (2015) also conducted a population viability analysis (PVA) for the Tortuguero, Costa Rica, and Florida, USA nesting sites (as well as 2 others: Isla Aguada, Mexico and Guanahacabibes, Cuba). The PVAs evaluated the probabilities of nesting populations declining to 2 separate biological thresholds after 100 years: (1) a trend-based reference point where nesting populations decline by 50% and (2) the number of total adult females falls to 300 or fewer at these sites (Seminoff et al. 2015). Seminoff et al. (2015) pointed out that PVAs do not fully incorporate spatial structure or threats. They also assume all environmental and man-made pressures will remain constant in the forecast period, while also relying solely on nesting data.

The Tortuguero, Costa Rica, PVA indicated a 0.7% probability that this population will fall below the 50% decline threshold at the end of 100 years, and a 0% probability that this population will fall below the absolute abundance reference point of 100 nesting females per year at the end of 100 years (Seminoff et al. 2015). For the Florida, USA, population, the PVA indicated there is a 0.3% probability that this population will fall below the 50% decline threshold at the end of 100 years, and a 0% probability this population falls below the absolute abundance threshold of 100 nesting females per year at the end of 100 years (Seminoff et al. 2015).

In summary, nesting at the primary nesting beaches has been increasing over the course of the decades. Additionally, the PVAs for the Florida and Tortuguero, Costa Rica, nesting beaches indicate no more than a 0.7% probability those populations will reach the 50% decline threshold at the end of 100 years, and a 0% probability these populations will fall below the absolute abundance threshold of 100 nesting females per year at the end of 100 years (Seminoff et al. 2015). We believe these nesting trends are indicative of a species with a high number of sexually mature individuals. Since the abundance trend information for NA DPS green sea turtles is clearly increasing, we believe the potential lethal take of 42 NA DPS green sea turtles every 3 years attributed to the proposed action will not have any measurable effect on that trend. Therefore, we believe the proposed action is not reasonably expected to cause an appreciable reduction in the likelihood of survival of the green sea turtle in the wild.

The NA DPS of green sea turtles does not have a separate recovery plan at this time. However, an Atlantic Recovery Plan for the population of Atlantic green sea turtles (NMFS and USFWS 1991) does exist. Since the animals within the NA DPS all occur in the Atlantic Ocean and would have been subject to the recovery actions described in that plan, we believe it is appropriate to continue using that Recovery Plan as a guide until a new plan, specific to the NA DPS, is developed. The Atlantic Recovery Plan lists the following relevant recovery objectives over a period of 25 continuous years:

> *Objective: The level of nesting in Florida has increased to an average of 5,000 nests per year for at least 6 years.*

Objective: A reduction in stage class mortality is reflected in higher counts of individuals on foraging grounds.

According to data collected from Florida's index nesting beach survey from 1989-2015, green sea turtle nest counts across Florida have increased approximately ten-fold from a low of 267 in the early 1990s to a high of 27,975 in 2015 (http://myfwc.com/research/wildlife/sea-turtles/nesting/2015-nesting-trends/). There are currently no estimates available specifically addressing changes in abundance of individuals on foraging grounds. Given the clear increases in nesting, however, it is likely that numbers on foraging grounds have increased.

The potential lethal take of up to 42 NA DPS green sea turtles every 3 years will result in a reduction in numbers when captures occur, but it is unlikely to have any detectable influence on the recovery objective and trends noted above. Nonlethal captures of these sea turtles would not affect the adult female nesting population or number of nests per nesting season. Thus, the proposed action will not impede achieving the recovery objectives above and will not result in an appreciable reduction in the likelihood of NA DPS green sea turtles' recovery in the wild. Additionally, our estimate of future captures is based on our belief that the same or a similar level of capture occurred in the past and that we have still seen positive trends in the status of this species with that level.

Conclusion

The effects associated with the proposed action are not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of the NA DPS of green sea turtle in the wild.

7.2.2.3 SA DPS

The proposed action may result in up to 6 green sea turtle captures from the SA DPS (3 nonlethal, 3 lethal) every 3 years. The potential nonlethal capture of 3 SA DPS green sea turtles every 3 years is not expected to have any measurable impact on the reproduction, numbers, or distribution of these species. The individuals suffering nonlethal injuries are expected to fully recover such that no reductions in reproduction or numbers of green sea turtles are anticipated. The captures may occur anywhere in the action area and the action area encompasses a tiny portion of green sea turtles' overall range/distribution within the SA DPS. Since any incidentally caught animal would be released within the general area where caught, no change in the distribution of SA DPS green sea turtles is anticipated.

The potential lethal take of 3 green sea turtles every 3 years would reduce the number of green sea turtles, compared to their numbers in the absence of the proposed action, assuming all other variables remained the same. Lethal interactions would also result in a potential reduction in future reproduction, assuming the individuals caught would at least in some years be female and would have survived otherwise to reproduce. For example, an adult green sea turtle can lay 1-7 clutches (usually 2-3) of eggs every 2-4 years, with 110-115 eggs/nest, of which a small percentage is expected to survive to sexual maturity. The anticipated lethal interactions are expected to occur anywhere in the action area and sea turtles generally have large ranges in which they disperse; thus, no reduction in the distribution of green sea turtles within the SA DPS is expected from these captures.

Whether the reductions in numbers and reproduction of this species would appreciably reduce its likelihood of survival depends on the probable effect the changes in numbers and reproduction would have relative to current population sizes and trends. In Section 3.2.5, we summarized available information on number of nesters and nesting trends at SA DPS beaches. Seminoff et al. (2015) estimated that there are greater than 63,000 nesting females in the SA DPS, though they noted the adult female nesting abundance from 37 beaches could not be quantified. The nesting at Poilão, Guinea-Bissau, accounted for approximately 46% of that estimate (approximately 30,000 nesters), with Ascension Island, United Kingdom, (approximately 13,400 nesters; 21%), and the Galibi Reserve, Suriname (approximately 9,400 nesters; 15%) also accounting for a large portion of the overall nesting (Seminoff et al. 2015).

Unlike the NA DPS, the data available for nesting beaches in the SA DPS are not sufficient to conduct PVAs. Seminoff et al. (2015) reported that while trends cannot be estimated for many nesting populations due to the lack of data, they could discuss possible trends at some of the primary nesting sites. Seminoff et al. (2015) indicated that the nesting concentration at Ascension Island (United Kingdom) is one of the largest in the SA DPS and the population has increased substantially over the last 3 decades (Broderick et al. 2006; Glen et al. 2006). Mortimer and Carr (1987) counted 5,257 nests in 1977 (about 1,500 females), and 10,764 nests in 1978 (about 3,000 females) whereas from 1999–2004, a total of about 3,500 females nested each year (Broderick et al. 2006). Since 1977, numbers of nests on 1 of the 2 major nesting beaches, Long Beach, have increased exponentially from around 1,000 to almost 10,000 (Seminoff et al. 2015). From 2010 to 2012, an average of 23,000 nests per year was laid on Ascension (Seminoff et al. 2015). Seminoff et al. (2015), caution that while these data are suggestive of an increase, historic data from additional years are needed to fully substantiate this possibility.

Seminoff et al. (2015) reported that the nesting concentration at Galibi Reserve and Matapica in Suriname was stable from the 1970s through the 1980s. From 1975–1979, 1,657 females were counted (Schulz 1982), a number that increased to a mean of 1,740 females from 1983–1987 (Ogren 1989b), and to 1,803 females in 1995 (Weijerman et al. 1998). Since 2000, there appears to be a rapid increase in nest numbers (Seminoff et al. 2015).

In the Bijagos Archipelago (Poilão, Guinea-Bissau), Parris and Agardy (1993 as cited in Fretey, 2001) reported approximately 2,000 nesting females per season from 1990 to 1992, and Catry et al. (2002) reported approximately 2,500 females nesting during the 2000 season. Given the typical large annual variability in green sea turtle nesting, Catry et al. (2009) suggested it was premature to consider there to be a positive trend in Poilão nesting, though others have made such a conclusion (Broderick et al. 2006). Despite the seeming increase in nesting, interviews along the coastal areas of Guinea-Bissau generally resulted in the view that sea turtles overall have decreased noticeably in numbers over the past two decades (Catry et al. 2009). In 2011, a record estimated 50,000 green sea turtle clutches were laid throughout the Bijagos Archipelago (Seminoff et al. 2015).

Nesting at the primary nesting beaches has been increasing over the course of the decades. We believe these nesting trends are indicative of a species with a high number of sexually mature individuals. Since the abundance trend information for green sea turtles is clearly increasing, we believe the potential lethal take of 3 green sea turtles every 3 years attributed to the proposed action will not have any measurable effect on that trend. Therefore, we believe the proposed action is not reasonably expected to cause an appreciable reduction in the likelihood of survival of the SA DPS of green sea turtle in the wild.

Like the NA DPS, the SA DPS of green sea turtles does not have a separate recovery plan in place at this time. However, an Atlantic Recovery Plan for the population of Atlantic green sea turtles (NMFS and USFWS 1991) does exist. Since the animals within the SA DPS all occur in the Atlantic Ocean and would have been subject to the recovery actions described in that plan, we believe it is appropriate to continue using that Recovery Plan as a guide until a new plan, specific to the SA DPS, is developed. In our analysis for the NA DPS, we stated that the Atlantic Recovery Plan lists the following relevant recovery objectives over a period of 25 continuous years:

> *Objective: The level of nesting in Florida has increased to an average of 5,000 nests per year for at least 6 years.*

> *Objective: A reduction in stage class mortality is reflected in higher counts of individuals on foraging grounds.*

The nesting recovery objective is specific to the NA DPS, but demonstrates the importance of increases in nesting to recovery. As previously stated, nesting at the primary SA DPS nesting beaches has been increasing over the course of the decades. There are currently no estimates available specifically addressing changes in abundance of individuals on foraging grounds. Given the clear increases in nesting and in-water abundance, however, it is likely that numbers on foraging grounds have increased.

The potential lethal take of up to 3 SA DPS green sea turtles every 3 years will result in a reduction in numbers when captures occur, but it is unlikely to have any detectable influence on the trends noted above. Nonlethal captures of sea turtles would not affect the adult female nesting population or number of nests per nesting season. Thus, the proposed action is not in opposition to the recovery objectives above and will not result in an appreciable reduction in the likelihood of the SA DPS of green sea turtles' recovery in the wild. Additionally, our estimate of future captures is based on our belief that the same or a similar level of capture occurred in the past, and yet we have still seen positive trends in the status of this species.

Conclusion
The effects associated with the proposed action are not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of the SA DPS of green sea turtle in the wild.

7.2.3 Hawksbill Sea Turtles

The proposed action may result in up to 5 hawksbill sea turtle captures, 3 of which are expected to be lethal and 2 of which are expected to be nonlethal, and 1 additional lethal hawksbill vessel strike, every 3 years. The 2 expected nonlethal captures are not expected to have any measurable impact on the reproduction, numbers, or distribution of this species. The individuals are expected to fully recover such that no reductions in reproduction or numbers of hawksbill sea turtles are anticipated. The captures may occur anywhere in the action area and the action area encompasses a tiny portion of hawksbill sea turtles' overall range/distribution. Since both incidentally caught animal would be released within the general area where caught, no change in the distribution of hawksbill sea turtles is anticipated.

