Endangered Species Act - Section 7 Consultation
Biological Opinion

Action Agency:	National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Highly Migratory Species Division
Activity:	Continued Authorization of the Atlantic Shark Fisheries via the Consolidated HMS Fishery Management Plan as Amended by Amendments 3 and 4 and the Federal Authorization of a Smoothhound Fishery (F/SER/2011/06520)
Consulting Agency:	National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Protected Resources Division
Approved by:	Roy E. Crabtree, Ph.D., Regional Administrator
Date Issued:	DEC 12 2012

List of Frequently Used Acronyms

ACCSP	Atlantic Coastal Cooperative Statistics Program
ALWTRP	Atlantic Large Whale Take Reduction Plan
ALWTRT	Atlantic Large Whale Take Reduction Team
ASMFC	Atlantic States Marine Fisheries Commission
CCL	Curved Carapace Length
COE	United States Army Corps of Engineers
CPUE	Catch Per Unit Effort
CSFOP	Commercial Shark Fishery Observer Program
DAM	Dynamic Area Management
DPS	Distinct Population Segment
DWH	Deepwater Horizon
EFP	Exempted Fishing Permit
EEZ	Exclusive Economic Zone
EPA	Environmental Protection Agency
ESA	Endangered Species Act of 1973
F/SF1	Highly Migratory Species Division
F/SER3	Southeast Regional Office-Protected Resources Divison
FMP	Fishery Management Plan
HMS	Highly Migratory Species
ITS	Incidental Take Statement
LCS	Large Coastal Sharks
LOF	List of Fisheries
LPS	Large Pelagics Survey
MMPA	Marine Mammal Protection Act of 1972
MRIP	Marine Recreational Information Program
MSA	Mixed Stock Analysis
MSFCA	Magnuson-Stevens Fishery Conservation and Management Act
NEFOP	Northeast Fisheries Observer Program
NER	Northeast Regional Office
NSED	National Sawfish Encounter Database
PCB	Polycholrinatedbiphenyl
PRD	Protected Resources Division
RPA	Reasonable and Prudent Alternatives
SAM	Seasonal Area Management
SAR	Stock Assessment Report
SCL	Straight Carapace Length
SCS	Small Coastal Sharks
SEFSC	Southeast Fisheries Science Center
SGOP	Shark Gillnet Observer Program
SI/M	Serious Injury or Mortality
STSSN	Sea Turtle Stranding and Salvage Network
TED	Turtle Excluder Device
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
USN	United States Navy
VTR	Vessel Trip Reporting Program
YOY	Young of the Year

Introduction

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. § 1531 *et seq*.), requires that each federal agency ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or to result in the destruction or adverse modification of any designated critical habitat of such species. National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) share responsibilities for administering the ESA. When the action of a federal agency may affect a species or designated critical habitat protected under the ESA, that agency is required to consult with either NMFS or USFWS, depending on the species and/or critical habitat that may be affected.

Consultations on most listed species and critical habitat in the marine environment are conducted between the action agency and NMFS. Consultations are concluded after NMFS determines that an action is not likely to adversely affect listed species or critical habitat, or issues a biological 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 likely, the opinion must identify reasonable and prudent alternatives (RPAs) to the action, if any, that would avoid such impacts. The opinion also includes an incidental take statement (ITS) specifying the amount or extent of incidental taking that may result from the proposed action. Non-discretionary reasonable and prudent measures to minimize the impact of incidental taking are included, and conservation recommendations are made. No incidental destruction or adverse modification of critical habitat can be authorized. Therefore, there are no reasonable and prudent measures, only RPAs that must avoid destruction or adverse modification.

This document represents NMFS' opinion based on our review of the potential effects from the authorization of a smoothhound (*Mustelus canis*) fishery in federal waters, under Amendment 3 to the Consolidated Highly Migratory Species (HMS) Fishery Management Plan (FMP), and the continued authorization of the federal Atlantic shark fisheries 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 Magnuson-Stevenson Fishery Conservation and Management Act (MSFCA) (16 U.S.C. §1801 *et seq*.) and the consulting agency under the ESA. For the purposes of this consultation, the Highly Migratory Species Division (F/SF1) is considered the action agency and the consulting agency is the Southeast Regional Office-Protected Resources Divison (F/SER3).

This opinion is based on information provided in sea turtle, smalltooth sawfish, and large whale recovery plans; past and current sea turtle, large whale, smalltooth sawfish, and Atlantic sturgeon research; population modeling efforts; and other relevant scientific data and reports cited in the Literature Cited (Section 12) section of this document.

1.0 Consultation History

On May 20, 2008, NMFS completed the last formal consultation on the Atlantic shark fisheries. The opinion (hereafter, the 2008 opinion) concluded that the continued authorization of the shark fisheries as managed under the Consolidated HMS FMP, including Amendment 2, was not likely to jeopardize the continued existence of green, hawksbill, Kemp's ridley, leatherback, or loggerhead sea turtles or smalltooth sawfish. An ITS was issued specifying the amount and extent of anticipated take on a three-year basis, along with RPMs and associated terms and conditions deemed necessary and appropriate to minimize the impact of these takes. Other listed species were found to be not likely to be adversely affected. No critical habitat overlapped with the action area, thus none was affected.

In a February 12, 2009, memorandum, F/SF1 supplied a list of management measures under consideration for Amendment 3 to the Consolidated HMS FMP. The memorandum requested a consultation assessment be conducted to determine if any of the proposed measures would trigger the need to reinitiate Section 7 consultation on the May 2008 biological opinion on the effects of Atlantic shark fisheries on listed species and critical habitat.

Amendment 3 to the Consolidated HMS FMP (74 FR 36892; July 24, 2009) would implement measures to bring smoothhound sharks under federal management and end overfishing of blacknose and shortfin mako sharks. The amendment would also implement measures to rebuild blacknose sharks consistent with the 2007 small coastal shark (SCS) stock assessment, the MSFCA, and other domestic law. Specifically, Amendment 3 would: (1) establish quotas for blacknose sharks and non-blacknose SCS, (2) take action at the international level to end overfishing of shortfin mako through participation in appropriate international fisheries organizations, (3) implement a federal permit for the smoothhound fishery, (4) establish a commercial quota for smoothhound, and (5) establish a separate, 6-metric-ton (mt) whole weight (ww), smoothhound set-aside quota for the exempted fishing program.

F/SER3 responded to the consultation assessment request via phone conversations in late March 2009. F/SER3 and F/SF1 held meetings and exchanged e-mails during May 2009 to discuss and resolve potential issues related to management measures proposed under Amendment 3. During these meetings and in subsequent discussions, F/SF1 was informed F/SER3 did not believe that reinitiation of consultation was required based on the information provided.

In a July 31, 2009, memorandum, F/SF1 requested F/SER3 review the Draft Environmental Impact Statement (DEIS) and related proposed rule with respect to 2008 Section 7 consultation on the Atlantic shark fisheries. The memorandum stated Amendment 3 was not likely to adversely affect any listed species or designated critical habitat because it would cause no effects that were not previously considered in the May 2008 biological opinion for the Atlantic shark fisheries. The memorandum stated that since the completion of the May 2008 biological opinion, the level of authorized incidental take had not been exceeded and there was no new information indicating the action was affecting ESA-listed species in a way not previously considered. Additionally, the action had not been modified in any way causing effects not previously considered, and no new species had been listed or critical habitat designated that may be affected by the action. Therefore, none of the reinitiation criteria at 50 CFR 402.16 had been met.

In late August 2009, F/SER3 contacted F/SF1 to indicate that additional consultation might be required to address potential effects from the authorization of a new federal fishery for smoothhound. Discussions continued throughout September and October regarding whether the impacts of the smoothhound fishery on protected resources were considered in other biological opinions conducted for other federal fisheries that are fished in a similar manner and region.

In an October 26, 2009, e-mail, F/SF1 informed F/SER3 that, as a result of public comment, some of the preferred alternatives identified in the DEIS (e.g., prohibiting gillnet gear south of North Carolina and some shark quota levels) were unlikely to be alternatives selected in the Final EIS (FEIS). Other measures, such as those authorizing a smoothhound fishery, would likely remain unchanged in the FEIS.

In a November 13, 2009, memorandum (see Appendix 1), F/SER3 responded to F/SF1's July 31, 2009, memorandum and the October 26, 2009, e-mail. F/SER3 concurred with F/SF1's determination in the July 31, 2009, memorandum that the measures in Amendment 3 to rebuild blacknose shark stocks and end overfishing of blacknose sharks and shortfin mako sharks did not trigger any of the criteria at 50 CFR 402.16. However, F/SER3 stated that authorizing a federal fishery for smoothhound likely represented new federal activity for which effects to listed species and designated critical habitat had not been evaluated. F/SER3 recommended F/SF1 review that portion of the proposed action to determine if it required consultation. F/SER3 also requested specific information regarding the smoothhound management measures likely to be selected in the FEIS, any available information on the operation of the smoothhound fishery, and potential routes of effects to protected species so a detailed effects analysis could be conducted.

F/SF1 responded by requesting consultation in a December 4, 2009, memorandum, which stated that the smoothhound measure did represent new activity under the FMP. The memorandum included all the information required for reinitiating consultation under the ESA and requested by F/SER3 to date. In a December 10, 2009, e-mail, F/SER3 requested additional information on the recreational fishery for smoothhound, including information on the location of fishing (i.e., state versus federal waters) and numbers of animals caught annually. F/SF1 staff provided the requested data in an e-mail on December 18, 2009. In December 2009 and January 2010, F/SER3 shared portions of the draft biological opinion with F/SF1 per request; F/SF1 provided comment.

In January 2010, F/SER3 consulted with NMFS' Northeast Regional Office (NER) Protected Resources Division (PRD) to discuss approaches for addressing potential adverse effects to ESA-listed large whales in this consultation. NER PRD advised F/SER3 that they were awaiting, and were likely to rely significantly on, a new population assessment from the Northeast Fisheries Science Center on North Atlantic right whales. Because F/SER3 anticipated that the assessment might significantly affect the analysis of impacts of the smoothhound fishery on ESA-listed whale species, F/SER3 advised F/SF1 that additional time would be needed to receive the new assessment and use it as a basis for the North Atlantic right whale analysis.

F/SF1 agreed to wait for the Section 7 consultation. However, because of MSFCA requirements, F/SF1 needed to take action to end overfishing of blacknose sharks. To meet their MSFCA obligation they finalized Amendment 3, which established among other things, the management measures to end overfishing of blacknose sharks. To meet National Environmental Policy Act requirements, an FEIS was published in March 2010. A final rule published in June 2010 making effective all non-smoothhound actions. The final rule described the measures for smoothhound as outlined in the Amendment, but noted those requirements would not become effective until the biological opinion was completed and outreach with fishermen could be conducted.

During the development of the biological opinion, questions arose regarding whether evaluating just the actions pertaining to smoothhound was appropriate. Following discussions between F/SF1, F/SER3, GCSE, GCF, and National Oceanic and Atmospheric Administration (NOAA) General Counsel in August and September 2011, it was determined that a biological opinion evaluating only the actions pertaining to smoothhound was not appropriate. When consulting on FMP actions, NMFS must consider not only the effects of the specific management measures proposed but also the effects of all shark fishing activity authorized under the FMP. Since smoothhound sharks would be managed with the other Atlantic shark fisheries under the same FMP, all shark fisheries needed to be considered together. In a memorandum dated November 29, 2011, F/SF1 requested the consultation consider all Atlantic shark fishing activities, including the new smoothhound fishery. Thus, the scope of the biological opinion was expanded to evaluate the continued authorization of the commercial and recreational shark fisheries in the Atlantic, Gulf of Mexico, and Caribbean Sea, including the potential effects from initiation of federal management for smoothhound shark.

F/SF1 is also implementing Amendment 4 to the 2006 Consolidated Atlantic HMS FMP for HMS fishery management measures in the U.S. Caribbean territories including Puerto Rico and the U.S. Virgin Islands (USVI). Because there are substantial differences between some segments of the U.S. Caribbean HMS fisheries and the HMS fisheries that occur off the mainland of the United States,[1] F/SF1 will implement management measures that would amend the HMS fishery management regulations, including those related to Atlantic sharks in the U.S. Caribbean.

On February 6, 2012, five distinct population segments (DPSs) of Atlantic sturgeon were listed under the ESA; the listing became effective on April 6, 2012. F/SER3 requested additional information on the proposed action to evaluate any potential effects to the newly listed DPSs of the Atlantic sturgeon. That information was received during numerous phone calls and e-mails between F/SF1 and F/SER3 during February and April 2012. The consultation package was considered complete on April 11, 2012.

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[1] These difference include things like: small-scale commercial fishermen in the Caribbean that may not be currently operating within the HMS fishing and dealer permit requirements; smaller vessels; limited availability of processing and cold storage facilities; shorter trips; limited profit margins; and high local consumption of catches.

2.0 Description of Proposed Action

The MSFCA grants authority to the Secretary of Commerce ("Secretary") to manage oceanic shark species within the U.S. Exclusive Economic Zone (EEZ). The Secretary designated that that authority to NMFS. NMFS must manage fisheries to maintain optimum yield by rebuilding overfished fisheries and preventing overfishing, consistent with the National Standards. Additionally, any management measures must also be consistent with other domestic laws including, but not limited to, the National Environmental Protection Act, the ESA, the Marine Mammal Protection Act (MMPA), and the Coastal Zone Management Act.

Within NMFS, F/SF1 has the lead in developing regulations for all HMS fisheries, although some actions (e.g., Atlantic Large Whale Take Reduction Plan) are taken by other offices if the main legislation (e.g., the MMPA) driving the action is not the MSFCA or the Atlantic Tunas Convention Act. F/SF1 currently manages sharks in four management units (SCS, pelagic sharks, large coastal sharks [LCS], and prohibited species). HMS shark species not under the current management units remain under Secretarial authority. Should the Secretary determine any of those species are in need of conservation and management, F/SF1 has the authority to manage those species. Based on public comments, F/SF1 determined that federal management of smoothhound sharks is appropriate.

A directed commercial fishery for smoothhound sharks has been in existence for some time. Commercial landings of smoothhound sharks have been documented every year since 1994 (ACCSP unpublished data). Smoothhound sharks are most frequently landed opportunistically by fishermen targeting species that are more valuable (as measured by number of trips). However, a relatively small group of fishermen appear to be directly targeting smoothhound sharks, and the bulk of reported landings can be attributed to the directed sink gillnet fishery. Since smoothhound sharks have not previously been federally managed, very little is known about the operation of the fishery in federal waters. However, limited landings data from the commercial[2] and recreational[3] sectors are available. These data represent the best available information for evaluating the current smoothhound fishery. The intent of bringing smoothhound sharks under federal management is to improve the quality and increase the quantity of data available on the federal smoothhound fishery's operation, level of effort, and number of participants. The measures in Amendment 3 are intended to have as little effect as possible on the existing operation of the smoothhound fishery.

The smoothhound fishery is proposed to be managed under the "smoothhound complex," which includes smooth dogfish (*Mustelus canis)* and Florida smoothhounds (*Mustelus norrisi*). Emerging molecular and morphological research has determined that Florida smoothhounds (*Mustelus norrisi*) may have been misclassified as a separate species from smooth dogfish (*Mustelus canis)* (Jones, SEFSC, to NMFS, pers. comm. 2009). Additionally, NMFS' Southeast Fisheries Science Center (SEFSC) advised that there is insufficient data at this time to separate smooth dogfish and Florida smoothhound stocks, and that they should be treated as a single stock

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[2] Commercial data are available via the Atlantic Coastal Cooperative Statistics Program (ACCSP).

[3] Recreational data are available via the Marine Recreational Fishing Statistics Survey (MRFSS), this information is now collected via the the Marine Recreational Information Program (MRIP).

until scientific evidence indicates otherwise. Based on this taxonomic correction and SEFSC advice, F/SF1 considers Florida smoothhounds to be smoothhound sharks for the purposes of management. Creation of the smoothhound complex also helps to minimize confusion with the spiny dogfish fishery.

F/SF1 proposes to implement several actions to achieve their smoothhound management goals including: (1) establishing a federal permit requirement for the commercial and recreational retention of smoothhound sharks in federal waters; (2) requiring smoothhound shark fins to be naturally attached to the carcass; (3) prohibiting at-sea processing (filleting); (4) requiring commercial smoothhound vessels holding a smoothhound federal permit to carry an observer, if selected; (5) requiring commercial fishermen to sell smoothhound landings to federally-permitted dealers; (6) requiring all federally-permitted dealers buying smoothhound to report those landings; and (7) establishing commercial and set-aside quotas.

NMFS continues to authorize the commercial and recreational shark fisheries in the Atlantic, Gulf of Mexico, and Caribbean Regions via the current regulations and management measures for these fisheries. No new regulations are proposed for the Gulf of Mexico and Atlantic Region shark fisheries. F/SF1 has recently made changes to the management scheme for Atlantic sharks in the Caribbean region, effective January 2, 2013 (77 FR 59842; October 1, 2012).

Because there are substantial differences between some segments of the U.S. Caribbean HMS fisheries and the HMS fisheries that occur in Gulf of Mexico and Atlantic regions, F/SF1 amended the HMS fishery management regulations in the U.S. Caribbean. The actions relevant to Caribbean shark fisheries include: (1) creating a Caribbean permit allowing fishing for and sales of non-prohibited Atlantic sharks (excluding sandbar); (2) codifying retention limits for Atlantic sharks; (3) collect landings data through cooperative agreements with existing territorial government programs; (4) authorize the possession of rod and reel, handline, and bandit gear; (5) restrict the size of vessels eligible to be issued a Caribbean permit to those 45 feet or less LOA; (6) limit the Caribbean permit to be valid only for fishing in the U.S. Caribbean Region; (7) stipulate that the Caribbean permit may not be held in combination with any other HMS permit (NMFS 2012a). With these changes, F/SF1 has implemented a zero retention limit for all sharks caught by fishers holding these new permits. Any changes to increase the retention limits for sharks will be conducted through framework procedures and rulemaking.

A description of the current regulations for all other Atlantic, Gulf of Mexico, and Caribbean Region shark fisheries are provided Section 2.1 and the proposed management measures for smoothhound are provided in Section 2.2.

2.1 Overview of Existing Management Measures for All Other Atlantic Sharks

In 1993, NMFS implemented the FMP for Sharks of the Atlantic Ocean. The 1993 FMP established a fishery management unit consisting of 39 frequently caught species of Atlantic sharks, separated into three groups for assessment and regulatory purposes: LCS, SCS, and pelagic sharks. The 1993 FMP concluded that LCS were overfished, that pelagic sharks and SCS were fully fished, and that stock recovery to levels of the 1970s would be slow due to the relatively low intrinsic rates of increase exhibited by these species. A rebuilding plan for LCS was established and wide range of management measures implemented.

Over the years, numerous amendments to the FMP have been implemented to rebuild overfished stocks and to prevent overfishing of Atlantic sharks in commercial and recreational fisheries. Section 3.1.1 of Final Amendment 3 to the Consolidated HMS FMP includes a detailed history of domestic shark management. Changes in management measures and regulations have generally resulted from new stock assessments, which have continued to find at least some shark stocks overfished, slower to rebuild than expected, and/or experiencing overfishing. Regulations have also been implemented to minimize the impacts of the shark fisheries on MMPA and ESA-listed species.

In 1999, HMS created an FMP that combined the 1993 Atlantic Shark FMP and the Atlantic Swordfish FMPs into a single FMP. This new FMP also managed tunas for the first time; Atlantic billfish continued to be managed under a separate FMP. In 2006, NMFS consolidated the management of Atlantic billfish with that of swordfish, tunas, and sharks into one comprehensive FMP (i.e., the Consolidated HMS FMP). In addition to FMP Amendments, other regulatory actions that have been taken over the years include opening and closing of fisheries and adjustments to quota allocations.

Today, there are 39 species of Atlantic sharks managed by NMFS, divided into four primary groups for management: LCS, SCS, pelagic sharks, and prohibited species. The LCS complex is comprised of 11 species including sandbar, silky, tiger, blacktip, spinner, bull, lemon, nurse, scalloped hammerhead, great hammerhead, and smooth hammerhead sharks. SCS consist of finetooth, Atlantic sharpnose, blacknose, and bonnethead sharks. Pelagic sharks consist of blue, oceanic whitetip, porbeagle, shortfin mako, and thresher sharks. Prohibited sharks consist of sand tiger, bigeye sand tiger, whale, basking, white, dusky, bignose, Galapagos, night, Caribbean reef, smalltail, Caribbean sharpnose, narrowtooth, Atlantic angel, longfin mako, bigeye thresher, sevengill, sixgill, and bigeye sixgill sharks. Smoothounds would be managed as separate "smoothhound complex", bringing the number species management groups to five, and the total number of managed Atlantic shark species to 41.[4]

A summary of the primary federal shark management measures and regulations currently in place is provided in Tables 2.1-2.3. The complete set of regulations is available at 50 CFR Part 635. Authorized gears in Atlantic shark commercial fisheries include: pelagic or bottom longline, strike-net/gillnet (sink or drift), rod-and-reel, handline, and bandit gear. Rod-and-reel and handline are the only gears authorized in the Atlantic shark recreational fishery. A variety of regulatory tools are used to manage commercial shark fisheries including species and species-complex quotas, retention limits, time and area closures, fishing seasons, and fishing regions. The recreational shark fishery is managed using bag limits, minimum size requirements, and landing requirements (sharks must be landed with head and fins attached. Species restrictions (i.e., possession of 19 species of sharks is prohibited) apply to both commercial and recreational fisheries. Likewise, both commercial and recreational fishermen are subject to monitoring and reporting requirements. Monitoring and reporting are important for evaluating the efficacy of

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[4] The smoothhound complex would consist of two species, the smooth dogfish (*Mustelus canis*) and Florida smoothhounds (*Mustelus norrisi*).

fishery regulations in meeting the goals and objectives of the FMP and other applicable laws (for further discussion see Section 2.3). In addition to commercial and recreational fishing regulations, there are also regulations governing NOAA-funded and other scientific research activity, exempted fishing, and exempted educational activity with respect to Atlantic HMS (see Section 2.4). A number of regulations are also in place to minimize or prevent adverse effects from these fisheries on ESA- and MMPA-listed species (Section 2.8). Note that management measures for smoothhound sharks are not yet effective, and therefore, are not included in the following tables.

Table 2.1 Regulations and Management Measures for Commercial Shark Fisheries in the Atlantic and Gulf of Mexico Regions

Management Tool	Current Regulations
Species Groups	Non-sandbar LCS, LCS, non-blacknose SCS, SCS, pelagic sharks, other than blue and porbeagle, blue sharks, porbeagle sharks, and prohibited sharks. There is a mechanism to add or remove prohibited shark species, as needed, via rulemaking
Quotas/Species Complexes	- Non-sandbar LCS – Gulf of Mexico – 390.5 mt dw; Atl – 187.8 mt dw - Research Fishery: sandbar sharks - 87.9 mt dw; non-sandbar LCS - 37.5 mt dw - Non-blacknose SCS: 221.6 mt dw - Blacknose sharks: 19.9 mt dw - Pelagic sharks, other than blue and porbeagle: 488 mt dw - Blue sharks: 273 mt dw - Porbeagle: 1.7 mt dw - Display and Scientific Research: 60 mt ww - Fisheries close when landings reach, or are expected to reach, 80% of the quota - Both the non-blacknose SCS and blacknose quota close when landings in either fishery reach or are expected to reach 80% of the quota - Overharvests and underharvests are deducted from/added to the next year's quota, dependent upon stock status - Count state landings after federal closure against federal quota
Retention Limits	- LCS: 33 sharks per vessel per trip for directed permit holders and 3 sharks per vessel per trip for incidental permit holders - SCS and pelagic sharks: No retention limit for directed permit holders and 16 SCS and pelagic sharks combined per vessel per trip for incidental permit holders
Landing Condition	- Commercial: sharks must be landed with fins and tail naturally attached to the carcass Recreational: sharks must be landed with head, fins, and tail naturally attached to the carcass
Fishing Regions	- Non-Sandbar LCS: 2 Regions; Atlantic - Maine through East Florida; Gulf of Mexico = West Florida (Key West) through Texas and the U.S. Caribbean; applicable to commercial fisheries for non-sandbar LCS; - SCS and pelagic sharks managed under one region
Permits/Reporting	- Permits: limited access for commercial fisheries; Exempted Fishing Permits (EFP), including Display Permits, Scientific Research Permits, EFPs, Letters of Acknowledgment, and Chartering Permit requirements - Logbooks: (Coastal Fisheries or HMS logbook) must be submitted by fishermen within 7 days of offloading any sharks - Observers: mandatory observer coverage if selected (research fishery subject to 100% observer coverage) - Dealer Reporting: Effective January 1, 2013, dealer reports must be submitted electronically on a weekly basis.
Seasons	- One season for each species or species complex. Open upon notice in the Federal Register - Season closes with a 5 day notice when landings reach or are expected to reach 80 % of the quota
Time/Area closures	- Mid-Atlantic Shark Closed Area (i.e., bottom longline gear closure, January - July from approximately Oregon Inlet to Cape Fear, North Carolina out to around the 60-fathom line) and Caribbean Sustainable Fisheries Act seasonal bottom longline closures - The Atlantic Large Whale Take Reduction Team (ALWTRT) has implemented a suite of gear restrictions, observer requirements, etc., to reduce the likelihood of interaction between shark gillnet gear and endangered North Atlantic right whales during the calving period - Several pelagic longline time/area closures apply if shark permit holders are using this gear.
Sea Turtle Release Gear and Handling Requirements and Protected Species Workshops	- All vessels with bottom longline gear required to possess, maintain, and utilize handling and release gear for protected resources (same requirements as pelagic longline vessels) - All sharks not retained must be released in a manner that ensures the maximum probability of survival - Must have Protected Species Workshop certification - Shark dealers are required to have shark identification workshop certification

Table 2.2 Regulations and Management Measures for Commercial Shark Fisheries in the Caribbean Region

Management Tool	Current Regulations
Retention Limits	Zero retention of all sharks
Landing Condition	- If the retention of sharks is eventually authorized, all sharks will be required to be landed with fins and tail naturally attached to the carcass
Permits/Reporting	- Caribbean Commercial Small Boat (CCSB) Permit: allows holder to fish for and sell sharks in the U.S. Caribbean Region. The CCSB permit authorizes the possession and use of rod and reel, handline, and bandit gear to target sharks. The vessels eligible for a CCSB permit are those 45 feet or less in length overall (LOA). The CCSB permit is only valid for fishing and sales in the U.S. Caribbean Region, and may not be held in combination with any other HMS vessel permit (including HMS permits for recreational harvest) - Landings data will be collected through cooperation with NMFS and existing territorial government fisheries data collection programs, as specified by those programs.

Table 2.3 Regulations and Management Measures for Recreational Anglers Landing Sharks in the Atlantic, Gulf of Mexico, and Caribbean Regions

Management Tool	Current Regulations
Size and Possession Limit:	- 1 shark >54 inches per vessel per trip, also 1 sharpnose and 1 bonnethead per person per trip with no minimum size limits
Landing Condition	- Recreational: sharks must be landed with head, fins, and tail naturally attached to the carcass
Authorized Species	- LCS: blacktip, spinner, bull, nurse, tiger, lemon, smooth hammerhead, great hammerhead, and scalloped hammerhead - SCS: Atlantic sharpnose, bonnethead, finetooth, blacknose, - Pelagics: shortfin mako, common thresher, oceanic whitetip, blue, and porbeagle Note: oceanic whitetip and hammerhead sharks (not including bonnethead sharks) cannot be retained if tunas and/or swordfish are also retained
Permits/Reporting	- HMS Angling permit - Charter/Headboat permit - General Category permit (shark fishing tournaments) - Must participate in MRIP and the Large Pelagic Survey, if asked

2.2 Proposed Management Measures Affecting the Smoothhound Shark Fishery

Permits

F/SF1 would establish a federal permit requirement for commercial and recreational fishermen to retain smoothhound caught in federal waters. Recreational fishermen would need to obtain either an HMS Angling or Charter/Headboat permit, and commercial fishermen would need to obtain a commercial smoothhound permit. Commercial smoothhound permits would allow anyone fishing with an authorized gear for HMS fisheries to land smoothhound sharks. Permit holders fishing with trawl gear would be restricted to only landing incidentally caught smoothhound sharks. To be considered incidental, smoothhound can represent no more than 25 percent of the total catch by weight. A federal permit requirement would allow NMFS to collect data regarding participants in the fishery. Placing smoothhound under federal management would require fishermen retaining this species to comply with applicable regulations in the Atlantic, Gulf of Mexico, and Caribbean Sea. Smoothhound fishermen with a federal permit would be required to abide by the federal regulations, even when fishing for smoothhound in state waters, unless state regulations are more restrictive. Amendment 3 would also give NMFS the ability to select smoothhound vessels to carry an observer. Smoothhound fishermen would not be required to attend the protected species release, disentanglement, and identification workshops (NMFS 2010a).

Landing and Reporting Requirements
All landed smoothhound would be required to be sold to federally-permitted dealers. All federally-permitted dealers buying smoothhound would be required to report those landings to NMFS (NMFS 2010a). To provide NMFS time to determine the range of the fishery, the potential overlap with other fisheries, and any possible reporting redundancies, smoothhound fishermen will not be required to submit logbook reports for smoothhound (NMFS 2010a).

Commercial Quota
The quota for smoothhound shark would be set equal to the maximum annual landings between 1998-2007, plus two standard deviations from that period, for a total of 1,577,319 lbs dw. This alternative would allow the fishery to continue to operate up to the maximum level of utilization from 1998-2007, with an added buffer of two standard deviations to account for under-reporting in the fishery (NMFS 2010a).

Set-Aside Quota
A separate set-aside quota of 6 mt ww for smoothhound would be established for the exempted fishing program. There is already a 60-mt ww set-aside quota for sharks for the exempted fishing program, but because smoothhound shark have not been federally managed in the past, they are not included in the current quota (NMFS 2010a).

Table 2.4 Proposed Management Measures Affecting the Smoothhound Shark Fishery

Proposed Management Measure	Management Measure Description
Federal Permit Requirement	Add smoothhound shark under NMFS management and establish a federal commercial and recreational permit requirement.
Landing and Reporting Requirements	Catch may only be sold to federally-permitted dealers; Dealers must report all smoothhound shark landings; Vessels must carry observers, if selected.
Commercial Quota	Establish a smoothhound shark quota equal to the maximum annual landings from 1998-2007, plus two standard deviations (1,577,319 lbs dw).
Exempted Fishing Program Set-Aside Quota	Establish a separate smoothhound shark set-aside quota for the exempted fishing program of 6-mt ww.

2.3 Monitoring and Reporting

2.3.1 Commercial Shark Fisheries in the Gulf of Mexico and Atlantic Regions

Commercial fisheries for Atlantic sharks are monitored through a combination of vessel logbooks, dealer reports, port sampling, cooperative agreements with states, and scientific observer coverage. NMFS collects shark data through reports from owners/operators of permitted vessels under a mandatory commercial logbook program, the Commercial Shark Fishery Observer Program (CSFOP), the Pelagic Observer Program, and the Shark Gillnet Observer Program (SGOP). Logbooks contain information on fishing vessel activity, including dates of trips, number of sets, area fished, number of fish, and other marine species caught, released, and retained. Observer data contains additional information such as gear information and biological data for individual animals. Observer data can be used to verify logbook data. In 2003, NMFS began to collect economic data inputs such as volume and cost of fishing from 20 percent of the fleet. Commercial landings data for sharks are also collected by seafood dealers and port agents who routinely record the weight and average ex-vessel price of sharks. Dealer reports must be submitted to NMFS twice a month for all sharks.

Commercial Shark Bottom Longline Fishery Observer Program

Observation of the directed shark bottom longline fishery has been ongoing since 1994 (Burgess and Morgan 2003). From 1994 through 2001, observer coverage was conducted on a voluntary basis. Beginning with the 2002 fishing season, observer coverage of the shark-directed bottom longline fishery became mandatory (50 CFR 635.7, NMFS 2003a). Observer coverage from 1994 through the first trimester season of 2005 was coordinated by the CSFOP, Florida Museum of Natural History, University of Florida, Gainesville, Florida (Burgess and Morgan 2003). Starting with the second trimester season of 2005, responsibility for the fishery observer program was transferred to the SEFSC, Panama Laboratory (Hale et al. 2007).