The lethal take of up to 4 hawksbill sea turtles every 3 years would reduce the number of hawksbill sea turtles, compared to the number that would have been present in the absence of the proposed action, assuming all other variables remained the same. Any potential lethal interaction could also result in a reduction in future reproduction, assuming the individual would be a female and would have survived to reproduce in the future. For example, an adult hawksbill sea turtle can lay 3-5 clutches of eggs every few years (Meylan and Donnelly 1999; Richardson et al. 1999) with up to 250 eggs/nest (Hirth and Latif 1980). Thus, the loss of a female could preclude the production of thousands of eggs and hatchlings, of which a fraction would otherwise survive to sexual maturity and contribute to future generations. Sea turtles generally have large ranges in which they disperse; thus, no reduction in the distribution of hawksbill sea turtles is expected from this capture.

In the absence of any total population estimates for hawksbill sea turtles nesting trends are the best proxy we have for estimating population changes. The 3-year status review estimated between 22,000 and 29,000 adult females existed in the Atlantic basin at the time of its writing in 2007 (NMFS 2013b); this estimate does not include juveniles of either sex or mature males. The potential loss of up to 4 hawksbills every 3 years would equal only 0.0136% of the adult female population, which is only a portion of the entire population. Hawksbill nesting trends also indicate an improvement over the last 20 years. A survey of historical nesting trends (i.e., 20-100 years ago) for the 33 nesting sites in the Atlantic Basin found declines at 25 of those sites and data were not available for the remaining 8 sites. However, in the last 20 years, nesting trends have been improving. Of those 33 sites, 10 sites now show an increase in nesting, 10 sites showed a decrease, and data for the remaining 13 are not available (NMFS 2013b).

Our evaluation of the impact of future captures is based on our belief that the same level of capture occurred in the past. It is worth noting that this level of capture has already occurred in the past, yet we have still seen positive trends in the status of this species. We believe increases in nesting over the last 20 years, relative to the historical trends, indicate improving population numbers. Additionally, even when we conservatively evaluate the potential effects of the proposed action on a portion of the hawksbill population (i.e., adult females) we believe the impacts will be minor relative to the entire population. Thus, we believe the potential loss of up to 4 hawksbill sea turtles every 3 years will not have any detectable effect on the population, distribution or reproduction of hawksbills. Therefore, we do not believe the proposed action will cause an appreciable reduction in the likelihood of survival.

The Recovery Plan for the population of the hawksbill sea turtles (NMFS and USFWS 1993) lists the following relevant recovery objectives over a period of 25 continuous years:

> *Objective: The adult female population is increasing, as evidenced by a statistically significant trend in the annual number of nests on at least 5 index beaches, including Mona Island (Puerto Rico) and Buck Island Reef National Monument (U.S. Virgin Islands).*
>
> *Objective: The numbers of adults, subadults, and juveniles are increasing, as evidenced by a statistically significant trend on at least 5 key foraging areas within Puerto Rico, USVI, and Florida.*

Nesting populations are increasing at the Puerto Rico (Mona Island) and U.S. Virgin Islands (Buck Island Reef National Monument) index beaches. Also in the U.S. Caribbean, additional nesting beaches are now being more systematically monitored to allow for future population trend assessments. Elsewhere in the Caribbean outside U.S. jurisdiction, nesting populations in Antigua/Barbuda and Barbados are increasing; however, other important nesting concentrations in the insular Caribbean are decreasing or their status is unknown, including Antiqua/Barbuda (except Jumby Bay), Bahamas, Cuba (Doce Leguas Cays), Jamaica, and Trinidad and Tobago (NMFS 2013b).

The status of adults, subadults, and juveniles on foraging grounds is being monitored via in-water research. An in-water research project at Mona Island, Puerto Rico, has been ongoing for 15 years. However, abundance indices have not yet been incorporated into a rigorous analysis or a published trends assessment, as of yet. In addition, standardized in-water surveys have been initiated within the wider Caribbean (e.g., Pearl Cays, Nicaragua), but the time series is not long enough to detect a trend. In Florida, 2 in-water projects have been ongoing in Key West and Marquesas Keys conducted by the In-Water Research Group and Palm Beach County (NMFS 2013b).

The proposed action could cause the loss of up to 4 hawksbill sea turtles every 3 years and the animals may or may not be an adult and may or may not be a female. Additionally, our evaluation of a potential future mortality is based our belief that the same level of interactions occurred in the past, and with that level we have still seen positive trends in the status of this species. We determined the potential lethal captures associated with the proposed action would not have any detectable influence on the magnitude of those trends. While information on trends for adults, subadults, and juveniles at key foraging areas is not yet available, we also believe it is unlikely the potential removal of 4 hawksbills every 3 years will have any detectable influence over the numbers of adults, subadults, and juveniles occurring at 5 key foraging areas. Thus, we believe the proposed action is not likely to impede the recovery objectives above and will not result in an appreciable reduction in the likelihood of hawksbill sea turtles' recovery in the wild.

Conclusion

The effects associated with the proposed action are not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of the hawksbill sea turtle in the wild.

7.2.4 Kemp's Ridley Sea Turtles

The proposed action may result in up to 178 Kemp's ridley sea turtle captures, of which 57 are expected to be lethal and 121 are expected to be nonlethal, and 2 additional lethal Kemps ridley sea turtle vessel strikes, every 3 years. The nonlethal capture of 120 Kemp's ridley sea turtles every 3 years is not expected to have any measurable impact on the reproduction, numbers, or distribution of this species. The individuals are expected to fully recover such that no reductions in reproduction or numbers of Kemp's ridley sea turtles are anticipated. The captures may occur anywhere in the action area and the action area encompasses a tiny portion of Kemp's ridley sea turtles' overall range/distribution. Since any incidentally caught animals would be released within the general area where caught, no change in the distribution of Kemp's ridley sea turtles is anticipated.

The lethal take of up to 59 Kemp's ridley sea turtles every 3 years would reduce the species' population compared to the number that would have been present in the absence of the proposed action, assuming all other variables remained the same. The TEWG (1998a) estimates age at maturity from 7-15 years. Females return to their nesting beach about every 2 years (TEWG 1998a). The mean clutch size for Kemp's ridleys is 100 eggs/nest, with an average of 2.5 nests/female/season. Lethal captures could also result in a potential reduction in future reproduction, assuming at least some of these individuals would be female and would have survived to reproduce in the future. While we have no reason to believe the proposed action will disproportionately affect females, the annual loss of up to 59 sea turtles every 3 years, could preclude the production of thousands of eggs and hatchlings, of which a fractional percentage is expected to survive to sexual maturity. Thus, the death of any females would eliminate their contribution to future generations, and result in a reduction in sea turtle reproduction. The anticipated captures are expected to occur anywhere in the action area and sea turtles generally have large ranges; thus, no reduction in the distribution of Kemp's ridley sea turtles is expected from the capture of these individuals.

In the absence of any total population estimates for Kemp's ridley sea turtles, nesting trends are the best proxy we have for estimating population changes. Heppell et al. (2005) predicted in a population model that the Kemp's ridley sea turtle population is expected to increase at least 12-16% per year and that the population could attain at least 10,000 females nesting on Mexico beaches by 2015. NMFS et al. (2011d) contains an updated model which predicts that the population is expected to increase 19% per year and also predicts that the population could attain at least 10,000 females nesting on Mexico beaches by 2011. Approximately 25,000 nests would be needed for an estimate of 10,000 nesters on the beach, based on an average 2.5 nests/nesting female. In 2009, the population was on track with 21,144 nests, but an unexpected and as yet unexplained drop in nesting occurred in 2010 (loss of 13,302 nests), deviating from the NMFS et al. (2011d) model prediction. A subsequent increase to 20,570 nests occurred in 2011. In 2012, the number had increased again. Researchers documented 21,797 nests in Tamaulipas, Mexico (Burchfield 2013), and 209 nests were reported in Texas as of August 2012. The number of nests documented in Mexico declined to 16,385 again in 2013 and to 11,279 nests in 2014. In 2015, nesting in Mexico improved to 14,006 recorded nests (J. Pena, Gladys Porter Zoo, pers. comm. to M. Barnette, NMFS SERO PRD, October 19, 2015). Also, based on preliminary numbers, 2016 is looking like a very good year for Kemp's nesting with around 18,000 registered nests in Mexico. This would be the 4th highest ever nesting season for Kemp's and the third year in a row of increasing nests in Mexico. We will not know if the population is continuing the general trajectory predicted by the model until future nesting data are available. Of course, this updated model assumes that current survival rates within each life stage remain constant. The recent increases in Kemp’s ridley sea turtle nesting seen in the last two decades is likely due to a combination of management measures including elimination of direct harvest, nest protection, the use of TEDs, reduced trawling effort in Mexico and the U.S., and possibly other changes in vital rates (TEWG 1998b; TEWG 2000b). While these results are encouraging, the species’ limited range as well as low global abundance makes it particularly vulnerable to new sources of mortality as well as demographic and environmental randomness, all of which are often difficult to predict with any certainty.

The nesting trend over the last 2 decades appears to be evidence of an increasing population, although recent drops in nesting remain a source of concern. Additionally, our evaluation of potential future mortalities is based our belief that the same level of interactions occurred in the past, and with that level we have still seen positive trends in the status of this species. Thus, we believe the potential loss of up to 60 Kemp’s ridley sea turtles every 3 years will not have any detectable effect on the population, distribution or reproduction of Kemp’s ridley sea turtles. Therefore, we do not believe the proposed action will cause an appreciable reduction in the likelihood of survival.

The Kemp’s ridley recovery plan defines the recovery goal as: “…conserv[ing] and protect[ing] the Kemp’s ridley sea turtle so that protections under the Endangered Species Act are no longer necessary and the species can be removed from the List of Endangered and Threatened Wildlife” (NMFS et al. 2011a). The recovery plan for the Kemp’s ridley sea turtle (NMFS et al. 2011c) lists the following relevant recovery objective:

> *Objective:* A population of at least 10,000 nesting females in a season (as measured by clutch frequency per female per season) distributed at the primary nesting beaches (Rancho Nuevo, Tepehuajes, and Playa Dos) in Mexico is attained. Methodology and capacity to implement and ensure accurate nesting female counts have been developed.

With respect to this recovery objective, the preliminary nesting numbers for in 2015, indicate there were 10,351 nests in Rancho Nuevo, 890 in Tepehuajes, and 1,535 in Playa Dos, Mexico, for a total of 12,776 nests. This number represents approximately 5,110 nesting females for the season based on 2.5 clutches/female/season. The number of nests reported annually from 2010 to 2014 overall declined; however they rebounded some in 2015. Although there has been a substantial increase in the Kemp's ridley population within the last few decades, the number of nesting females is still below the number of 10,000 nesting females per season required for downlisting (NMFS and USFWS 2015). Since we concluded that the potential loss of up to 59 Kemp's ridley sea turtles every 3 years is not likely to have any detectable effect on nesting trends, we do not believe the proposed action will impede the progress toward achieving this recovery objective. Thus, we believe the proposed action will not result in an appreciable reduction in the likelihood of Kemp's ridley sea turtles' recovery in the wild.

Conclusion
The effects associated with the proposed action are not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of the Kemp's ridley sea turtle in the wild.

7.2.5 Leatherback Sea Turtles

The proposed action may result in up to 5 leatherback sea turtle captures, 4 of which are expected to be lethal, and 1 lethal leatherback vessel strike every 3 years. The nonlethal capture of 1 leatherback sea turtles every 3 years, or even up to 5 in the event more than one survives, is not expected to have any measurable impact on the reproduction, numbers, or distribution of this species. The individuals are expected to fully recover such that no reductions in reproduction or numbers of this species are anticipated. Since these captures may occur anywhere in the action area and would be released within the general area where caught, no change in the distribution of leatherback sea turtles is anticipated.

The lethal take of up to 5 leatherback sea turtles every 3 years would reduce the population by that number compared to the number that would have been present in the absence of the proposed action, assuming all other variables remained the same. Lethal captures could also result in a potential reduction in future reproduction, assuming one or more of these individuals would be female and would have survived otherwise to reproduce in the future. For example, an adult female leatherback sea turtle can produce up to 700 eggs or more per nesting season (Schultz 1975). Although a significant portion (up to approximately 30%) of the eggs can be infertile, the annual loss of adult female sea turtles, on average, could preclude the production of thousands of eggs and hatchlings of which a small percentage would be expected to survive to sexual maturity. While we have no reason to believe the proposed action will disproportionately affect females, the death of any female leatherbacks that would have survived otherwise to reproduce would eliminate its and its future offspring's contribution to future generations. The anticipated lethal interactions are expected to occur anywhere in the action area. Given these sea turtles generally have large ranges, no reduction in the distribution of leatherback sea turtles is expected from the proposed action.

The Leatherback Turtle Expert Working Group estimated there are between 34,000-95,000 total adults (20,000-56,000 adult females; 10,000-21,000 nesting females) in the North Atlantic based on 2004 and 2005 nesting count data. The potential loss of up to 6 leatherback sea turtles every 3 years accounts for only 0.00005-0.0001% of those population estimates, which are only a subset of the entire population. We do not believe these potential loses will have any detectable impact on these population numbers.

Of the 15 leatherback nesting populations in the North Atlantic, 7 show an increase in nesting (Florida, Puerto Rico [not Culebra], St. Croix-U.S. Virgin Islands, British Virgin Islands, Trinidad, Guyana, and Brazil) and 3 have shown a decline in nesting (Puerto Rico [Culebra], Costa Rica [Tortuguero], and Costa Rica [Gandoca]). The most important nesting populations (French Guiana and Suriname) have remained stable. Suriname and French Guiana may represent over 40% of the world's leatherback population (Spotila et al. 1996), accounting for between 31,000 to 60,000 nests annually (NMFS USFWS 2013).

The main nesting areas in Puerto Tico are at Fajardo on the main island of Puerto Rico and on the island of Culebra. Between 1978 and 2005, nesting increased in Puerto Rico from a minimum of 9 nests recorded in 1978 and to a minimum of 469-882 nests recorded each year between 2000 and 2005 (NMFS USFWS 2013). However since 2004, nesting has steadily declined in Culebra, which appears to reflect a shift in nest site fidelity rather than a decline in the female population (NMFS USFWS 2013).

In the U.S. Virgin Islands, St. Croix (Sandy Point National Wildlife Refuge), leatherback nesting was estimated to increase at 13% per year from 1994 through 2001. However, nesting data from 2001 through 2010 indicate nesting has slowed, possibly due to fewer new recruits and lowered reproductive output (NMFS USFWS 2013). The average annual growth rate was calculated as approximately 1.1 (with an estimated confidence interval between 1.07 and 1.13) using the number of observed females at Sandy Point, St. Croix, from 1986 to 2004 (TEWG 2007).

In Costa Rica, Tortuguero, leatherback nesting has decreased 88.5% overall from 1995 through 2011 (NMFS USFWS 2013). Troëng et al. (2007) estimated a 67.8% overall decline from 1995 through 2006. However, these estimates are based on an extrapolation of track survey data, which has consistently underestimated the number of nests reported during the surveys (NMFS USFWS 2013). Regardless of the method used to derive the estimate, the number of nests observed over the last 17 years has declined. Troeng et al. (2004) found a slight decline in the number of nests at Gandoca, Costa Rica, between 1995 and 2003, but the confidence intervals were large. Data between 1990 and 2004 at Gandoca averaged 582.9 (+ 303.3) nests each year, indicating nest numbers have been lower since 2000 (Chacón-Chaverri and Eckert 2007), and the numbers are not increasing (TEWG 2007).

Aside from the nesting declines in Tortuguero, which are significant, most of the other nesting populations appear to be increasing or are remaining stable, including the most significant populations in French Guiana and Suriname. Since we anticipate a low number of mortalities every 3 years and we have no reason to believe nesting females will be disproportionately affected, we believe the potential mortalities associated with the proposed action will have no detectable effect on current nesting trends.

Since we do not anticipate the proposed action will have any detectable impact on the population overall, or current nesting trends, we do not believe the proposed action will cause an appreciable reduction in the likelihood of survival.

The Atlantic recovery plan for the U.S. population of the leatherback sea turtles (NMFS and USFWS 1992) lists the following relevant recovery objective:

> *Objective*: The adult female population increases over the next 25 years, as evidenced by a statistically significant trend in the number of nests at Culebra, Puerto Rico; St. Croix, U.S. Virgin Islands; and along the east coast of Florida.

We believe the proposed action is not likely to impede the recovery objective above and will not result in an appreciable reduction in the likelihood of leatherback sea turtles' recovery in the wild. As noted previously, the Florida and St. Croix nesting populations are increasing. The nesting population in Culebra, Puerto Rico, had been increasing since the late 1970s but has been declining in recent years; however, it appears these declines may reflect a shift in nest site fidelity rather than a decline in the female population. Since we concluded that the potential loss of up to 5 leatherback sea turtles every 3 years is not likely to have any detectable effect on these nesting trends, we do not believe the proposed action is impeding the progress toward achieving this recovery objective. Thus, we believe the proposed action will not result in an appreciable reduction in the likelihood of leatherback sea turtles' recovery in the wild.

Conclusion

The effects associated with the proposed action are not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of the leatherback sea turtle in the wild.

7.3 Smalltooth Sawfish

Only the U.S. DPS of smalltooth sawfish is listed; therefore, our jeopardy analysis must determine if the proposed action is likely to appreciably reduce the likelihood of survival and recovery of the smalltooth sawfish U.S. DPS.

The proposed action may result in 8 large juvenile or adult smalltooth sawfish takes every 3 years, but no mortality is anticipated. The short-term, nonlethal effects anticipated on smalltooth sawfish are not expected to have any measurable effect on the reproduction, numbers, or distribution of wild populations of smalltooth sawfish. The individuals are expected to fully recover such that no reductions in reproduction or numbers of this species are anticipated. The take may occur anywhere within the range of the species in the South Atlantic region and would be released within the general area where caught, thus no change in the distribution of smalltooth sawfish is anticipated. Based on this information, the snapper-grouper fishery is not expected to affect the reproduction, numbers, or distribution of wild populations of smalltooth sawfish. Therefore, the proposed action will not reduce the smalltooth sawfish population's likelihood of surviving and recovering in the wild.

7.4 Nassau grouper

As discussed in section 5, we expect a total of 1,387 Nassau grouper to be incidentally captured annually in the snapper-grouper fishery. While no information exists on injury or post-release mortality for Nassau grouper captured in the snapper-grouper fishery, the best available information suggests that estimates of Nassau grouper release mortality are probably best approximated in the snapper-grouper fishery by estimates for red grouper (20%). Applying the 20% rate to the annual average number of expected Nassau groupers caught provides an annual average expected mortality of 282 fish (please refer to Section 5.4.3 for details on how this number was calculated).

The majority (approximately 80%) of interactions will not result in mortality. The individuals suffering stress and nonlethal injuries are expected to recover such that the potential nonlethal capture of these animals would not have any measurable impact on the reproduction, numbers, or distribution of these species. The takes may occur anywhere in the action area, which encompasses only a small portion of Nassau grouper overall range/distribution. Because 80% of the incidentally caught animals would be released within the general area where caught, no change in the distribution of Nassau grouper is anticipated.

The potential lethal capture of 282 Nassau grouper annually would reduce the number of fish in the population. The species consists of a single population over a broad geographic range. As discussed in this Opinion, insufficient stock assessment or population estimates exist for the Nassau grouper, therefore there is no population abundance data or trend data to which the 282 annual mortalities can be compared. Additionally, data does not exist regarding the size class, age, sex ratio, or reproductive status of the 282 annual expected mortalities, therefore it is not possible to incorporate these variables into this analysis. As mentioned in the *Status of the Species*, although there are few data on historic abundance of Nassau grouper off the U.S. mainland, it appears that abundance was once high in southern Florida and anecdotal reports from spearfishers noted large daily catches in the 1950s. It appears that Nassau grouper were once caught in much greater numbers from the upper Florida Keys and the Bahamas and the species was reported frequently at Alligator Reef in the Florida Keys. Additionally, historically, Nassau grouper was a component of the grouper fishery in Florida, suggesting once healthy (sub)population(s) in southeastern U.S. mainland waters that does not exist today.

However, the anticipated mortalities are not expected to affect the species distribution. As previously mentioned 80% of all captures are being returned alive to the area from which they are caught. The removal of 282 fish annually would result in a future reduction in reproduction as a result of lost reproductive potential, as some of these individuals could potentially have reproduced in the future. However, the extent of this loss of contribution is unclear, as no spawning aggregations exist in the action area, and it is not known if the fish taken by the fishery are reproducing. Additionally, the animals taken would represent a small fraction of the entire population (which ranges throughout the Caribbean). We do not believe the reductions in numbers resulting from the proposed action are likely to reduce the population's ability to persist into the future.

Farmer (2016b) summarized the results of the factors leading to listing the Nassau grouper and discussed two threats that are "high risk" that are key to affecting the current status of the species and will continue to affect it over the foreseeable future—fishing at spawning aggregations and inadequate law enforcement (especially to control fishing on aggregations). Farmer (2016b) stated that existing regulatory mechanisms and law enforcement have not been effective in preventing fishing at many spawning aggregation sites. Many countries have few, if any, specific Nassau grouper regulations. Instead they rely on general fisheries regulations (e.g., Anguilla, Antigua-Barbuda, Colombia, and Cuba all rely only on size limits, while Guadeloupe and Martinique, Honduras, Jamaica, Mexico, St. Lucia, and the Turks and Caicos rely on a variety of general fishing regulations). Additionally, where Nassau grouper-specific regulations do exist, law enforcement in many foreign countries is less than adequate, thus rendering the regulations ineffective.

Harvest of the Nassau grouper in the United States has been illegal since the early 1990s and is not authorized in the snapper-grouper fishery. Therefore, no animals are targeted in the United States (which includes the area fished by the snapper-grouper fishery). While incidental capture occurs in the fishery, no known spawning aggregations exist off of Florida, therefore the snapper-grouper fishery is not fishing, even accidentally, on spawning aggregations and is not contributing to one of the main reasons the Nassau grouper was listed. Additionally, the fishery does not contribute to lack of enforcement issue, as no fishing on aggregations occurs.

Furthermore, mortalities due to the proposed action have been significantly reduced since fishing for Nassau grouper was prohibited in the 1990s in U.S. federal waters, from an average of over 15,000 annually pre-1993 to an average of a little under 300 annually since 2004. Since 1993, a ban on fishing/possessing Nassau grouper was implemented for the state of Florida and has since been enacted in all U.S. state waters. The species was fully protected in both state and federal waters of Puerto Rico by 2004. The Caribbean Fishery Management Council, with support of local fishermen, established a no-take marine protected area off the southwest coast of St. Thomas, U.S.V.I. in 1990. This area, known as the Hind Bank Marine Conservation District (HBMCD), was intended to protect red hind and their spawning aggregations, as well as a former Nassau grouper spawning site (Brown 2007).