Currently, observation of the directed shark bottom longline fishery is conducted by randomly selecting owners and vessels possessing a valid directed shark fishing permit, such that observer coverage reaches 4 to 6 percent. Selection letters are sent approximately one month before the next fishing season; permit holders receiving selection letters must then contact NMFS and indicate their intent to fish in the next fishing season. Observers are dispatched to selected vessels that intend to fish in the upcoming fishing season. While onboard, observers collect data pertaining to gear characteristics, set and haulback information, environmental conditions, species caught and their condition (i.e., alive, dead, damaged, or unknown), and the final disposition of the catch (i.e., kept, released, finned, etc.) (Hale et al. 2007).

Commercial Gillnet Fishery Observer Program

The SGOP Program is coordinated by SEFSC. From 1999 through 2004, there was 100 percent observer coverage of the Southeast shark drift gillnet fishery during the North Atlantic right whale calving season (November 15-March 31). This coverage level was in response to a May 1997 biological opinion on HMS fisheries, which specified this requirement as part of a RPA to avoid jeopardy of North Atlantic right whales. The requirement was implemented via the 1999 Atlantic Large Whale Take Reduction Plan (ALWTRP) and the 1999 HMS FMP. Outside this season (April 1–November 14), the level of observer coverage had to attain a sample size large enough to provide estimates of sea turtle and smalltooth sawfish interactions with a coefficient of variation of 0.3, as recommended by NMFS (2004d). In 2005, the shark gillnet observer program was expanded to include all vessels that have an active directed shark permit and fish with sink gillnet gear. These vessels were not previously subject to observer coverage because they were either targeting non-HMS or were not fishing gillnets in a drift or strike-net fashion. Amendments to the ALWTRP regulations in 2007 vacated the 100 percent observer coverage requirement during North Atlantic right whale season. Observer resources were reallocated allowing all anchored (sink, stab, and set), strike, and drift gillnet vessels, from Florida to North Carolina, to be observed year-round (Baremore et al. 2007).

Vessels are randomly selected on a seasonal basis (winter, spring, summer, and fall) from a pool of vessels that had either a current directed or incidental shark permit and reported fishing with gillnet gear during the previous year. Permit holders selected for participating in the program are notified approximately a month before the upcoming fishing season. Upon notification, the permit holder must contact NMFS and indicate their intent to fish in the upcoming season. For each set and haulback, observers record beginning and end times of setting and hauling, estimated length of net set, sea and wind states, latitude and longitude coordinates, and water depth. Observers monitor the catch and bycatch as the nets are hauled aboard. Disposition (kept, discarded alive, or discarded dead) is recorded for each species brought on board, and measurements/samples of 10 randomly selected individuals from each species are taken if time permits (Baremore et al. 2007).

2.3.2 Commercial Shark Fisheries in the Caribbean Region

Commercial landings for all HMS species (including sharks, if retention limits are increased) will be collected via the Cooperative Statistics Program (CSP). The CSP collects landings data from the commercial and recreational fisheries of the Southeast Region of the United States. NMFS administers the noncompetitive program providing funds to the states for port agents, clerical personnel, and statistical supervisors to collect and process fisheries data. State personnel enter all landings statistics and biological data through user terminals into a SEFSC database. Landings data for vessels issued a new CCSB permit would be collected by Puerto Rico and the USVI using funds allocated from the CSP. Puerto Rico and the USVI will be responsible for submitting those data to the SEFSC and meeting any other requirements determined to appropriate by NMFS.

2.3.3 Recreational Shark Fisheries in the Gulf of Mexico, Atlantic, and Caribbean Region

NMFS currently conducts statistical surveys of portions of the recreational fisheries, including shark recreational fisheries. The primary survey vehicles of the recreational sector conducted by NMFS are the Marine Recreational Information Program (MRIP). Anglers either register directly on the MRIP webpage, or are automatically registered in the MRIP surveys and the large pelagics survey (LPS). MRIP also includes a National Saltwater Angler Registry. Anglers are automatically registered for the National Saltwater Angler Registry by their home states when purchasing a state fishing license. HMS permit holders are exempt from registering; however, others fishing on the boat must still register or get the state license, if required. The LPS was originally designed to estimate the annual recreational catches of bluefin tuna from Virginia through New England, and the LPS collects catch information on other HMS at certain times and in certain areas.

NMFS collects recreational catch-and-release data from dockside and telephone surveys (the LPS and MRIP) for the rod-and-reel fishery and uses these data to estimate total landings and discards. Statistical problems associated with small sample size remain an obstacle to estimating bycatch reliably in the rod-and-reel fishery. Coefficient of variations (CVs)[5] can be high for many HMS (rare event species in the MRIP) and the LPS does not cover all times/geographic areas for non-bluefin tuna species. In addition, selecting recreational vessels for voluntary logbook reporting may be an option for collecting bycatch information for this sector of the HMS fishery.

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[5] Coefficient of variation is the standard deviation of a group of values divided by their mean.

NMFS has the authority to use observers to voluntarily collect bycatch information from vessels with HMS Charter/Headboat or Angling category permits. Many of the charter/headboat vessels are required to complete federal and/or state logbooks (e.g., the NMFS Northeast Region Vessel Trip Report (VTR) Program), in which they are required to report all fishing information, including that for HMS and bycatch. NMFS is currently evaluating various alternatives to increase logbook coverage of vessels fishing for HMS, such as selecting additional HMS vessels to report in logbooks or be selected for observer coverage, and is also investigating alternatives for electronic reporting.

In April 1998, NMFS implemented a mandatory registration system for tournaments involving any billfish with mandatory reporting, if selected. The Consolidated HMS FMP extended the requirement to tournaments directed at any Atlantic HMS, to improve estimates of HMS catches and landings by tournament participants. Tournament registration allows NMFS to establish a participant universe to expedite outreach to recreational fishermen who participate in tournaments. The reporting forms also provide NMFS with catch, release, and fishing effort statistics that are useful in characterizing the fishery. Because the LPS does not collect recreational fishing data in the southeastern United States or the Gulf of Mexico, tournament data can provide information on which species are targeted in these areas, as well as release rates for each species.

2.4 Management of Fishery Regulation Exemption Permits

Regulations at 50 CFR 600.745 and 50 CFR 635.32 govern scientific research activity, exempted fishing, and exempted educational activity with respect to Atlantic HMS. EFPs and display permits are requested and issued for sharks under the authority of the MSFCA (16 U.S.C. 1801 et seq.). EFPs are issued to individuals conducting research or other fishing activities for sharks using private (non-scientific) vessels that require exemptions from fishing regulations, and may be necessary because possession of certain shark (and other HMS) species is restricted during many times of the year. Display permits are issued to individuals who are collecting sharks for public display. Letters of Acknowledgement (LOAs) are also given to outside researchers conducting shark research from research vessels, which is not subject to regulation under MSFCA but is sometimes funded by NOAA to aid MSFCA management needs.

EFPs and collection permits involve fishing by commercial or research vessels using fishing methods similar or identical to those used in the smoothhound or Atlantic shark fisheries. Under these circumstances, any adverse effects from those activities would likely be similar to those analyzed in this opinion. Each EFP and collection permit request includes a detailed description of the type of fishing and/or collection activities proposed, the gears to be used, and anticipated level of effort. If the fishing methods are similar, and the associated fishing effort does not represent a significant increase beyond the levels expected in the fishery described herein, then issuance of some EFPs 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 is unlikely to add additional effects or increase fishing effort beyond what is otherwise likely to accrue from the vessel’s normal commercial activities. Therefore, the issuance of EFPs for fishing consistent with the description of Atlantic shark or smoothhound shark fishery in Section 2.5-2.7 that does not increase fishing effort significantly is considered within the scope of this opinion. Each EFP is analyzed to determine whether the activity and effort fall within the scope of this opinion. If so, any takes occurring during these activities would then be authorized under this biological opinion. The number of fishery regulation exemption permits issued covering sharks from 2008 to 2011 by category are listed in Table 2.5.

Table 2.5 Number of EFPs, Display Permits, and SRPs for Sharks Issued 2008-2011

Permit type		2008	2009	2010	2011
Exempted Fishing Permit	Sharks for display	5	4	4	3
	HMS for display	1	2	2	2
	Shark research on a non-scientific vessel	4	4	9	8
	HMS research on a non-scientific vessel	7	5	2	2
	Shark Fishing	0	0	0	0
Total		17	15	17	15

2.5 Description of Shark Fisheries in the Gulf of Mexico and Atlantic Regions

Atlantic sharks are targeted and caught incidentally by both commercial and recreational fishermen. Commercial landings data are presented in Tables 2.5-2.7 to depict the overall effort of each sector. NMFS 2010a includes detailed information on the extent of commercial and recreational shark fishing by state and by individual communities in its state and community profiles.

2.5.1 Commercial Fisheries in the Gulf of Mexico and Atlantic Regions

Historic Overview, Catch and Landings Data

United States commercial shark fisheries have been sporadic over the years. In 1937, the price of soupfin shark liver skyrocketed when it was discovered to be the richest source of vitamin A available in commercial quantities. The shark fishery in the Caribbean Sea, off the coast of Florida, and in the Gulf of Mexico first developed in response to this high demand (Wagner 1966 in NMFS 2007a). At that time, shark fishing gear included gillnets, anchored bottom longlines, pelagic longlines, and other hook-and-line and benthic lines for deepwater fishing. These gears were slightly different than the gears used today and are fully described in Wagner (1966). By 1950, the availability of synthetic vitamin A caused most shark fisheries to be abandoned. A small fishery for porbeagle developed in the early 1960s off the U.S. Atlantic coast involving Norwegian fishermen who had overfished their own fishing areas. Between 1961 and 1964, their catch increased from 1,800 to 9,300 mt, then declined to 200 mt (Casey et al. 1978 in NMFS 2007a). There was also a small-scale, short-lived, upswing in the commercial shark fishery in Florida during 1964-1968 along the southeast coastal counties and in the Keys because leather from hides became more valuable, and because of shark attacks on Florida’s flourishing commercial mackerel fishing operations (Otwell et al. 1985).

It was not until the late 1970s that U.S. Atlantic commercial shark fisheries developed rapidly, due to increased demand for their meat, fins, and cartilage. At that time sharks were perceived to be underutilized as a fishery resource. The high commercial value of shark fins led to the controversial practice of finning or removing the valuable fins from sharks and discarding the carcass. Growing demand for shark products encouraged expansion of the commercial fishery throughout the late 1970s and the 1980s. Tuna and swordfish vessels began to retain a greater proportion of their shark incidental catch, and some directed fishery effort expanded as well. As catches accelerated through the 1980s, shark stocks suffered a precipitous decline. Peak commercial landings of LCS and pelagic sharks were reported in 1989 (NMFS 2007a). Historically, SCS were incidental catch in commercial fisheries and commonly used as bait. Today SCS are still sold for bait, as well as for their fins and occasionally their meat.

The geographic extent of where directed and incidental commercial shark permit holders reside today is large, but is currently concentrated in four states: Florida (54 percent of shark permits), New Jersey (11 percent of shark permits), Louisiana (7 percent of shark permits), and North Carolina (6 percent of shark permits) (NMFS 2010a). North of North Carolina, commercial shark fishing is largely incidental to the capture of other species, particularly HMS tuna species (NMFS 2006a).

Commercial shark landings data from 2004 through 2011 are provided in Tables 2.5-2.7. Landings are not always indicative of the area where fishing occurs. For example, many of the New England and North Carolina vessels have been reported to fish as far south as Florida, and Texas vessels have fished across the Gulf of Mexico east to Florida.

Table 2.6 Commercial Landings of Atlantic LCS in lbs dw, 2004-2011
(Source: Cortés pers. comm., 2012)

Large Coastal Sharks (LCS)	2004	2005	2006	2007	2008	2009	2010	2011
Bignose*	0	98	46	0	104	0	0	0
Blacktip	1,092,600	894,768	1,255,255	1,091,502	573,723	601,116	858,311	572,209
Bull	49,556	118,364	173,375	154,945	186,882	207,502	222,795	228,522
Dusky*	1,025	874	4,209	2,064	0	486	0	14
Hammerhead, great	0	0	0	0	0	0	0	49
Hammerhead, smooth	92	54	150	0	358	4,025	7,802	110
Hammerhead, unclassified	116,546	182,387	141,068	65,232	55,907	159,937	95,654	104,324
Lemon	67,810	74,436	65,097	72,583	53,427	82,311	46,397	82,290
Night*	0	0	0	0	0	0	0	208
Nurse	317	152	2,258	15	58	147	71	27
Sandbar	1,223,241	1,246,966	1,501,277	691,928	86,640	167,958	129,332	140,333
Sand tiger**	1,832	4,149	3,555	210	0	15	18	20
Silky	11,808	18,237	16,173	16,496	4,794	5,474	1,188	1,635
Spinner	14,806	47,670	96,259	17,888	123,660	37,047	91,087	71,189
Tiger	30,976	39,387	50,749	34,169	29,712	23,046	48,954	58,753
White**	58	0	122	0	117	0	0	0
Unclassified, assigned to LCS	603,229	519,654	499,069	182,240	247,639	224,137	17,994	225,784
Unclassified, fins	137,375	135,774	152,111	98,010	55,482	79,849	73,513	75,675
Total (excluding fins)	3,213,896 (1,458 mt dw)	3,147,196 (1,428 mt dw)	3,808,662 (1,728 mt dw)	2,329,272 (1,057 mt dw)	1,363,021 (618 mt dw)	1,513,201 (686 mt dw)	1,519,603 (689 mt dw)	1,485,467 (684 mt dw)

* indicates species that were prohibited in the commercial fishery as of June 21, 2000.

** indicates species that were prohibited as of April 1997.

Table 2.7 Commercial Landings of Atlantic Small Coastal Sharks in lbs dw, 2004-2011

(Source: Cortés pers. comm., 2012)

Small Coastal Sharks (SCS)	2004	2005	2006	2007	2008	2009	2010	2011
Atlantic angel*	818	3,587	500	29	91	0	96	11
Blacknose	68,108	124,039	187,907	91,438	134,255	149,874	220,271	32,273
Bonnethead	29,402	33,295	33,408	53,638	60,970	55,319	11,741	41,270
Finetooth	121,036	109,774	80,536	138,542	80,833	150,932	92,698	211,876
Sharpnose, Atlantic	230,880	354,255	459,184	332,160	324,622	277,261	220,271	261,295
Unclassified, assigned to SCS	1,407	9,821	1,289	2,384	23,077	34,429	851	36,639
Total (excluding fins)	451,651 (205 mt dw)	634,885 (288 mt dw)	763,327 (346 mt dw)	618,191 (280 mt dw)	623,848 (283 mt dw)	667,815 (303 mt dw)	357,855 (162 mt dw)	583,364 (265 mt dw)

* indicates species that were prohibited in the commercial fishery as of June 21, 2000.

Table 2.8 Commercial Landings of Atlantic Pelagic Sharks in lbs dw, 2004-2011

(Source: Cortés pers. comm., 2012)

Pelagic Sharks	2004	2005	2006	2007	2008	2009	2010	2011
Bigeye thresher*	719	267	68	0	0	0	28	135
Blue shark	423	0	588	0	3,229	4,793	9,135	13,370
Mako, longfin*	1,827	403	2,198	2,042	1,896	25,264	289	3,465
Mako, shortfin	217,171	156,082	103,040	165,966	120,255	141,456	220,400	207,630
Mako, unclassified	50,978	35,241	28,557	38,170	39,661	9,383	0	0
Oceanic whitetip	1,082	713	354	787	1,899	933	796	2,435
Porbeagle	5,832	2,452	3,810	3,370	5,259	3,609	4,097	5,933
Thresher	44,915	41,230	27,740	46,391	47,528	33,333	61,290	47,462
Unclassified, pelagic	0	0	571	0	0	154	0	0
Unclassified, assigned to pelagic	356,522	16,427	25,917	5,453	14,819	6,650	16,160	33,884
Total (excluding fins)	679,469 (308 mt dw)	252,815 (115 mt dw)	192,843 (87 mt dw)	262,179 (119 mt dw)	234,546 (106 mt dw)	225,575 (102 mt dw)	312,195 (142 mt dw)	314,314 (143 mt dw)

* indicates species that were prohibited in the commercial fishery as of June 21, 2000.

Number of Participants/Permit Holders

Fishermen who wish to sell sharks caught in federal waters must possess a federal shark permit (directed or incidental). As part of the 1999 FMP, NMFS implemented a limited access system for the commercial shark fishery so permits can only be obtained through transfer or sale, subject to upgrading restrictions. The purpose of limited access was to reduce latent effort in the shark fishery and prevent further overcapitalization. Based on current and historical participation, implementation of limited access reduced the number of shark permit holders from over 2,200 before limited access to only 607 by October of 2003. As of October 1, 2011, the number of permit holders had declined to 479 commercial permit holders; of these, 217 (45 percent) had directed shark permits and the remaining 262 (55 percent) hold incidental permits and target species other than sharks. Not all permit holders are active in the fishery in any given year. NMFS estimates that there are 101 active vessels with directed permits and 54 active vessels with incidental permits based on 2011 data. (NMFS unpublished data). Active vessels are defined as those reporting any amount of landed shark during the 2011 calendar year. The addresses of these permit holders range from Texas through Maine, with nearly half of the permit holders located in Florida.

Fishing Seasons and Vessel Characteristics

Seasons are established based on quota availability, catch rates, and public comment. Between 1997 and 2003, the fishery was managed via two seasons. During that time, the LCS fishing season was generally open for three months (January-March) in the first fishing season and a few weeks (July-August) in the second season. From 2004-2007, the fishery has been managed via trimesters to provide for fishing opportunities throughout the year and to reduce fishing effort during months critical for shark pupping. Beginning in 2008, there has been one fishing season starting on or around January 1; however, starting dates have been modified to accommodate fishery participants in different regions.

Given the short fishing season for sharks, fishermen have had to diversify in order to maintain their financial viability, either into other fisheries or other occupations. Vessels often engage in shark fishing on a seasonable basis, depending on the area fished and the length of the fishing season, and fish for other species at other times of the year. NMFS permit databases indicate that approximately 98 percent of permitted shark fishermen hold fishing permits in other fisheries (NMFS 2010a). In 2010, of the 503 directed and incidental shark permit holders, 81 percent also hold king or Spanish mackerel permits; 61 percent hold dolphin/wahoo permits; 36 percent hold directed swordfish permits; 21 percent hold snapper-grouper permits, and 22 percent hold Gulf of Mexico reef fish permits (NMFS 2010a).

In the directed fishery, vessels range in length from 14 to 87 feet, with an average length of 45.5 feet. In the incidental category, vessels range in length from 15 to 125 feet, with an average length of 50.6 feet (NMFS 2007a).

2.5.1.1 Description of Bottom Longline Fishing

The shark bottom longline fishery is active in the U.S. Atlantic Ocean and Gulf of Mexico from North Carolina to Texas. Vessels in the fishery are typically fiberglass and average 50 feet in length. These vessels make 4,000 to 9,000 sets per year (Hale and Carlson 2007, Hale et al. 2007). Longline gear typically consists of a heavy monofilament mainline with lighter weight monofilament gangions. Some fishermen may occasionally use a flexible 1/16-inch wire rope as gangion material or as a short leader above the hook. The gear is set at sunset and allowed to soak overnight before hauling in the morning. Skates, sharks, or various finfishes are used as bait. Longline gear characteristics vary regionally. Hale et al. (2012) generalize the gear as normally consisting of about 0.5-13.7 km of longline and 4-1,000 hooks. Haul characteristics also vary by region (Hale and Carlson 2007, Hale et al. 2007; Hale et al. 2012).

HMS-permitted bottom longline vessels targeting LCS outside the sandbar shark research fishery captured primarily LCS, though SCS, pelagic sharks, spiny dogfish, and smoothhound sharks were also caught. Recent observer data indicate trips targeting LCS had relatively low bycatch of other species; shark species typically comprise over 96.2 percent of the catch (Hale et al. 2012); LCS comprise the greatest amount of the catch. For example, on the LCS targeted trips, LCS comprised 48.7 percent of the shark catch in 2011, while SCS comprised 47.7 percent of the shark catch in 2011. On trips targeting sandbar shark within the research fishery, sharks comprised 97.6 percent of the catch. Sandbar sharks accounted for 47.3 percent of the shark catch, followed by LCS at 41.4 percent, and SCS at 8.3 percent (Hale et al. 2012).

Table 2.9 Bottom Longline Gear and Haul Characteristics Based on Observer Data

(Hale and Carlson 2007, Hale et al. 2007, Hale et al. 2009, Hale et al. 2010, Hale et al. 2011, Hale et al. 2012)

Observed Gear and Haul Characteristics	Region							
	Gulf of Mexico		Atlantic		Gulf of Mexico and Atlantic*			
	2007[1]	2008[2]	2007[3]	2008[4]	2009[5]	2010[6]	2011 (NRF)[7]	2011 (RF)[8]
Mainline length range (km)	12.9-31.4	6-26	5.6-50	4-28	0.6-15	0.5-13.7	3.9-22.6	0.2-27.8
Average mainline length (km)	18	15.2	21.1	16	6.9	4.8	11.8	7.3
Average bottom depth fished (m)	25.4	37.9	40.2	16.2	62.5	39.8	12.7	43.8
Hooks fished per set	228-1,067	180-1,200	96-1,075	54-804	42-1,067	31-1,000	100-742	4-654
Average hooks fished per set	602.5	552	587	385	403	312.7	387.3	230
Hook type/ Size used (C = Circle Hook J = J-Hook)	18/0 C.=41.7% of hauls, 14/0 J=20.8% of hauls, J&C mixed =29.2% of hauls (14.0 C=most common 2nd hook, i.e., 57.1% of hauls using 2 hooks)	18/0 C.=56.1% of hauls, 14.0 J=26.8% of hauls, J&C mixed =63.4% of hauls (18.0 C=most common 2nd hook, i.e., 84.6% of hauls using 2 hooks)	12/0 J=33.3% of hauls, 18 C= 23.1% of hauls, J&C mixed=25.6% of hauls (18/0 C.=most common 2nd hook, i.e., 50.0% of hauls using 2 hooks).	20/0 C.=53.8% of hauls, J&C mixed=42.3% of hauls (18/0 C.=most common 2nd hook, i.e., 90.9% of hauls using 2 hooks).	18/0 C.=52.5% of hauls, J= 53.3% of hauls (12/0 J=13.1% of J-hauls), J&C mixed=33.3% of hauls (18/0 C.=most common 2nd hook, i.e., 87.9% of hauls using 2 hooks).	18/0 C.=50.3% of hauls, 12/0 J= 26.1% of hauls, J&C mixed=15.5% of hauls (18/0 C.=most common 2nd hook, i.e., 56.0% of hauls using 2 hooks).	20/0 C.=53.9% of hauls; 18/0 C.=most common 2nd hook, (i.e., 76.9% of hauls using 2 hooks).	18/0 C.=46.9% of hauls; 14/0 J= 22.3% of hauls;18/0 C.=most common 2nd hook, (i.e., 15.1% of hauls using 2 hooks).
Average soak duration (hrs)	10.9	11.3	11.9	11.5	20.3	12.8	12.0	11.6

* Data from both regions were combined in 2009, 2010, and 2011 due to confidentiality concerns

NRF = Fishing outside of the sandbar shark research fishery; RF = Fishing associated with the sandbar shark research fishery

[1] Based on 24 hauls on 7 trips observed in the GOM

[2] Based on 41 hauls on 27 trips observed in the GOM

[3] Based on 39 hauls on 21 trips in the U.S. Atlantic

[4] Based on 16 hauls on 16 trips in the U.S. Atlantic

[5] Based on 99 hauls on 78 trips in the GOM and South Atlantic

[6] Based on 161 hauls on 105 trips in the GOM and South Atlantic

[7] Based on 13 hauls on 8 trips in the GOM and South Atlantic

[8] Based on 211 hauls on 121 trips in the GOM and South Atlantic

2.5.1.2 Description of Gillnet Fishing

Atlantic shark gillnet fisheries operate along the southeastern U.S. Atlantic coast between Florida and North Carolina and in the Gulf of Mexico (Passerotti 2011). "Gillnet" is defined at 50 CFR 600.2 as a panel of netting, suspended vertically in the water by floats along the top and weights along the bottom, to entangle fish that attempt to pass through it. A gillnet is essentially a vertical wall of monofilament or twine netting designed to wedge and gill fish as they attempt to swim through. Wedging occurs when an animal is stuck in the mesh at its point of greatest girth. Gilling occurs when a fish penetrates the mesh and the twine slips behind the gill cover preventing the fish from escaping (DeAlteris 1998).

The targeting of sharks with gillnets in federal waters and how the fishery is conducted is largely the result of and is dictated by regulations. Legislation in South Carolina, Georgia, and Florida has prohibited the use of commercial gillnets in state waters, thereby forcing some of these vessels into deeper waters under federal jurisdiction. As reviewed later in Section 2.8.1, regulations stemming from the ALWTRP restrict where and how gear can be set, with specific conditions for shark gillnet operations in certain areas and during certain times of the year.

Gillnets are used to capture both LCS and SCS (Gulak et al. 2012); however, gillnets are the dominant gear type for catching SCS. There are three primary types of gillnet sets or fishing methods used to target sharks: drift, strike, and sink. Gear and haul characteristics typically vary depending on the fishing method used. A summary of each method is provided below. Observed gear and haul characteristics data are then provided in Tables 2.10-2.12.

Drift Net Fishing

Drift gillnets are used exclusively in federal waters adjacent to Florida, Georgia, and North Carolina to target coastal shark species and finfish, with catches dominated by Atlantic sharpnose sharks (*Rhizoprionodon terraenovae*) and mackerel (Carlson and Bethea 2007, Trent et al. 1997). The drift gillnet fishery off the coast of Florida and Georgia developed during the early 1990s, but there are rarely vessels that target sharks and use drift gillnets at this time although there is an occasional trip in the South Atlantic and Gulf of Mexico regions. When a vessel fishes drift gillnet gear, the vessel sets the net in a straight line off the stern. The net soaks at the surface for a period of time, is inspected at various occasions during the soak, and is then hauled onto the vessel when the captain or crew feels the catch is adequate (Carlson and Bethea 2007). In 2011, no drift gillnet vessels were observed fishing (Gulak et al. 2012).

Strike Net Fishing

Many of the same vessels initially targeting sharks with drift gillnets began targeting coastal sharks using "strike sets" during the late 1990s. Generally, a "strike" means to make a short set, directed on a known concentration of sharks. When a vessel fishes a strike gillnet, the vessel uses the net to encircle a school of sharks. Fishing is done usually during daylight hours, using visual sighting of shark schools from the vessel, a spotter plane, or both. The net generally fishes from the surface to the bottom to prevent sharks from escaping either under or over the net. The gear is hauled back onto the vessel without much soak time (Carlson and Bethea 2007). The inability to locate the school in federal waters and poor weather conditions sometimes results in unsuccessful trips (i.e., no sets per trip) (Carlson et al. 2005).

Strike sets typically targeted blacktip sharks (*Carcharhinus limbatus*), and 99 percent of the catch of these sets is sharks (Carlson and Bethea 2007). Carlson et al. (2005) documented vessels used for strike-netting sharks (smaller open boats with an electric power roller system) are also used for hauling part of the gear as well as tending the net during the strike-net operation. Moreover, the larger driftnet boats are also used for setting the gear during strike-net operations.

Strike gillnet use in the Atlantic shark fishery was significantly reduced after implementation of Amendment 2 to the 2006 HMS FMP. The LCS trip limits set in that amendment are 33 sharks per vessel per trip and are low enough that use of this gear is cost-prohibitive. Additionally, Amendment 3 to the 2006 Consolidated HMS FMP lowered the quota for SCS and created a separate quota for blacknose sharks. These measures further reduced use of strike gillnets. This gear is rarely used today; only two vessels conducted a total of four strike gillnet trips in 2011 (Gulak et al. 2012).

Sink Net Fishing

Sink gillnets targeting sharks occur throughout the southeast U.S. coastal waters south of Cape Hatteras, North Carolina. Shark catches are dominated by Atlantic sharpnose, blacktip, and blacknose sharks. Sink gillnets target schooling sharks and typically have relatively short soak durations of one to four hours. All sink gillnets are fished on the bottom regardless of target species. The vessels fishing sink gillnet gear on the bottom are some of the same vessels in the shark drift gillnet fishery. The net is set off the stern of the vessel and checked by hand every 15-20 minutes. Large floats with drop lines are located at both ends of the gear. Vessels sometimes fish several sink gillnets at once (Carlson and Bethea 2007).

Table 2.10 Drift Gillnet Gear and Haul Characteristics Based on Observer Data

(Sources: Garrison 2007, Baremore 2007, Passerotti and Carlson 2009, Passerotti et al. 2010, Passerotti et al. 2011; Gulak et al. 2012)

Drift Gear and Haul Characteristics of Gillnet by Fishing Technique Based on Observer Data	**Drift**					
	2005-2006[1]	2007[2]	2008[3]	2009[4]	2010[5]	2011
Net length (m)	182-2,645	494-986	183-823	274-2,103	183-1,097	No vessels were observed fishing with drift gillnets in 2011
Net depth (m)	~12	15.2	3.1-6.1	2.4-11.0	6.1-15.2	
Stretched mesh size (cm)	12.7-25.4	12.7	7.6-15.2	7.9-22.9	12.1-13.9	
Average water depths sets made in (m)	20.9	--	--	--	--	
Average set duration (hrs)	0.3	0.17 (0.07 SD)	0.08 (0.02 SD)	0.10 (0.09 SD)	0.13 (0.14 SD)	
Average haul time (hrs)	3.3	3.67 (1.62 SD)	0.37 (0.24 SD)	0.52 (0.54 SD)	1.40 (1.64 SD)	
Entire fishing process time (Average time net was first set until time haulback completed) (hrs)	10.2	9.48 (0.88 SD)	2.70 (1.93 SD)	2.15 (3.39 SD)	4.07 (4.88 SD)	

[1] Based on 4 vessels making a combined 35 sets over 4 trips observed in 2005 and 2006.

[2] Based on 3 vessels making a combined 4 sets over 4 trips observed in 2007.

[3] Based on 5 vessels making a combined 68 sets over 9 trips observed in 2008

[4] Based on 12 vessels making a combined 225 sets over 43 trips observed in 2009

[5] Based on 4 vessels making a combined 14 sets over 8 trips observed in 2010

Table 2.11 Strike Gillnet Gear and Haul Characteristics Based on Observer Data

(Sources: Garrison 2007, Baremore 2007, Passerotti and Carlson 2009, Passerotti et al. 2010, Passerotti et al. 2011; Gulak et al. 2012)

Strike Gear and Haul Characteristics of Gillnet by Fishing Technique Based on Observer Data	**Strike**				
	2005-2006[1]	2007-2008	2009[2]	2010	2011[3]
Net length (m)	14-1,372	No vessels were observed fishing with strike gillnets in 2007 or 2008	365.8-548.6	No vessels were observed fishing with strike gillnets in 2010	Data cannot be presented due to confidentiality issues
Net depth (m)	21-30		18.3-27.4		
Stretched mesh size (cm)	22.9-30.4		11.4-17.8		
Average water depths sets made in (m)	21.2		--		
Average set duration (hrs)	0.1		0.12 (0.07 SD)		
Average haul time (hrs)	0.9 (0.7 SD)		0.96 (0.76 SD)		
Entire fishing process time (Average time net was first set until time haulback completed) (hrs)	3.2		2.13 (2.15 SD)		

[1] Based on 8 vessels making a combined 84 sets over 106 trips observed in 2005 and 2006.

[2] Based on 3 vessels making a combined 6 sets over 4 trips observed.

[3] Based on 2 vessels making 4 strike net sets during 4 trips

Table 2.12 Sink Gillnet Gear and Haul Characteristics Based on Observer Data

(Sources: Garrison 2007, Baremore 2007, Passerotti and Carlson 2009, Passerotti et al. 2010, Passerotti et al. 2011; Gulak et al. 2012)

Sink Gear and Haul Characteristics of Gillnet by Fishing Technique Based on Observer Data	**Sink**					
	2006[1]	2007[2]	2008[3]	2009[4]	2010[5]	2011[6]
Net length (m)	137-2051	91-732	45.7-1,646.0	22.9-914.4	27.4-1097.0	91.4-548.6
Net depth (m)	2-8	--	1.2-7.6	2.7-8.5	0.9-8.2	1.5-7.6
Stretched mesh size (cm)	7.3-20.3	14.7-25.4	7.0-30.5	6.4-20.3	6.4-17.1	6.4-19.1
Most frequently used stretched mesh size (cm)	--	17.8	--	--	--	--
Average water depths sets made in (m)	17.5 (21.3 SD)	16.7 (15.2 SD)	10.5	21.4 (14.9 SD)	13.9 (29.5 SD)	14.6 (4.3 SD)
Average set duration (hrs)	0.1 (1.0 S.D.)	0.1 (0.04 SD)	0.09 (0.04 SD)	0.14 (0.48 SD)	0.07 (0.13 SD)	0.07 (0.04 SD)
Average haul time (hrs)	1.1 (1.0 SD)	0.07 (0.6 SD)	0.64 (1.10 SD)	0.64 (0.60 SD)	0.49 (0.59 SD)	0.56 (0.34 SD)
Entire fishing process time (Average time net was first set until time haulback completed) (hrs)	6.1 (6.5 SD)	4.5 (2.6 SD)	2.36 (3.80 SD)	1.09 (3.56 SD)	3.66 (6.37 SD)	7.64 (16.03 SD)

[1] Based on 11 vessels making a combined 249 sets over 72 trips observed in 2006.