The abundance of Nassau grouper has been dramatically reduced in relation to historical records, but abundance is not currently so low that the species is at risk of extinction from stochastic events, environmental variation, anthropogenic perturbations, lack of genetic diversity, or depensatory processes. Although the proposed action would reduce abundance of Nassau grouper, spawning is still occurring and abundance is increasing in some locations (e.g. Cayman Islands and Bermuda) where adequate protections are effectively being implemented. The abundance of Nassau grouper in these protected areas is large enough to sustain the overall population and help limit extinction risk. Additionally, conservation efforts in some nations (U.S., Puerto Rico, U.S.V.I., and Belize) have almost certainly prevented further declines. The proposed action is not affecting or contributing to the key threats facing the species (e.g., it does not fish on spawning aggregations). We do not believe the reductions in numbers resulting from the proposed action are likely to reduce the population's ability to persist into the future, and the proposed action will not appreciably reduce the likelihood of the Nassau grouper's survival within its range.

We next considered whether the proposed action is likely to impede the recovery of Nassau grouper. Because the Nassau grouper has only recently been listed, no recovery plan yet exists for the species. However, a key step in recovering a species is to reduce threats identified as contributing to a species' threatened or endangered status; only by alleviating these threats can lasting recovery be achieved. As discussed earlier, NMFS (2016) analyzed the threats facing this species and those that are "high risk" include:

- fishing at spawning aggregations: and
- inadequate law enforcement (particularly at spawning aggregations)

The proposed action (snapper-grouper fishery) is prohibited from fishing for Nassau grouper. While incidental take does occur in the fishery, no spawning aggregations exist in the action area. Therefore the fishery does not fish at them and does not contribute to the effects of this major threat on recovery. Similarly, as fishing at aggregations does not occur, law enforcement is not relevant and the fishery does not negatively contribute to the impact of this threat as it relates to recovery. We conclude the proposed action will not appreciably diminish the likelihood of recovery for the Nassau grouper.

Conclusion

In conclusion, we believe that the effects associated with the proposed action are not expected to cause an appreciable reduction in the likelihood of both the survival and recovery of the Nassau grouper.

8.0 Conclusion

After reviewing the current status of the species, the environmental baseline, the effects of the proposed action, and cumulative effects, it is NMFS's Biological Opinion that the proposed action is not likely to jeopardize the continued existence of the NARW, loggerhead sea turtle NWA DPS, leatherback sea turtle, Kemp's ridley sea turtle, green sea turtle NA DPS, green sea turtle SA DPS, hawksbill sea turtle, smalltooth sawfish U.S. DPS, and Nassau grouper.

9.0 Incidental Take Statement

Section 9 of the ESA and protective regulations issued pursuant to Section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption.

Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. *Incidental take* is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that would otherwise be considered prohibited under Section 9 or Section 4(d), but which is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the RPMs and the terms and conditions of the incidental take statement (ITS) of the Opinion.

NMFS is not including an incidental take authorization for NARWs in connection with this Opinion because (1) an incidental take statement cannot be lawfully issued under the ESA for a marine mammal unless incidental take authorization exists for that marine mammal under the MMPA (see 16 U.S.C. § 1536(b)(4)(C)) and (2) the incidental take of ESA-listed whales by the Snapper-Grouper fishery has not been authorized under section 101(a)(5) of the MMPA. Because no ITS is included, no incidental take by the snapper-grouper fishery is authorized under the ESA.
NMFS recognizes that an ITS normally identifies the level of incidental take that requires reinitiation of ESA section 7 consultation. While NMFS cannot include an ITS for NARWs in this Opinion under the language of the ESA, it has included numerical "triggers" for reinitiation of ESA section 7 consultation. Specifically, as set forth in Section 12 below, reinitiation will occur if greater than one NARW is entangled in BSB trap/pot gear or gear consistent with BSB trap/pot over the next 25 year period. As stated above in Section 8 of the Opinion, NMFS has concluded that if take stays below this trigger, it would not likely reduce appreciably the likelihood of both survival and recovery of the whale species.

An exemption for the take of Nassau grouper in connection with this Opinion is not needed because take of this species is not prohibited; NMFS has not promulgated a Section 4(d) rule for this species. However, one Federal circuit has held that non-prohibited incidental take must be included in the ITS.[25] Providing an exemption from Section 9 liability is not the only purpose of specifying take in an incidental take statement. Specifying incidental take ensures we have a metric against which we can measure whether or not reinitiation of consultation is required. It also ensures that we identify reasonable and prudent measures that we believe are necessary or appropriate to minimize the impact of such incidental take.

9.1 Anticipated Amount of Incidental Take

[25] *Center for Biological Diversity v. Salazar*, 695 F.3d 893 (9th Cir. 2012). Though the *Salazar* case is not a binding precedent for this action, which occurs outside of the Ninth Circuit, we find the reasoning persuasive and are following the case out of an abundance of caution and in anticipation that the ruling will be more broadly followed in future cases.

The numbers presented herein Table 9.1 represent total anticipated takes by species over 3-year periods. No more than 921 hardshell sea turtles (i.e., all hardshell species combined) are anticipated and therefore authorized for any 3 year period. Nassau grouper takes are not prohibited, but are included in the table for tracking and reinitiation purposes only as explained in Section 9. Annual take estimates of these species can have variability because of natural and anthropogenic factors, or because documented interactions are relatively rare. As a result, monitoring fisheries using 1-year estimated take levels based on documented interactions is largely impractical. Based on our experience monitoring fisheries, we believe a 3-year time period is appropriate. This approach will allow us to reduce the likelihood of requiring reinitiation unnecessarily because of inherent variability in take levels, but still allow for an accurate assessment of how the proposed action is affecting these species versus our expectations.

Table 9.1 Summary of Anticipated 3-Year Take and Mortality Estimates By Species

Species	Take Type	Total
NWA DPS Loggerhead Sea Turtles	Total	629
	Lethal	208
Kemp's Ridley Sea Turtles	Total	180
	Lethal	59
Leatherback Sea Turtles	Total	6
	Lethal	5
NA DPS Green Sea Turtle	Total	111
	Lethal	42
SA DPS Green Sea Turtles	Total	6
	Lethal	3
Hawksbill Sea Turtles*	Total	6
	lethal	4
Smalltooth Sawfish	Total	8
	Lethal	0
Nassau Grouper	Total	4,161
	Lethal	846

9.2 Effect of the Take

NMFS has determined the level of anticipated take associated with the proposed action and specified in Section 9.1 is not likely to jeopardize the continued existence of the loggerhead sea turtle, leatherback sea turtle, Kemp's ridley sea turtle, green sea turtle, hawksbill sea turtle, smalltooth sawfish, and the Nassau grouper.

9.3 Reasonable and Prudent Measures (RPMs)

Section 7(b)(4) of the ESA requires NMFS to issue to any agency whose proposed action is found to comply with Section 7(a)(2) of the ESA, but may incidentally take individuals of listed species, a statement specifying the impact of that taking. It also states that RPMs necessary or appropriate to minimize the impacts from the agency action, and terms and conditions to implement those measures, must be provided and implemented.

The RPMs and terms and conditions are required, per 50 CFR 402.14 (i)(1)(ii) and (iv), to document the incidental take by the proposed action and to minimize the impact of that take on ESA-listed species. These measures and terms and conditions are non-discretionary, and must be implemented by NMFS for the protection of Section 7(o)(2) to apply. NMFS has a continuing duty to regulate the activity covered by this incidental take statement. If it fails to adhere to or require grantees to adhere to the terms and conditions of the incidental take statement through enforceable terms of grants or other documents, and/or fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of Section 7(o)(2) may lapse for prohibited take. To monitor the impact of the incidental take, NMFS must report the progress of the action and its impact on the species to F/SER3 as specified in the incidental take statement [50 CFR 402.14(i)(3)].

We have determined that the following RPMs are necessary or appropriate to minimize the impacts of future sea turtle, smalltooth sawfish, and Nassau grouper takes or to limit adverse effects to these species to predictable levels, and to monitor levels of incidental take during the proposed action:

1) <u>Minimizing Stress and Increasing Survival Rates Through Best Handling Practices:</u>
In our evaluation of the effects of each fishery component, we described how gear can adversely affect sea turtles, smalltooth sawfish, and Nassau grouper. Most, if not all, sea turtles, smalltooth sawfish, and Nassau grouper released after capture on South Atlantic snapper-grouper hook-and-line gear experience some degree of physiological injury (hooking trauma, lacerations/abrasions, etc.). The severity of these events depends not only upon actual interaction, but also on the amount of gear remaining on the animal at the time of release. The handling of an animal can also greatly affect its chance of surviving the event. Certain behavior by fishers may also reduce the likelihood of takes. NMFS must ensure that any caught sea turtle, Nassau grouper, or smalltooth sawfish is handled in a way that minimizes adverse effects (e.g., stress) to the animal and increases the likelihood of its survival.

2) <u>Monitoring the Frequency and Magnitude of Incidental Take:</u>
The jeopardy analyses for sea turtles, smalltooth sawfish, and Nassau grouper are all based on the assumption that the frequency, magnitude, and impact of takes estimated in this Opinion are generally accurate. If our estimates prove to be underestimates or the life history parameters of listed species are inaccurate, we risk having misjudged the potential adverse effects to these species. Thus it is important that we monitor and track both the level of take occurring specific to the South Atlantic snapper-grouper fishery and the status of listed species. Therefore, NMFS must ensure that monitoring and reporting: (1) detects and documents any adverse effects resulting from the South Atlantic snapper-grouper fishery; (2) assesses the actual level of incidental take in comparison with the anticipated incidental take documented in this Opinion; (3) detects when the level of anticipated take is exceeded; and (4) collects improved data.

9.4 Terms and Conditions

To be exempt from take prohibitions established by Section 9 of the ESA, NMFS must comply with or ensure compliance with the following terms and conditions, which implement the RPMs described above. These terms and conditions are non-discretionary.

The following terms and conditions implement RPM No. 1.

1) NMFS must continue to conduct outreach and in-person training to promote that captures be avoided to the extent practicable and that any listed species captured are handled in a way that minimizes adverse effects and increases the likelihood of survival. Outreach and in-person training should be directed at increasing the knowledge, experience, ability, and willingness of all snapper-grouper FMU fishers to remove gear from animals and/or handle them in a way that minimizes adverse effects. As part of these effort, NMFS must:

(a) Establish and/or maintain a NMFS point of contact (POC) for each fishery component to answer questions from pertaining to sea turtle release gear and safe handling and other species' release protocols. POC(s) should actively reach out to fishers to (1) learn about their experiences, (2) trouble-shoot problems, and (3) share solutions and successful experience with other fisherman and NMFS scientist s and managers.

(b) Distribute information and conduct in-person training and education on: (1) Identifying listed species, (2) how to use required and recommended sea turtle gear removal equipment and follow handling protocols to maximize post-release survival, and (3) the importance of maximizing gear removal to maximize post-release survival, and (4) and on reporting interactions with listed species (e.g. STSSN, ISED).

(c) Distribute targeted messages to permit holders via the dynamic cover letter application of the permit information management system.

(d) Increase collaboration and communication with federal and state agency partners (e.g., Sea Grant, the SAFMC, Florida Fish and Wildlife Research Institute) on promoting ways that recreational fishing takes can be avoided to the extent practicable and handling protocols and guidelines that minimize adverse effects and increases the likelihood of survival. For example, guidelines for sea turtles should include the following or something similar, at minimum:

a. Do not leave baited hooks and line unattended. If you are watching you are less likely to catch something you didn't want to.
b. Watch for sea turtles surfacing in the vicinity of where you are fishing. Avoid casting in the direction of any sighted sea turtles to avoid the possibility of their capture.
c. Simply cutting lines and leaving entangled gear on sea turtles is strongly discouraged. If a sea turtle is cut loose with the line attached, the flipper may eventually become badly infected, and this could lead to mortality.