[2] Based on 6 vessels making a combined 60 sets over 17 trips observed in 2007.

[3] Based on 14 vessels making a combined 134 sets over 41 trips observed in 2008

[4] Based on 14 vessels making a combined 190 sets over 38 trips observed in 2009

[5] Based on 17 vessels making a combined 281 sets over 53 trips observed in 2010

[6] Based on 23 vessels making a combined 398 sets during 71 trips observed in 2011

2.5.2 Description of the Recreational Fishery

Historic Overview, Catch, and Landings Data

The recreational shark fishery extends from Maine to Texas and throughout the Caribbean. For many years sharks were viewed as a “trash” fish and a nuisance as they often took other fish as they were hauled in by anglers. They were also often called “the poor man’s marlin.” However, since the 1960s there has been increasing interest in catching sharks using light tackle.

Recreational landings of sharks are an important component of HMS fisheries. U.S. recreational shark harvest of LCS peaked in 1983 with a recorded catch of 746,600 fish. By 2001, the U.S. recreational shark harvests of LCS had declined by 80 percent to 142,000 fish (Cortés and Neer 2002), with blacktip and sandbar sharks dominating the catches at 36 and 27 percent, respectively. Recreational harvests of SCS have fluctuated between 34,000 and 190,000 fish per year since the mid-1980s, with Atlantic sharpnose comprising about 60 percent of the catch in recent years. For pelagic species, some of which are considered prized game fish (e.g., shortfin mako sharks), recreational harvests have fluctuated from a peak of approximately 93,000 fish in 1985 to a low of about 3,800 fish in 2001. Recreational harvests of blue sharks accounted for 47 and 53 percent of the total catches of pelagic sharks in 1999 and 2000. From 1991 through 2001, the MRFSS intercept survey sampled 13,056 shore- and vessel-based fishing trips which reported catching a shark in the management unit. These sampled trips caught a total of 40,960 sharks. The number of sharks caught per total trips sampled shows no trend, but the percentage of sharks released by private and party boats has increased as trip limits have been reduced. The percentage of sharks released from shore-based fishing trips has remained constant (Babcock and Pikitch 2002).

Recreational shark fishing with rod-and-reel is a popular sport at all social and economic levels, largely because the resource is accessible. Sharks can be caught virtually anywhere in salt water, depending upon the species. Most recreational shark fishing takes place from small to medium-size vessels. Recreational shark fisheries are often exploited in nearshore waters by private vessels and charter/headboats. However, there is also some shore-based fishing and some offshore fishing.[6] Shortfin mako sharks, white sharks, and large pelagic sharks are generally accessible only to those aboard ocean going vessels. Most recreational fishing effort for SCS likely occurs in state waters; these species are caught from piers or the shore.

Charter vessel fishing for sharks is becoming increasingly popular. In most U.S. waters, this type of fishing occurs from May to September. In some regions, certain species are heavily targeted, e.g., sharpnose and blacktips in the Carolinas, and shortfin mako and large white sharks at Montauk, New York. Many charter vessels also fish for sharks out of ports in Ocean City, Maryland, and Wachapreague, Virginia. Headboats may land the smaller shark species, but they usually do not target sharks specifically, except for a headboat fishery for sharpnose sharks based in Port Aransas, Texas (NMFS 1999a).

Many charterboat operators are promoting light tackle fishing for sharks as a way of building catches for their clients and business for themselves. Although a number of charterboat

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[6] This opinion assesses fishing for sharks only in the EEZ, where NMFS has jurisdiction.

operators advertise shark fishing as part of their offering, the recreational fishery is primarily a catch-and-release fishery using light tackle. Shark fishing tends to be incidental to tuna and billfish fishing offshore, particularly north of North Carolina. Species typically retained for personal consumption include mako, thresher, and blacktip sharks (NMFS 2006a).

Fishing tournaments are an important component of HMS recreational fisheries. Although billfish and yellowfin tuna are the predominant target species in HMS fishing tournaments, LCS, SCS and pelagic sharks are also frequently targeted in HMS tournaments (i.e., 15 LCS tournaments, 7 SCS tournaments, and 60 pelagic shark tournaments in 2008). Tournaments typically target shortfin mako, blue, and thresher sharks. Porbeagle sharks may also be landed. Pelagic shark tournaments are predominantly held in the Northeast; however, there has been an increase in the number of Gulf of Mexico tournaments. Louisiana/Texas, New York/New Jersey, and Massachusetts/Maine areas are the primary areas for pelagic shark fishing tournaments. LCS and SCS fishing tournaments are conducted much less frequently. Annual recreational landings by species groups, including prohibited species, from 2002-2009 are presented in Table 2.13.

Table 2.13 Estimates of Total Recreational Harvest of Atlantic Sharks, 2002-2009
(Cortés and Neer 2005, Cortés, pers. comm., in NMFS 2010b)

Species Group	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
LCS (# fish x 1,000)	80.6	89	67.4	85	59.1	68.8	45.0	63.7
Pelagic (# fish x 1,000)	4.7	4.3	5.0	5.4	16.5	9.0	2.8	7.8
SCS (# fish x 1,000)	152.5	134.3	127.0	118.9	117.2	167.6	107.9	100
Unclassified (# fish x 1,000)	5.4	18.4	28.5	47.6	7.5	23.9	6.1	15.1

Number of Participants/Permits
In 2002, NMFS published a final rule (67 FR 777434, December 18, 2002), effective March 2003, expanding the HMS recreational permit requirement from tuna only to sharks and all HMS species, and defining charter and headboat operations. This established a requirement that owners of charterboats or headboats that are used to fish for, take, retain, or possess Atlantic tunas, sharks, swordfish, or billfish must obtain a HMS Charter Headboat permit.

There has been a significant increase in angling category permits over the last several years, from 13,263 in 2002 to 24,476 in 2010. The total number of Charter Headboat permits increased from 3,963 in 2005 to 4,174 in 2010 (NMFS 2010b). The number of anglers fishing from charter/headboats and private vessels that target sharks is unknown, but is significantly less than the number targeting other HMS species (e.g., tunas).

Gear and Fishing Technique Characteristics
Rod-and-reel consists of a handheld fishing rod with a manually or electronically operated reel attached. Handline consists of a line, sinker, leader, and at least one hook. The line is usually stored on a small spool and rack and can vary in length. The line varies in material from a natural fiber to synthetic nylon. The sinkers vary from stones to cast lead. The hooks are single to multiple arrangements in umbrella rigs. An attraction device must be incorporated into the hook, usually a natural bait and artificial lure (DeAlteris 1998).

Recreational fishing practices vary depending on the species targeted. Most fishermen targeting sharks use light tackle and practice catch-and-release (NMFS 2006a). Recreational fishermen targeting LCS and SCS sharks generally use rod-and-reel with a single hook (circle or J-hook) and fish baits on the bottom while the vessel is drifting or stationary. Recreational fisheries for pelagic sharks are often prosecuted similarly to other pelagic species (billfish, tunas) by trolling rigged baits and lures at relatively high speed. Also, natural baits are rigged and set to drift from anchored or drifting vessels. Chum or other attractants may be used.

Since 2008, if a tournament has a billfish prize category, participating anglers are required to use circle hooks regardless of the target species. For shark fishing tournaments, this circle hook tournament requirement only applies to those vessels holding HMS permits.

2.6 Description of Shark Fisheries in the Caribbean Region

Commercial Fisheries

The majority of participants in the Caribbean shark fisheries are small-scale commercial vessels using handgear (handline, rod and reel). Prior to the implementation of Amendment 2 to the 2006 Consolidated HMS FMP in 2008, the primary target species in the fisheries were sandbar and blacktip sharks, although many other shark species were caught as well. In 2010, no shark HMS limited access fishing permits were held by residents of Puerto Rico, St. Thomas, St. Croix, or St. John. One shark dealer permit was held by a resident of Puerto Rico.

Puerto Rico reported approximately 10.1 metric tons of commercial shark landings for 2006 (PR DNER, 2007). Puerto Rico reported approximately 11.8 metric tons of commercial shark landings for 2010 (David Gloeckner, pers. comm., in NMFS 2012a). However, it is not clear what portion of these landings or what species were harvested from federal waters. Currently, little information is available regarding shark catches in the USVI, however less than one metric ton was reported by St. Thomas and St. John (combined) in 2010 (David Gloeckner, pers. comm., in NMFS 2012a).

Recreational Fisheries

Currently, subject to certain restrictions and limitations, including those specified at 50 CFR §635.22(a)(2), federal regulations state that recreational anglers can retain blacktip, spinner, bull, lemon, nurse, great hammerhead, smooth hammerhead, scalloped hammerhead, tiger, bonnethead, Atlantic sharpnose, finetooth, blacknose, porbeagle, common thresher, shortfin mako, oceanic whitetip, and blue sharks. Recreational anglers cannot retain any prohibited species, sandbar, or silky sharks. Recreational anglers can land one shark from the above list with a minimum fork length (FL) of 54 inches per vessel per trip, in addition to one Atlantic sharpnose (no minimum size) and one bonnethead shark (no minimum size) per person per trip. Sharks may be retained on recreational vessels issued an HMS Angling or HMS charter headboat permit.

The limited possession of fishing permits and dealer permits and reporting of recreational catch has resulted in limited catch and landings data from the U.S. Caribbean fisheries. However, some of these fishermen have federal permits for other species (i.e., snapper, grouper, pelagics) and are required to report all landings, including shark, due to the regulations of these fisheries.

Trip-ticket data from Puerto Rico and the USVI offers the best source of shark landings data. Those data indicate sharks are rarely targeted, but rather caught as bycatch. Since sharks are infrequently targeted little information is currently available about the gears and baits used to target these species.

2.7 Description of the Commercial Smoothhound Shark Fishery

Comparison to the Spiny Dogfish Fishery
The proposed action would place smoothhound under federal management with the intention of gaining a better understanding of the smoothhound fishery's characteristics before further management measures, such as vessel logbook reporting, are taken. Since little is known about the specifics of the fishery, we use the best available information about the smoothhound fishery and similar fisheries to describe the fishery's operation. Anecdotal evidence and landings data indicate there are strong similarities between the gear types and techniques used in spiny dogfish (*Squalus acanthias*) and smoothhound (*Mustelus canis*) fisheries. However, it does not appear that smoothhound fishermen are simply a subset of spiny dogfish fishermen (July 8, 2009, memorandum from HMS to MAFMC). Smoothhound shark are primarily harvested in March-May, when spiny dogfish landings are relatively low. VTR data indicate that beginning in June smoothhound landings fall markedly as spiny dogfish landings increase dramatically and dominate the landings for the remaining months (June-February) (VTR Database, unpublished data). VTR landings data from 2004-2007 indicate approximately 15 percent of vessels reporting landings of smoothhound and spiny dogfish had trips where smoothhound was the target species.[7] Clear temporal differences and differences in target species indicate it is not appropriate to classify the smoothhound shark fishery as a subset spiny dogfish fishery. However, given the similarities between the two fisheries, when information is lacking about the smoothhound fishery we rely on the characterization of the analogous spiny dogfish fisheries to overcome our knowledge gaps.

2.7.1 Area of Operation

Smoothhounds are landed in both the Northeast and Mid-Atlantic Regions, with the majority of landings being reported in the Mid-Atlantic Region (ACCSP Database, unpublished data).[8] Many fishermen in the Mid-Atlantic Region have been reporting smoothhound landings. From 2004-2011, the highest proportion of smoothhound landings coming from federal waters was in 2004 at 47 percent, the lowest in 2007 at 27 percent, and the mean was 36 percent (VTR Database, unpublished data).

Confidentiality agreements regarding landings data require the use of two datasets to best understand the temporal and spatial distribution of fishing effort. ACCSP landings data are the best available for understanding smoothhound catch geographically (i.e., by state) and seasonality. VTR data is more appropriate for trip-level analysis.

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[7] Trips targeting smooth dogfish were defined as trips with smooth dogfish landings of 80 percent or more.
[8] Since 1994, no landings of smooth dogfish have been reported north of Massachusetts and south of South Carolina.

Smoothhound Landings by State

ACCSP data indicate that from 2006-2010 the majority of smoothhound shark landings came from North Carolina (45.7 percent), Virginia (22.2 percent), and New Jersey (15.4 percent); eight other states also recorded landings during those years (see Table 2.14) (ACCSP Database, unpublished data). North Carolina, Virginia, and New Jersey accounted for just over 80 percent of all smoothhound landings from 2006-2010 (ACCSP Database, unpublished data). Data on the number of vessels reporting smoothhound landings supports the premise that the fishery is centered in the Mid-Atlantic Region. VTR data, a primarily Northeast United States reporting system, indicate an average of 278 vessels reported smoothhound landings annually from 2006-2010. VTR data cover a geographical range that extends across most of the fishery's range. Therefore, this number is likely a slight underestimate.

Table 2.14 ACCSP Smoothhound Shark Landings by State, 2006-2010

State	Percentage of All Landings
North Carolina	45.7
Virginia	22.2
New Jersey	15.4
New York	7.3
Maryland	6.1
Rhode Island	1.4
South Carolina	0.6
Massachusetts	0.5
Delaware	0.5
Connecticut	0.2
Maine	< 0.1

Temporal Smoothhound Landings

From 2006-2010, North Carolina, Virginia, New Jersey, New York, Maryland, and Rhode Island comprised over 96 percent of all smoothhound landings (ACCSP Database, unpublished data). During that period, landings from these six Mid-Atlantic states were recorded in each month, with peak landings in May. Landings were highest from March through June; 500,000 total pounds or more were recorded during each of those months. Another peak in landings occurs in November with over 650,000 total pounds. Landings were lowest in January.

These data also indicate seasonal shifts in peak landings. Of the six states with the majority of landings, North Carolina had the highest landings from November-April, and represents almost all landings from January through April. In May, landings are dominated by Virginia. New Jersey and New York have modest but consistent landings through the warmer months of May-September (ACCSP data, unpublished data). The monthly landings by state are summarized in Table 2.15.

Table 2.15 NMFS ACCSP Data Total Monthly Landings by State, 2006-2010 Combined

	Landings by State (lbs)					
Month	**NC**	**VA**	**NJ**	**NY**	**MD**	**RI**
January	205,083	68,747	956	454	140	0
February	310,018	15,250	68	89	0	0
March	654,859	0	247	936	923	0
April	1,377,543	255,357	2,145	1,237	31,547	35
May	165,799	1,079,071	142,700	58,626	205,497	28,577
June	10,982	59,789	213,253	98,339	103,712	29,854
July	13,174	6,356	211,568	129,973	15,415	11,813
August	4,139	21,424	167,025	115,319	5,486	22,270
September	21,684	16,719	228,722	83,011	27,518	9,993
October	37,326	7,028	41,893	40,132	48,157	1,800
November	465,598	56,767	96,971	15,355	9,710	0
December	155,980	74,801	46,417	5,976	8,538	213

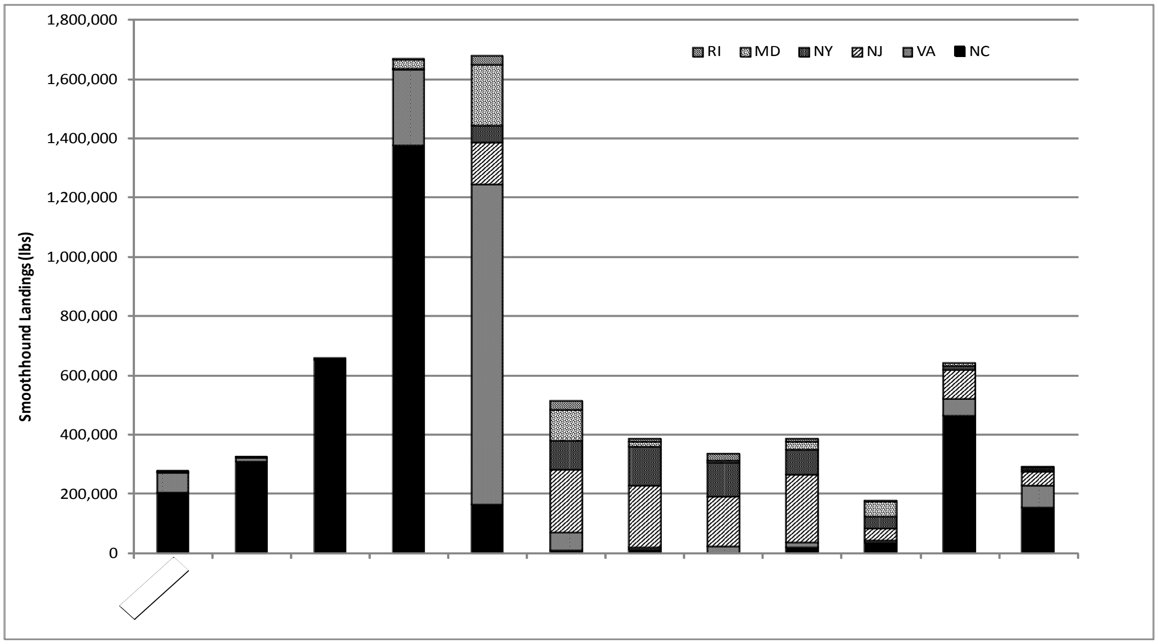


Figure 2.15 Landings of Smoothhound by State and Month, 2006-2010 Combined

2.7.2 Gear Type

Sink/Anchored Gillnet Gear

Gillnet was the predominant gear type used to land smoothhound from 2007-2010 (NMFS dealer weigh-out data; unpublished data). Among gillnet gear, anchored and sink gillnet gear accounted for 92 percent of gillnet landings. Sink/anchored gillnets may also be called set nets and vary in length and depth. A sink gillnet is one in which the top line (i.e., float line) of the net is submerged below the surface of the water. The sink gillnet is a vertical wall of netting with a weighted leadline that allows the net to hang in the water column just above the ocean floor (NMFS 1996a). At the end of each net, the float line attaches to the lead line, forming bridles to which the next net in the string is attached. The end nets of the string are anchored and attached to the surface buoy line. Polypropylene (floating) line is used between the anchor line and surface line to prevent chafing. Sink gillnet gear is designed to be fished on or near the bottom in the lower third of the water column. The net is designed to capture mid-water or bottom-dwelling fish (NMFS 2001a).

In North Carolina, the majority of sink gillnets targeting spiny dogfish are anchored (NCDMF 2000, Steve et al. 2001). They are typically monofilament nets, 12 ft deep, from 600-3,000 ft long, with mesh sizes ranging from 5.5- to 7-inch-stretched mesh (Street 1996, Steve et al. 2001). Net panels are tied together and set as a "string" over an area where fish are suspected to be. Nets are set over the transom of the boat using a net reel. Large buoys, "high fliers", or both are attached to one or both ends by enough line to allow the net to sink below the surface of the water. A crew of one or two will pick the net as it is hauled in over the transom and onto the net reel (Ross 1989). Soak times can be less than 8 hours or 12 to 24 hours (Steve et al. 2001). Weather can also influence soak times. If weather does not permit retrieval, some nets may be left to soak for 2 to 3 days. Fishermen targeting spiny dogfish fished anywhere from state waters out to 20 miles (Thorpe and Beresoff 2000). Water depths at this distance from shore are approximately 100 ft (30 m). The similarities in species life histories of smooth and spiny dogfish and the similarities in operation of the two fisheries targeting these species indicate smoothhound fishermen are likely fishing the same areas.

2.8 Other Actions and Regulations Affecting the Proposed Action

2.8.1 Atlantic Large Whale Take Reduction Plan

The ALWTRP is a plan promulgated under the MMPA to reduce serious injury and mortality (SI/M) to four large whale stocks that occur incidentally in certain fisheries. The target whale stocks are the North Atlantic right whale western North Atlantic stock, humpback whale western North Atlantic stock, fin whale western North Atlantic stock, and minke whale Canadian East Coast stock.

To reduce serious injuries and mortality the ALWTRP targets certain Category I and II fisheries under the MMPA’s List of Fisheries (LOF). The LOF assigns specific categories to commercial fisheries based on their interactions with marine mammals. Category I designates fisheries with frequent serious injuries and mortalities incidental to commercial fishing; Category II designates fisheries with occasional serious injuries and mortalities; and Category III designates fisheries with a remote likelihood or no known serious injuries or mortalities.

Currently, the ALWTRP affects the following fisheries: the Northeast/Mid-Atlantic American lobster trap/pot, Northeast sink gillnet, Mid-Atlantic gillnet, Southeast U.S. Atlantic shark and Southeast Atlantic gillnet, the Northeast anchored float gillnet, Northeast drift gillnet, Atlantic blue crab, and Atlantic mixed species trap/pot fisheries (NMFS NERO 2010). The bottom longline sector of Atlantic shark fisheries is a Category III fishery under the 2012 LOF (76 FR 73912; November 29, 2011) and is not managed by the ALWTRP.

The ALWTRP has several components including restrictions on where and how gear can be set, research into whale populations, whale behavior, as well as fishing gear interactions and modifications. The ALWTRP also includes an outreach component to inform and collaborate with fishermen and a disentanglement program. The first ALWTRP went into effect in 1997. The regulations were updated in February 1999, and again in December of 2000. In January 2002, NMFS published three rules that: (1) made further modifications to commercial fishing gear, (2) established a system for restricting fishing in areas where unexpected aggregations of North Atlantic right whales are observed, and (3) established restricted areas based on the annual, predictable aggregations of North Atlantic right whales. In June 2007, NMFS published a final rule expanding the Southeast U.S. Restricted Area and prohibiting gillnet fishing or possession during the North Atlantic right whale calving season, with some exceptions (NERO 2010).

The most recent update to the ALWTRP was in 2007. In October 2007, NMFS issued a final rule implementing broad-based gear modifications including expanded weak link and sinking groundline requirements, additional gear marking requirements, changes in boundaries, seasonal restrictions for gear modifications, expanded exempted areas, and regulatory language changes for the purposes of clarification and consistency.

The gillnet gear requirements under the ALWTRP differ for each management area and change based on location, season, and gear type. Since portions of the ALWTRP specifically address the Atlantic shark fisheries and would apply to the smoothhound fishery, the following discussion describes those requirements. Following that discussion, the ALWTRP requirements specific to other types of gillnet gear are described.

2.8.1.1 Atlantic Shark Fisheries Gillnet Gear Requirements

Requirements in the final rule implementing the ALWTRP that pertained to Atlantic shark gillnet fisheries included gear requirements (e.g., a general prohibition on having line floating at the surface), a prohibition on storing inactive gear at sea, and time area closures and other restrictions on setting shark gillnets off the coasts of Georgia and Florida and in the mid-Atlantic. The area from 27°51’ N (near Sebastian Inlet, Florida) to 32°00 N (near Savannah, Georgia) extending from the shore outward to 80° W was closed to shark gillnet fishing, except for strike-netting, each year from November 15-March 31. Observer coverage was required for the use of gillnets in the area from West Palm Beach, Florida (26°46.5 N) to Sebastian Inlet (27°51 N) from November 15 through March 31. The plan also contained non-regulatory aspects including gear research, public outreach, scientific research, a network to inform mariners when North Atlantic right whales are in an area, and increasing efforts to disentangle whales caught in fishing gear.

Gillnet Management Areas

The Southeast Gillnet Management Areas have four subregions: the Southeast U.S. (SEUS) Restricted Area North, the SEUS Restricted Area South, the SEUS Monitoring Area, and Other Southeast Gillnet Waters; Figure 2.3 is a map showing each location (NMFS NERO 2010).

SEUS Restricted Area North

The SEUS Restricted Area North includes waters north of 29°00 N (near Ponce de Leon Inlet, Florida) to 32°00 N (near the Georgia/South Carolina border) from the shoreline eastward to 80°00 W, and off South Carolina, within 35 nautical miles of the shoreline. Little River Inlet, South Carolina, is not located in the Southeast U.S. Restricted Area North.

SEUS Restricted Area South

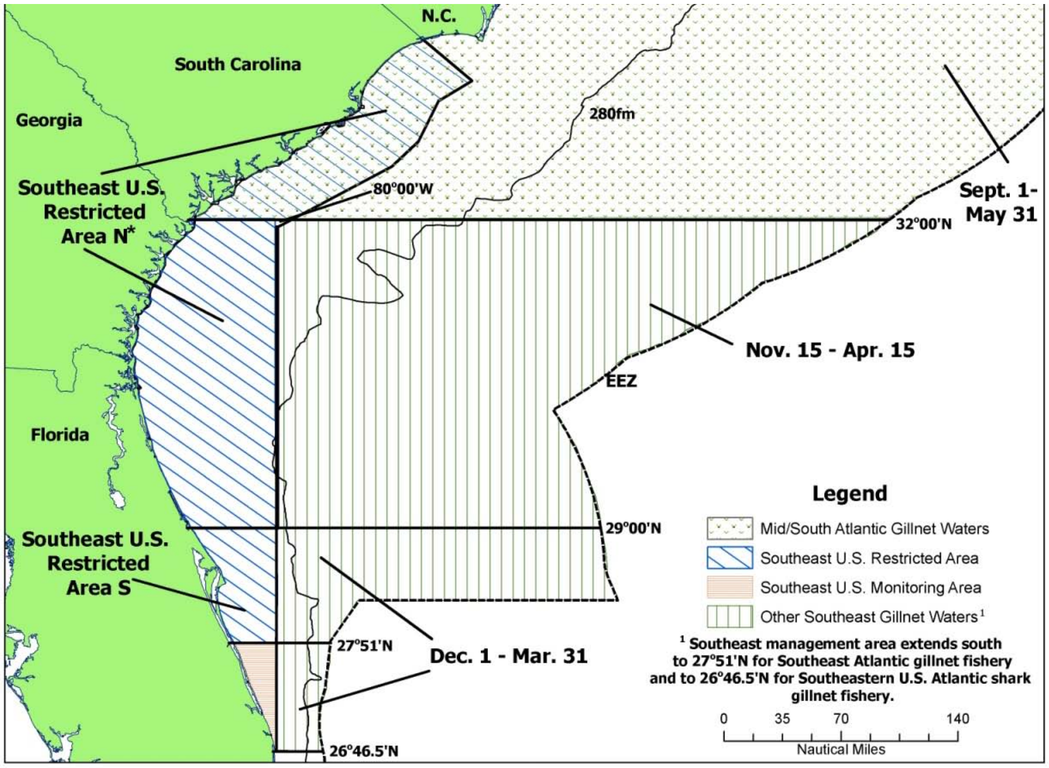
The SEUS Restricted Area South includes waters north of 27°51' N (near Sebastian Inlet, Florida) to 29°00 N (near Ponce de Leon Inlet, Florida) from the shoreline eastward to 80°00 W.

SEUS Monitoring Area

The SEUS Monitoring Area is a management area for the Southeastern U.S. Atlantic shark gillnet fishery only, and includes the area along the coast from 27°51 N (near Sebastian Inlet, Florida) south to 26°46.5 N (near West Palm Beach, Florida) and extending from the shoreline or exemption line eastward to 80°00 W.

Other Southeast Gillnet Waters

Other Southeast Gillnet Waters consists of the area from 32°00 N (near Savannah, Georgia) south to 27°51 N for the Southeast Atlantic gillnet fishery, and from 32°00 N (near Savannah, Georgia) south to 26°46.50 N for the Southeastern U.S. Atlantic shark gillnet fishery, and extending from 80°00 W east to the eastern edge of the EEZ, for both the Southeast Atlantic gillnet fishery and the Southeastern U.S. Atlantic shark gillnet fisheries.



* Includes area created by a recent Southeast ALWTRP action (The area north of 32°00' N lat. is included in the Southeast U.S. Restricted Area from Nov. 15 - April 15, and Mid/South Atlantic Gillnet Waters from Sept. 1 - Nov. 14 and April 16 - May 31)

Figure 2.1 ALWTRP Southeast Gillnet Management Areas

Gillnet Gear Requirements

Specific regulations for shark gillnet fisheries,[9] pursuant to the ALWTRP, as amended, include:

- Possession of and fishing with gillnet gear in the Southeast U.S. Restricted Area North is prohibited from November 15-April 15, with an exemption for transit through the area if gear is stowed.
- Fishing with gillnet gear is prohibited in the Southeast U.S. Restricted Area South from December 1-March 31, with an exemption for strike-net component of the Southeastern U.S. Atlantic shark gillnet fishery. Fishing for sharks with gillnet with a 5-inch or greater stretch mesh size in the Southeast U.S. Restricted Area South is authorized, if the following criteria are met:
    - The gillnet is deployed so that it encloses an area of water;
    - a valid commercial directed shark limited access permit has been issued to the vessel in accordance with § 635.4 of this title and is on board;
    - no net is set or remains in the water at night or when visibility is less than 500 yards (460 m);
    - each set is made under the observation of a spotter plane;
    - no gillnet is set within 3 nautical miles (5.6 km) of a right, humpback, or fin whale;
    - gillnet is removed immediately from the water if a right, humpback, or fin whale moves within 3 nautical miles (5.6 km) of the set gear;
    - a vessel operator calls the SEFSC, Panama City Laboratory (phone 850-234-6541, fax 850-235-3559) at least 48 hours prior to departure on fishing trips in order to arrange for observer coverage. If Panama City Laboratory requests an observer be taken, gillnetting is not allowed unless an observer is onboard the vessel during the fishing trip; and
    - gear is marked as follows:
        - Gear is marked with a green marking (to indicate gillnet gear) and a blue marking (to indicate area); marks must be 4-inch long and the two color marks must be within 6-inch of each other. If the color of the rope is the same as or similar to a color code, a white mark may be substituted for that color code.
        - Marks may be dyed, painted, or marked with thin, colored whipping line; thin, colored plastic or heat-shrink tubing or other material; or a thin line may be woven into or through the line;
        - All buoy lines must be permanently marked within 2 feet of the top and midway along the length of the buoy line. Each net panel must be marked along both the float line and the lead line at least once every 100 yards.

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[9] Under the ALWTRP shark gillnet is "gillnet gear for shark with webbing of 5 inches or greater stretched mesh." 50 CFR 229.32(b)(2)(i)(A).

- In the Southeast U.S. Monitoring Area (waters landward of 80°W from 27°51 N to 26°46.5′ N), fishermen must use vessel monitoring systems (VMS) from December 1-March 31.

2.8.1.2 Other ALWTRP Requirements Applicable to the Proposed Action

The current distribution of fishing effort for smoothhound shark and other Atlantic sharks also occurs outside of the areas with specific requirements for shark gillnet gear described above. Shark fishing efforts also occur in two other ALWTRP management areas: the Northeast gillnet management areas, and the Mid/South Atlantic Gillnet waters. The Northeast Gillnet Management Areas comprise four sub regions described below (NERO 2010). Gillnet gear requirements for each sub region differ by location, season, and gear type. Below is a description of the location of each management area, the effective dates for gillnet gear restrictions, and in general terms, the requirements of each gear type ("the gillnet requirements") (see below for discussion of requirements). Appendix 2 contains the specific requirements for each gillnet gear type and individual maps of each management area.

Gillnet Management Areas
The Northeast Gillnet Management Areas are comprised of four subregions: the Cape Cod Bay Restricted Area, the Great South Channel Restricted Area, the Stellwagen Bank/Jeffrey's Ledge Restricted Area, and Other Northeast Gillnet Waters; Figure 2.2 is a map showing each location (NMFS NERO 2010).

Cape Cod Bay Restricted Area (CCB)
The CCB includes the area bounded by: 42°04.8 N/70°10 W; 42°12 N/70°15 W; 42°12 N/70°30 W; 41°46.8 N/70°30 W; and on the south and east by the interior shoreline of Cape Cod, Massachusetts. Inside the CCB restricted area, measures to protect large whales are enacted seasonally (January 1-May 15; May 16-December 31) and apply to all gillnet fishing in this area. From January 1-May 15, all gillnet fishing within this area is prohibited, and from May 16-December 3 the gillnet requirements are effective [50 CFR 229.32 (d)(2) and (e)(1)].