2) NMFS must examine ways to reduce mortality of Nassau grouper. This includes, but is not limited to, examining possible modifications to fishing practices that can be adopted through changes in fishery management plan related regulations, as well as recommended best fishing practices. NMFS must assess:

(a) the potential effectiveness of non-stainless steel circle hooks on reducing injury and mortality to Nassau grouper. If deemed an effective measure, NMFS shall consider revision of regulations to expand their current use to include areas south of 28° N. lat. for fishing activities that could incidentally capture Nassau grouper.

(b) the potential effectiveness of fishing practices after fish are captured that could reduce and minimize the effects of fishing. This includes, but is not limited to 1) de-hooking and 2) treatment for barotrauma, e.g., the possible use of "descender" devices. If deemed effective, NMFS shall consider revision of regulations to implement their use for incidentally caught Nassau grouper.

The following terms and conditions implement RPM No. 2:

3) NMFS must review and/or continue to review all available data sources (e.g., logbook, observer, STSSN, ISED) for observed or documented take of sea turtles, smalltooth sawfish, and Nassau grouper in the South Atlantic snapper-grouper fishery to monitor their incidental take.

4) NMFS must work with the SAFMC in developing its Bycatch Reporting Amendment to evaluate the current standardized bycatch reporting methodologies under the Snapper-Grouper FMP. As part of this evaluation, NMFS and the SAFMC must consider increasing the self-reporting of sea turtles, Nassau grouper, and smalltooth sawfish captures in commercial hook-and-line gear targeting snapper-grouper from the current 20% under the SDDP to 100% as one option.

5) Although logbooks can be used to collect sea turtle discard data, these data cannot be independently verified and, even with potential increased selection in the future via term and condition No. 4, will likely be under-reported. As a major fishery in the Southeast Region, NMFS must recognize enhancing existing tools (e.g., observers, logbook requirements, electronic technologies) to collect bycatch data in the South Atlantic snapper-grouper as a SERO science priority.

6) Any observer that is deployed must record information as specified on the SEFSC sea turtle life history form for any sea turtle captured. For any smalltooth sawfish captured, observers must record the date, time, location (latitude/longitude), water depth, estimated total length, estimated length of saw, tag ID(s) if present, gear, target species, tackle (hook brand, type, size, etc.), where hooked and/or entangled, and bait type. For any Nassau grouper captured, observers must record the date, time, location (latitude/longitude), water depth, estimated total length, tag ID(s) if present, gear, target species, tackle (hook brand, type, size, etc.), where hooked, and bait type. Observers must scan incidentally taken sea turtles for PIT tags and visually look for flipper tags. Photographs must be taken whenever feasible to

confirm species identity and release condition. If feasible, observers should also tag any sea turtles or smalltooth sawfish caught and collect tissue samples for genetic analysis. This Opinion serves as the permitting authority for such tagging and tissue samples (without the need for an additional Section 10 permit). NMFS must ensure that any observers employed are equipped with the tools, supplies, training, and instructions to collect and store tissue samples. Samples collected must be analyzed to determine the genetic identity of individual sea turtles or smalltooth sawfish caught in the fisheries.

7) NMFS must work with its partners to ensure that STSNN participants collect fishing gear found associated with sea turtle strandings and submit it, along with a completed Fishing Gear Submission Form and a copy of the corresponding STSSN Stranding Report to the SEFSC, for fishery type identification. A database containing this information must be maintained and incorporated into the STSSN database at least annually, and a summary of the results shared with F/SER3.

8) NMFS must continue to investigate ways to better quantify and assess the extent of interactions between offshore marine anglers and sea turtles. NMFS must assess the pilot surveys conducted to date relating to sea turtles and their effectiveness in quantifying the extent of sea turtle interactions between offshore marine recreational anglers. The findings of these studies must be documented in a report and/or publication, as well as recommendations for how to move forward with data collection.

9) MRIP is the agency's source of recreational catch and effort data. NMFS (F/PR and SERO PRD and OST) must work together in (a) ensuring that MRIP implementation strategies underway do not foreclose options for collecting listed species interaction data via MRIP surveys, and (b) considering how recommendations stemming from term and condition No. 8 can be implemented.

10) Bycatch estimates need to be combined with quantitative stock assessments to provide improved understanding of how listed species are adversely affected by estimated bycatch levels. NMFS must improve its quantitative stock assessment of the primary incidentally caught species (i.e., loggerhead sea turtles). A sufficient quantitative stock assessment includes, but is not limited to, an integrative modeling framework for quantitative stock assessment and the necessary fishery independent data needed to support such assessments.

11) SERO must collaborate with the SEFSC and OST to prepare an annual report that includes the following information:
(a) Detailed information on any take (including mortalities) in the South Atlantic snapper-grouper fishery reported or observed) via available data sources
(b) total observed and reported and /or estimated effort by fishery component
(c) A summary of outreach and training conducted under term and condition No.1.
(d) A summary of actions taken under term and condition No. 9.
(e) Progress toward the goal of term and condition No. 10.

NARW Monitoring

NMFS will continue to monitor levels of NARW entanglement in the snapper grouper fishery. NMFS has recently developed a monitoring strategy for the ALWTRP and will produce an annual report stating the most up-to-date SI/M average. To provide the most up-to-date SI/M information possible, the five-year average will consist of the most recently available year's data from the annual SI/M report averaged with the previous 4 years of data obtained from the U.S. Atlantic and Gulf of Mexico Marine Mammal SAR. Analyzing the data in this way will reduce the two year lag associated with using SAR estimates alone by one year.

For the purposes of monitoring NARW entanglement and SI/M, NMFS will use the serious injury determination reports, SARs, and the ALWTRP monitoring reports to collect entanglement information. NMFS will re-examine fishery entanglements and associated SI/M annually. Using these data, NMFS will determine if the entanglement rate is significantly different than what was evaluated in this Opinion.

10.0 Conservation Recommendations

Section 7(a)(1) of the ESA directs federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

The following additional measures are recommended.

NARWs:

1. NMFS should continue to monitor and evaluate the effectiveness of the ALWTRP, particularly the impacts of the broad based gear requirements implemented in 2008 and 2009, as well as the implementation of the vertical line strategy. As part of the monitoring plan for the ALWTRP, NMFS's goal should be to detect a change in the frequency of entanglements and/or serious injuries and mortalities associated with entanglements. Metrics to consider in detecting this change could include: observed time lapses between detected large whale entanglements, known large whale serious injuries and mortalities due to entanglement, and analysis of whale scarring data.
2. NMFS should continue to undertake and support aerial surveys, passive acoustic monitoring, and the Sighting Advisory System.
3. NMFS should continue to develop and implement measures to reduce the risk of ship strikes of large whales.
4. NMFS should continue to undertake and support disentanglement activities, in coordination with the states, other members of the disentanglement and stranding network, and with Canada.
5. NMFS should continue to cooperate with the Canadian government to compare research findings and facilitate implementation in both countries of the most promising risk reduction practices for large whales.
6. NMFS should foster funding opportunities and cooperative partnerships that support research for lineless fishing (i.e., no vertical buoy lines) for BSB.
7. NMFS should promote the use of ropes with breaking strengths equal to or less than 1700 lb for the BSB trap/pot fishery. New research suggests that if fisheries were to utilize ropes with breaking strengths less than or equal to 1700-lb breaking strength, the number of life-threatening entanglements for large whales would decrease by at least 72% (Knowlton et al. 2015).
8. In general, NMFS should avoid allowing any new fishing activities (e.g., exempted fishing permits) buoyed during the November through April timeframe.

Sea Turtles:

9. NMFS should support in-water abundance estimates of sea turtles to achieve more accurate status assessments for these species and to better assess the impacts of incidental take during snapper-grouper fishing.

Smalltooth Sawfish:

10. NMFS should conduct or fund research or alternative methods (e.g., surveys) on the distribution, abundance, and migratory behavior of adult smalltooth sawfish off southeast Florida and the Florida Keys to better understand their occurrence in federal waters and potential for interaction with snapper-grouper fisheries.
11. NMFS should conduct or fund reproductive behavioral studies to ensure that any incidental capture of smalltooth sawfish during fishing activities is not disrupting any such activities.

Nassau Grouper:

12. NMFS should fund or conduct future research to identify where Nassau grouper in the action area spawn.
13. NMFS should fund or conduct future research that gathers information that furthers understanding of population abundance.
14. NMFS should collect data describing Nassau grouper locations and movements in the Atlantic Ocean, by depth and substrate to assist in future assessments of interactions between fishing gear and migratory and feeding behavior.
15. NMFS should collect information on incidental catch rates and condition of Nassau grouper in fisheries that use gear similar to that used in the snapper-grouper fishery to assist in future assessments of gear impacts to the species.
16. NMFS should fund or collect future research to identify ways to reduce the 20% mortality rate of incidentally captured Nassau grouper in the fishery.

11.0 Reinitiation of Consultation

This concludes formal consultation on the proposed action. As provided in 50 CFR 402.16, reinitiation of formal consultation is required if discretionary federal action agency involvement or control over the action has been retained, or is authorized by law, and if (1) the amount or extent of the taking specified in the incidental take statement is exceeded; (2) new information reveals effects of the agency action that may affect listed species or designated critical habitat in a manner or to an extent not previously considered in this Opinion; (3) the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in the Opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, F/SER2 must immediately request reinitiation of formal consultation.

In addition to the reinitiation criteria provided above, numerical reinitiation triggers have been developed for NARWs. The trigger is greater than one NARW entangled in BSB trap/pot gear or gear consistent with BSB trap/pot over the next 25 year period. This trigger metric is based on calculations of potential take in the BSB trap/pot fishery as described in the Effects to NARWs chapter, section 5.1. Reinitiation will be required if NMFS determines that greater than one NARW is entangled in BSB trap/pot gear or gear consistent with BSB trap/pot over the next 25 year period.

In summary, reinitiation of formal consultation is required if:

- Greater than one NARW is entangled in BSB trap/pot gear or gear consistent with BSB trap/pot over the next 25 year period.;
- Any of the standard four re-initiation triggers identified above are met.