Great South Channel Restricted Area (GSC)
The GSC includes the waters bounded by; 41°40 N/69°45 W; 41°00 N/69°05 W; 41°38 N/68°13 W; and 42°10 N/68°31 W [50 CFR 229.32 (d)(3) and (e)(2)]. The Great South Channel Sliver Restricted Gillnet Area ("Sliver Area") includes the area bounded by:
41°02.2 N/69°02 W; 41°43.5 N/69°36.3 W; 41°40 N/69°45 W; and 41°00 N/69°05 W [50 CFR 229.32 (d)(4) and (e)(3)]. From April 1-June 30, all gillnet fishing (except within the Sliver Area) is prohibited in the GSC restricted area. The GSC is open to gillnet fishing from July 1–March 31 (year-round in the Sliver Area) in accordance with the gillnet restrictions [50 CFR 229.32(d)(3-4) and (e)(2-3)].

Stellwagen Bank/Jeffrey's Ledge Restricted Area (SB/JL)
The SB/JL includes all federal waters of the Gulf of Maine (except those designated as the Cape Cod Bay Restricted Area) that lie south of 43°15 N and west of 70°00 W. The gillnet requirements are effective year-round in the SB/JL restricted area [50 CFR 229.32 (d)(5) and (e)(4)].

Other Northeast Gillnet Waters (ONGW)

ONGW are all U.S. waters from the United States/Canada border to Long Island, New York, at 72°30 W south to 36°33.03 N and east to the eastern edge of the EEZ, with the exception of the CCB, SB/JL, and GSC where the restriction noted above apply. Gillnet fishing is open year-round in the ONGW management area; in accordance with the gillnet requirements [50 CFR 229.32 (d)(6) and (e)(5)].

Figure 2.2 Map of the Northeast Gillnet Management Areas

Mid/South Atlantic Gillnet Waters

The ALWTRP defines these waters as all U.S. waters bounded on the north from Long Island, New York, at 72°30 W south to 36°33.03 N, and then east to the eastern edge of the EEZ, and bounded on the south by 32°00 N and east to the eastern edge of the EEZ (see Figure 2.2 [50 CFR 229.32 (d)(7) and (e)(6), NERO 2010]). Inside the Mid/South Atlantic Gillnet waters, the gillnet requirements of the Northeast Management Areas apply from September 1-May 1, with the exception of a minor difference in the gear marking requirements.

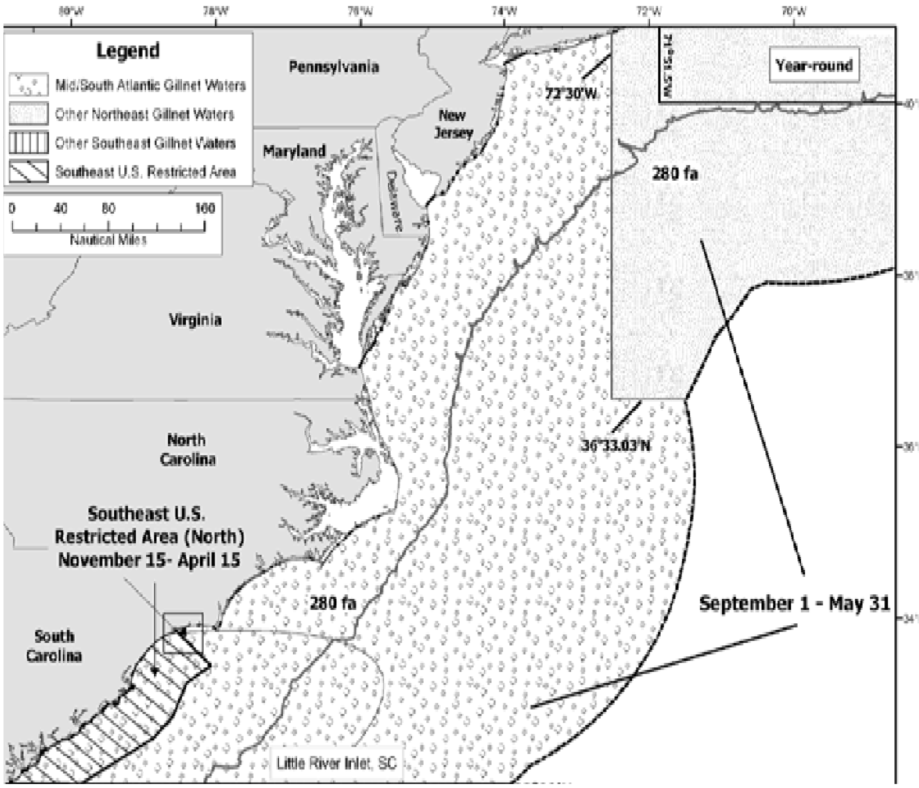


Figure 2.3 Map of the Mid/South Atlantic Gillnet Waters Management Area

Gillnet Gear Requirements

All gillnets fished in the Northeast Gillnet Management Areas, the Mid/South Atlantic Gillnet Waters, the SEUS Restricted Area North, the SEUS Restricted Area South, the SEUS Monitoring Area, and OSGW must abide by the specific gear marking requirements. Anchored gillnets must follow the universal gear requirements (no line floating at the surface, no wet storage of gear, and anchored gear must be hauled out of the water at least once every 30 days). Fishermen are also encouraged to maintain their buoy lines as knot-free as possible. Anchored gillnets must also have all buoys attached to the main buoy line with a weak link having a maximum breaking strength of 1,100 lbs. All net panels are required to have a weak link with a maximum breaking strength of 1,100 lbs in the center of the floatline of each 50-fathom net panel in a net string, or every 25 fathoms for longer panels. Gillnets that do not return to port with the vessel must be anchored with the holding power of at least a 22-lb Danforth-style anchor at each end of the net string [50 CFR 229.32 (d)(1-7)].

Within the Northeast and Mid/South Atlantic Gillnet Areas, no drift gillnet gear may be fished at night unless the gear is tended (i.e., attached to the vessel), and all drift gillnet gear must be removed from the water and stowed on board before returning to port during the effective dates [50 CFR 229.32 (e)(1-6)]. Appendix 2 provides a more detailed description of the requirements for each area and gear type.

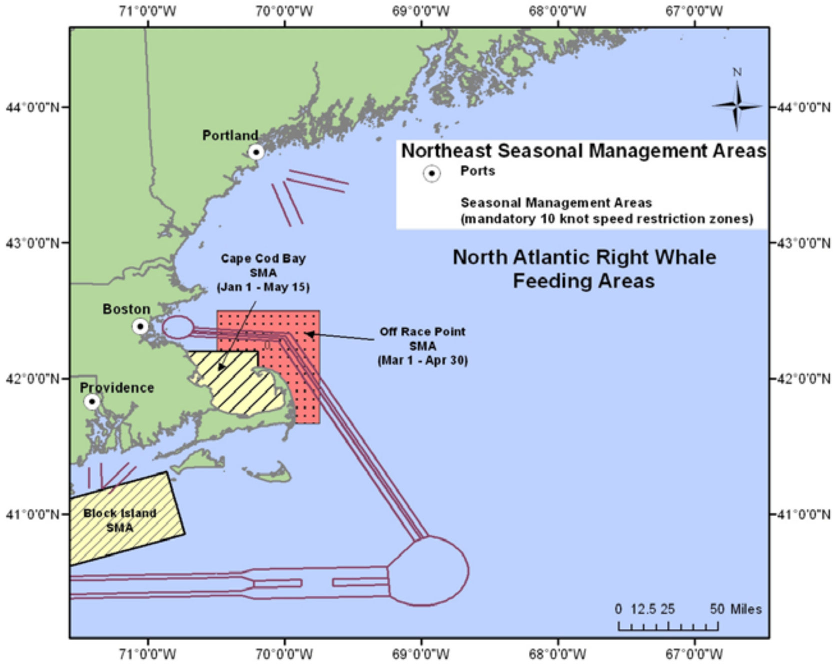
In the SEUS Restricted Area North, gillnet fishing of any kind is prohibited from November 15-April 15 each year. Outside this area and time of year gillnet fishing in the Southeast Atlantic

Gillnet Fishery targeting Spanish mackerel and the Southeast Atlantic Shark Gillnet fishery are authorized in certain locations and under specific operating requirements. Appendix 2 provides a more detailed description of the requirements for each area and gear type.

2.8.2 Rule to Reduce Ship Strikes with North Atlantic Right Whales

In October 2008, NMFS published a final rule (73 FR 60173, October 10, 2008) establishing regulations to implement a 10-knot speed restriction applying to all vessels 65 ft or greater in overall length in certain locations and at certain times of the year along the east coast of the U.S. Atlantic seaboard. The purpose of this regulation is to reduce the likelihood of deaths and serious injuries caused by collisions with ships. Vessels may operate at a speed greater than 10 knots only if necessary to maintain a safe maneuvering speed in an area where conditions severely restrict vessel maneuverability as determined by the pilot or master. If a deviation from the 10-knot speed restriction is necessary, the following information must be entered into the logbook: reasons for deviation, speed at which vessel was operated, latitude and longitude at time of deviation, time and duration of deviation. The master of the vessel shall sign and date the logbook entry. Presently, this rule is set to expire on December 9, 2013.

Seasonal management areas (SMAs) were established off the Northeast, Mid-Atlantic, and the Southeast; Figures 2.4, 2.5, and 2.6 show each of these SMAs.[10] Additionally, NMFS may implement voluntary Dynamic Management Areas (DMAs). Mariners will be encouraged, but not required, to either avoid DMAs or travel through them at 10 knots or less.



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[10] Seasonal Area Management or Seasonal Managements Areas (SMA) refer to areas where the annual aggregations of right whales is predictable. These areas require specific gear modifications for lobster trap/pot and anchored gillnet gear in these areas on a seasonal basis to reduce the potential impacts to North Atlantic right whales.

Figure 2.4 Northeast U.S. Seasonal Management Area

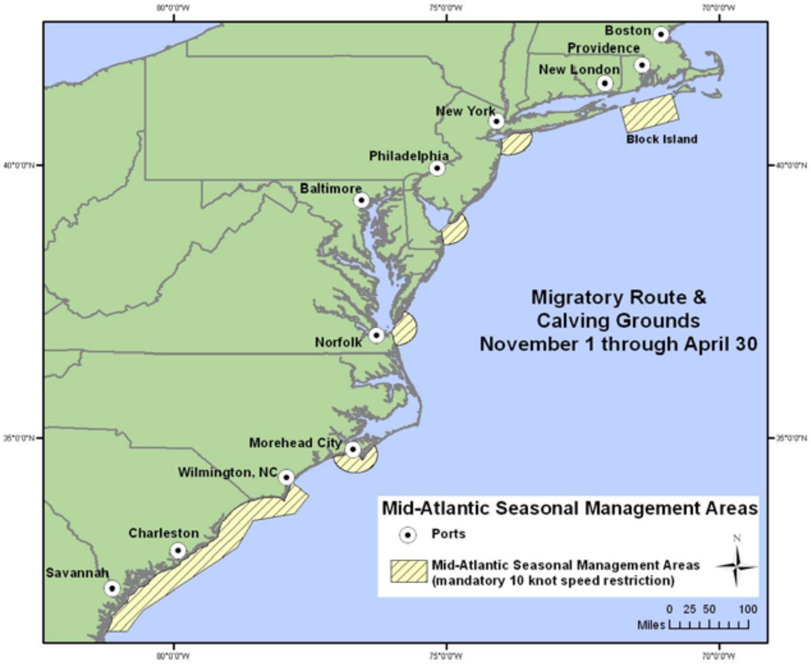

Figure 2.5 Mid-Atlantic U.S. Seasonal Management Area

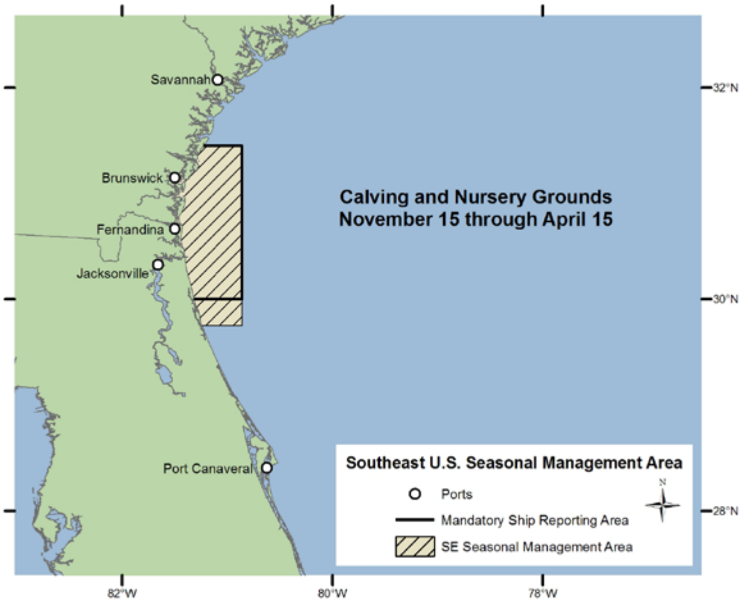

Figure 2.6 Southeast U.S. Seasonal Management Area

2.8.3 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.

2.8.4 Mid-Atlantic Large-Mesh Gillnet Closure

NMFS published a final rule (67 FR 71895, December 3, 2002) enacting seasonal closures in the Mid-Atlantic EEZ for fishing with gillnets with a stretched mesh size of eight inches or greater, which was subsequently changed to seven inches or greater (71 FR 24776; April 26, 2006). The purpose of the action was to reduce the impact of large-mesh gillnet fisheries operating in areas where sea turtles were known to occur. The seasonal closure applies to (see Figure 2.7):

- Waters north of 33°51.0 N (North Carolina/South Carolina border at the coast) and south of 35°46.0 N (Oregon Inlet, North Carolina) at any time;
- Waters north of 35°46.0 N (Oregon Inlet, North Carolina) and south of 36°22.5 N (Currituck Beach Light, North Carolina) from March 16-January 14;
- Waters north of 36°22.5 N (Currituck Beach Light, North Carolina) and south of 37° 34.6 N (Wachapreague Inlet, Virginia) from April 1-January 14; and
- Waters north of 37° 34.6 N (Wachapreague Inlet, Virginia) and south of 37° 56.0 N (Chincoteague, Virginia) from April 16-January 14.

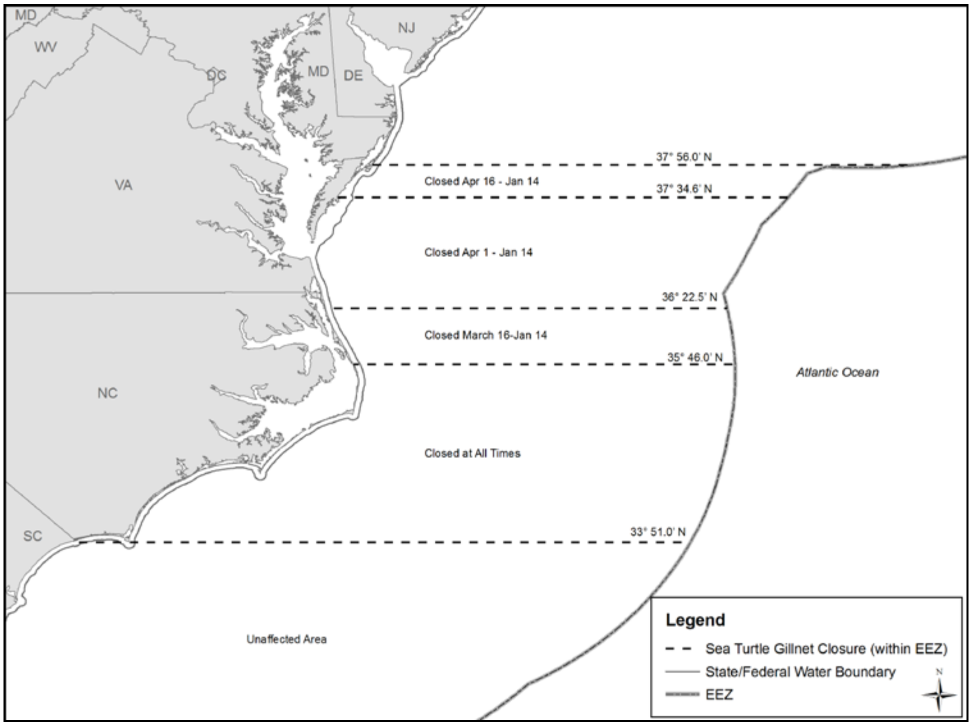

Figure 2.7 Mid-Atlantic Large Mesh Gillnet Closure Areas

2.9 Action Area

Atlantic shark fisheries are managed under the Consolidated HMS FMP throughout the U.S. EEZ in the Atlantic Ocean, the Gulf of Mexico, and the Caribbean Sea; smoothhound are proposed to be managed under the HMS FMP. Throughout the U.S. EEZ in the Atlantic Ocean Gulf of Mexico, and Caribbean, the Atlantic shark and smoothhound fisheries may affect one or more listed species; therefore, the action area for this opinion is the U.S. Atlantic, Gulf of Mexico, and Caribbean regions. 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 (Figures 2.2 and 2.3). Gillnet fishing effort has concentrations northwest of the Florida Keys and along the central and east coast of Florida (Figure 2.4). Maps of the areas where gillnet and bottom longline sets were observed from 2008-2010 are available in Appendix 3. From 2006-2010, smoothhound landings were only reported from South Carolina to Maine (ACCSP unpublished data).

3.0 Species and Critical Habitat That May Be Affected

Marine Mammals	**Status**
Blue whale (*Balaenoptera musculus*)	Endangered
Sei whale (*Balaenoptera borealis*)	Endangered
Sperm whale (*Physeter macrocephalus*)	Endangered
Fin whale (*Balaenoptera physalus*)	Endangered
Humpback whale (*Megaptera novaeangliae*)	Endangered
North Atlantic right whale (*Eubalaena glacialis*)	Endangered
Sea Turtles	
Green sea turtle (*Chelonia mydas*)	Endangered/Threatened[11]
Hawksbill sea turtle (*Eretmochelys imbricata*)	Endangered
Kemp's ridley sea turtle (*Lepidochelys kempii*)	Endangered
Leatherback sea turtle (*Dermochelys coriacea*)	Endangered
Loggerhead sea turtle (*Caretta caretta*)	Threatened[12]
Invertebrates	
Elkhorn coral (*Acropora palmata*)	Threatened
Staghorn coral (*Acropora cervicornis*)	Threatened
Fish	
Gulf of Maine Atlantic salmon *(Salmo samar)*	Endangered[13]
Smalltooth sawfish (*Pristis pectinata*)	Endangered[14]
Shortnose sturgeon (*Acipenser brevirostrum*)	Endangered
Gulf sturgeon (*Acipenser oxyrinchus desotoi*)	Threatened
Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*)	Endangered/Threatened[15]

Critical Habitat Designated for:
Elkhorn and staghorn coral
North Atlantic right whale
Leatherback sea turtle

We have determined that the proposed action is not likely to adversely affect blue whales, sei whales, sperm whales, Gulf sturgeon, shortnose sturgeon, Gulf of Maine Atlantic salmon, leatherback sea turtle critical habitat, elkhorn and staghorn corals or their designated critical habitat. We also determined that the proposed action will have no effect on North Atlantic right whale critical habitat. Therefore, they are excluded from further analysis and consideration in this opinion. The following discussion summarizes our rationale for these determinations.

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[11] Green sea turtles in U.S. waters are listed as threatened except for the Florida and Pacific coast of Mexico breeding populations, which are listed as endangered.

[12] The NW Atlantic Distinct Population Segment (DPS).

[13] Only the Gulf of Maine DPS is listed as endangered.

[14] The United States DPS.

[15] The Gulf of Maine DPS is listed as threatened; the remaining 4 DPSs are listed as endangered.

3.1 Analysis of Species Not Likely to be Adversely Affected

Blue, Sei, and Sperm Whales

We believe the chance of a blue, sei, or sperm whale being affected by the proposed action is discountable. Blue, sei, and sperm whales are predominantly found seaward of the continental shelf, where smoothhound and Atlantic shark fishing does not occur. Sightings of sperm whales are almost exclusively in the continental shelf edge and continental slope areas (Scott and Sadove 1997). Sei and blue whales also typically occur in deeper waters and neither is commonly observed off the U.S. East Coast (CETAP 1982, Wenzel et al. 1988, Waring et al. 2002 and 2006). The smoothhound fishery typically operates from state waters out approximately 20 miles (Thorpe and Beresoff 2000). Water depths at this distance from shore are approximately 100 ft. The HMS bottom longline fishery typically operates in Southeast waters of approximately 50-205 ft depths on average and the gillnet portion of this fishery primarily takes place in water approximately 30-70 ft in depth (Passerotti and Carlson 2009, Passerotti et al. 2010, Hale et al. 2009, Hale et al. 2010). Based on the depths at which these fisheries likely occur, these species of whales are expected to be rare in the action area and we believe the chance of a blue, sei, or sperm whale being affected by the proposed action is discountable.

Elkhorn and Staghorn Corals

Acroporid corals require relatively clear, well circulated water. Typical water temperatures in which these species occur range from 21°-29°C, but these species are capable of withstanding temperatures above the seasonal maximums for short periods of time. The environmental conditions of most of the Gulf of Mexico, Atlantic, and Caribbean EEZ are not suitable for Acroporid corals. Elkhorn coral commonly grows in turbulent shallow water on the seaward face of reefs in water ranging from 3-15 ft in depth, but have been found to 100 ft. Staghorn coral commonly grows in more protected, deeper water ranging from 15-65 ft in depth and have been found in rare instances to 200 ft.

Elkhorn and staghorn corals have a very limited distribution in the Gulf of Mexico, Atlantic, and Caribbean EEZ where HMS shark permit holders fish. There are only discrete areas in the U.S. Gulf of Mexico and EEZ with suitable depth and water quality conditions to support *Acropora* spp. In the Atlantic, these locations include the Florida Keys National Marine Sanctuary (FKNMS), and in the Gulf of Mexico in the Flower Garden Banks National Marine Sanctuary,[16] and areas northwest of the Florida Keys and in the Tortugas area. In the Caribbean, the total area of fishable habitat (i.e., 600 ft or less) is about 2,467 nm^2. Only 355 nm^2 (14.4%) of that area occurs in federal waters where NMFS authorizes fishing: 116 nm^2 (4.7%) off Puerto Rico; 240 nm^2 (9.7%), off the USVI. Of that area, only 4.1 percent is considered critical habitat for elkhorn and staghorn coral (NMFS unpublished data), which is the only place we would anticipate finding either species. The exact location and numbers of colonies in that area are not known.

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[16] There are two known colonies of elkhorn at the FGNMS located 100 mi off the coast of Texas. The Flower Garden Banks National Marine Sanctuary is a group of three areas of salt domes that rise to approximately 50 ft water depth and are surrounded by water depths of 200-400 ft.

Potential routes of effect on elkhorn and staghorn corals associated with fishing activity include abrasion and breakage resulting from: (1) vessel groundings, (2) anchoring, (3) damaging fishing practices, and (4) fishing/marine debris (*Acropora* BRT 2005). Damaging fishing practices involve gear being dragged along or moved across, directly landing on, or becoming wrapped around coral reef habitat. Density of elkhorn and staghorn and fishing gear are primary factors determining whether potential adverse impacts occur.

Any adverse effects from floating gillnets (i.e., drift or strike nets) are extremely unlikely to occur and are discountable because they are fished off the bottom and are not likely to come into contact with elkhorn or staghorn corals. Bottom longlines and sink gillnets are primarily used in sandy and muddy bottom habitats where coral would not occur. Thus, we believe adverse effects to elkhorn and staghorn coral from these gears are extremely unlikely and discountable. The commercial shark fisheries in the Caribbean target sharks at mid-water depths with rod-and-reel gear; these gears also do not come in contact with corals.

Off of Florida, in the areas where elkhorn and staghorn coral are most likely to occur, regulations are in place to protect them from the potential routes of the effects described above. FKNMS Regulations at 15 CFR §922.163 establish specific prohibitions against injuring corals (including elkhorn and staghorn), anchoring on corals, and grounding vessels on corals. Additionally, this section prohibits the discharge of fishing/marine debris into the waters of the FKNMS. Regulations at 15 CFR §922.164 provide additional protection for corals (including elkhorn and staghorn) occurring within specific management areas within in the FKNMS, prohibiting the use of vessel-towed or anchored bottom fishing gears or nets. The East and West Flower Garden Banks and Tortugas North and South Reserves (i.e., no-take areas) also have regulations to prevent adverse effects on corals from occurring.

Similar regulations do not exist in the Caribbean EEZ. However, elkhorn and staghorn coral are located on the benthos and would only very rarely be at risk from moving vessels. Vessels need sufficient water to navigate without encountering the bottom, and when transiting shallow areas vessels typically transit slowly. Shark fishing vessels embarking and returning from offshore fishing trips would likely travel via maintained channel waters where interactions would be even more unlikely. While offshore, the bathymetry of the region makes vessel groundings extremely unlikely to occur. In the areas where elkhorn and staghorn corals may occur in the Caribbean EEZ, depths range from 24-54 ft. The smaller artisanal style boats used to target sharks in the Caribbean are extremely unlikely to run aground in waters of that depth. Thus, we believe the likely impacts from vessel groundings on elkhorn and staghorn coral are extremely unlikely to occur and are discountable.

Most shark fishing vessels troll for sharks, though anchoring is possible. In the Caribbean, only four percent of federal waters is considered habitat suitable to even support elkhorn and staghorn colonies. Given the general rarity of the species, a much smaller percentage of that four percent is anticipate to have elkhorn and staghorn colonies. We believe that because vessels often *do not* anchor while targeting sharks, in conjunction with the relative rarity of elkhorn and staghorn in the very small portion of the Caribbean EEZ, makes it extremely unlikely that any vessel targeting sharks would cause damage to elkhorn or staghorn corals via anchoring. Additionally, Amendment 4 to the Consolidated FMP set a commercial retention limit for sharks at 0. Thus, we anticipate no commercial vessels will even be targeting sharks, further minimizing the chance of any adverse affects to elkhorn and staghorn corals from shark vessels.

The unlikelihood of elkhorn and staghorn occurring where fishing is likely to occur, in combination with the measures in place to protect elkhorn and staghorn where they may occur in the FKNMS, shark fishing practices, and the current retention prohibition on sharks in the Caribbean make any adverse effect on elkhorn and staghorn corals from the proposed action extremely unlikely to occur and discountable.

Gulf Sturgeon

Gulf sturgeon are not likely to be adversely affected by the proposed action. The Gulf sturgeon is an anadromous fish, inhabiting coastal rivers from Louisiana to Florida during the warmer months and over-wintering in estuaries, bays, and the Gulf of Mexico. Available data indicate Gulf sturgeon conduct alongshore migrations and primarily use shallow (2-6 m) nearshore areas as late wintering habitats (Edwards et al. 2007). HMS shark fisheries operate far offshore of these areas. No Gulf sturgeon have ever been observed caught during shark fishing. Based on this information, adverse effects from the proposed action are discountable.

Shortnose Sturgeon

Shortnose sturgeon are benthic fish that mainly occupy the deep channel sections of large rivers. They can be found in rivers along the western Atlantic coast from St. Johns River, Florida (possibly extirpated from this system), to the St. John River in New Brunswick, Canada. The species is estuarine anadromous[17] in the southern portion of its range (i.e., south of Chesapeake Bay), while some northern populations are freshwater amphidromous[18] (NMFS 1998a). Since the Atlantic shark fisheries (including smoothhound) do not operate in or near the rivers where concentrations of shortnose sturgeon are most likely found, it is highly unlikely that the fisheries will affect shortnose sturgeon.

Gulf of Maine Atlantic Salmon

The endangered Gulf of Maine Atlantic salmon distinct population segment (DPS) includes the wild population of Atlantic salmon of rivers and streams from the lower Kennebec River north to the U.S.-Canada border (i.e., Dennys, East Machias, Machias, Pleasant, Narraguagus, Ducktrap, and Sheepscot Rivers and Cove Brook. An anadromous species, juvenile salmon in New England rivers typically migrate to sea in May after a two- to three-year period of development in freshwater streams. The salmon remain at sea for two winters before returning to their U.S. natal rivers to spawn from mid-October through early November. While at sea, salmon generally undergo extensive migrations in the Northwest Atlantic to waters off Canada and Greenland, thus, they are widely distributed seasonally over much of the region. Although the Consolidated HMS FMP does authorize shark fishing within a portion of this species' range, the only directed shark fishing known to actually occur in that area is limited to seasonal recreational shark fishing with rod-and-reel. Captures of wild Atlantic salmon incidental to fishing for any species or by research/survey operations in the U.S. EEZ are exceedingly rare;

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[17] Estuarine anadromous fish breed in freshwater but otherwise live in estuarine environments.

[18] Amphidromous fish make non-breeding movements between fresh and saltwater. Northern shortnose sturgeon do also ascend rivers for spawning.

the potential for the proposed action to affect Atlantic salmon via fishery interactions is discountable.

Elkhorn and Staghorn Coral Critical Habitat

The physical or biological feature of elkhorn and staghorn coral critical habitat essential to their conservation is substrate of suitable quality and availability to support larval settlement and recruitment, and reattachment and recruitment of asexual fragments. Substrate of suitable quality and availability is defined as consolidated hardbottom or dead coral skeleton that is free from fleshy macroalgae cover and sediment cover, occurring in water depths from the mean high water (MHW) line to 98 feet.

Four areas of critical habitat were designated in Florida, Puerto Rico, St. Thomas/St. John, USVI, and St. Croix, USVI. The Florida area contains three sub-areas: (1) The shoreward boundary for Florida sub-area A begins at the 6-ft contour at the south side of Boynton Inlet, Palm Beach County at 26°32'42.5" N; then runs due east to the point of intersection with the 98-ft contour; then follows the 98-ft contour to the point of intersection with latitude 25°45'55" N, Government Cut, Miami-Dade County; then runs due west to the point of intersection with the 6-ft contour, then follows the 6-ft contour to the beginning point; (2) The shoreward boundary of Florida sub-area B begins at the MLW line at 25°45'55" N, Government Cut, Miami-Dade County; then runs due east to the point of intersection with the 98-ft contour; then follows the 98-ft contour to the point of intersection with longitude 82°W; then runs due north to the point of intersection with the South Atlantic Fishery Management Council (SAFMC) boundary at 24°31’35.75” N; then follows the SAFMC boundary to a point of intersection with the MLW line at Key West, Monroe County; then follows the MLW line, the SAFMC boundary (see 50 CFR 600.105(c)), and the COLREGS line (see 33 CFR 80.727. 730, 735, and 740) to the beginning point; and (3) The seaward boundary of Florida sub-area C (the Dry Tortugas) begins at the northern intersection of the 98-ft contour and longitude 82°45’W; then follows the 98-ft contour west around the Dry Tortugas, to the southern point of intersection with longitude 82°45’W; then runs due north to the beginning point.

The Puerto Rico area includes all areas surrounding the islands of the Commonwealth of Puerto Rico, 98 ft in depth and shallower, seaward of the COLREGS line (see 33 CFR 80.738). The St. Thomas/St. John area and the St. Croix area includes all areas surrounding these islands, and smaller surrounding islands, where the water depths are 98 ft and shallower.

Since floating gillnets (i.e., drift or strike nets) are fished near the surface and are not likely to come into contact with substrate of suitable quality and availability or dead coral skeleton, any adverse effect from these gear types are extremely unlikely to occur and are discountable. Recreational shark fishing targeting pelagic sharks troll hook-and-line gear at mid-water depths and are also extremely unlikely to come in contact with the essential feature of *Acropora* critical habitat. Bottom longlines and sink gillnets are fished at the bottom. However, we believe adverse effects to *Acropora* critical habitat essential features from these gears are extremely unlikely to occur and discountable. Bottom longline and sink gillnets are primarily used in sandy and muddy bottom habitats where the essential feature would not occur. Additionally, neither bottom longlines nor sink gillnets cause consolidated sediment to become unconsolidated, nor do they cause sedimentation or the growth of macroalgae. For these reasons, we believe any adverse affects to designated critical habitat for elkhorn and staghorn are extremely unlikely to occur and discountable.