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Appendix 1. Regulatory Measures

Document	All Actions Effective Date:	Proposed Rule Final Rule	Major Actions (Note that not all details are provided here. Please refer to Proposed and Final Rules for all impacts of listed documents.)
FMP (1983)	08/31/83	PR: 48 FR 26843 FR: 48 FR 39463	-12-inch (in) total length (TL) limit – red snapper, yellowtail snapper, red grouper, Nassau grouper; -8-in limit – black sea bass; -4-in trawl mesh size; -Gear limitations – poisons, explosives, fish traps, trawls; -Designated modified habitats or artificial reefs as Special Management Zones (SMZs).
Regulatory Amendment #1 (1987)	03/27/87	PR: 51 FR 43937 FR: 52 FR 9864	-Prohibited fishing in SMZs except with hand-held hook-and-line and spearfishing gear; -Prohibited harvest of goliath grouper in SMZs.
Amendment #1 (1988)	01/12/89	PR: 53 FR 42985 FR: 54 FR 1720	-Prohibited trawl gear to harvest fish south of Cape Hatteras, NC, and north of Cape Canaveral, FL; -Directed fishery defined as vessel with trawl gear and ≥ 200 lb s-g on board; -Established rebuttable assumption that vessel with s-g on board had harvested such fish in the exclusive economic zone (EEZ).
Regulatory Amendment #2 (1988)	03/30/89	PR: 53 FR 32412 FR: 54 FR 8342	-Established 2 artificial reefs off Ft. Pierce, FL as SMZs.
Emergency Rule	8/3/90	55 FR 32257	-Added wreckfish to the fishery management unit (FMU); -Fishing year beginning 4/16/90; -Commercial quota of 2 million pounds (lb); -Commercial trip limit of 10,000 lb per trip.
Fishery Closure Notice	8/8/90	55 FR 32635	- Fishery closed because the commercial quota of 2 million lb was reached.
Notice of Control Date	09/24/90	55 FR 39039	-Anyone entering federal wreckfish fishery in the EEZ off S. Atlantic states after 09/24/90 was not assured of future access if limited entry program developed.
Amendment #2 (1990)	10/30/90	PR: 55 FR 31406 FR: 55 FR 46213	-Prohibited harvest/possession of goliath grouper in or from the EEZ; -Defined overfishing for goliath grouper and other species.
Emergency Rule Extension	11/1/90	55 FR 40181	-Extended the measures implemented via emergency rule on 8/3/90.
Regulatory	11/02/90	PR: 55 FR 28066	-Established artificial reef at Key Biscayne, FL as SMZ;

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Amendment #3 (1989)		FR: 55 FR 40394	-Fish trapping, bottom longlining, spear fishing, and harvesting of Goliath grouper prohibited in SMZ.
Amendment #3 (1990)	01/31/91	PR: 55 FR 39023 FR: 56 FR 2443	-Added wreckfish to the FMU; -Defined optimum yield and overfishing; -Required permit to fish for, land, or sell wreckfish; -Required catch and effort reports from selected, permitted vessel; -Established control date of 03/28/90; -Established a fishing year for wreckfish starting April 16; -Established a process to set annual quota, with initial quota of 2 million lb; provisions for closure; -Established 10,000-lb trip limit; -Established a spawning season closure for wreckfish from January 15 to April 15; -Provided for annual adjustments of wreckfish management measures.
Notice of Control Date	07/30/91	56 FR 36052	-Anyone entering federal snapper grouper fishery (other than for wreckfish) in the EEZ off S. Atlantic states after 07/30/91 was not assured of future access if limited entry program developed.
Amendment #4 (1991)	01/01/92	PR: 56 FR 29922 FR: 56 FR 56016	-Prohibited gear: fish traps except black sea bass traps north of Cape Canaveral, FL; entanglement nets; longline gear inside 50 fathoms; bottom longlines to harvest wreckfish; powerheads and bangsticks in designated SMZs off S. Carolina. -Defined overfishing/overfished and established rebuilding timeframe: red snapper and groupers ≤ 15 years (year 1 = 1991); other snappers, greater amberjack, black sea bass, red porgy ≤ 10 years (year 1 = 1991); -Required permits (commercial & for-hire) and specified data collection regulations; -Established an assessment group and annual adjustment procedure (framework); -Permit, gear, and vessel ID requirements specified for black sea bass traps; -No retention of snapper grouper spp. caught in other fisheries with gear prohibited in snapper grouper fishery if captured snapper grouper had no bag limit or harvest was prohibited. If had a bag limit, could retain only the bag limit; -8-in TL limit – lane snapper; -10-in TL limit – vermilion snapper (recreational only); -12-in TL limit – red porgy, vermilion snapper (commercial only), gray, yellowtail, mutton, schoolmaster, queen, blackfin, cubera, dog, mahogany, and silk snappers; -20-in TL limit – red snapper, gag, and red, black, scamp, yellowfin, and yellowmouth

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			groupers; -28-in fork length (FL) limit – greater amberjack (recreational only); -36-in FL or 28-in core length – greater amberjack (commercial only); -Bag limits – 10 vermilion snapper, 3 greater amberjack -Aggregate snapper bag limit – 10/person/day, excluding vermilion snapper and allowing no more than 2 red snappers; -Aggregate grouper bag limit – 5/person/day, excluding Nassau and goliath grouper, for which no retention (recreational & commercial) is allowed; -Spawning season closure – commercial harvest greater amberjack > 3 fish bag prohibited in April south of Cape Canaveral, FL; -Spawning season closure – commercial harvest mutton snapper > snapper aggregate prohibited during May and June; -Charter/headboats and excursion boat possession limits extended.
Amendment #5 (1992)	04/06/92	PR: 56 FR 57302 FR: 57 FR 7886	For wreckfish: -Established limited entry system with individual transferable quotas (ITQs); -Required dealer to have permit; -Rescinded 10,000-lb trip limit; -Required off-loading between 8 am and 5 pm; -Reduced occasions when 24-hour advance notice of offloading required for off-loading; -Established procedure for initial distribution of percentage shares of total allowable catch (TAC).
Emergency Rule	8/31/92	57 FR 39365	For black sea bass (bsb): -Modified definition of bsb pot; -Allowed multi-gear trips for bsb; -Allowed retention of incidentally-caught fish on bsb trips.
Emergency Rule Extension	11/30/92	57 FR 56522	For Black Sea Bass: -Modified definition of bsb pot; -Allowed multi-gear trips for bsb; -Allowed retention of incidentally-caught fish on bsb trips.
Regulatory Amendment #4 (1992)	07/06/93	FR: 58 FR 36155	-For Black Sea Bass: -Modified definition of bsb pot; -Allowed multi-gear trips for bsb; -Allowed retention of incidentally-caught fish on bsb trips.

Document	All Actions Effective Date:	Proposed Rule Final Rule	Major Actions (Note that not all details are provided here. Please refer to Proposed and Final Rules for all impacts of listed documents.)
Regulatory Amendment #5 (1992)	07/31/93	PR: 58 FR 13732 FR: 58 FR 35895	-Established 8 SMZs off South Carolina, where only hand-held, hook-and-line gear and spearfishing (excluding powerheads) was allowed.
Amendment #6 (1993)	07/27/94	PR: 59 FR 9721 FR: 59 FR 27242	-Set up separate commercial TAC levels for golden tilefish and snowy grouper; -Established commercial trip limits for snowy grouper, golden tilefish, speckled hind, and warsaw grouper; -Included golden tilefish in grouper recreational aggregate bag limits; -Prohibited sale of warsaw grouper and speckled hind; -100% logbook coverage upon renewal of permit; -Creation of the *Oculina* Experimental Closed Area; -Data collection needs specified for evaluation of possible future individual fishing quota system.
Amendment #7 (1994)	01/23/95	PR: 59 FR 47833 FR: 59 FR 66270	-12-in FL – hogfish; -16-in TL – mutton snapper; -Required dealer, charter and headboat federal permits; -Allowed sale under specified conditions; -Specified allowable gear and made allowance for experimental gear; -Allowed multi-gear trips in NC; -Added localized overfishing to list of problems and objectives; -Adjusted bag limit and crew specs. for charter and head boats; -Modified management unit for scup to apply south of Cape Hatteras, NC; -Modified framework procedure.
Regulatory Amendment #6 (1994b)	05/22/95	PR: 60 FR 8620 FR: 60 FR 19683	-Established actions which applied only to EEZ off Atlantic coast of FL: Bag limits – 5 hogfish/person/day (recreational only), 2 cubera snapper/person/day > 30-in TL; 12-in TL – gray triggerfish.
Notice of Control Date	04/23/97	62 FR 22995	-Anyone entering federal black sea bass pot fishery off South Atlantic states after 04/23/97 was not assured of future access if limited entry program developed.
Interim Rule Request	1/16/98		-The South Atlantic Fishery Management Council (Council) requested all Amendment 9 measures except black sea bass pot construction changes implemented as an interim request under the Magnuson-Stevens Act.
Action Suspended	5/14/98		-NMFS informed the Council that action on the interim rule request was suspended.
Emergency Rule	9/24/98		-Council requested Amendment 9 implementation via emergency rule.

Document	All Actions Effective Date:	Proposed Rule Final Rule	Major Actions (Note that not all details are provided here. Please refer to Proposed and Final Rules for all impacts of listed documents.)
Request			
Amendment #8 (1997)	12/14/98	PR: 63 FR 1813 FR: 63 FR 38298	-Established program to limit initial eligibility for snapper grouper fishery: -Must have demonstrated landings of any species in the snapper grouper FMU in 1993, 1994, 1995 or 1996; and have held valid snapper grouper permit between 02/11/96 and 02/11/97; -Granted transferable permit with unlimited landings if vessel landed ≥ 1,000 lb of snapper grouper species in any of the years; -Granted non-transferable permit with 225-lb trip limit to all other vessels; -Modified problems, objectives, optimum yield (OY), and overfishing definitions; -Expanded the Council's habitat responsibility; -Allowed retention of snapper grouper species in excess of bag limit on permitted vessel with a single bait net or cast nets on board; -Allowed permitted vessels to possess filleted fish harvested in The Bahamas under certain conditions.
Request not Implemented	1/22/99		-NMFS informed the Council that the Final Rule for Amendment 9 would be effective 2/24/99; therefore they did not implement the emergency rule.
Regulatory Amendment #7 (1998a)	01/29/99	PR: 63 FR 43656 FR: 63 FR 71793	-Established 10 SMZs at artificial reefs off South Carolina.

Document	All Actions Effective Date:	Proposed Rule Final Rule	Major Actions (Note that not all details are provided here. Please refer to Proposed and Final Rules for all impacts of listed documents.)
Amendment #9 (1998)	2/24/99	PR: 63 FR 63276 FR: 64 FR 3624	-Red porgy: 14-in TL (recreational and commercial); 5 fish rec. bag limit; no harvest or possession > bag limit, and no purchase or sale, in March and April; -Black sea bass: 10-in TL (recreational and commercial); 20 fish rec. bag limit; required escape vents and escape panels with degradable fasteners in bsb pots; -Greater amberjack: 1 fish rec. bag limit; no harvest or possession > bag limit, and no purchase or sale, during April; quota = 1,169,931 lb; began fishing year May 1; prohibited coring; -Specified size limits for several snapper grouper species (indicated in parentheses [inches TL]): including yellowtail snapper (12), mutton snapper (16), red snapper (20); red grouper, yellowfin grouper, yellowmouth grouper, and scamp (20) ; -Vermilion snapper: 11-in TL (recreational), 12-in TL commercial; -Gag: 24-in TL (recreational); no commercial harvest or possession > bag limit, and no purchase or sale, during March and April; -Black grouper: 24-in TL (recreational and commercial); no harvest or possession > bag limit, and no purchase or sale, during March and April; -Gag and Black grouper: within 5 fish aggregate grouper bag limit, no more than 2 fish may be gag or black grouper (individually or in combination); -All snapper grouper without a bag limit: aggregate recreational bag limit 20 fish/person/day, excluding tomtate and blue runner; -Vessels with longline gear aboard may only possess snowy, warsaw, yellowedge, and misty grouper, and golden, blueline and sand tilefish.
Emergency Action	9/3/99	64 FR 48326	-Reopened the Amendment 8 permit application process.
Emergency Interim Rule	09/08/99, expired 08/28/00	64 FR 48324 and 65 FR 10040	-Prohibited harvest or possession of red porgy.

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Amendment #11 Comprehensive Sustainable Fisheries Act Amendment (1998)	12/02/99	PR: 64 FR 27952 FR: 64 FR 59126	-Maximum sustainable yield (MSY) proxy: goliath and Nassau grouper = 40% static spawning potential ratio (SPR); all other species = 30% static SPR; -OY: hermaphroditic groupers = 45% static SPR; goliath and Nassau grouper = 50% static SPR; all other species = 40% static SPR -Overfished/overfishing evaluations: BSB: overfished (minimum stock size threshold (MSST)=3.72 mp, 1995 biomass=1.33 mp); undergoing overfishing (maximum fishing mortality threshold (MFMT)=0.72, F1991-1995=0.95) Vermilion snapper: overfished (static SPR = 21-27%) Red porgy: overfished (static SPR = 14-19%). Red snapper: overfished (static SPR = 24-32%) Gag: overfished (static SPR = 27%) Scamp: no longer overfished (static SPR = 35%) Speckled hind: overfished (static SPR = 8-13%) Warsaw grouper: overfished (static SPR = 6-14%) Snowy grouper: overfished (static SPR = 5-15%) White grunt: no longer overfished (static SPR = 29-39%) Golden tilefish: overfished (couldn't estimate static SPR) Nassau grouper: overfished (couldn't estimate static SPR) Goliath grouper: overfished (couldn't estimate static SPR) -overfishing level: goliath and Nassau grouper = F > F40% static SPR; all other species: = F > F30% static SPR Approved definitions for overfished and overfishing. MSST = [(1-M) or 0.5 whichever is greater]* B_{MSY}. MFMT = $F_{MSY.}$
Amendment #10 Comprehensive Essential Fish Habitat Amendment (1998)	07/14/00	PR: 64 FR 37082 and 64 FR 59152 FR: 65 FR 37292	-Identified essential fish habitat (EFH) and established habitat areas of particular concern (HAPC) for species in the snapper grouper FMU.

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Amendment #12 (2000)	09/22/00	PR: 65 FR 35877 FR: 65 FR 51248	For Red porgy: -MSY=4.38 mp; OY=45% static SPR; MFMT=0.43; MSST=7.34 mp; rebuilding timeframe=18 years (1999=year 1); -no sale of red porgy during Jan-April; -1 fish bag limit; -50-lb bycatch commercial trip limit May-December; -Modified management options and list of possible framework actions.
Amendment #9 (1998) resubmitted	10/13/00	PR: 63 FR 63276 FR: 65 FR 55203	-Commercial trip limit for greater amberjack.
Regulatory Amendment #8 (2000)	11/15/00	PR: 65 FR 41041 FR: 65 FR 61114	-Established 12 SMZs at artificial reefs off Georgia; revised boundaries of 7 existing SMZs off Georgia to meet CG permit specs; restricted fishing in new and revised SMZs.
Amendment #13A (2003)	04/26/04	PR: 68 FR 66069 FR: 69 FR 15731	-Extended for an indefinite period the regulation prohibiting fishing for and possessing snapper grouper species within the *Oculina* Experimental Closed Area.
Notice of Control Date	10/14/05	70 FR 60058	-Considered management measures to further limit participation or effort in the commercial fishery for snapper grouper species (excluding wreckfish).
Amendment #13C (2006)	10/23/06	PR: 71 FR 28841 FR: 71 FR 55096	-End overfishing of snowy grouper, vermilion snapper, black sea bass, and golden tilefish. Increase allowable catch of red porgy. Year 1 = 2006; 1. Snowy Grouper Commercial: -Quota = 151,000-lb gutted weight (gw) in year 1, 118,000-lb gw in year 2, and 84,000- lb gw in year 3 onwards. -Trip limit = 275-lb gw in year 1, 175-lb gw in year 2, and 100-lb gw in year 3 onwards; Recreational: -Limit possession to one snowy grouper in 5 grouper per person/day aggregate bag limit; 2. Golden Tilefish

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			Commercial: Quota of 295,000-lb gw, 4,000 lb gw trip limit until 75% of the quota is taken when the trip limit is reduced to 300-lb gw. Do not adjust the trip limit downwards unless 75% is captured on or before September 1; Recreational: Limited possession to 1 golden tilefish in 5 grouper per person/day aggregate bag limit; 3. Vermilion Snapper Commercial: Quota of 1,100,000-lb gw; Recreational: 12-in TL size limit. 4. Black Sea Bass Commercial: Quota of 477,000-lb gw in year 1, 423,000 lb gw in year 2, and 309,000-lb gw in year 3 onwards; -Required use of at least 2-in mesh for the entire back panel of black sea bass pots effective 6 months after publication of the Final Rule; -Required black sea bass pots be removed from the water when the quota is met; -Changed fishing year from calendar year to June 1 – May 31; Recreational: Recreational allocation of 633,000-lb gw in year 1, 560,000-lb gw in year 2, and 409,000-lb gw in year 3 onwards. Increase minimum size limit from 10-in to 11-in for year 1 and to 12-in for year 2; -Reduced recreational bag limit from 20 to 15 per person per day; -Changed fishing year from the calendar year to June 1 through May 31. 5. Red Porgy Commercial and recreational: -Retained 14-in TL size limit and seasonal closure (retention limited to the bag limit); -Specified a commercial quota of 127,000-lb gw and prohibit sale/purchase and prohibit harvest and/or possession beyond the bag limit when quota is taken and/or during January through April; -Increased commercial trip limit from 50-lb ww to 120 red porgy (210-lb gw) during May through December;--Increased recreational bag limit from one to three red porgy per person per day.
Notice of Control Date	3/8/07	72 FR 60794	-Considered measures to limit participation in the snapper grouper for-hire sector.

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Amendment #15A (2008)	3/14/08	73 FR 14942	- Established rebuilding plans and status determination criteria for snowy grouper, black sea bass, and red porgy.
Notice of Control Date	12/4/08	74 FR 7849	-Established a control date for the golden tilefish portion of the snapper grouper fishery in the South Atlantic.
Notice of Control Date	12/4/08	74 FR 7849	-Established control date for black sea bass pot sector in the South Atlantic.
Amendment #14 (2007)	2/12/09	PR: 73 FR 32281 FR: 74 FR 1621	-Established eight deepwater Type II marine protected areas (MPAs) to protect a portion of the population and habitat of long-lived deepwater snapper grouper species.
Amendment #16 (2009)	7/29/09	PR: 74 FR 6297 FR: 74 FR 30964	-Specified status determination criteria for gag and vermilion snapper; For gag: -Specified interim allocations 51% commercial & 49% recreational; -Recreational and commercial shallow water grouper spawning closure January through April; -Directed commercial quota = 352,940-lb gw; -Reduced 5-fish aggregate grouper bag limit, including tilefish species, to a 3-fish aggregate; -Captain and crew on for-hire trips cannot retain the bag limit of vermilion snapper and species within the 3-fish grouper aggregate; For vermilion snapper: -Specified interim allocations 68% commercial & 32% recreational; -Directed commercial quota split Jan-June =315,523-lb gw and 302,523-lb gw July-Dec; -Reduced bag limit from 10 to 5 and a recreational closed season November through March; -Required de-hooking tools.
Amendment #15B (2008)	2/15/10	PR: 74 FR 30569 FR: 74 FR 58902	-Prohibited the sale of bag-limit caught snapper grouper species; -Reduced the effects of incidental hooking on sea turtles and smalltooth sawfish; -Adjusted commercial renewal periods and transferability requirements; -Implemented plan to monitor and assess bycatch; -Established reference points for golden tilefish; -Established allocations for snowy grouper (95% commercial & 5% recreational) and red porgy (50% commercial & 50% recreational).

Document	All Actions Effective Date:	Proposed Rule Final Rule	Major Actions (Note that not all details are provided here. Please refer to Proposed and Final Rules for all impacts of listed documents.)
Amendment #19 Comprehensive Ecosystem-Based Amendment 1 (CE-BA1) (2009)	7/22/10	PR: 75 FR 14548 FR: 75 FR 35330	-Provided presentation of spatial information for EFH and EFH-HAPC designations under the Snapper Grouper FMP; -Designation of deepwater coral HAPCs.
Amendment #17A (2010)	12/3/10 red snapper closure; circle hooks 3/3/2011	PR: 75 FR 49447 FR: 75 FR 76874	-Required use of non-stainless steel circle hooks when fishing for snapper grouper species with hook-and-line gear north of 28˚N latitude in the South Atlantic EEZ; -Specified an annual catch limit (ACL) and an accountability measure (AM) for red snapper with management measures to reduce the probability that catches will exceed the stocks' ACL; -Specified a rebuilding plan for red snapper; -Specified status determination criteria for red snapper; -Specified a monitoring program for red snapper.
Emergency Rule	12/3/10	75 FR 76890	-Delayed the effective date of the area closure for snapper grouper species implemented through Amendment 17A.
Amendment #17B (2010)	1/30/11	PR: 75 FR 62488 FR: 75 FR 82280	-Specified ACLs, annual catch targets (ACT), and AMs, where necessary, for 9 species undergoing overfishing; -Modified management measures as needed to limit harvest to the ACL or ACT; -Updated the framework procedure for specification of total allowable catch; -Prohibited harvest of 6 deepwater species seaward of 240 feet to curb bycatch of speckled hind and warsaw grouper.
Regulatory Amendment #10 (2010)	5/31/11	PR: 76 FR 9530 FR: 76 FR 23728	-Eliminated closed area for snapper grouper species approved in Amendment 17A.

Document	All Actions Effective Date:	Proposed Rule Final Rule	Major Actions (Note that not all details are provided here. Please refer to Proposed and Final Rules for all impacts of listed documents.)
Regulatory Amendment #9 (2011)	Bag limit: 6/22/11 Trip limits: 7/15/11	PR: 76 FR 23930 FR: 76 FR 34892	-Established trip limits for vermilion snapper and gag; -Increased trip limit for greater amberjack; -Reduced bag limit for black sea bass.
Amendment #23 Comprehensive Ecosystem-based Amendment 2 (CE-BA2) (2011)	1/30/12	PR: 76 FR 69230 FR: 76 FR 82183	-Designated the Deepwater MPAs as EFH-HAPCs; -Limit harvest of snapper grouper species in SC SMZs to the bag limit; -Modify sea turtle release gear.
Amendment # 25 Comprehensive Annual Catch Limit Amendment; (2011)	4/16/12	PR: 76 FR 74757 Amended PR: 76 FR 82264 FR: 77 FR 15916	-Established acceptable biological catch (ABC) control rules, establish ABCs, ACLs, and AMs for species not undergoing overfishing; -Removed some species from South Atlantic FMU and designate others as ecosystem component species; -Specified allocations between the commercial and, recreational sectors for species not undergoing overfishing; -Limited the total mortality for federally managed species in the South Atlantic to the ACLs.
Regulatory Amendment #11 (2011)	5/10/12	PR: 76 FR 78879 FR: 77 FR 27374	-Eliminated 240 ft harvest prohibition for 6 deepwater species.
Amendment #18A (2012)	7/1/12	PR: 77 FR 16991 FR: 77FR3 2408	-Limited participation and effort in the black sea bass sector (32 endorsements/vessels); -Modified management of the black sea bass pot sector (limited pots to 35 per vessel; required that pots be brought back to shore after each trip; modified AMs; established a 1,000-lb gw commercial trip limit; increased the recreational minimum size limit from 12-in to 13-in TL; and increased the commercial minimum size limit from 10-in to 11-in TL; -Improved the accuracy, timing, and quantity of fisheries statistics.