North Atlantic Right Whale Critical Habitat
North Atlantic right whale critical habitat (50 FR 28793, June 3, 1994) has been designated in the action area in coastal Florida and Georgia. The unit is defined from the mouth of the Altamaha River, Georgia, to Jacksonville, Florida, out 15 nautical miles and from Jacksonville, Florida, to Sebastian Inlet, Florida, out five nautical miles. The area was designated because of its importance as a calving area. Although sightings of North Atlantic right whales off Georgia and Florida primarily include adult females and calves, juveniles and adult males have also been observed. North Atlantic right whales are most abundant in this area from mid-November through March (Slay et al. 1996). The essential environmental features (typically referred to as the essential features) of the southeastern critical habitat area are related to water depth, water temperature, and bathymetry. Smoothhound and Atlantic shark fishing activities will have no impact on these features. Thus, the proposed action will not affect designated critical habitat for the North Atlantic right whale.

Leatherback Sea Turtle Critical Habitat
Critical habitat for leatherback sea turtles was designated to provide protection to sea turtles using the designated waters for courting, breeding, and as access to and from nesting areas on Sandy Point Beach, St. Croix, USVI. The area designated occurs in the waters adjacent to Sandy Point on the southwest corner of St. Croix, USVI, in waters from the 100-fathom curve shoreward to the level of mean high tide, with boundaries at 17°42′12”N and 64°50′00″W.

Critical habitat for leatherback sea turtles is not likely to be adversely affected by the proposed action. Over 99 percent of leatherback critical habitat designated in the action area lies within USVI waters, due to the bathymetry around St. Croix. Thus, authorized fishing activities under the proposed action have little to no overlap with the critical habitat area and the proposed action is extremely unlikely to have any measurable effect on sea turtles’ use of these areas.

3.2 Analysis of Species Likely to be Adversely Affected

North Atlantic right whales, humpback whales, fin whales, green, Kemp’s ridley, leatherback, hawksbill and loggerhead sea turtles, smalltooth sawfish, and Atlantic sturgeon are all likely to be adversely affected by the proposed action. Each of these species is migratory and is known to occur in areas where Atlantic shark and smoothhound gillnet fishing occurs. All of these species have either been documented as captured incidentally in Atlantic shark and smoothhound gear or are vulnerable to capture in gears used in these fisheries. The remaining sections of this opinion will focus solely on these species.

The species subsections below are synopses of the best available information on the life history, distribution, population trends, and current status of sea turtles, smalltooth sawfish, Atlantic sturgeon, and large whale species that are likely to be adversely affected by the proposed action. Additional information on large whales (for this biological opinion “large whales” refer to North Atlantic right whales, humpback whales, and fin whales) can be found in a number of published documents, including: recovery plans for the North Atlantic right whale (NMFS 2005a), humpback whale (NMFS 1991), and the fin whale (NMFS 2010c). Additional background information on the status of sea turtle species can be found in a number of published documents, including: recovery plans and 5-year status reviews for the Atlantic green sea turtle (NMFS and USFWS 1991a, 2007a), Kemp's ridley sea turtle (USFWS and NMFS 1992, 2007b), leatherback sea turtle (NMFS and USFWS 1992b, 2007c), loggerhead sea turtle (NMFS and USFWS 1991b, 2008); Pacific sea turtle recovery plans (NMFS and USFWS 1998a,b); sea turtle stock assessments, and biological reports (NMFS and USFWS 1995, Marine Turtle Expert Working Group (TEWG) 1998, 2000, 2007, and 2009; NMFS SEFSC 2001, Conant et al. 2009). Information on the smalltooth sawfish include the smalltooth sawfish status review (NMFS 2000), the proposed and final listing rules, and several publications (Simpfendorfer 2001, Seitz and Poulakis 2002, Simpfendorfer and Wiley 2004, Poulakis and Seitz 2004). Information on Atlantic sturgeon comes from tagging and genetic studies (Wirgin et al. 2000, King et al. 2001, Waldman et al. 2002, ASSRT 2007, Grunwald et al. 2008), fisheries bycatch studies (Stein et al. 2004b, ASMFC 2007) and peer-reviewed articles on Atlantic sturgeon life history (Bigelow and Schroeder 1953, Vladykov and Greeley 1963, Mangin 1964, Pikitch et al. 2005, Dadswell 2006, ASSRT 2007).

3.2.1 North Atlantic Right Whale

Historically, North Atlantic right whales have occurred in all the world's oceans from temperate to subarctic latitudes (Perry et al. 1999). In both hemispheres, they are observed at low latitudes and in nearshore waters where calving takes place in the winter months, and in higher latitude foraging grounds in the summer (Clapham et al. 1999, Perry et al. 1999).

The North Atlantic right whale (*Eubalaena glacialis*) has been listed as endangered under the ESA since 1973. It was originally listed in June 1970 as the "northern Atlantic right whale" as endangered under the Endangered Species Conservation Act, the precursor to the ESA. The species is also designated as depleted under the MMPA.

In December 2006, NMFS completed a comprehensive review of the status of right whales in the North Atlantic and North Pacific Oceans. Based on the findings from the status review, NMFS concluded that right whales in the northern hemisphere exist as two species: North Atlantic right whale (*Eubalaena glacialis*) and the North Pacific right whale (*Eubalaena japonica*). NMFS determined that each of the species is in danger of extinction throughout its range. In 2008, based on the status review, NMFS listed the endangered northern North Atlantic right whale (*Eubalaena spp.*) as two separate endangered species: the North Atlantic right whale (*E. glacialis*) and North Pacific right whale (*E. japonica*) (73 FR 12024; March 6, 2008).

The International Whaling Commission (IWC) recognizes two North Atlantic right whale populations in the North Atlantic: a western and eastern population (IWC 1986). It is thought that the eastern population migrated along the coast from northern Europe to Northwest Africa. The current distribution and migration patterns of the eastern North Atlantic right whale population, if extant, are unknown. Sighting surveys from the eastern Atlantic Ocean suggest that North Atlantic right whale presence in this region is rare (Best et al. 2001) and it is unclear whether a viable population in the eastern North Atlantic still exists (Brown 1986, NMFS 1991b). Photo-identification work has shown that some of the whales observed in the eastern

Atlantic were previously identified as western Atlantic North Atlantic right whales (Kenney 2002). This opinion will focus on the North Atlantic right whale (*Eubalaena glacialis*) which occurs in the action area.

Life History/Distribution

North Atlantic right whales generally occur from the southeast United States to Canada (e.g., Bay of Fundy and Scotian Shelf) (Kenney 2002, Waring et al. 2009). They follow an annual pattern of migration between low latitude winter calving grounds and high latitude summer foraging grounds (Perry et al. 1999, Kenney 2002). The distribution of North Atlantic right whales in high latitudes seems linked to the distribution of their principal zooplankton prey, calanoid copepods (Winn et al. 1986, NMFS 2005a, Baumgartner and Mate 2005, Waring et al. 2009). North Atlantic right whales are most abundant in Cape Cod Bay between February and April (Hamilton and Mayo 1990, Schevill et al. 1986, Watkins and Schevill 1982) and in the Great South Channel in May and June (Kenney et al. 1986, Payne et al. 1990, Kenney et al. 1995, Kenney 2001) where they have been observed feeding predominantly on copepods of the genera *Calanus* and *Pseudocalanus* (Baumgartner and Mate 2005, Waring et al. 2009). North Atlantic right whales also frequent Stellwagen Bank and Jeffrey's Ledge, as well as Canadian waters including the Bay of Fundy and Browns and Baccaro Banks in the summer through fall (Mitchell et al. 1986, Winn et al. 1986, Stone et al. 1990). The consistency with which North Atlantic right whales occur in these locations is relatively high compared to other marine species. However, these studies also highlight the high interannual variability in North Atlantic right whale use of some habitats.

Calving is known to occur in the winter months in coastal waters off of Georgia and Florida (Kraus et al. 1988). Calves have also been sighted off the coast of North Carolina during winter months suggesting the calving grounds may extend as far north as Cape Fear. In the North Atlantic it appears that not all reproductively active females return to the calving grounds each year (Kraus et al. 1986, Payne 1986). Patrician et al. (2009) analyzed photographs of a North Atlantic right whale calf sighted in the Great South Channel in June of 2007 and determined the calf appeared too young to have been born in the known southern calving area. Although it is possible the female traveled south to New Jersey or Delaware to give birth, evidence suggests that calving in waters of the northeastern United States is possible. The location of some portion of the population during the winter months remains unknown (NMFS 2005a). However, recent aerial surveys conducted under the North Atlantic right whale Sighting Survey (NARWSS) program have indicated that some individuals may reside in the northern Gulf of Maine during the winter. In 2008, 2009, and 2010, North Atlantic right whales were sighted on Jeffrey's and Cashes Ledge, Stellwagen Bank, and Jordan Basin during December to February (Khan et al. 2009, 2010, 2011).

Telemetry data have shown lengthy and somewhat distant excursions into deep water off of the continental shelf (Mate et al. 1997) as well as extensive movements over the continental shelf during the summer foraging period (Mate et al. 1992, Mate et al. 1997, Bowman 2003, Baumgartner and Mate 2005). Knowlton et al. (1992) reported several long-distance movements as far north as Newfoundland, the Labrador Basin, and southeast of Greenland; in addition, re-sightings of photographically identified individuals have been made off Iceland, arctic Norway, and in the old Cape Farewell whaling ground east of Greenland. The Norwegian sighting (September 1999) represents one of only two sightings this century of a North Atlantic 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. Similarly, records from the Gulf of Mexico (Moore and Clark 1963, Schmidly et al. 1972) represent either geographic anomalies or a more extensive historic range beyond the sole known calving and wintering ground in the waters of the southeastern United States. The frequency with which North Atlantic right whales occur in offshore waters in the southeastern United States remains unclear (Waring et al. 2010).

Population Dynamics and Status

An estimate of the pre-exploitation population size for the North Atlantic right whale is not available. As is the case with most wild animals, an exact count of North Atlantic right whales cannot be obtained. However, reasonable abundance estimates can be obtained as a result of the extensive study of the North Atlantic right whale population. In 1999, IWC workshop participants agreed upon a minimum direct-count estimate of 263 North Atlantic right whales alive in 1996 and noted that the true population was unlikely to be much greater than this estimate (Best et al. 2001). Based on a census of individual whales using photo-identification techniques and an assumption of mortality for those whales not seen in seven years, a total 299 North Atlantic right whales was estimated in 1998 (Kraus et al. 2001), and a review of the photo-ID recapture database on October 21, 2011, indicated that 444 individually recognized whales were known to be alive during 2009 (Waring et al. in review). Because this 2011 review was a nearly complete census, it is assumed this estimate represents a minimum population size. The minimum number alive population index for the years 1990-2009 suggests a positive trend in numbers. These data reveal a significant increase in the number of live whales catalogued from 1990-2009, but with significant variation due to apparent losses exceeding gains during 1998-1999. Mean growth rate for the period was 2.6 percent (Waring et al. in review).

A total of 316 North Atlantic right whale calves have been born from 1993-2010, with 21 known calf mortalities during the same period (Waring et al. in review). The mean calf production for the 18-year period from 1993-2010 is estimated to be 17.5 per year (Waring et al. in review). Accounting for calf moralities during the period the net gain in mean calf production from 1993-2010 was 16.4 per year. Calving numbers have been sporadic, with large differences among years, including a second largest calving season in 2000/2001 with 31 North Atlantic right whale births (Waring et al. 2010). Three calving years seasons (1997/98, 1998/99, 1999/2000) had low recruitment levels with only 11 calves born. The last nine calving seasons (2000-2009) have been remarkably better with 31, 21, 19, 17, 28, 19, 23, 23, and 39 births, respectively (Waring et al. 2010). However, North Atlantic right whales also continue to experience losses of calves, juveniles, and adults.

As is the case with other mammalian species, there is an interest in monitoring the number of females in the North Atlantic right whale population since their numbers will affect the population trend (whether declining, increasing or stable). Kraus et al. (2007) reviewed reproductive parameters for the period 1983-2005, and estimated calving intervals to have changed from 3.5 years in 1990 to over five years between 1998-2003, and then decreased to just over 3 years in 2004 and 2005. Kraus et al. (2007) also reported that as of 2005, 92 reproductively-active females had been identified and Schick et al. (2009) estimated 97 breeding females. From 1983-2005, the number of new mothers recruited to the population (with an estimated age of 10 for the age of first calving), varied from 0-11 each year with no significant increase or decline over the period (Kraus et al. 2007). By 2005, 16 North Atlantic right whales had produced at least 6 calves each, and 4 cows had at least seven calves. Two of these cows were at an age which indicated a reproductive life span of at least 31 years (Kraus et al. 2007). As described above, the 2000/01-2006/07 calving seasons had relatively high calf production and have included additional first-time mothers (e.g., eight new mothers in 2000/2001). However, over the same time period there have been continued losses to the North Atlantic right whale population including the death of mature females as a result of anthropogenic mortality (like that described in Glass et al. 2009, below). Of the 15 serious injuries and mortalities documented between 2003-2007, at least nine were adult females, three of which were carrying near-term fetuses and four of which were just starting to bear calves (Waring et al. 2009). Since the average lifetime calf production is 5.25 calves (Fujiwara and Caswell 2001), the deaths of these nine females represent a loss of reproductive potential of as many as 47 animals. However, it is important to note that not all North Atlantic right whale mothers are equal with regards to calf production. For example, North Atlantic right whale #1158 had only one calf over a 25-year period (Kraus et al. 2007). In contrast, one of the largest North Atlantic right whales on record was a female nicknamed “Stumpy,” was first sighted in 1975 and known to be a prolific breeder, successfully rearing calves in 1980, 1987, 1990, 1993, and 1996 (Moore et al. 2007). At the time of her death, she was estimated to be 30 years of age and carrying her sixth calf; the near-term fetus also died (NMFS 2006b).

Abundance estimates are an important part of assessing the status of the species. However, for Section 7 purposes, the population trend (i.e., whether increasing or declining) provides better information for assessing the effects of a proposed action on the species. As described in previous opinions, data collected in the 1990s suggested that North Atlantic right whales were experiencing a slow but steady recovery (Knowlton et al. 1994). However, Caswell et al. (1999) used photo-identification data and modeling to estimate survival and concluded that North Atlantic right whale survival decreased from 1980 to 1994. Modified versions of the Caswell et al. (1999) model as well as several other models were reviewed at the 1999 IWC workshop (Best et al. 2001). Despite differences in approach, all of the models indicated a decline in North Atlantic right whale survival in the 1990s relative to the 1980s with female survival, in particular, apparently affected (Best et al. 2001). In 2002, NMFS’ NEFSC hosted a workshop to review North Atlantic right whale population models to examine: (1) potential bias in the models and (2) changes in the subpopulation trend based on new information collected in the late 1990s (Clapham et al. 2002). Three different models were used to explore North Atlantic right whale survivability and to address potential sources of bias. Although biases were identified that could negatively affect the results, all three modeling techniques resulted in the same conclusion; survival has continued to decline and seems to be focused on females (Clapham et al. 2002). Increased mortalities in 2004 and 2005 were cause for serious concern (Kraus et al. 2005). Calculations indicate that this increased mortality rate would reduce population growth by approximately 10 percent per year (Kraus et al. 2005). Despite the preceding, examination of the minimum number alive population index calculated from the individual sightings database, as it existed on October 21 2011, for the years 1990-2009 suggests a positive and slowly accelerating trend in population size. These data reveal a significant increase in the number of catalogued whales with a geometric mean growth rate for the period of 2.6 percent (Waring et al. in review).

Threats

Healthy reproduction is critical for the recovery of the North Atlantic right whale (Kraus et al. 2007). Researchers have suggested that the population has been affected by a decreased reproductive rate (Best et al. 2001, Kraus et al. 2001). Factors that have been suggested as affecting the North Atlantic right whale reproductive rate include reduced genetic diversity (and/or inbreeding), contaminants, biotoxins, disease, and nutritional stress. Although it is believed that a combination of these factors is likely causing an effect on North Atlantic right whales (Kraus et al. 2007), there is currently no evidence available to determine their potential effect, if any. The dramatic reduction in the North Atlantic right whale population believed to have occurred due to commercial whaling may have resulted in 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). Analyses are currently underway to assess this relationship further as well as the influence of genetic characteristics on the potential for species recovery (Frasier et al. 2007). Studies by Schaeff et al. (1997) and Malik et al. (2000) indicate that North Atlantic right whales are less genetically diverse than South Atlantic right whales (*Eubalaena australis*). However, several apparently healthy populations of cetaceans, such as sperm whales and pilot whales, have even lower genetic diversity than observed for western North Atlantic right whales (IWC 2001).

Similarly, while contaminant studies have confirmed that North Atlantic right whales are exposed to and accumulate contaminants, researches could not conclude that these contaminant loads were negatively affecting North Atlantic right whale 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 North Atlantic right whales 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 North Atlantic right whales. 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 whales (Rolland et al. 2007). Although there are no published data concerning the effects of biotoxins on North Atlantic right whales, researchers are now certain that North Atlantic right whales are being exposed to measurable quantities of paralytic shellfish poisioning toxins and domoic acid via trophic transfer through the presence of these biotoxins in prey upon which they feed (Durbin et al. 2002, Rolland et al. 2007).

Data indicating whether North Atlantic right whales are food-limited are difficult to evaluate (Kraus et al. 2007). North Atlantic right whales 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 North Atlantic right whales. In the same study, blubber thickness was also compared among years of differing prey abundances. During a year of low prey abundances, North Atlantic right whales had significantly thinner blubber than during years of greater prey abundances. The results suggest that blubber thickness is indicative of North Atlantic right whale energy balance and that the marked fluctuations in the North Atlantic right whale 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 North Atlantic right whales. 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 North Atlantic right whales. 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. North Atlantic right whale calving rates since the early 1980s seem to follow a similar pattern, where stable calving rates were noted from 1982-1992, but then two major, multi-year declines occurred from 1993-2001, consistent with the drops in copepod abundance. It has been hypothesized that North Atlantic right whale calving rates are a function of food availability as well as the number of females available to reproduce (Greene et al. 2003, Greene and Pershing 2004). Some believe the effects of increased climate variability on North Atlantic right whale calving rates should be incorporated into future modeling studies so that it may be possible to determine how sensitive North Atlantic right whale population numbers are to variable climate forcing (Greene and Pershing 2004).

There is general agreement that North Atlantic right whale recovery is also negatively affected by anthropogenic mortality. From 2006-2010, North Atlantic right whales had the highest proportion of entanglement and ship strike events relative to the number of total events (mortality, entanglement, or ship strike) for any species of large whale (Henry et al. 2012). Given the small population size and low annual reproductive rate of North Atlantic right whales, human sources of mortality may have a greater effect to relative population growth rate than for other large whale species (Waring et al. 2010). For the period 2006-2010, the annual human-caused mortality and serious injury rate for the North Atlantic right whale averaged 3.0 per year (2.4 in U.S. waters; 0.6 in Canadian waters) (Waring et al. in review). Nineteen confirmed North Atlantic right whale mortalities were reported along the U.S. east coast and adjacent Canadian Maritimes from 2006-2010 (Henry et al. 2012). These numbers represent the minimum values for SI/M for this period. Given the range and distribution of North Atlantic right whales in the North Atlantic, and the fact that positively buoyant species like North Atlantic right whales may become negatively buoyant if injury prohibits effective feeding for prolonged periods, it is highly unlikely that all carcasses will be observed (Moore et al. 2004, Glass et al. 2009). Moreover, carcasses floating at sea often cannot be examined sufficiently and may generate false negatives if they are not towed to shore for further necropsy (Glass et al. 2009). Decomposed and/or unexamined animals represent lost data, some of which may relate to human impacts (Waring et al. 2010).

Of the 19 total confirmed North Atlantic right whale mortalities (2006-2010) described in Henry et al. (2012), 4 were confirmed to be entanglement mortalities (1 female calf, 1 male calf, 2 adult males) and 5were confirmed to be ship strike mortalities (1 adult females, 1 female of unknown age, 1 female calf, 1 male calf, and 1 yearling male). Serious injury involving North Atlantic right whales was documented for five entanglement events (1 adult female, 1 adult male, 1 juvenile male, 1 juvenile female, and 1 juvenile of unknown sex) and one ship-strike event (a yearling male).

Even when entanglement or vessel collision does not cause direct mortality, it may weaken or otherwise affect individuals so that further injury or death is likely (Waring et al. 2010). Some North Atlantic right whales that have been entangled were subsequently involved in ship strikes (Hamilton et al. 1998a), suggesting that the animal may have become debilitated by the entanglement to such an extent that it was less able to avoid a ship. Similarly, skeletal fractures and/or broken jaws sustained during a vessel collision may heal, but then compromise a whale's ability to efficiently filter feed (Moore et al. 2007). A necropsy of North Atlantic right whale #2143 found dead in January 2005 suggested the animal (and her near-term fetus) died after healed propeller wounds from a previous ship strike re-opened and became infected as a result of pregnancy (Moore et al. 2007, Glass et al. 2008). Sometimes, even with a successful disentanglement, an animal may die of injuries sustained by fishing gear (e.g., RW #3107) (Waring et al. 2009).

Entanglement records from 1990-2010 include 74 confirmed North Atlantic right whale entanglement events (Waring et al. in review). Because whales often free themselves of gear following an entanglement event, scarification analysis of living animals may provide better indications of fisheries interactions rather than entanglement records (Waring et al. in review). Data presented in Knowlton et al. (2008) indicate the annual rate of entanglement interaction remains at high levels. From 1980-2004, a review of 493 photo-identified individuals found 625 separate entanglement interactions. Approximately 358 out of 493 animals (72.6 percent of the population) were entangled at least once: 185 animals bore scars from a single entanglement; however, one animal showed scars from 6 different entanglement events. The number of male and female North Atlantic right whales bearing entanglement scars was nearly equivalent (142/202 females, 71.8 percent; 182/224 males, 81.3 percent), indicating that North Atlantic right whales of both sexes are equally vulnerable to entanglement. However, juveniles appear to become entangled at a higher rate than expected if all age groups were equally vulnerable. For all years but one (1998), the proportion of juvenile, entangled North Atlantic right whales exceeded their proportion within the population. Based on photographs of catalogued animals from 1935 through 1995, Hamilton et al. (1998a) estimated that 6.4 percent of the North Atlantic right whale population exhibit signs of injury from vessel strikes. Reports received from 2006-2010 indicate that humpback whales had a greater number of confirmed ship strike mortalities (n=10) than North Atlantic right whales (n=5). However, in 2006 there were four confirmed North Atlantic right whale ship strike mortalities, more than any other species in any single year from 2006-2010. North Atlantic right whales had one confirmed ship strike event resulting in serious injury, more than any other species (Henry et al. 2012).

Recent bioacoustics research conducted at Cornell University also indicates that an increase in ocean noise from greater vessel traffic, acoustic instruments used to find undersea oil and gas deposits, and undersea construction may be impacting large whales. This ocean noise appears to be obscuring the sounds large whales use to communicate over long distances. This effect appears to be of particular concern for North Atlantic right whales because their predicted hearing range, 12 Hz–22 kHz, overlaps with most noises from shipping activities (Parks 2003, Parks and Clark 2007). These human-generated sounds can potentially damage North Atlantic right whale hearing or limit the distance in which they can communicate (Clark et al. 2007). Acoustic disruptions not only interfere with communication, but may also affect large whales' ability to find mates and possibly prey (Ramanujan 2010, Allen 2011).

The North Atlantic right whale is also expected to be affected by global climate change. The impacts are likely to be related to changes in sea temperatures, changes in salinity due to melting ice and increased rainfall, and the loss of polar habitats.

Water temperature appears to be the main influence on geographic ranges of cetacean species (Macleod 2009). North Atlantic right whales 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 North Atlantic right whale 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.

The direct effects of increased CO_2 concentrations, and associated decrease in pH (ocean acidification), on marine mammals are unknown (Learmonth et al. 2006). Marine plankton is a vital food source for North Atlantic right whales. Studies have demonstrated adverse impacts from ocean acidification via a reduction in the ability of marine algae and free-swimming zooplankton to maintain protective shells, as well as a reduction in the survival of larval marine species. A decline in the marine plankton could have serious consequences for the marine food web.

Global climate change may affect the marine plankton species North Atlantic right whales feed upon. Climatic changes may alter ocean currents, storm frequency, rainfall amounts, salinity levels, and ice melt rates, and will likely increase river inputs/runoff (nutrients and pollutants). Each of these parameters may affect the distribution, abundance, and migration of these plankton species (Waluda et al. 2001, Tynan and DeMaster 1997, Learmonth et al. 2006). However, more information is needed to determine what impacts global climate change may have on the timing and extent of population movements, abundance, recruitment, distribution, and species composition of prey (Learmonth et al. 2006).

These climatic changes are also likely to affect marine mammals. 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 (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).

3.2.2 Humpback Whales

Humpback whales inhabit all major ocean basins from the equator to subpolar latitudes. With the exception of the northern Indian Ocean population, they generally follow a predictable migratory pattern in both hemispheres, feeding during the summer in the higher near-polar latitudes and migrating to lower latitudes in the winter where calving and breeding takes place (Perry et al. 1999). Humpbacks are listed as endangered under the ESA. The information presented below reflects the status of humpback whales throughout their global range.

3.2.2.1 North Pacific, Northern Indian Ocean, and Southern Hemisphere

Humpback whales in the North Pacific feed in coastal waters from California to Russia and in the Bering Sea. They migrate south to wintering destinations off Mexico, Central America, Hawaii, southern Japan, and the Philippines (Carretta et al. 2011). Although the IWC only considered one stock (Donovan 1991), there is evidence to indicate multiple populations migrating between their respective summer/fall feeding areas to winter/spring calving and mating areas within the North Pacific Basin (Angliss and Outlaw 2007, Carretta et al. 2011). Within the Pacific Ocean, NMFS recognizes three management units within the U.S. EEZ for the purposes of managing this species under the MMPA: the California-Oregon-Washington stock (feeding areas off the U.S. west coast), the central North Pacific stock (feeding areas from Southeast Alaska to the Alaska Peninsula) and the western North Pacific stock (feeding areas from the Aleutian Islands, the Bering Sea, and Russia) (Carretta et al. 2011). Because fidelity appears to be greater in feeding areas than in breeding areas, the stock structure of humpback whales is defined based on feeding areas (Carretta et al. 2011). Recent research efforts via the Structure of Populations, Levels of Abundance, and Status of Humpback Whales (SPLASH) Project estimated the abundance of humpback whales to be just under 20,000 whales for the entire North Pacific, a number which doubles previous population predictions (Calambokidis et al. 2008). There are indications that the California-Oregon-Washington stock was growing in the 1980s and early 1990s with a best estimate of 8 percent growth per year (Carretta et al. 2011). The best available estimate for the California-Oregon-Washington stock is 2,043 whales (Carretta et al. 2011). The central North Pacific stock is estimated at 4,005 (Allen and Angliss 2011), and various studies report that it appears to have increased in abundance at rates between 6.6-10 percent per year (Allen and Angliss 2011). Although there is no reliable population trend data for the western North Pacific stock, as surveys of the known feeding areas are incomplete and many feeding areas remain unknown, minimum population size is currently estimated at 732 whales (Allen and Angliss 2011).

The Northern Indian Ocean population of humpback whales consists of a resident stock in the Arabian Sea, which apparently does not migrate (Minton et al. 2008). The lack of photographic matches with other areas suggests this is an isolated subpopulation. The Arabian Sea subpopulation of humpback whales is geographically, demographically, and genetically isolated, residing year-round in sub-tropical waters of the Arabian Sea (Minton et al. 2008). Although potentially an underestimate due to small sample sizes and insufficient spatial and temporal coverage of the population's suspected range, based on photo-identification, the abundance estimate off the coast of Oman is 82 animals [60-111 95% confidence interval (CI)](Minton et al. 2008).

The Southern Hemisphere population of humpback whales is known to feed mainly in the Antarctic, although some have been observed feeding in the Benguela Current ecosystem on the migration route west of South Africa (Reilly et al. 2008a). The IWC Scientific Committee recognizes seven major breeding stocks, some of which are tentatively further subdivided into substocks. The seven major breeding stocks, with their respective breeding ground estimates in parenthesis, include Southwest Atlantic (6,251), Southeast Atlantic (1,594), Southwest Indian Ocean (5,965), Southeast Indian Ocean (10,032), Southwest Pacific (7,472), central South Pacific (not available), and Southeast Pacific (2,917) (Reilly et al. 2008a). The total abundance estimate of 36,600 humpback whales for the southern hemisphere is negatively biased due to no available abundance estimate for the central South Pacific subpopulation and only a partial estimate for the Southeast Atlantic subpopulation. Additionally, these abundance estimates have been obtained on each subpopulations wintering grounds, and the possibility exists that the entire population does not migrate to the wintering grounds (Reilly et al. 2008a).

Like other whales, southern hemisphere humpback whales were heavily exploited for commercial whaling. Although they were given protection by the IWC in 1963, Soviet whaling data made available in the 1990s revealed that 48,477 southern hemisphere humpback whales were taken from 1947-1980, contrary to the original reports to the IWC which accounted for the take of only 2,710 humpbacks (Zemsky et al. 1995, IWC 1995, Perry et al. 1999).

3.2.2.2 North Atlantic

Life History/Distribution

Humpback whales from most Atlantic feeding areas calve and mate in the West Indies and migrate to feeding areas in the northwestern Atlantic during the summer months. Most of the humpbacks that forage in the Gulf of Maine visit Stellwagen Bank and the waters of Massachusetts and Cape Cod Bays. Previously, the North Atlantic humpback whale population was treated as a single stock for management purposes; however, due to the strong fidelity to the region displayed by many whales, the Gulf of Maine stock was reclassified as a separate feeding stock (Waring et al. 2011). The Gulf of St. Lawrence, Newfoundland/Labrador, western Greenland, Iceland, and northern Norway are the other regions that represent relatively discrete subpopulations. Sightings are most frequent from mid-March through November between 41^{o}N and 43^{o}N, from the Great South Channel north along the outside of Cape Cod to Stellwagen Bank and Jeffrey's Ledge (CeTAP 1982), and peak in May and August. Small numbers of individuals may be present in this area year-round, including the waters of Stellwagen Bank. They feed on a number of species of small schooling fishes, particularly sand lance and Atlantic herring, targeting fish schools and filtering large amounts of water for their associated prey. It is hypothesized humpback whales may also feed on euphausiids (krill) as well as capelin (Waring et al. 2011, Stevick et al. 2006).

In winter, whales from waters off New England, Canada, Greenland, Iceland, and Norway, migrate to mate and calve primarily in the West Indies where spatial and genetic mixing among these groups does occur (Waring et al. 2010). Various papers (Clapham and Mayo 1990, Clapham 1992, Barlow and Clapham 1997, Clapham et al. 1999) summarize information gathered from a catalogue of photographs of 643 individuals from the western North Atlantic population of humpback whales. These photographs identified reproductively mature western North Atlantic humpbacks wintering in tropical breeding grounds in the Antilles, primarily on Silver and Navidad Banks, north of the Dominican Republic. The primary winter range also includes the Virgin Islands and Puerto Rico (NMFS 1991a).

Humpback whales use the Mid-Atlantic as a migratory pathway to and from the calving/mating grounds, but it may also be an important winter feeding area for juveniles. Since 1989, observations of juvenile humpbacks in the Mid-Atlantic have been increasing during the winter months, peaking January through March (Swingle et al. 1993). Biologists theorize that non-reproductive animals may be establishing a winter feeding range in the Mid-Atlantic since they are not participating in reproductive behavior in the Caribbean. Swingle et al. (1993) identified a shift in distribution of juvenile humpback whales in the nearshore waters of Virginia, primarily in winter months. Identified whales using the Mid-Atlantic area were found to be residents of the Gulf of Maine and Atlantic Canada (Gulf of St. Lawrence and Newfoundland) feeding groups, suggesting a mixing of different feeding populations in the Mid-Atlantic region. Strandings of humpback whales have increased between New Jersey and Florida since 1985, consistent with the increase in Mid-Atlantic whale sightings. Strandings were most frequent during September through April in North Carolina and Virginia waters, and were composed primarily of juvenile humpback whales of no more than 11 meters in length (Wiley et al. 1995).

Population Dynamics/Status

Photographic mark-recapture analyses from the Years of the North Atlantic Humpback (YONAH) project gave an ocean-basin-wide estimate of 11,570 animals during 1992/1993 and an additional genotype-based analysis yielded a similar but less precise estimate of 10,400 whales (95% CI = 8,000-13,600) (Waring et al. 2010). For management purposes under the MMPA, the estimate of 11,570 individuals is regarded as the best available estimate for the North Atlantic population (Waring et al. 2011, Fleming and Jackson 2011). The best, recent estimate for the Gulf of Maine stock is 847 whales, derived from a 2006 line-transect aerial sighting survey (Waring et al. 2011, Fleming and Jackson 2011).