Document	All Actions Effective Date:	Proposed Rule Final Rule	Major Actions (Note that not all details are provided here. Please refer to Proposed and Final Rules for all impacts of listed documents.)
Amendment #24 (2011)	7/11/12	PR: 77 FR 19169 FR: 77 FR 34254	-Specified MSY, rebuilding plan (including ACLs, AMs, and OY, and allocations for red grouper.
Regulatory Amendment #12 (2012)	10/9/12	FR: 77 FR 61295	-Adjusted the ACL and OY for golden tilefish; -Considered specifying a commercial ACT; -Revised recreational AMs for golden tilefish;
Amendment #20A (2012)	10/26/12	PR: 77 FR 19165 FR: 77 FR 59129	-Redistributed latent shares for the wreckfish individual transfer quota (ITQ) program.
Amendment #18B (2013)	5/23/13	PR: 77 FR 75093 FR: 77 FR 23858	-Limited participation and effort in the golden tilefish commercial sector through establishment of a longline endorsement; -Modified trip limits; -Specified allocations for gear groups (longline and hook and line);
Regulatory Amendment #13 (2013)	7/17/13	PR: 78 FR 17336 FR: 78 FR 36113	-Revised the ABCs, ACLs (including sector ACLs), and ACTs implemented by the Comprehensive ACL Amendment. The revisions may prevent a disjunction between the established ACLs and the landings used to determine if AMs are triggered.
Amendment #28 (2013)	8/23/13	PR: 78 FR 25047 FR: 78 FR 44461	-Established regulations to allow harvest of red snapper in the South Atlantic.

Document	All Actions Effective Date:	Proposed Rule Final Rule	Major Actions (Note that not all details are provided here. Please refer to Proposed and Final Rules for all impacts of listed documents.)
Regulatory Amendment #18 (2013)	9/5/13	PR: 78 FR 26740 FR: 78 FR 47574	-Adjusted ACLs for vermilion snapper and red porgy, and remove the 4-month recreational closure for vermilion snapper.
Regulatory Amendment #15 (2013)	9/12/13	PR: 78 FR 31511 FR: 78 FR 49183	-Modified the existing specification of OY and ACL for yellowtail snapper in the South Atlantic; -Modified the existing gag commercial ACL and AM for gag that requires a closure of all other shallow water groupers (black grouper, red grouper, scamp, red hind, rock hind, graysby, coney, yellowmouth grouper, and yellowfin grouper) in the South Atlantic when the gag commercial ACL is met or projected to be met.
Regulatory Amendment #19 (2013)	ACL: 9/23/13 Pot closure: 10/23/13	PR: 78 FR 39700 FR: 78 FR 58249	-Adjusted the ACL for black sea bass and implement an annual closure on the use of black sea bass pots from November 1 to April 30.
Amendment #27 (2014)	1/27/2014	PR:78 FR 78770 FR: 78 FR 57337	-Established the South Atlantic Council as the responsible entity for managing Nassau grouper throughout its range including federal waters of the Gulf of Mexico; -Modified the crew member limit on dual-permitted snapper grouper vessels; -Modified the restriction on retention of bag limit quantities of some snapper grouper species by captain and crew of for-hire vessels; -Minimized regulatory delay when adjustments to snapper grouper species' ABC, ACLs, and ACTs are needed as a result of new stock assessments; -Addressed harvest of blue runner by commercial fishers who do not possess a South Atlantic Snapper Grouper Permit.
Amendment #31 Joint South Atlantic and Gulf of Mexico Generic Headboat Reporting	1/27/2014	PR:78 FR 59641 FR: 78 FR 78779	-Included under the Generic charter/headboat reporting amendment, that modified required logbook reporting for headboat vessels to require electronic reporting, regarding snapper grouper landings.

Document	All Actions Effective Date:	Proposed Rule Final Rule	Major Actions (Note that not all details are provided here. Please refer to Proposed and Final Rules for all impacts of listed documents.)
Amendment (2013)			
Blueline Tilefish Emergency Rule	4/17/2014 through 10/10/2014 or 4/18/2015	PR: 79 FR 21636 FR:79 FR 61262	-Removed the blueline tilefish portion from the deep-water complex ACL; -Established separate commercial and recreational ACLs and AMs for blueline tilefish.
Regulatory Amendment # 21	11/6/2014	PR: 79 FR 44735 FR: 79 FR 60379	-Modified the definition of the overfished threshold for red snapper, blueline tilefish, gag, black grouper, yellowtail snapper, vermilion snapper, red porgy, and greater amberjack
Regulatory Amendment #14	12/8/2014	PR: 79 FR 22936 FR: 79 FR 66316	-Modified the fishing year for greater amberjack; -Modified the fishing year for black sea bass; -Modified the AMs for vermilion snapper and black sea bass; -Modify the trip limit for gag.
Amendment #32	3/30/2015	PR: 80 FR 3207 FR: 80 FR 16583	-End overfishing of blueline tilefish; -Separated blueline tilefish from the deepwater complex; -Specified ACLs for blueline tilefish and the deepwater complex; -Specified AMs for blueline tilefish; -Revised AMs for the deepwater complex; -Specify recreational ACTs for blueline tilefish.
Amendment #29	7/1/2015	NOA:79 FR 69819 PR: 79 FR 72567 FR: 80 FR 30947	-Updated the Council's ABC control rule to incorporate methodology for determining the ABC of unassessed species, adjust ABCs for 14 unassessed snapper-grouper species, adjust ACLs and ACTs for 3 species complexes and four snapper-grouper species based on revised ABCs; -Modified and implement gray triggerfish minimum size limits; -Established a commercial split season and commercial trip limits for gray triggerfish.

Document	All Actions Effective Date:	Proposed Rule Final Rule	Major Actions (Note that not all details are provided here. Please refer to Proposed and Final Rules for all impacts of listed documents.)
Regulatory Amendment #22	Effective September 11, 2015, except for the amendments to §§ 622.190(b) and 622.193(r)(1) which were effective August 12, 2015	PR:80 FR 31880 FR:80 FR 48277	-Adjusted ACLs and OY for gag and wreckfish; -Modified the gag bag limit within the aggregate grouper bag limit.
Regulatory Amendment #20	8/20/2015	PR: 80 FR 18797 FR: 80 FR 43033	-Increased the recreational and commercial ACLs for snowy grouper; -Adjusted the rebuilding strategy; -Increased the commercial trip limit; -Modified the recreational fishing season.
Amendment # 33 Dolphin Wahoo Amendment 7 and Snapper Grouper Amendment 33	12/28/2015	NOA:80 FR 55819 PR:80 FR 60601 FR:80 FR 80686	-Allowed dolphin and wahoo fillets to enter the U.S. EEZ after lawful harvest in The Bahamas; -Specified the condition of any dolphin, wahoo, and snapper-grouper fillets; -Described how the recreational bag limit is determined for any fillets; -explicitly prohibited the sale or purchase of any dolphin, wahoo, or snapper-grouper recreationally harvested in The Bahamas; -Specified the required documentation to be onboard any vessels that have these fillets; -Specified transit and stowage provisions for any vessels with fillets.
Amendment #34 Generic Accountability Measures and Dolphin Allocation Amendment	2/22/2016	NOA:80 FR 41472 PR:80 FR 58448 FR:81 FR 3731	-Modified AMs for snapper-grouper species; -Modified the AM for commercial golden crab fishery; -Adjusted sector allocations for dolphin.

Appendix 2 - Anticipated Incidental Take of ESA-Listed Species in Federal Fisheries

Fishery	ITS Authorization Period	Sea Turtle Species				
		Loggerhead (NWA DPS)	Leatherback	Kemp's ridley	Green (NA DPS)	Hawksbill
Batched Consultation* (gillnet) [NER]	1 Year	269-No more than 167 lethal (Takes based on a 5-yr average)	4-No more than 3 lethal	4-No more than 3 lethal	4-No more than 3 lethal	None
Batched Consultation* (bottom trawl) [NER]	1 Year	213-No more than 71 lethal (Takes based on a 4-yr average)	4-No more than 2 lethal	3-No more than 2 lethal	3-No more than 2 lethal	None
Batched Consultation* (trap/pot) [NER]	1 Year	1-Lethal or nonlethal	4-Lethal or nonlethal	None	None	None
Coastal Migratory Pelagics [SER]	3 Years	27 Total, 7 lethal	1- Lethal	8- Total, 2 lethal	31-Total, 9 lethal	1- Lethal
Dolphin-Wahoo [SER]	1 Year	12-No more than 2 lethal	12-No more than 1 lethal	3 for all species in combination-no more than 1 lethal take		
HMS-Pelagic Longline [SER]	3 Years	1,905-No more than 339 lethal	1,764-No more than 252 lethal	105-No more than 18 lethal for these species in combination		
HMS-Shark Fisheries [SER]	3 Years	126-No more than 78 lethal	18-No more than 9 lethal	36-No more than 21 lethal	57-No more than 33 lethal	18-No more than 9 lethal
Red Crab [NER]	1 Year	1-Lethal or nonlethal	1-Lethal or nonlethal	None	None	None

* Batched consultation includes the Northeast Multispecies, Monkfish, Spiny Dogfish, Atlantic Bluefish, Northeast Skate Complex, Mackerel/Squid/Butterfish, and Summer Flounder/Scup/Black Sea Bass Fisheries

Anticipated Incidental Takes of Sea Turtles, continued

Fishery	ITS Authorization Period	Sea Turtle Species				
		Loggerhead	Leatherback	Kemp's ridley	Green	Hawksbill
South Atlantic Snapper-Grouper [SER] (Up until this current consultation was conducted).	3 Years	202-No more than 67 lethal	25-No more than 15 lethal	19-No more than 8 lethal	39-No more than 14 lethal	4-No more than 1 lethal
Southeastern U.S. Shrimp [SER]	1 Year	Anticipated shrimp trawl effort (i.e., 132,900 days fished in the Gulf of Mexico and 14,560 trips in the south Atlantic) and fleet TED compliance (i.e., compliance resulting in overall average sea turtle catch rates in the shrimp otter trawl fleet at or below 12%) are used as surrogates for numerical sea turtle take levels.				
Atlantic Sea Scallop – Dredge [NER]	1 Year	161 – No more than 46 lethal	2 –Lethal Takes (gears combined)	3 – No more than 2 Lethal (gears combined)	2 - Lethal takes (gears combined)	None
Atlantic Sea Scallop – Trawl [NER]	1 Year	140 – No more than 66 lethal				None

* Batched consultation includes the Northeast Multispecies, Monkfish, Spiny Dogfish, Atlantic Bluefish, Northeast Skate Complex, Mackerel/Squid/Butterfish, and Summer Flounder/Scup/Black Sea Bass Fisheries

Anticipated Incidental Take of Smalltooth Sawfish

Fishery	3-Year Incidental Take of Smalltooth Sawfish
ATLANTIC HMS-SHARK FISHERIES	32– No more than 7 lethal takes
COASTAL MIGRATORY PELAGICS	1 Nonlethal takes
SOUTH ATLANTIC SNAPPER-GROUPER (UP UNTIL THIS CURRENT CONSULTATION)	8 Nonlethal takes
SOUTHEASTERN U.S. SHRIMP	288– No more than 105 lethal takes

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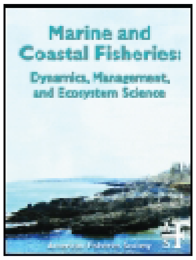

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Evaluation of Alternatives to Winter Closure of Black Sea Bass Pot Gear: Projected Impacts on Catch and Risk of Entanglement with North Atlantic Right Whales Eubalaena glacialis

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