Population modeling, using data obtained from photographic mark-recapture studies, estimates the growth rate of the Gulf of Maine stock to be at 6.5 percent for the period 1979-1991 (Barlow and Clapham 1997). More recent analysis for the period 1992-2000 estimated lower population growth rates ranging from 0 to 4.0 percent, depending on calf survival rate (Clapham et al. 2003 in Waring et al. 2010). However, it is unclear whether the apparent decline in growth rate is a bias result due to a shift in distribution documented for the period 1992-1995, or whether the population growth rates truly declined due to high mortality of young-of-the-year (YOY) whales in U.S. Mid-Atlantic waters (Waring et al. 2010). Regardless, calf survival appears to have increased since 1996, presumably accompanied by an increase in population growth (Waring et al. 2010). Stevick et al. (2003) calculated an average population growth rate of 3.1 percent in the North Atlantic population overall for the period 1979-1993.

Threats

As is the case with other large whales, the major known sources of anthropogenic mortality and injury of humpback whales occur from fishing gear entanglements and ship strikes. For the period 2006-2010, the minimum annual rate of human-caused mortality and serious injury to the Gulf of Maine humpback whale stock averaged 7.8 animals per year (U.S. waters, 7.2; Canadian waters, 0.6) (Waring et al. in review). From 2006-2010, humpback whales were involved in 101 confirmed entanglement events (Henry et al. 2012). Over the five-year period, humpback whales were the most commonly observed entangled whale species; entanglements accounted for 9 mortalities and 20 serious injuries (Henry et al. 2012).

Based on photographs taken between 2000-2002 of the caudal peduncle and fluke of humpback whales, Robbins and Mattila (2004) estimated that at least half (48-57 percent) of the sample (187 individuals) had a high likelihood of prior entanglement. Evidence suggests that entanglements have occurred at a minimum rate of 8-10 percent per year. Scars acquired by Gulf of Maine stock humpback whales between 2000 and 2002 suggest a minimum of 49 interactions with gear took place. Based on composite scar patterns, it was believed that male humpback whales were more vulnerable to entanglement than females. Males may be subject to other sources of injury that could affect scar pattern interpretation. Images were obtained from a humpback whale breeding ground; 24 percent exhibited raw injuries, presumably a result from aggressive or defensive behavioral interactions. However, current evidence suggests that breeding ground interactions alone cannot explain the higher frequency of healed scar patterns among Gulf of Maine stock male humpback whales (Robbins and Matilla 2004).

In March 2012, a commercial smoothhound fisherman reported an entangled humpback whale in gillnet gear while fishing in North Carolina state waters. The animal was reported to be approximately 25 ft long (likely a juvenile). The fishing gear reportedly included “weak links” and had been soaking for approximately three hours when it was retrieved and the animal was discovered. The gear was initially entangled around the head and tail, but the whale reportedly freed itself of approximately 98 percent of the gear. The animal was observed swimming away and it has not been sighted again as of the writing of this biological opinion.

Between 2006 and 2010, humpback whales were also involved in 10 confirmed ship strike events (Henry et al. 2012). Of the 10 confirmed ship strikes, all of the events were fatal (Waring et al. in review). It was assumed that all of these events involved members of the Gulf of Maine stock of humpback whales unless a whale was confirmed to be from another stock; in reports prior to 2007, only events involving whales confirmed to be members of the Gulf of Maine stock were included. There were also many carcasses that washed ashore or were spotted floating at sea for which the cause of death could not be determined. Decomposed and/or unexamined animals (e.g., carcasses reported but not retrieved or no necropsy performed) represent 'lost data' some of which may relate to human impacts (Glass et al. 2009, Waring et al. 2010).

Humpback whales may also be adversely affected by habitat degradation, habitat exclusion, acoustic trauma, harassment, or reduction in prey resources due to trophic effects resulting from a variety of activities including fisheries operations, vessel traffic, and coastal development. Currently, there is no evidence that these types of activities are affecting humpback whale populations. However, Geraci et al. (1989) provide strong evidence that a mass mortality of humpback whales from 1987-1988 resulted from the consumption of mackerel whose livers contained high levels of saxitoxin, a naturally occurring red tide toxin, the origin of which remains unknown. It has been suggested that the occurrence of a red tide event is related to an increase in freshwater runoff from coastal development, leading some observers to suggest that such events may become more common among marine mammals as coastal development continues (Clapham et al. 1999). There have been three additional known cases of a mass mortality involving large whale species along the East Coast between 1998 and 2008. In the 2006 mass mortality event, 21 dead humpback whales were found between July 10 and December 31, 2006, triggering NMFS to declare an unusual mortality event (UME) for humpback whales in the northeast United States. The UME was officially closed on December 31, 2007, after a review of 2007's humpback whale strandings and mortality showed that the elevated numbers were no longer being observed. The cause of the 2006 UME has not been determined to date, although investigations are ongoing.

Changes in humpback whale distribution in the Gulf of Maine have been found to be associated with changes in herring, mackerel, and sand lance abundance associated with local fishing pressures (Stevick et al. 2006, Waring et al. 2010). Shifts in relative finfish species abundance correspond to changes in observed humpback whale movements (Stevick et al. 2006). However, there is no evidence that humpback whales were adversely affected by these trophic changes.

Humpback whales may also be expected to be affected by global climate change. The impacts are likely to be related to changes in sea temperatures, changes in salinity due to melting ice and increased rainfall, and the loss of polar habitats.

The effects of increased CO_2 concentrations, and associated decrease in pH (ocean acidification), on marine mammals are unknown (Learmonth et al. 2006). Marine plankton is a vital food source for many marine species. Studies have demonstrated adverse impacts from ocean acidification via a reduction in the ability of marine algae and free-swimming zooplankton to maintain protective shells, as well as a reduction in the survival of larval marine species. A decline in the marine plankton could have serious consequences for the marine food web, ultimately affecting prey species of humpback whales.

Additionally, global climate change may alter ocean currents, storm frequency, rainfall amounts, salinity levels, ice melt rates, and will likely increase river inputs/runoff (nutrients and pollutants). Each of these parameters may also affect the distribution, abundance, and migration of prey species for the humpback whale (Waluda et al. 2001, Tynan and DeMaster 1997, Learmonth et al. 2006). However, more information is needed to determine what impacts global climate change may have on the timing and extent of population movements, abundance, recruitment, distribution, and species composition of prey (Learmonth et al. 2006).

3.2.3 Fin Whales

Fin whales are widely distributed in the world's oceans. The fin whale has been listed as "endangered" under the ESA since its passage in 1973. Although populations were depleted by whaling, tens of thousands of animals remain worldwide. Commercial whaling for this species ended in the North Pacific in 1976, in the Southern Ocean in 1976-77, and in the North Atlantic in 1987. Fin whales are still hunted in Greenland, subject to catch limits under IWC's "aboriginal subsistence whaling" scheme (NMFS 2010c).

3.2.3.1 Pacific Ocean

Within the U.S. waters of the Pacific, fin whales are found seasonally off the coast of North America and Hawaii and in the Bering Sea during the summer (Allen and Angliss 2010). Although stock structure in the Pacific is not fully understood, NMFS recognizes three fin whale stocks in U.S. Pacific waters for the purposes of managing this species under the MMPA. These are: Alaska (Northeast Pacific), California-Washington-Oregon, and Hawaii (Carretta et al. 2011). Reliable estimates of current abundance for the entire Northeast Pacific fin whale stock are not available (Allen and Angliss 2010). A provisional population estimate of 5,700 was calculated for the Alaska stock west of the Kenai Peninsula by adding estimates from multiple surveys (Allen and Angliss 2010). This can be considered a minimum estimate for the entire stock because it was estimated from surveys that covered only a portion of the range of the species (Allen and Angliss 2010). An annual population increase of 4.8 percent between 1987-2003 was estimated for fin whales in coastal waters south of the Alaska Peninsula (Allen and Angliss 2010). This is the first estimate of population trend for North Pacific fin whales; however, it must be interpreted cautiously due to the uncertainty in the initial population estimate and the population structure (Allen and Angliss 2010). The best available estimate for the California-Washington-Oregon stock is 3,044, which is likely an underestimate (Carretta et al. 2011). The best available estimate for the Hawaii stock is 174, based on a 2002 line-transect survey (Carretta et al. 2011).

Stock structure for fin whales in the southern hemisphere is unknown. Prior to commercial exploitation, the abundance of southern hemisphere fin whales is estimated to have been at 400,000 (IWC 1979, Perry et al. 1999). There are no current estimates of abundance for southern hemisphere fin whales. Since these fin whales do not occur in U.S. waters, there is no recovery plan or stock assessment report for the southern hemisphere fin whales.

3.2.3.2 Atlantic Ocean

Fin whales inhabit a wide range of latitudes between 20°-75°N and 20°-75°S (Perry et al. 1999). Fin whales are ubiquitous in the North Atlantic and occur from the Gulf of Mexico and Mediterranean Sea northward to the edges of the arctic ice pack (NMFS 1998b). The overall pattern of fin whale movement is complex, consisting of a less obvious north-south pattern of migration than that of right and humpback whales. The overall distribution may be based on prey availability as this species preys opportunistically on both invertebrates and fish (Watkins et al. 1984). Fin whales are larger and faster than humpback and North Atlantic right whales and are less concentrated in nearshore environments.

This species is commonly found from Cape Hatteras northward. A number of researchers have suggested the existence of fin whale subpopulations in the North Atlantic based on local depletions resulting from commercial overharvesting (Mizroch and York 1984) or genetics data (Bérubé et al. 1998). Photo-identification studies in western North Atlantic feeding areas, particularly in Massachusetts Bay, have shown a high rate of annual return by fin whales, both within years and between years (Seipt et al. 1990) suggesting some level of site fidelity. The Scientific Committee of the IWC has proposed stock boundaries for North Atlantic fin whales. Fin whales off the eastern United States, Nova Scotia, and southeastern coast of Newfoundland are believed to constitute a single stock of fin whales under the present IWC scheme (Donovan 1991). However, it is uncertain whether the proposed boundaries define biologically isolated units (Waring et al. 2010).

Life History/Distribution

During aerial surveys from 1978-1982, fin whales accounted for 24 percent of all cetaceans and 46 percent of all large cetaceans sighted over the continental shelf between Cape Hatteras and Nova Scotia (Waring et al. 2010). Underwater listening systems have also demonstrated that the fin whale is the most acoustically common whale species heard in the North Atlantic (Clark 1995). The single most important area for this species appeared to be from the Great South Channel, along the 50-m isobath past Cape Cod, over Stellwagen Bank, and past Cape Ann to Jeffrey’s Ledge (Hain et al. 1992).

Like right and humpback whales, fin whales are believed to use North Atlantic waters primarily for feeding, and more southern waters for calving. However, it is still unclear where the majority of fin whales overwinter, calve, and mate. Clark (1995) reported a general pattern of fin whale movements in the fall from the Labrador/Newfoundland region, south past Bermuda, and into the West Indies, but neonate strandings along the U.S. Mid-Atlantic coast from October through January suggest the possibility of an offshore calving area (Hain et al. 1992).

Fin whales achieve sexual maturity at 6-10 years of age in males and 7-12 years in females (Jefferson et al. 2008), although physical maturity may not be reached until 20-30 years (Aguilar and Lockyer 1987). Conception is believed to occur in tropical and subtropical areas during the winter with birth of a single calf after an 11-12 month gestation (Jefferson et al. 2008). The calf is weaned 6-11 months after birth (Perry et al. 1999). The mean calving interval is 2.7 years (Agler et al. 1993).

The predominant prey of fin whales varies greatly in different geographical areas depending on what is locally available (IWC 1992). In the western North Atlantic, fin whales feed on a variety of small schooling fish (i.e., herring, capelin, sand lance) as well as squid and planktonic crustaceans (Wynne and Schwartz 1999). Fin whales feed by filtering large volumes of water for their prey through their baleen plates.

Population Trends and Status

Various estimates have been provided to describe the current status of fin whales in western North Atlantic waters. One method used the catch history and trends in Catch Per Unit Effort (CPUE) to obtain an estimate of 3,590 to 6,300 fin whales for the entire western North Atlantic

(Perry et al. 1999). Hain et al. (1992) estimated that about 5,000 fin whales inhabit the northeastern U.S. continental shelf waters. The Draft 2012 Stock Assessment Report (SAR) gives a best estimate of abundance for fin whales in the western North Atlantic of 3,522 (CV = 0.27). However, this estimate must be considered extremely conservative in view of the incomplete coverage of the known habitat of the stock and the uncertainties regarding population structure and whale movements between surveyed and unsurveyed areas (Waring et al. 2010). The minimum population estimate for the western North Atlantic fin whale is 2,817 (Waring et al. in review). However, there are insufficient data at this time to determine population trends for the fin whale (Waring et al. in review). Other estimates of the abundance of fin in the North Atlantic are presented in Pike et al. (2008) and Hammond et al. (2011). Pike et al. (2008) estimate the abundance of fin whales to be 27,493 (CV 0.2) in waters around Iceland and the Denmark Strait. Hammond et al. (2008) estimates the abundance of 19,354 (CV 0.24) fin whales in the eastern North Atlantic.

Threats

The major known sources of anthropogenic mortality and injury of fin whales include entanglement in commercial fishing gear and ship strikes. The minimum annual rate of confirmed human-caused SI/M to North Atlantic fin whales from 2006-2010 was 2.0 (Waring et al. in review). During this five year period, there were seven confirmed entanglements (3 fatal; 4 serious injuries) and nine ship strikes (all fatal) (Henry et al. 2012). Fin whales are believed to be the cetacean most commonly struck by large vessels (Laist et al. 2001). In addition, hunting of fin whales continued well into the 20th century. Fin whales were given total protection in the North Atlantic in 1987, with the exception of an aboriginal subsistence whaling hunt for Greenland (Gambell 1993, Caulfield 1993). However, Iceland has increased its whaling activities in recent years and reported a catch of 136 whales in the 1988/89 and 1989/90 seasons (Perry et al. 1999), 7 in 2006/07, and 273 in 2009/2010. Fin whales may also be adversely affected by habitat degradation, habitat exclusion, acoustic trauma, harassment, or reduction in prey resources due to trophic effects resulting from a variety of activities.

Fin whales may also be expected to be affected by global climate change. The impacts are likely to be related to changes in sea temperatures, changes in salinity due to melting ice and increased rainfall, and the loss of polar habitats.

The effects of increased CO_2 concentrations, and associated decrease in pH (ocean acidification), on marine mammals are unknown (Learmonth et al. 2006). Marine plankton is a vital food source for many marine species. Studies have demonstrated adverse impacts from ocean acidification via a reduction in the ability of marine algae and free-swimming zooplankton to maintain protective shells, as well as a reduction in the survival of larval marine species. A decline in the marine plankton could have serious consequences for the marine food web, ultimately affecting prey species of fin whales.

Additionally, global climate change may alter ocean currents, storm frequency, rainfall amounts, salinity levels, ice melt rates, and will likely increase river inputs/runoff (nutrients and pollutants). Each of these parameters may also affect the distribution, abundance, and migration of prey species for the humpback whale (Waluda et al. 2001, Tynan and DeMaster 1997, Learmonth et al. 2006). However, more information is needed to determine what impacts global climate change may have on the timing and extent of population movements, abundance, recruitment, distribution, and species composition of prey (Learmonth et al. 2006).

3.2.4 Loggerhead Sea Turtle – NW 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 designating nine DPSs for loggerhead sea turtles (76 FR 58868, September 22, 2011; effective October 24, 2011). The DPSs established by this rule are: (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 DPS (NWA DPS) is the only one that occurs within the action area and therefore is the only one to be considered in this opinion. No critical habitat has been designated as of the time of this opinion.

Species Description, Distribution, and Population Structure

Loggerheads are large sea turtles. Adults in the southeast United States have an average straight carapace length (SCL) of approximately 92 cm. The corresponding weight is approximately 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 costals, 5 vertebrals, and a nuchal (precentral) scute that is in contact with the first pair of costal scutes (Dodd 1988).

The loggerhead sea turtle inhabits continental shelf and estuarine environments and occurs throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans (Dodd 1988). 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).

In the western North Atlantic, the majority of loggerhead nesting is concentrated along the coasts of the United States from southern Virginia to Alabama. Additional nesting beaches are found along the northern and western Gulf of Mexico, eastern Yucatán Peninsula, at Cay Sal Bank in the eastern Bahamas (Addison and Morford 1996, Addison 1997), off the southwestern coast of Cuba (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 United States and Caribbean Sea. Little is known about the distribution of adult males who are seasonally abundant near nesting beaches. Aerial surveys suggest that loggerheads in U.S. waters are distributed as a whole in the following proportions: 54 percent in the southeast U.S. Atlantic, 29 percent in the northeast U.S. Atlantic, 12 percent in the eastern Gulf of Mexico, and 5 percent in the western Gulf of Mexico (TEWG 1998). Shallow-water habitats with large expanses of open-ocean access, such as Florida Bay, provide resident foraging areas year round for significant numbers of male and female adult loggerheads. Juveniles are also found in enclosed, shallow-water estuarine environments not frequented by adults (Epperly et al. 1995a). Further offshore, adults primarily inhabit continental shelf waters, from New England south to Florida, the Caribbean, and Gulf of Mexico (Schroeder et al. 2003). Benthic, immature loggerheads foraging in northeastern U.S. waters are known to migrate southward in the fall as water temperatures cool and then migrate back northward in spring (Epperly et al. 1995a, Keinath 1993, Morreale and Sandora 1998, Shoop and Kenney 1992).

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 five 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 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 2000); and (5) a Dry Tortugas nesting subpopulation, occurring in the islands of the Dry Tortugas, near Key West, Florida. Based on recent advances in genetic analyses, the recovery plan for the Northwest Atlantic population of loggerhead sea turtles concluded that there is no genetic distinction between loggerheads nesting on adjacent beaches along the Florida Peninsula and that specific boundaries for subpopulations could not be designated based on genetic differences alone. Thus, the 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: (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 encompass the same sea turtle populations that comprise the NWA DPS.

Life History Information

Loggerhead sea turtles reach sexual maturity between 20 and 38 years of age, although this varies widely among populations (Frazer and Ehrhart 1985, NMFS SEFSC 2001). The annual mating season for loggerhead sea turtles occurs from late March to early June, and eggs are laid throughout the summer months. Female loggerheads lay an average of 4.1 nests within a nesting season (Murphy and Hopkins 1984) and have an average remigration interval of 3.7 years (Tucker 2010). The average number of eggs laid per nest varies from 100 to 126 eggs for nests occurring along the southeastern U.S. coast (Dodd 1988).

Loggerheads originating from the western Atlantic nesting aggregations are believed to lead a pelagic existence in the North Atlantic Gyre for 7-12 years (Bolten et al. 1998). Stranding records indicate that when immature loggerheads reach 40-60 cm SCL, they begin to occur in coastal inshore waters of the continental shelf throughout the U.S. Atlantic and Gulf of Mexico (Witzell 2002). Recent 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 (Laurent et al. 1998, Bolten and Witherington 2003). These studies suggest some sea turtles may either remain in the pelagic habitat in the North Atlantic longer than hypothesized or move back and forth between pelagic and coastal habitats interchangeably (Witzell 2002).

As post-hatchlings, loggerheads hatched on U.S. beaches migrate offshore and become associated with *Sargassum* habitats, driftlines, and other convergence zones (Carr 1986) (Witherington 2002). Juveniles are omnivorous and forage on crabs, mollusks, jellyfish and vegetation at or near the surface (Dodd 1988). Subadult and adult loggerheads are primarily found in coastal waters and prey on benthic invertebrates such as mollusks and decapod crustaceans in hard bottom habitats.

Abundance and Trends

A number of stock assessments and similar reviews (TEWG 1998, TEWG 2000, TEWG 2009, NMFS SEFSC 2001, NMFS SEFSC 2009, Heppell et al. 2003, NMFS and USFWS 2008, Conant et al. 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. However, due to the strong nest site fidelity of female turtles, nesting beach surveys can provide a reliable assessment of trends in the adult female population, as long as such studies are sufficiently long and effort and methods are standardized [see e.g., NMFS and USFWS (2008)]. NMFS and USFWS (2008) concluded that the lack of change in two 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. Analysis of available data for the Peninsular Florida Recovery Unit through 2008 led to the conclusion that the observed decline in nesting for that unit could best be explained by an actual decline in the number of adult female loggerheads in the population (Witherington et al. 2009).

Annual nest totals from beaches within what NMFS and USFWS have defined as the Northern Recovery Unit (NRU) averaged 5,215 nests from 1989-2008, a period of near-complete surveys of NRU nesting beaches (GDNR unpublished data, NCWRC unpublished data, SCDNR unpublished data), and represent approximately 1,272 nesting females per year (4.1 nests per female, (Murphy and Hopkins 1984). The loggerhead nesting trend from daily beach surveys showed a significant decline of 1.3 percent annually. Nest totals from aerial surveys conducted by SCDNR showed a 1.9 percent annual decline in nesting in South Carolina since 1980. Overall, there is strong statistical data to suggest the NRU has experienced a long-term decline up through 2008. Data since 2008 has shown improved nesting numbers and cause for cautious optimism, but future nesting years will need to be analyzed to determine if a change in trend is occurring. In 2008, 841 loggerhead nests were observed compared to the 10-year average of 715 nests in North Carolina. The number dropped to 276 in 2009, but subsequently rose to 846 in 2010, 948 in 2011, and 1,070 in 2012. In South Carolina, 2008 was the seventh highest nesting year on record since 1980, with 4,500 nests, but this did not change the long-term trend line indicating a decline on South Carolina beaches. Then in 2009 nesting dropped to 2,183, with subsequent increases to 3,141 (2010), 4,015 (2011) and 4,592 (2012). Georgia beach surveys located a total of 1,648 nests in 2008. This number surpassed the previous statewide record of 1,504 nests in 2003. In 2009, the number of nests declined to 998. From 2010 to 2012 new statewide records were established each year: 1,760 in 2010; 1,992 in 2011; and 2,220 in 2012 (with 19 "unknowns" some of which were likely loggerheads). According to analyses by Georgia DNR, in 2008 the 40-year time series trend data showed an overall decline in nesting, but the shorter comprehensive survey data (20 years) indicated a stable population (SCDNR 2008). Given the nesting increases since 2008, the population trend can be expected to be stable, if not increasing (all GDNR, NCWRC, and SCDNR nesting data located at www.seaturtle.org).

Another consideration that may add to the importance and vulnerability of the NRU is the sex ratio of this subpopulation and its potential importance for genetic diversity. Research conducted over a limited timeframe but across multiple years found that while the small Northern subpopulation can produce a larger proportion of male hatchlings than the large Peninsular Florida subpopulation, the sex ratio is female biased. In most years, the extent of the female bias is likely to be less extreme based upon current information. However, because their absolute numbers are small, their contribution to overall hatchling sex ratios is small (Wyneken et al. 2004, Wyneken et al. presentation 2 Feb 2012). Since nesting female loggerhead sea turtles exhibit nest fidelity, the continued existence of the Northern subpopulation is related to the number of female hatchlings that are produced. Fewer females will limit the number of subsequent offspring produced by the subpopulation.

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 a mean of 64,513 loggerhead nests per year, representing approximately 15,735 nesting females per year (NMFS and USFWS 2008). The statewide estimated nest total for 2010 was 73,708 and 68,587 in 2011 (FWRI nesting database). However, the statewide census survey effort is less consistent and the index nesting beach data provides a better understanding of the nesting trends. An analysis of the index nesting beach data show a 26 percent decline in nesting by the PFRU between 1989 and 2008, and a mean annual rate of decline of 1.6 percent, despite a large increase in nesting for 2008, to 38,643 nests (NMFS and USFWS 2008, Witherington et al. 2009, FWRI nesting database). However, this trend changed with subsequent years of nesting, especially as a result of the dramatic increase over the last five years of nesting. In 2009, nesting levels dropped to approximately 32,717 nests, below 2008 levels but still higher than the lows of 2004, 2006, and 2007. In 2010, a large increase was seen, with 47,880 nests on the index nesting beaches (FWRI nesting database). The 2010 Florida index nesting number was the largest since 2000. With the addition of data through 2010, the nesting trend for the NWA DPS of loggerheads became only slightly negative and not statistically different from zero (no trend) (NMFS and USFWS 2010). Nesting at the index nesting beaches in 2011 declined from 2010, but was still the second highest since 2001, at 43,595 nests (FWRI nesting database). Nesting in 2012 reached 58,172 at the index beaches, the second highest number of nests ever recorded since the start of the index beach surveys in 1989.[19] With the recent nesting increase through 2012, the negative trend seen post-1998 has been reversed, with analysis showing no demonstrable trend. Additionally, there is now an

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[19] Only 1998 was a better nesting year with 59,918 nests.

overall increase in nest count from 1989 through 2012 (FWRI nesting database; http://myfwc.com/research/wildlife/sea-turtles/nesting/loggerhead-trends/).

The remaining three recovery units - Dry Tortugas (DTRU), Northern Gulf of Mexico (NGMRU), and Greater Caribbean (GCRU) - are much smaller nesting assemblages but 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 an average of 246, but with 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 significant declining trend of 4.7 percent annually (NMFS and USFWS 2008). 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. Similarly, nesting survey effort has been inconsistent among the GCRU nesting beaches and no trend can be determined for this recovery unit. Zurita et al. (2003) found a statistically significant increase in the number of nests on seven of the beaches on Quintana Roo, Mexico, from 1987-2001, where survey effort was consistent during the period. However, nesting has declined since 2001, and the previously reported increasing trend appears to not have been sustained (NMFS and USFWS 2008).

Even prior to the recent change in the nesting trend, in-water research suggested the possibility that the abundance of neritic juvenile loggerheads was steady or increasing (Ehrhart et al. 2007), M. Bresette, pers. comm. regarding captures at the St. Lucie Power Plant, SCDNR unpublished SEAMAP-SA data (Epperly et al. 2007). Ehrhart et al. (2007) found no significant regression-line trend in the long-term dataset. However, notable increases in recent years and a statistically significant increase in catch-per-unit-effort (CPUE) of 102.4 percent from the 4-year period of 1982-1985 to the 2002-2005 periods were found. Epperly et al. (2007) determined the trends of increasing loggerhead catch rates from all the aforementioned studies in combination provide evidence of an increase in neritic juvenile loggerhead abundance in the southeastern United States in the recent past. A study led by the South Carolina Department of Natural Resources found that standardized trawl survey CPUEs for loggerheads from South Carolina to North Florida was 1.5 times higher in summer 2008 than summer 2000. However, even though there were persistent inter-annual increases from 2000-2008, the difference was not statistically significant, likely due to the relatively short time series. Comparison to other datasets from the 1950s through 1990s showed much higher CPUEs in recent years regionally and in the South Atlantic Bight, leading SCDNR to conclude that it is highly improbable that CPUE increases of such magnitude could occur without a real and substantial increase in actual abundance (Arendt et al. 2009). Whether this increase in abundance represents a true population increase among juveniles or merely a shift in spatial occurrence is not clear. NMFS and USFWS (2008), citing (Bjorndal et al. 2005), 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 Stage III individuals (oceanic/neritic juveniles, historically referred to as small benthic juveniles), which could indicate a relatively large cohort that will recruit to maturity in the near future (TEWG 2009). However, in-water studies throughout the eastern United States also indicate a substantial decrease in the abundance of the smallest Stage III loggerheads, a pattern also corroborated by stranding data (TEWG 2009).

The NMFS Southeast Fishery Science Center (SEFSC) has 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). This model does not incorporate existing trends in the data (such as nesting trends) but instead relies on utilizing the available information on the relevant life-history parameters for sea turtles and then predicts future population trajectories based upon model runs using those parameters. Therefore, the model results do not build upon, but instead are complementary to, the trend data obtained through nest counts and other observations. 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. Model runs were done for each individual recovery unit as well as the western North Atlantic population as a whole, and the resulting trajectories were found to be very similar. One of the most robust results from the model was an estimate of the adult female population size for the western North Atlantic in the 2004-2008 time frame. The distribution resulting from the model runs suggests the adult female population size to be likely between approximately 20,000 to 40,000 individuals, with a low likelihood of being up to 70,000 (NMFS SEFSC 2009). 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 SEFSC 2009). It is important to note that number of nests was used in part to determine the number of females, and the analysis took the very conservative approach of using the lowest nesting total for the 2004-2008 period. As detailed previously, nesting numbers have risen dramatically since 2008. Therefore, the estimates of female populations described in NMFS SEFSC (2009) do not reflect those increases, and are likely underestimates.

Threats

The loggerhead sea turtle faces numerous natural and man-made threats that influence its status and affect the ability of the species to recover. As many of the threats affecting loggerheads are either the same or similar in nature to threats affecting other listed sea turtle species, many of the threats identified in this section below are discussed in a general sense for all listed sea turtles rather than solely for loggerheads. Threats specific to a particular species are then discussed in the corresponding status sections where appropriate.

The Loggerhead Biological Review Team determined that the greatest threats to the Northwest Atlantic DPS of loggerheads result from cumulative fishery bycatch in neritic and oceanic habitats (Conant et al. 2009). Domestic fishery operations often capture, injure, and kill sea turtles at various life stages. Loggerheads in the pelagic environment are exposed to U.S. Atlantic pelagic longline fisheries. Although loggerhead sea turtles are most vulnerable to pelagic longlines during their immature life history stage, there is some evidence that benthic juveniles may also be captured, injured, or killed by pelagic fisheries as well (Lewison et al. 2004). 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. Loggerheads in the benthic environment in waters off the coastal United States are exposed to a suite of other fisheries in federal and state waters including trawl, gillnet, purse seine, hook-and-line, including bottom longline and vertical line (e.g., bandit gear, handline, and rod-reel), pound net, and trap fisheries. For example, in the spring of 2000, a total of 275 loggerhead carcasses were found on North Carolina beaches. The cause of death for most of the sea turtles recovered was unknown, but the mass mortality event was suspected to have been from a large-mesh gillnet fishery operating offshore in the preceding weeks. Section 4 of this opinion for provides more specific information regarding federal fisheries affecting sea turtles within the action area. In addition to domestic fisheries, sea turtles are subject to direct as well as incidental capture in numerous foreign fisheries, further exacerbating the ability of sea turtles to survive and recover throughout their ranges. For example, pelagic, immature loggerhead sea turtles circumnavigating the Atlantic are exposed to international longline fisheries including the Azorean, Spanish, and various other fleets (Bolten et al. 1994, Aguilar et al. 1995, Crouse 1999). Bottom longlines in the coastal waters of Madeira, Portugal, are reported to take an estimated 500 pelagic immature loggerheads each year (Dellinger and Encamacao 2000) 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 operating in numerous foreign countries and pose a significant threat to sea turtles. Many unreported takes or incomplete records by foreign fleets make it difficult to evaluate the total impact that international fishing pressure is having on listed sea turtles. Regardless, international fisheries represent a continuing threat to sea turtle survival and recovery throughout their ranges.

There are also many non-fishery impacts affecting the status of sea turtle species, both in the marine and terrestrial environment. 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, can entrain and kill sea turtles (NMFS 1997). Sea turtles entering coastal or inshore areas may also become entrained 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, and scientific research activities.

Coastal development can deter or interfere with sea turtle nesting by affecting nesting success and degrading nesting habitats. Construction of buildings and pilings, beach armoring and renourishment, and sand extraction can all affect nesting habitat (Lutcavage et al. 1997, Bouchard et al. 1998). Coastal development may directly, through loss of beach habitat, or indirectly, through changing thermal profiles and increasing erosion, decrease the amount of nesting area available to females (Ackerman 1997, Witherington et al. 2003, Witherington et al. 2007). Coastal development may also change the natural behaviors of both adults and hatchlings (Ackerman 1997, Witherington et al. 2003, Witherington et al. 2007). 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).

Predation by various land predators is a threat to developing nests and emerging hatchlings. Additionally, 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).

Pollutants such as pesticides, hydrocarbons, organochlorides (e.g. DDT and PCBs), and others may cause adverse health effects to sea turtles (Iwata et al. 1993, Grant and Ross 2002, Garrett 2004, Hartwell 2004). Multiple municipal, industrial, and household sources, as well as atmospheric transport, introduce these into the marine environment. Storelli et al. (1998) 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. 1991). It is thought that dietary preferences were likely to be the main differentiating factor among species. Recent efforts have led to improvements in regional water quality in the action area, although the more persistent chemicals are still detected and are expected to endure for years (Mearns 2001, Grant and Ross 2002). 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 may indirectly affect listed species by reducing food availability in the action area.

At this time, the total effects of the DWH oil spill on ESA-listed sea turtles are not known. However, oil spills generally impact all sea turtle species via the same three primary pathways: ingestion – via direct consumption or indirectly via prey items that have been exposed to oil; absorption – via direct contact; and inhalation – via breathing volatile organics released from oil or from "dispersants."

Additionally, disruption of foraging or migratory movements due to surface or subsurface oil; loss of foraging resources which could lead to compromised growth, health, and/or reproductive potential; harm to foraging, resting and/or nesting habitats; and disruption of nesting sea turtles and nests is also possible. Chronic exposure to oil in the form of tarballs, slicks, or elevated background concentrations may exacerbate other natural and man-made stresses (Milton et al. 2003). Since hatchlings spend a greater portion of their time at the sea surface than adults they may at greater risk of exposure to floating oil slicks (Lutcavage et al. 1995).

Frazier (1980) suggested that olfactory impairment from chemical contamination could represent a substantial indirect effect in sea turtles, since a keen sense of smell apparently plays an important role in navigation and orientation. Oiled nesting beaches may also affect the locational imprinting of hatchlings, and thus impair their ability to return to their natal beaches to breed and nest (Milton et al. 2003). Regardless of age class, ingested tarballs are likely to have a variety of effects including: starvation from gut blockage, decreased absorption efficiency, absorption of toxins, effects of general intestinal blockage (such as local necrosis or ulceration), interference with fat metabolism, and buoyancy problems caused by the buildup of fermentation gases (floating prevents turtles from feeding and increases their vulnerability to predators and boats), among others. Oil can also kill the seagrass beds that some sea turtle species feed upon.

Little is known about the effects of dispersants on sea turtles. While inhaling petroleum vapors can irritate sea turtles' lungs, dispersants can interfere with lung function through their surfactant (detergent) effect. Dispersant components absorbed through the lungs or gut may affect multiple organ systems, interfering with digestion, respiration, excretion, and/or salt-gland function-similar to the empirically demonstrated effects of oil alone (Hoff and Shigenaka 2003).

During the response phase to the DWH oil spill (April 26 – October 20, 2010) a total of 88 (21 alive and 67 dead) loggerhead sea turtles were recovered, either as strandings (dead or debilitated generally onshore or nearshore) or were collected offshore during sea turtle search and rescue operations. It is unclear how many of those without direct evidence of oil were actually impacted by the spill and spill-related activities versus other sources of mortality. There were likely additional mortalities that were undetected and, therefore, currently unknown. We believe the relative proportion of the population exposed to the effects of the DWH spill was relatively small compared to the likely population size. Additionally, the majority of nesting for the Northwest Atlantic Ocean loggerhead DPS occurs on the Atlantic coast, which was not impacted by the spill. However, it is likely that impacts to the Northern Gulf of Mexico Recovery Unit (NGMRU) of the NWA loggerhead DPS would be proportionally much greater than the impacts occurring to other recovery units because of impacts to nesting (as described above) and a larger proportion of the NGMRU recovery unit, especially mating and nesting adults, being exposed to the spill. However, the impacts to that recovery unit, and the possible effect of such a disproportionate impact on that small recovery unit to the NWA DPS and the species, remain unknown.

All sea turtle species are also susceptible to cold stunning. However, cold-stunning is not considered a major source of mortality in most cases. As temperatures fall below 8°-10°C, sea 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 1989).

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, for the most part, be predicted with any degree of certainty; however significant impacts to the hatchling sex ratios of loggerhead turtles may result (NMFS and USFWS 2007d). In sea turtles, sex is determined by temperature in 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 2007d). Modeling suggests an increase of 2°C in air temperature compared to long-term mean air temperature through 2005 would result in a sex ratio of over 80 percent female offspring for loggerheads nesting near Southport, North Carolina; increases up to 7.5°C above mean would lead to 100 percent female sex ratio bias. The same increase in air temperatures at nesting beaches in Cape Canaveral, Florida, would result in close to 100 percent female offspring. More ominously, an air temperature increase of 3°C is likely to exceed the thermal threshold of most clutches in Cape Canaveral, leading to death (Hawkes et al. 2007). Warmer sea surface temperatures have been correlated with an earlier onset of loggerhead nesting in the spring (Weishampel et al. 2004, Hawkes et al. 2007), as well as short inter-nesting intervals (Hays et al. 2002) and shorter nesting season (Pike et al. 2006).

The effects from increased temperatures may be exacerbated 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 2007d). 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 (Daniels et al. 1993, Fish et al. 2005, Baker et al. 2006). 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, etc.) could influence the distribution and abundance of phytoplankton, zooplankton, submerged aquatic vegetation, crustaceans, mollusks, forage fish, etc., which could ultimately affect the primary foraging areas of sea turtles.

Actions have been taken to reduce anthropogenic impacts to loggerhead sea turtles from various sources, particularly since the early 1990s. These include lighting ordinances, predation control, and nest relocations to help increase hatchling survival, as well as measures to reduce the mortality of pelagic immatures, benthic immatures, and sexually mature age classes from various fisheries and other marine activities. Recent actions have taken significant steps towards reducing the recurring sources of mortality of sea turtles in the environmental baseline and improving the status of all loggerhead subpopulations. For example, the Turtle Excluder Device (TED) regulation published on February 21, 2003 (68 FR 8456), represents a significant improvement in the baseline effects of trawl fisheries on loggerhead sea turtles, though shrimp trawling is still considered to be one of the largest source of anthropogenic mortality on loggerheads (NMFS SEFSC 2009).

3.2.5 Green Sea Turtle

The green sea turtle was listed as threatened under the ESA on July 28, 1978, except for the Florida and Pacific coast of Mexico breeding populations which were listed as endangered. Critical habitat for the green sea turtle was designated on September 2, 1998, for the waters surrounding Isla Culebra, Puerto Rico, and its associated keys. No critical habitat exists in the action area for this consultation.

Species Description, Distribution, and Population Structure

Green sea turtles have a smooth carapace with four 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, brown and black in starburst or irregular patterns (Lagueux 2001).

Green sea turtles are distributed circumglobally, mainly in waters between the northern and southern 20°C isotherms (Hirth 1971) and nesting occurs in more than 80 countries worldwide (Hirth and USFWS 1997). The two largest nesting populations are found at Tortuguero, on the Caribbean coast of Costa Rica, and Raine Island, on the Great Barrier Reef in Australia. The complete nesting range of green sea turtles within the southeastern United States includes sandy beaches of mainland shores, barrier islands, coral islands, and volcanic islands between Texas and North Carolina as well as the USVI and Puerto Rico (NMFS and USFWS 1991a, Dow et al. 2007). However, the vast majority of green sea turtle nesting within the southeastern United States occurs in Florida (Meylan et al. 1995, Johnson and Ehrhart 1994). Principal U.S. nesting areas for green sea turtles are in eastern Florida, predominantly Brevard through Broward counties. For more information on green sea turtle nesting in other ocean basins, refer to the 1991 Recovery Plan for the Atlantic Green Turtle (NMFS and USFWS 1991a) or the 2007 Green Sea Turtle 5-Year Status Review (NMFS and USFWS 2007a).

In U.S. Atlantic and Gulf of Mexico waters, green sea turtles are found in 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, Carr 1984), 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 (Wershoven and Wershoven 1992, Guseman and Ehrhart 1992). The summer developmental habitat for green 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.

Adults of both sexes are presumed to migrate between nesting and foraging habitats along corridors adjacent to coastlines and reefs (Hays et al. 2001) and, like loggerheads, are known to migrate from northern areas in the summer back to warmer waters of the south in the fall and winter to avoid seasonally cold seawater temperatures. In terms of genetic structure, regional subpopulations show distinctive mitochondrial DNA properties for each nesting rookery (Bowen et al. 1992, Fitzsimmons et al. 2006). Despite the genetic differences, green sea turtles from separate nesting origins are commonly found mixed together on foraging grounds throughout the species' range. However, such mixing occurs at extremely low levels in Hawaiian foraging areas, perhaps making this central Pacific population the most isolated of all green turtle populations occurring worldwide (Dutton et al. 2008).

Life History Information

Green sea turtles exhibit particularly slow growth rates [about 1-5 cms per year (Green 1993, McDonald-Dutton and Dutton 1998)] and also have one of the longest ages to maturity of any sea turtle species [i.e., 20-50 years (Chaloupka and Musick 1997, Hirth and USFWS 1997)]. The slow growth rates are believed to be a consequence of their largely herbivorous, low-net energy diet (Bjorndal 1982). Upon reaching sexual maturity, females begin returning to their natal beaches (i.e., the same beaches where they were born) to lay eggs (Balazs 1982, Frazer and Ehrhart 1985) and are capable of migrating significant distances (hundreds to thousands of kilometers) between foraging and nesting areas. While females lay eggs every 2-4 years, males reproduce every year (Balazs 1983).

Green sea turtle mating occurs in the waters off nesting beaches. In the southeastern United States, females generally nest between June and September, and peak nesting occurs in June and July (Witherington and Ehrhart 1989). During the nesting season, females nest at approximately two-week intervals, laying an average of 3-4 nests (Johnson and Ehrhart 1996). The number of eggs per nest varies among subpopulations, but the average nest size is around 110-115 eggs. In Florida, green sea turtle nests contain an average of 136 eggs (Witherington and Ehrhart 1989), which will incubate for approximately 2 months before hatching. Survivorship at any particular nesting site is greatly influenced by the level of human-caused stressors. More pristine and less disturbed nesting sites (e.g., Great Barrier Reef in Australia) show higher survivorship values than nesting sites known to be highly disturbed (e.g., Nicaragua) (Campbell 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 period they feed close to the surface on a variety of marine algae and other life associated with drift lines and other debris. This early oceanic phase remains one of the most poorly understood aspects of green sea turtle life history (NMFS and USFWS 2007a). However, at approximately 20- to 25-cm carapace length, juveniles leave pelagic habitats and enter benthic foraging habitats. Growth studies using skeletochronology indicate that green sea turtles in the Western Atlantic shift from the oceanic phase to nearshore development habitats (protected lagoons and open coastal areas rich in sea grass and marine algae) after approximately 5-6 years (Zug and Glor 1998, Bresette et al. 2006). As adults, they feed almost exclusively on sea grasses and algae in shallow bays, lagoons, and reefs (Rebel and Ingle 1974) although some populations are known to also feed heavily on invertebrates (Carballo et al. 2002). 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). Based on flipper tagging and/or satellite telemetry studies, the majority of adult female Florida green sea turtles are believed to reside in nearshore foraging areas throughout the Florida Keys from Key Largo to the Dry Tortugas and in the waters southwest of Cape Sable, Florida, with some post-nesting turtles also residing in Bahamian waters as well (NMFS and USFWS 2007a).

Abundance and Trends
A summary of nesting trends is provided in the most recent 5-year status review for the species (NMFS and USFWS 2007a) in which the authors collected and organized abundance data from 46 individual nesting concentrations organized by ocean region (i.e., Western Atlantic Ocean, Central Atlantic Ocean, Eastern Atlantic Ocean, Mediterranean Sea, Western Indian Ocean, Northern Indian Ocean, Eastern Indian Ocean, Southeast Asia, Western Pacific Ocean, Central Pacific Ocean, and Eastern Pacific Ocean). The authors were able to determine trends at 26 of the 46 nesting sites and found that 12 appeared to be increasing, 10 appeared to be stable, and 4 appeared to be decreasing. With respect to regional trends, the Pacific, the Western Atlantic, and the Central Atlantic regions appeared to show more positive trends (i.e., more nesting sites increasing than decreasing) while the Southeast Asia, Eastern Indian Ocean, and possibly the Mediterranean Sea regions appeared to show more negative trends (i.e., more nesting sites decreasing than increasing). These regional determinations should be viewed with caution since trend data was only available for about half of the total nesting concentration sites examined in the review and that site specific data availability appeared to vary across all regions.

The western Atlantic region (focus of this opinion) was one of the best performing in terms of abundance in the entire review as there were no sites that appeared to be decreasing. The 5-year status review for the species identified eight geographic areas considered to be primary sites for green sea turtle nesting in the Atlantic/Caribbean and reviewed the trend in nest count data for each (NMFS and USFWS 2007a). These sites include: (1) Yucatán Peninsula, Mexico; (2) Tortuguero, Costa Rica; (3) Aves Island, Venezuela; (4) Galibi Reserve, Suriname; (5) Isla Trindade, Brazil; (6) Ascension Island, United Kingdom; (7) Bioko Island, Equatorial Guinea; and (8) Bijagos Archipelago, Guinea-Bissau. Nesting at all of these sites was considered to be stable or increasing with the exception of Bioko Island and the Bijagos Archipelago where the lack of sufficient data precluded a meaningful trend assessment for either site (NMFS and USFWS 2007a). Seminoff (2004) likewise reviewed green sea turtle nesting data for eight sites in the western, eastern, and central Atlantic, including all of the above with the exception that nesting in Florida was reviewed in place of Isla Trindade, Brazil. Seminoff (2004) concluded that all sites in the central and western Atlantic showed increased nesting, with the exception of nesting at Aves Island, Venezuela, while both sites in the eastern Atlantic demonstrated decreased nesting. These sites are not inclusive of all green sea turtle nesting in the Atlantic. However, other sites are not believed to support nesting levels high enough that would change the overall status of the species in the Atlantic (NMFS and USFWS 2007a). More information about site specific trends for the other major ocean regions can be found in the most recent 5-year status review for the species (see NMFS and USFWS 2007a).

By far, the largest known nesting assemblage in the western Atlantic region occurs at Tortuguero, Costa Rica. According to monitoring data on nest counts as well as documented emergences (both nesting and non-nesting events), there appears to be an increasing trend in this nesting assemblage since monitoring began in the early 1970s. For instance, from 1971-1975 there were approximately 41,250 average emergences documented per year and this number increased to an average of 72,200 emergences documented per year 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 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 growing at 4.9 percent annually. The number of females nesting per year on beaches in the Yucatán, Aves Island, Galibi Reserve, and Isla Trindade number in the hundreds to low thousands, depending on the site (NMFS and USFWS 2007a). 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 as well as the beaches on the Florida Panhandle (Meylan et al. 1995). More recently, green sea turtle nesting occurred on Bald Head Island, North Carolina; just east of the mouth of the Cape Fear River; on Onslow Island; and on Cape Hatteras National Seashore. In 2010, a total of 18 nests were found in North Carolina, 6 nests in South Carolina, and 6 nests in Georgia (nesting databases maintained on www.seaturtle.org). Increased nesting has also been observed along the Atlantic coast of Florida, on beaches where only loggerhead nesting was observed in the past (Pritchard 1997).

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 up until recently, the pattern of green turtle nesting has shown biennial peaks in abundance with a generally positive trend during the ten years of regular monitoring. According to data collected from Florida's index nesting beach survey from 1989-2011, green turtle nest counts across Florida have increased approximately tenfold from a low of 267 in the early 1990's to a high of 10,701 in 2011. In 2007, there were 9,455 green turtle nests found just on index nesting beaches, the highest since index beach monitoring began in 1989. The number fell back to 6,385 in 2008 and dropped under 3,000 in 2009, at first causing some concern, but 2010 saw an increase back to 8,426 nests on the index nesting beaches and then the high of 10,701was measured in 2011 (FWC Index Nesting Beach Survey Database). Modeling by Chaloupka and Balazs (2007) 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 percent.

There are no reliable estimates of the number of immature green sea turtles that inhabit coastal areas of the southeastern United States, where they come to forage. Ehrhart et al. (2007) have documented a significant increase in in-water abundance of green turtles in the Indian River Lagoon area. It is likely that immature green sea turtles foraging in the southeastern United States come from multiple genetic stocks; therefore, the status of immature green sea turtles in the southeastern United States might also be assessed from trends at all of the main regional nesting beaches, principally Florida, Yucatán, and Tortuguero.

Threats

The principal cause of past declines and extirpations of green sea turtle assemblages has been the overexploitation of green sea turtles 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. There are also significant and ongoing threats to green sea turtles from human-related causes in the United States. Similar to that described in more detail previously for loggerhead sea turtles, these threats include global climate change, beach armoring, erosion control, artificial lighting, beach disturbance (e.g., driving on the beach), pollution, foraging habitat loss as a result of direct destruction by dredging, siltation, boat damage, interactions with fishing gear, and oils spills. For all sea turtle species, the potential impacts of the DWH release are described in the Environmental Baseline section of this document.

Fibropapillomatosis disease is an increasing threat to green sea turtles. Presently, this disease is cosmopolitan and has been found to affect large numbers of animals in some areas, including Hawaii and Florida (Herbst 1994, Jacobson 1990, Jacobson et al. 1991). As noted previously in Section 3.2.4, all sea turtles are susceptible to cold stunning; however, for unknown reasons, green sea turtles appear to be the most susceptible sea turtle species. 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, with 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 turtles being found cold-stunned in Texas. Of these, approximately 620 were found dead or died after stranding and approximately 1,030 were rehabilitated and released. Additionally, during this same time frame, approximately 340 green turtles were found cold-stunned in Mexico, with approximately 300 of those reported as being subsequently released.

All of the DWH-related impacts mentioned for loggerhead sea turtles (e.g., direct oiling, inhalation of volatile compounds, etc.; see Section 3.2.4) are likely to have also affected green sea turtles. During the response phase to the DWH oil spill (April 26 – October 20, 2010) a total of 201 (172 alive and 29 dead) green sea turtles were recovered, either as strandings (dead or debilitated generally onshore or nearshore) or were collected offshore during sea turtle search and rescue operations. The mortality number of green sea turtles is lower than that for loggerheads despite loggerheads having far fewer total strandings, but this is because the majority of green sea turtles came from the offshore rescue (pelagic stage), of which almost all survived after rescue, whereas a greater proportion of the loggerhead recoveries were nearshore neritic stage individuals found dead. While green sea turtles regularly use the northern Gulf of Mexico, they have a widespread distribution throughout the entire Gulf of Mexico, Caribbean, and Atlantic. As described above, nesting is relatively rare on the northern coast of the Gulf of Mexico. Therefore, green sea turtles likely suffered adverse impacts from the DWH spill, a relatively small proportion of the population is expected to have been exposed to and directly impacted by the spill.

3.2.6 Leatherback Sea Turtle

The leatherback sea turtle was listed as endangered throughout its entire range on June 2, 1970 (35 FR 8491) under the Endangered Species Conservation Act of 1969. Critical habitat was designated in 1979 in coastal waters adjacent to Sandy Point, St. Croix, U.S. Virgin Islands. Designation of critical habitat in the Pacific Ocean occurred on January 26, 2012 (77 FR 4170). This designation includes approximately 16,910 square miles (43,798 square km) stretching along the California coast from Point Arena to Point Arguello east of the 3,000-meter depth contour; and 25,004 square miles (64,760 square km) stretching from Cape Flattery, Washington to Cape Blanco, Oregon east of the 2,000-meter depth contour.

Species Description, Distribution, and Population Structure

The leatherback is the largest sea turtle in the world. Mature males and females can reach lengths of over 2 m (6 ft) and weigh close to 900 kg (2000 lbs). The leatherback is the only sea turtle that lacks a hard, bony shell. A leatherback's carapace is approximately 4 cm thick and consists of a leathery, oil-saturated connective tissue overlaying loosely interlocking dermal bones. The ridged carapace and large flippers are characteristics that make the leatherback uniquely equipped for long-distance foraging migrations. Leatherbacks lack the crushing chewing plates characteristic of sea turtles that feed on hard-bodied prey (Pritchard 1971). Instead, they have pointed toothlike cusps and sharp-edged jaws that are adapted for a diet of soft-bodied pelagic (open ocean) prey, such as jellyfish and salps. A leatherback's mouth and throat also have backward-pointing spines that help retain gelatinous prey.

The leatherback sea turtle ranges farther than any other sea turtle species, exhibiting broad thermal tolerances (NMFS and USFWS 1995). They forage in temperate and subpolar regions between latitudes 71°N and 47°S in all oceans and undergo extensive migrations 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 SEFSC 2001). Female leatherbacks nest from the southeastern United States to southern Brazil in the western Atlantic and from Mauritania to Angola in the eastern Atlantic. The most significant nesting beaches in the Atlantic, and perhaps in the world, are located in French Guiana and Suriname (NMFS SEFSC 2001).

Previous genetic analyses of leatherbacks using only mitochondrial DNA (mtDNA) suggested that within the Atlantic basin there were at least three genetically distinct nesting populations: the St. Croix nesting population (USVI), the mainland nesting Caribbean population (Florida, Costa Rica, Suriname/French Guiana), and the Trinidad nesting population (Dutton et al. 1998). Further genetic analyses using microsatellite markers along with the mtDNA data and tagging data has resulted in Atlantic Ocean leatherbacks now being divided into seven groups or breeding populations: Florida, Northern Caribbean, Western Caribbean, Southern Caribbean/Guianas, West Africa, South Africa, and Brazil (TEWG 2007). General differences in migration patterns and foraging grounds may occur between the seven nesting assemblages, although data to support this is limited in most cases.

Life History Information

Leatherbacks are believed to be a relatively long-lived sea turtle species. 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). Past estimates showed that they reached sexual maturity faster than most other sea turtle species as Rhodin (1985) reported maturity for leatherbacks occurring at 3-6 years of age while Zug and Parham (1996) reported maturity occurring at 13-14 years of age. More recent research using sophisticated methods of analyzing leatherback ossicles has cast doubt on the previously accepted age to maturity figures, with leatherbacks in the western North Atlantic possibly not reaching sexual maturity until as late as 29 years of age (Avens and Goshe 2007). Female leatherbacks lay up to 10 nests during the nesting season (March through July in the United States) at 2-3 year intervals. They produce 100 eggs or more in each nest and, thus, can produce 700 eggs or more per nesting season (Schultz 1975). However, up to approximately 30 percent of the eggs may be infertile. Thus, the actual proportion of eggs that can result in hatchlings is less than this seasonal estimate. After 60-65 days, leatherback hatchlings with white striping along the ridges of their backs and on the margins of the flippers emerge from the nest. Leatherback hatchlings are approximately 50-77 cm in length, with fore flippers as long as their bodies, and weigh approximately 40-50 g. Although leatherbacks forage in coastal waters, they appear to remain primarily pelagic through all life stages (Heppell et al. 2003). Eckert (1999) found that leatherback juveniles remain in waters warmer than 26ºC until they exceed 100 cm in length. The location and abundance of prey, including medusae, siphonophores, and salps, in temperate and boreal latitudes likely has a strong influence on leatherback distribution in these areas (Plotkin 1995). Leatherbacks are known to be deep divers, with recorded depths in excess of a half mile (Eckert et al. 1989), but may also come into shallow waters to locate prey items.

Abundance and Trends

The status of the Atlantic leatherback population has been less clear than the Pacific population, which has shown dramatic declines at many nesting sites (Spotila et al. 2000, Santidrian Tomillo et al. 2007, Sarti Martinez et al. 2007). 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), a lesser degree of nest-site fidelity than occurs with the hardshell sea turtle species, and inconsistencies in the availability and analyses of data. However, coordinated efforts at 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 the vast majority of the nesting occurring in the Guianas and Trinidad. Past analyses had shown that the nesting aggregation in French Guiana had been declining at about 15 percent per year since 1987 (NMFS SEFSC 2001). However, from 1979-1986, the number of nests was increasing at about 15 percent annually, which could mean that the observed decline could be part of a nesting cycle that coincides with the erosion cycle of Guiana beaches described by Schultz (1975). It is thought that the cycle of erosion and reformation of beaches has resulted in shifting nesting beaches throughout this region. This was supported by the increased nesting seen in Suriname, where leatherback nest numbers had shown large increases concurrent with declines elsewhere (with more than 10,000 nests per year since 1999 and a peak of 30,000 nests in 2001), and the long-term trend for the overall Suriname and French Guiana population was thought to possibly show an increase (Girondot 2002 in Hilterman and Goverse 2003). In the past, many sea turtle scientists have agreed that the Guianas (and some would include Trinidad) should be viewed as one population and that a synoptic evaluation of nesting at all beaches in the region is necessary to develop a true picture of population status (Reichart et al. 2001). Genetics studies have added support to this notion and have resulted in the designation of the Southern Caribbean/Guianas stock. Using both Bayesian modeling and regression analyses, the TEWG (TEWG 2007) determined that the Southern Caribbean/Guianas stock had demonstrated a long-term, positive population growth rate (using nesting females as a proxy for population). This positive growth was seen within major nesting areas for the stock, including Trinidad, Guyana, and the combined beaches of Suriname and French Guiana (TEWG 2007).

The Western Caribbean stock includes nesting beaches from Honduras to Colombia. Within that range, nesting is most prevalent in Costa Rica, Panama, and the Gulf of Uraba in Colombia (Duque et al. 2000). The Caribbean coast 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 three index nesting beaches in the region (Tortuguero, Gandoca, and Pacuaré in Costa Rica) using various Bayesian and regression analyses indicated that the nesting population likely was not growing over the 1995-2005 time series of available data (TEWG 2007). Other modeling of the nesting data for Tortuguero indicates a possible 67.8 percent decline between 1995 and 2006 (Troëng et al. 2007).

Nesting data for the Northern Caribbean stock is available from Puerto Rico, St. Croix (USVI), 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 percent (TEWG 2007). At the primary nesting beach on St. Croix, the Sandy Point National Wildlife Refuge, nesting has fluctuated from a few hundred nests to a high of 1,008 in 2001, and the average annual growth rate has been approximately 1.1 percent from 1986-2004 (TEWG 2007). 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 percent 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 (TEWG 2007) estimated a significant annual nesting growth rate of 1.17 percent between 1989 and 2005. In 2007, a record 517 leatherback nests were observed on the index beaches in Florida, followed by 265 nests in 2008, a record 615 nests in 2009, a slight decline to 552 nests in 2010, and then a new record of 625 nests in 2011 (FWC Index Nesting Beach Survey Database). 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, but overall the trend shows rapid growth on Florida’s east coast beaches.

The West African nesting stock of leatherbacks is a large, important, but 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. However, it is known that Gabon has a very large amount of leatherback nesting, with at least 30,000 nests laid along its coast in one season (Fretey et al. 2007). Fretey et al. (2007) also 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 nesting stocks utilize the beaches of Brazil and South Africa. For the Brazilian stock, the TEWG (2007) analyzed the available data and determined that between 1988 and 2003 there was a positive annual average growth rate of 1.07 percent using regression analyses and 1.08 percent using Bayesian modeling. The South African stock has an annual average growth rate of 1.06 based on regression modeling and 1.04 percent using the Bayesian approach (TEWG 2007).

Estimates of total population size for Atlantic leatherbacks are difficult to ascertain due to the inconsistent nature of the available nesting data. In 1996, the entire Western Atlantic population was characterized as stable at best (Spotila et al. 1996), with numbers of nesting females reported to be on the order of 18,800. A subsequent analysis by Spotila (pers. comm.) indicated that by 2000, the Western Atlantic nesting levels had decreased to about 15,000 females. Spotila et al. (Spotila et al. 1996) estimated that the leatherback population for the entire Atlantic basin, including all nesting beaches in the Americas, the Caribbean, and West Africa, totaled approximately 27,600 adult females (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 (TEWG 2007).

Threats

Anthropogenic impacts to the leatherback population are similar to those facing other sea turtle species including interactions with fishery gear, marine pollution, destruction of foraging habitat, and threats to nesting beaches (see loggerhead status and trends section for more information on these threats). Of all the extant sea turtle species, leatherbacks seem to be the most vulnerable to entanglement in fishing gear, especially gillnet and pot/trap lines used in various fisheries around the world. This susceptibility may be the result 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 perhaps 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. 2002). For many years, the TEDs required in many U.S. fisheries were less effective at excluding the larger leatherback sea turtles compared to the smaller, hard-shelled turtle species. However, modifications to the design of TEDs have been required since 2003 that are expected to have reduced the amount of leatherback deaths that result from net capture. 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).

Investigations of the stomach contents of leatherback sea turtles revealed that a substantial percentage (44 percent of the 16 cases examined) contained some form of plastic debris (Mrosovsky 1981). 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 (1985) speculated that the object might resemble a food item by its shape, color, size or even movement as it drifts about, and induce a feeding response in leatherbacks. Just as with other sea turtles, nesting and foraging leatherback sea turtles are subjected to the effects from past and present oil spills occurring in the Gulf of Mexico and other regions (see loggerhead sea turtle status section for more information). At the time of this consultation, no confirmed deaths of leatherbacks have been recorded in the vicinity of the DWH spill site, although this does not mean that no mortality has occurred (NMFS et al. 2011). In addition to direct contact, ingestion of oil-contaminated prey items represents a particular threat to leatherbacks emanating from the DWH spill in the Gulf of Mexico and this may continue to be a threat to recovery in the years ahead.

As discussed in more detail in the loggerhead section above, 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. 2006, Witt et al. 2007); however, more studies need to be done to monitor how changes to prey items affect distribution and foraging success of leatherbacks so that population-level effects can be determined.

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. Critical habitat was designated on June 2, 1998, in coastal waters surrounding Mona and Monito Islands in Puerto Rico (63 FR 46693). No critical habitat exists within the action area for this consultation.

Species Description, Distribution, and Population Structure

Hawksbill sea turtles are small- to medium-sized (45 to 68 kilograms on average) although nesting females are known to weigh up to 80 kilograms in the Caribbean (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 food source as adults, and other invertebrates. The shells of hatchlings are 42 mm long and are mostly brown and somewhat heart-shaped (Hillis and Mackay 1989, van Dam and Sarti 1989, Eckert 1995).

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 (Lund 1985, Plotkin and Amos 1988, Amos 1989, Groombridge and Luxmoore 1989, Plotkin and Amos 1990, NMFS and USFWS 1998c, Meylan and Donnelly 1999). 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 in Buck Island Reef National Monument (BIRNM) was later identified 1,160 miles (1,866 kilometers) away in the Miskito Cays in Nicaragua (Spotila 2004).

Hawksbill sea turtles nest on insular and 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 other sea turtle species (NMFS and USFWS 2007e). It is believed that the widely dispersed nesting areas as well as the often low densities seen on nesting beaches is likely a result of overexploitation of previously large colonies that have since been depleted over time (Meylan and Donnelly 1999). The most significant nesting within the United States occurs in Puerto Rico and the USVI, specifically on Mona Island and BIRNM, respectively. Although nesting within the continental United States is typically rare, it can also occur along the southeast coast of Florida and the Florida Keys. The largest hawksbill sea turtle nesting population in the Western Atlantic occurs in the Yucatán Península of Mexico, where several thousand nests are recorded annually in the states of Campeche, Yucatán, and Quintana Roo (Spotila 2004, Garduno-Andrade et al. 1999). In the United States Pacific, hawksbill sea turtles nest on the beaches of the main island in Hawaii, primarily along the east coast of the island. Hawksbill sea turtle 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 2007e).

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 et al. 1996). The fact that hawksbills exhibit site fidelity to their natal beaches suggests that if subpopulations become extirpated they may not be replenished by recruitment 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 1-3 cm per year measured in the Indo-Pacific (Chaloupka and Limpus 1997, Whiting 2000, Mortimer et al. 2002, Mortimer et al. 2003) to a high of 5 cm or more per year measured at some sites in the Caribbean (León and Díez 1999, Díez and van Dam 2002). 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 et al. 2000, Chaloupka et al. 2004). 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 turtles found in the Indo-Pacific (i.e., 30-40 years) (Boulon 1983, Boulan 1994, Limpus and Miller 2000, Díez and van Dam 2002). Males are typically mature when their length reaches 69 cm while females are typically mature at 75 cm (Limpus 1992, Eckert 1995). Female hawksbills return to their natal beaches every 2-3 years to nest (Witzell 1983, Van Dam et al. 1991) and generally lay 3-5 nests per season (Richardson et al. 1999). Compared with other sea turtles, clutch size for hawksbills can be quite high (e.g., up to 250 eggs per nest) (Hirth and Abdel Latif 1980). Hawksbills may undertake developmental migrations (migrations as immatures) and reproductive migrations that involve travel over hundreds or thousands of kilometers (Meylan 1999a). Post-hatchlings (oceanic stage juveniles) are believed to live in the pelagic environment, taking shelter in floating algal mats and drift lines of flotsam and jetsam in the Atlantic and Pacific oceans (Musick and Limpus 1997) before recruiting to more coastal foraging grounds. In the Caribbean, hawksbills are known to almost exclusively feed on sponges (Meylan 1988, van Dam and Díez 1997) although at times they have been seen foraging on other food items, notably corallimorphs and zooanthids (van Dam and Díez 1997, Mayor et al. 1998, León and Díez 2000).

Reproductive females undertake periodic (usually non-annual) migrations to their natal beach 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 the nesting beach or to courtship stations along the migratory corridor. Hawksbills show a high fidelity to their foraging areas as well (van Dam and Díez 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 Díez 1998).

Abundance and Trends

At the time of this consultation, there are currently no reliable estimates of population abundance and trends for non-nesting hawksbills; 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 2007d). The largest nesting population of hawksbills appears to occur in Australia where approximately 2,000 hawksbills nest off the northwest coast and about 6,000 to 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, about 500-1,000 hawksbill nests are laid on Mona Island, Puerto Rico (Díez and van Dam 2007) and another 56-150 nests are laid on Buck Island off St. Croix (Meylan 1999b, Mortimer and Donnelly 2008). Nesting also occurs to a lesser extent on other additional beaches on St. Croix, St. John, St. Thomas, Culebra Island, Vieques Island, and mainland Puerto Rico. 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). Historic trends (i.e., 20-100 year time period) were determined for 58 of the 83 sites while recent abundance trends (i.e., within the past 20 years) were also determined 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 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 showing recent increases were all located in the Caribbean. 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). Buck Island and St. Croix's East End beaches support two 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. This increase is likely due to the conservation measures implemented when Buck Island Reef National Monument was expanded in 2001. More information about site specific trends for can be found in the most recent five year status review for the species (see NMFS and USFWS 2007d).

Threats

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 tortoiseshell from hundreds of thousands of sea turtles in the western Caribbean region was imported into the United Kingdom and France during the 19th and early 20th centuries (Parsons 1972). Additionally, hundreds of thousands of sea turtles were exported from the region to Japan prior to 1993, when a zero quota was imposed (Milliken and Tokunaga 1987 as cited in Bräutigam and Eckert 2006).

The continuing demand for the hawksbill's shell and other products (leather, oil, perfume, and cosmetics) represents an ongoing threat to recovery of the species. 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 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. Also, hawksbill sea turtle products are openly available in the Dominican Republic and Jamaica despite a prohibition on harvesting hawksbills and their eggs (Fleming 2001). In Cuba, 500 sea turtles are legally captured each year and while current nesting trends are unknown, the number of nesting females is suspected to be declining in some areas (Carrillo 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, but illegal trade is still occurring 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, etc.) and are also highly sensitive to the effects of climate change (e.g., higher incidences of disease and coral bleaching) (Wilkinson 2004, Crabbe 2008). Continued loss of coral reef communities (especially in the greater Caribbean region) is expected to impact foraging and represents a major threat to recovery of the species.

Hawksbills are also currently subject 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, etc.) as discussed in the loggerhead sea turtle status section. Hawksbill sea turtles are also susceptible to capture in nearshore artisanal fishing gear such as drift gillnetting, longlining, set gillnetting, and trawl fisheries with gillnets and artisanal hook-and-line gear representing the greatest impact to the species in the greater Caribbean region (NRC 1990, Lutcavage et al. 1997, Epperly 2003).

All of the DWH-related impacts mentioned for loggerhead sea turtles (e.g., direct oiling, inhalation of volatile compounds, etc; see Section 3.2.4.) are likely to have also affected hawksbill sea turtles. During the response phase to the DWH oil spill (April 26 – October 20, 2010) a total of 16 (all live) hawksbill sea turtles were recovered during sea turtle search and rescue operations. Based on information collected during the response, oceanic stage juvenile hawksbills use the offshore waters of the northern Gulf of Mexico, but overall they are proportionally fewer in number than the other species discussed above. Hawksbill nesting in the northern Gulf of Mexico is a very rare event. Therefore, it appears that the overall impact to hawksbill sea turtles from DWH oil spill was relatively low.

3.2.8 Kemp's Ridley Sea Turtle

The Kemp's ridley sea turtle was listed as endangered throughout its entire range on December 2, 1970 under the Endangered Species Conservation Act of 1969. No critical habitat has been designated for the species.

Species Description, Distribution, and Population Structure
The Kemp's ridley sea turtle is the smallest of all sea turtles with adults generally weighing less than 45 kilograms and having a carapace length of around 65 cm. Adults have an almost circular carapace with a grayish green color while the plastron is often pale yellow. There are two pairs of prefrontal scales on the head, five vertebral scutes, and five pairs of costal scutes. In the bridge adjoining the plastron to the carapace, there are four scutes, each of which is perforated by a pore. Hatchlings are usually grayish-black in color and weigh between 15-20 grams. This species has a very restricted range relative to other sea turtle species, with most adults occurring in the Gulf of Mexico in shallow nearshore waters, although adult-sized individuals sometimes are found on the eastern seaboard of the United States as well. Nesting is essentially limited to the beaches of the western Gulf of Mexico, primarily in the Mexican state of Tamaulipas, although few nests have also been recorded in Florida and the Carolinas (Meylan et al. 1995). Kemp's ridleys nest in daytime aggregations known as "arribadas", primarily at Rancho Nuevo, a stretch of beach in Mexico. Most of the population of adult females nests in this single locality (Pritchard 1969).

Life History Information
Kemp's ridley sea turtles reach sexual maturity at 7-15 years of age. While some turtles nest annually, the weighted mean remigration rate is approximately two years. Nesting generally occurs from April to July and females lay approximately 2.5 nests per season with each nest containing approximately 100 eggs (Márquez M 1994). Studies have shown that the time spent in the post-hatchling pelagic stage can vary from 1-4 years, while the benthic immature stage

typically lasts approximately 7-9 years (Schmid and Witzell 1997). Little is known of the movements of the post-hatching, planktonic stage within the Gulf of Mexico. Post-hatchling Kemp's ridleys are assumed to associate with floating seaweed (e.g. *Sargassum* spp.) where they would presumably feed on the available sargassum and associated infauna or other epipelagic species found in the Gulf of Mexico. Atlantic juveniles/subadults travel northward with the spring/summer warming to feed in the productive, coastal waters of Georgia through New England, returning southward with the onset of winter to escape the cold (Lutcavage and Musick 1985, Henwood and Ogren 1987, Ogren 1989). Upon leaving Chesapeake Bay in autumn, juvenile ridleys migrate down the coast, passing Cape Hatteras in December and January (Musick and Limpus 1997). These larger juveniles are joined there by juveniles of the same size from North Carolina sounds and smaller juveniles from New York and New England to form one of the densest concentrations of Kemp's ridleys outside of the Gulf of Mexico (Musick and Limpus 1997, Epperly et al. 1995b, Epperly et al. 1995c). Adult Kemp's ridleys primarily occupy neritic habitats, typically containing muddy or sandy bottoms where prey can be found. In the post-pelagic stages, Kemp's ridley sea turtles are largely crab eating, with a preference for portunid crabs (Bjorndal 1997). Stomach contents of Kemp's ridleys along the lower Texas coast consisted of a predominance of nearshore crabs and mollusks, as well as fish, shrimp and other foods considered to be scavenged discards from the shrimping industry (Shaver 1991).

Abundance and Trends

Of the seven 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 Rancho Nuevo beaches (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, nesting numbers were below 1,000 (with a low of 702 nests in 1985). However, observations of increased nesting in the 1990's suggested that the decline in the ridley population has stopped and the population is now increasing (USFWS 2000). The number of nests observed at Rancho Nuevo and nearby beaches increased at a mean rate of 11.3 percent per year from 1985 to 1999 (TEWG 2000). These trends are further supported by 2004-2007 nesting data from Mexico. The number of nests over that period has increased from 7,147 in 2004, to 10,099 in 2005, to 12,143 in 2006, and 15,032 during the 2007 nesting season (Gladys Porter Zoo nesting database 2007). In 2008, there were 17,882 nests in Mexico (Gladys Porter Zoo 2008), and nesting in 2009 reached 21,144 (Gladys Porter Zoo 2010). In 2010, nesting declined significantly, to 13,302 (Gladys Porter Zoo 2010). Nesting numbers rebounded in 2011 and 2012 from 2010's reduced nesting to 20,570 and 21,797, respectively (Gladys Porter Zoo 2012).

A small nesting population is also emerging in the United States, primarily in Texas, rising from 6 nests in 1996 to 128 in 2007, 195 in 2008, and 197 in 2009. Texas nesting then experienced a decline similar to that seen in Mexico for 2010, with 140 nests (National Park Service data, http://www.nps.gov/pais/naturescience/strp.htm), but nesting rebounded in 2011 with a record 199 nests, and increased again in 2012 to a new record of 209 (National Park Service data, http://www.nps.gov/pais/naturescience/current-season.htm).

The TEWG (2000) developed a population model to evaluate trends in the Kemp's ridley population through the application of empirical data and life history parameter estimates chosen by the investigators. Model results identified three trends over time in benthic immature Kemp's ridley sea turtles. Increased production of hatchlings from the nesting beach beginning in 1966 resulted in an increase in the population of benthic Kemp's ridleys (defined as 20-60 cm in length and approximately 2-9 years of age) that leveled off in the late 1970s. A second period of increase followed by leveling occurred between 1978 and 1989 as hatchling production was further enhanced by the cooperative program between the USFWS and Mexico's Instituto Nacional de Pesca to increase nest protection and relocation. A third period of steady increase has occurred since 1990, likely due to increased hatchling production and increased survival of immature and adult sea turtles, due to the required use of TEDs in U.S. and Mexican shrimp fisheries.

The original model projected that population levels could theoretically reach the Recovery Plan's intermediate recovery goal of 10,000 nesters by the year 2015 if the assumptions of age to sexual maturity and age specific survivorship rates used are correct. More recent models developed by Heppell et al. (2005) predict that the population is expected to increase at least 12-16 percent per year. NMFS et al. (2011) estimated a 19 percent increase in the updated models used for the 2011 five-year status review for the species. 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 are 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 1998, TEWG 2000). 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 stochasticity, all of which are often difficult to predict with any certainty.

Threats

Kemp's ridleys face many of the same threats as other sea turtle species, including global climate change, destruction of nesting habitat from storm events, natural predators at sea, and oceanic events such as cold-stunning (described in Section 3.2.4). Although cold-stunning can occur throughout the range of the species, it may be a greater risk for sea turtles that utilize the more northern habitats of Cape Cod Bay and Long Island Sound. For example, in the winter of 1999-2000, there was a major cold-stunning event where 218 Kemp's ridleys, 54 loggerheads, and 5 green sea turtles were found on Cape Cod beaches (R. Prescott, NMFS, pers. comm. 2001). Annual cold-stunning events do not always occur at this magnitude; the extent of episodic major cold-stun events may be associated with numbers of sea turtles utilizing Northeast waters in a given year, oceanographic conditions, and the occurrence of storm events in the late fall. Many cold-stunned sea turtles can survive if found early enough, but cold-stunning events can still represent a significant cause of natural mortality.

Although changes in the use of shrimp trawls and other trawl gear have helped to reduce mortality of Kemp's ridleys, this species is also affected by other sources of anthropogenic impacts similar to those discussed in previous sections. For example, in the spring of 2000, a total of 5 Kemp's ridley carcasses were recovered from the same North Carolina beaches where 275 loggerhead carcasses were found. Cause of death for most of the sea turtles recovered was unknown, but the mass mortality event was suspected to have been from a large-mesh gillnet fishery operating offshore in the preceding weeks. The five Kemp's ridley carcasses that were found are likely to have been only a minimum count of the number of Kemp's ridleys that were killed or seriously injured as a result of the fishery interaction because it is unlikely that all of the carcasses washed ashore.

All of the DWH-related impacts mentioned for loggerhead sea turtles (e.g., direct oiling, inhalation of volatile compounds, etc.; see Section 3.2.4) are also likely to have affected Kemp's ridley sea turtles. During the response phase to the DWH oil spill (April 26 – October 20, 2010) a total of 809 (328 alive, 481 dead) Kemp's ridley sea turtles were recovered during sea turtle search and rescue operations. We expect that additional mortalities occurred that were undetected and are, therefore, currently unknown. It is likely that the Kemp's ridley sea turtle was the species most impacted by the DWH event on a population level. Relative to the other species, Kemp's ridley populations are much smaller, yet number of animals recovered during the DWH oil spill response were much higher. The location and timing of the DWH event were also important factors. Although significant assemblages of juvenile Kemp's ridleys occur along the U.S. Atlantic coast, Kemp's ridley sea turtles use the Gulf of Mexico as their primary habitat for most life stages, including all of the mating and nesting. As a result, all mating and nesting adults in the population necessarily spend significant time in the Gulf of Mexico, as do all hatchlings as they leave the beach and enter the pelagic environment. However, it is unlikely all of those individuals encountered oil and/or dispersants, depending on the timing and location of their movements relative to the location of the subsurface and surface oil. The spill may have also disrupted foraging and resource availability, migrations, and other caused other unknown effects as the spill began in late April just before peak mating/nesting season (May-July). However, the distance from spill site to the primary mating and nesting areas in Tamaulipas, Mexico, greatly reduces the chance of these disruptions to adults breeding in 2010. Unfortunately, sea turtle returns from nesting beaches to foraging areas in the northern Gulf of Mexico occurred while the well was still spilling oil. At this time we cannot determine the specific reasons accounting for year-to-year fluctuations in numbers of Kemp's ridley nests (the number of nests increased in 2011 and 2012 as compared to 2010), but there may yet be long-term population impacts resulting from the oil spill. How quickly the species returns to the previous fast pace of recovery may depend in part on how much of an impact the DWH event has had on Kemp's ridley food resources (Crowder and Heppell 2011).

3.2.9 Smalltooth Sawfish – United States DPS

The smalltooth sawfish United States DPS was listed as endangered under the ESA on April 1, 2003 (68 FR 15674). Critical habitat for the species was designated on September 2, 2009 (74 FR 45353). The two critical habitat units are located along the southwestern coast of Florida between Charlotte Harbor and Florida Bay. These areas contain the following physical and biological features that are essential to the conservation of this species: red mangroves and shallow euryhaline habitats characterized by water depths between the Mean High Water Line and three feet (0.9 m) measured at Mean Lower Low Water. Smalltooth sawfish critical habitat does not exist within the action area of this consultation.

Species Description, Distribution, and Population Structure

The smalltooth sawfish is a tropical marine and estuarine elasmobranch fish species characterized by an extended snout ("rostrum") with a long, narrow, flattened, rostral blade with a series of transverse teeth along either edge. The rostrum has a saw-like appearance, hence the name sawfish. Although they are rays, sawfish appear in some respects to be more shark-like than ray-like, with only the trunk and the head ventrally flattened. The smalltooth sawfish is distinguished from a similar listed species, the largetooth sawfish, because it lacks a defined lower caudal lobe, has the first dorsal fin origin located over the origin of the pelvic fins (versus considerably in front of the origin of pelvics in the largetooth sawfish), and has 20 to 34 rostral teeth on each side of the rostrum (versus 14-23 in largetooth sawfish) (Bigelow and Schroeder 1953, Thorson 1973, McEachran and Fechhelm 1998, Compagno and Last 1999). The rostrum of the smalltooth sawfish, which is about a quarter of the total length of an adult specimen is somewhat longer than the rostrum of largetooth sawfish, which is about a fifth of its total length (Bigelow and Schroeder 1953).

Smalltooth sawfish generally inhabit shallow waters relatively close to shore in muddy and sandy bottoms. They are often found in sheltered bays, on shallow banks, and in estuaries or river mouths (NMFS 2000). Smalltooth sawfish are euryhaline, occurring in waters with a broad range of salinities from freshwater to full seawater (Simpfendorfer 2001), and many encounters are reported at the mouths of rivers or other sources of freshwater inflows (Simpfendorfer and Wiley 2004). Whether this observation represents a preference for river mouths because of physical characteristics (e.g., salinity) or habitat factors (e.g., mangroves or prey) or both is unclear (75 FR 61904). However, they will occupy deeper water. Poulakis and Seitz (2004) observed that nearly half of the encounters with adult-sized sawfish in Florida Bay and the Florida Keys occurred in depths from 200 to 400 ft (70 to 122 m). Simpfendorfer and Wiley (2005a) 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 smalltooth sawfish in depths up to 130 ft (NSED 2012).

Historic capture records of smalltooth sawfish within the United States range from Texas to New York. Peninsular Florida has historically been the United States region with the largest number of recorded captures and likely represents the core of the historic range (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. Water temperatures no lower than 16-18°C and the availability of appropriate coastal habitat serve as the major environmental constraints limiting the northern movements of smalltooth sawfish in the western North Atlantic. As a result, most records of this species from areas north of Florida occur during spring and summer periods (May to August) when inshore waters reach higher temperatures. Most specimens captured along the Atlantic coast north of Florida are large adults (over 10 feet) and 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). The coastal habitat of smalltooth sawfish suggests that their biology may favor the isolation of populations that may be unable to traverse large expanses of deep water or otherwise unsuitable habitat (Faria 2007).

Life History Information

Smalltooth sawfish are approximately 31 inches (80 cm) at birth (Simpfendorfer 2002) and may grow to a length of 18 feet (540 cm) or greater during their lifetime (Bigelow and Schroeder 1953). A recent study by Simpfendorfer et al. (2008) suggests juvenile smalltooth sawfish grow rapidly during their first two years of life. They report the stretched total length of juveniles increasing by an average of 65–85 cms in the first year and an average of 48–68 cm in the second year (Simpfendorfer et al. 2008). 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 to 0.13 per year and estimated population doubling times from 10.3 to 13.5 years. These low intrinsic rates of population increase suggests that the species is particularly vulnerable to excessive mortality and rapid population declines due to stochastic events, after which recovery may take decades. Overall, much uncertainty still remains in estimating life history parameters for smalltooth sawfish since very little information exists on size classes other than juveniles. Simpfendorfer (2000) estimated that smalltooth sawfish reach sexual maturity at 10-20 years of age, while Clark et al. (2004) estimated that males reach maturity more quickly (around 19 years old) than females (around 33 years old). Fertilization is internal as with all elasmobranch species and smalltooth sawfish are believed to produce eggs that are hatched inside the female, and the pups are born alive (i.e., ovoviviparous reproduction). Bigelow and Schroeder (1953) reported pregnant females carry 15-20 embryos, although the source of their data is unclear and may represent an overestimate of the true litter size. Thorson (1976) reported brood sizes of 1-13 individuals for largetooth sawfish in Lake Nicaragua, with a mean of 7.3 individuals. The gestation period for largetooth sawfish is approximately five months and females likely produce litters every second year. Although there are no studies on smalltooth sawfish reproductive traits, its similarity to the largetooth sawfish indicates that their reproductive biology may be similar, but reproductive periodicity has yet to be verified for either sawfish species.

Acoustic tracking results for very small juveniles (100-200 cm long) indicate that they spend the vast majority of their time in very shallow water (less than 1 ft deep) associated with shallow mud or sand banks and within red mangrove root systems. Simpfendorfer (2003) hypothesized that by staying in these very shallow areas juvenile are safer from predators (mostly sharks), increasing their overall chances of survival. Acoustic monitoring studies have shown that juveniles have high levels of site fidelity for specific nursery areas for periods lasting up to almost three months (Wiley and Simpfendorfer 2007). Encounter and research data indicate there is a tendency for smalltooth sawfish to move offshore and into deeper water as they grow. The relationship between the depth of smalltooth sawfish occurrence and their estimated size indicates that large animals roam over a much larger depth range than juveniles with larger sawfish regularly occurring at depths greater than 32 ft (10 m) (Simpfendorfer 2001, Poulakis and Seitz 2004, Simpfendorfer and Wiley 2004). Limited data are available on the site fidelity of adult smalltooth sawfish although Seitz and Poulakis (2002) suggested that they may have some level of site fidelity for relatively short periods of time. Historic records of smalltooth sawfish indicate that some large mature individuals migrated north along the U.S. Atlantic coast as temperatures warmed in the summer and then south as temperatures cooled (Bigelow and Schroeder 1953). However, given the very limited number of encounter reports from the east coast of Florida, Simpfendorfer and Wiley (2004) hypothesize the population previously undertaking the summer migration has declined to a point where the migration is currently undetectable or does not occur at all.

Smalltooth sawfish feed primarily on small fish with mullet, jacks, and ladyfish believed to be their primary food resources (Simpfendorfer 2001). By moving its saw rapidly from side to side through the water, the relatively slow-moving sawfish is able to strike at individual fish (Breder 1952). The teeth on the saw stun, impale, injure, or kill the fish. Smalltooth sawfish then rub their saw against the bottom to remove the fish before ingesting it. Smalltooth sawfish are also known to prey on crustaceans (mostly shrimp and crabs) found along the sea bottom (Norman and Fraser 1937, Bigelow and Schroeder 1953).

Abundance and Trends

Few long-term abundance data sets exist for the smalltooth sawfish, making it very difficult to estimate the current population size. However, Simpfendorfer (2001) estimated that the U.S. population size may number less than five percent of historic levels based on anecdotal data and the fact that the species range has contracted by nearly 90 percent, with south and southwest Florida the only areas known to currently support a reproducing population. Seitz and Poulakis (2002) and Poulakis and Seitz (2004) documented smalltooth sawfish occurrences during the period 1990-2002 along the southwest coast of Florida, and in Florida Bay and the Florida Keys, respectively. The studies reported a total of a total of 2,969 sawfish encounters during this period. In 2000, Mote Marine Laboratory also established a smalltooth sawfish public encounter database (now currently maintained by the Florida Museum of Natural History [FLMNH] at the University of Florida) to compile information on the distribution and abundance of sawfish. The National Sawfish Encounter Database (NSED) contains over 3,000 sawfish encounters reported from 2000-2012 (NSED 2012). Although encounter databases may provide a useful future means of measuring changes in the population and its distribution over time, accurate estimates concerning smalltooth sawfish abundance cannot be made at the current time because sampling efforts are not standardized across each study period.

Despite the lack of data on abundance, recent encounters with young-of-the-year, juveniles, and sexually mature smalltooth sawfish indicate that the Florida 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 2004). Data collected from Everglades National Park as part of an established fisheries monitoring program indicate a slightly increasing trend in abundance within the park over the past decade (Carlson et al. 2007, Carlson and Osborne 2012). Carlson and Osborne (2012) also report that other data sources appear to indicate that the current population of smalltooth sawfish is at least stable throughout its core range, with some evidence that the core range may be expanding.

Threats

The primary reason for the decline in smalltooth sawfish abundance has been bycatch in various commercial and recreational fisheries (NMFS 2009a). Smalltooth sawfish are vulnerable to capture in gillnets, otter trawls, trammel nets, seines, and hook-and-line gear. While there has never been a large-scale directed fishery for smalltooth sawfish, they can easily become entangled in gear (particularly net gear) directed at other commercial species. These interactions can result in serious injury or death. Snelson and Williams (1981) attributed the extirpation of smalltooth sawfish from the Indian River Lagoon off the east coast of Florida to heavy mortality associated with incidental captures by commercial fishermen. For instance, one fisherman interviewed by Evermann and Bean (1898) reported taking an estimated 300 smalltooth sawfish in just one netting season. Simpfendorfer (2002) extracted a data set from 1945-1978 of smalltooth sawfish landings by Louisiana shrimp trawlers containing both landings data and crude information on effort (number of vessels, vessel tonnage, number of gear units). The data show that smalltooth sawfish landings declined during that period from a high of 34,900 pounds in 1949 to less than 1,500 pounds in most years after 1967. In more recent years, the highest interaction with the species is reported for the Highly Migratory Species Atlantic Shark, Gulf of Mexico Reef Fish, and the Gulf of Mexico and South Atlantic shrimp trawl fisheries.

In addition to commercial fisheries, encounter data (i.e., NSED 2012) also documents that saws are sometimes removed from sawfish caught by recreational fishermen. Saws are likely removed to by fishermen to avoid injury or to keep as a type of trophy. While the current threat of mortality associated with recreational fisheries is likely low given that possession of the species in Florida has been prohibited since 1992, bycatch in fisheries is still the primary threat to the species.

Another major factor in the historical decline of smalltooth sawfish is habitat modification, especially nursery habitat for juveniles. Activities such as agricultural and urban development, dredge and fill operations, boating, erosion, and diversions of freshwater runoff contribute to these losses (SAFMC 1998). From 1943-1970, approximately 10,000 hectares of coastal wetlands were lost due to dredge-fill and other activities including substantial losses of mangroves at specific locations throughout Florida (Odum et al. 1982). While modification of mangrove habitat is currently regulated, some permitted direct and/or indirect damage to mangrove habitat from increased urbanization still occurs and is expected to continue to threaten survival and recovery of the species in the future. For instance, many of the areas known to have been used historically by juvenile sawfish have already been drastically modified (NMFS 2009a).

Smalltooth sawfish may be especially vulnerable to coastal habitat degradation due to their affinity for shallow estuarine systems. In addition to mangroves, other riverine, nearshore, and offshore areas have been dredged for navigation, construction of infrastructure, and marine mining. Orlando et al. (1994) analyzed 18 major southeastern estuaries and recorded over 703 miles of navigation channels and 9,844 miles of shoreline modifications. Habitat effects of dredging include the loss of submerged habitats by disposal of excavated materials, turbidity and siltation effects, contaminant release, alteration of hydrodynamic regimes, and fragmentation of physical habitats (SAFMC 1998). Modifications of natural freshwater flows into estuarine and marine waters through construction of canals and other controlled devices have changed temperature, salinity, and nutrient regimes; reduced both wetlands and submerged aquatic vegetation; and degraded vast areas of coastal habitat utilized by smalltooth sawfish (Reddering 1988, Whitfield and Bruton 1989, Gilmore 1995). No specific information is available on the effects of pollution on smalltooth sawfish but evidence from other elasmobranchs suggests that pollution disrupts endocrine systems and potentially leads to reproductive failure (Gelsleichter et al. 2006). Smalltooth sawfish may also alter seasonal migration patterns in response to warm water discharges from power stations (Simpfendorfer and Wiley 2005).

3.2.10 Atlantic Sturgeon

Five separate DPSs of the Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) were listed under the ESA effective April 6, 2012 (77 FR 5914; February 12, 2012). From north to south, the DPSs are Gulf of Maine, New York Bight, Chesapeake Bay, Carolina, and South Atlantic (Figure 3.1). The New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs are listed as endangered, and the Gulf of Maine DPS is listed as threatened. Tagging studies and genetic analyses (Wirgin et al. 2000, King et al. 2001, Waldman et al. 2002, ASSRT 2007, Grunwald et al. 2008) indicate that Atlantic sturgeon exhibit ecological separation during spawning throughout their range that has resulted in multiple, genetically distinct, interbreeding population segments. NMFS determined that each of the DPSs was significant based on their persistence in a unique ecological setting and the loss of a DPS would result in a significant gap in the range of the species and constitute an important loss of genetic diversity.

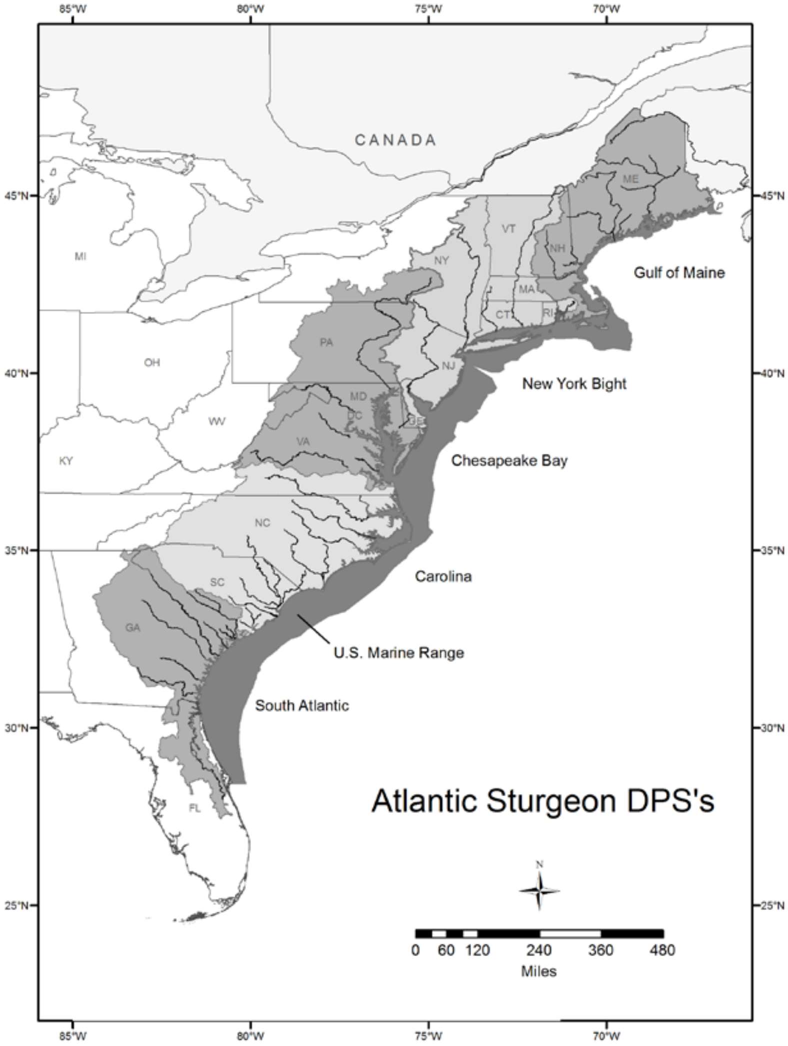

Figure 3.1 Map Depicting the Five DPSs of Atlantic sturgeon

General Life History

Atlantic sturgeon are long lived (approximately 60 years), late maturing, estuarine dependent, anadromous[20] fish (Bigelow and Schroeder 1953, Vladykov and Greeley 1963, Mangin 1964, Pikitch et al. 2005, Dadswell 2006, ASSRT 2007). They are a relatively large fish, even amongst sturgeon species (Pikitch et al. 2005). Atlantic sturgeons are bottom feeders that suck food into a ventrally-located protruding mouth (Bigelow and Schroeder 1953). Four barbells in front of the mouth assist the sturgeon in locating prey (Bigelow and Schroeder 1953). Diets of adult and migrant subadult Atlantic sturgeons include mollusks, gastropods, amphipods, annelids, decapods, isopods, and fish such as sand lance (Bigelow and Schroeder 1953, ASSRT 2007, Guilbard et al. 2007, Savoy 2007). Juvenile Atlantic sturgeon feed on aquatic insects, insect larvae, and other invertebrates (Bigelow and Schroeder 1953, ASSRT 2007, Guilbard et al. 2007).

Rate of maturation is affected by water temperature and gender. In general: (1) Atlantic sturgeon that originate from southern systems grow faster and mature sooner than those that originate from more northern systems; (2) males grow faster than females; (3) fully mature females attain a larger lengths than fully mature males; and (4) the length of Atlantic sturgeon caught since the mid-late 20th century have typically been less than 3 m (Smith et al. 1982, Smith et al. 1984, Smith 1985, Scott and Scott 1988, Young et al. 1998, Collins et al. 2000a, Caron et al. 2002, Dadswell 2006, ASSRT 2007, Kahnle et al. 2007, DFO 2011). The largest recorded Atlantic sturgeon was a female captured in 1924 that measured approximately 4.26 m (Vladykov and Greeley 1963). Dadswell (2006) reported seeing seven fish of comparable size in the St. John River estuary from 1973 to 1995. Observations of large-sized sturgeon are particularly important given that egg production is correlated with age and body size (Smith et al. 1982, Van Eenennaam et al. 1996, Van Eenennaam and Doroshov 1998, Dadswell 2006). However, while females are prolific with egg production ranging from 400,000 to 4 million eggs per spawning year, females only spawn at intervals of 2-5 years (Vladykov and Greeley 1963, Smith et al., 1982, Van Eenennaam et al. 1996, Van Eenennaam and Doroshov 1998, Stevenson and Secor 1999, Dadswell 2006). Given spawning periodicity and a female's relatively late age to maturity, the age at which 50 percent of the maximum lifetime egg production is achieved is estimated to be 29 years (Boreman 1997). Males also exhibit spawning periodicity of 1-5 years (Smith 1985, Collins et al. 2000a, Caron et al. 2002). Therefore, while long-lived, Atlantic sturgeon are exposed to a multitude of threats prior to achieving maturation and have a limited number of spawning opportunities once mature.

Water temperature plays a primary role in triggering the timing of spawning migrations (ASMFC 2009). Spawning migrations generally occur during February-March in southern systems, April-May in Mid-Atlantic systems, and May-July in Canadian systems (Murawski and Pacheco 1977, Smith 1985, Bain 1997, Smith and Clugston 1997, Caron et al. 2002). Male sturgeon begin upstream spawning migrations when waters reach approximately 6° C (43° F) (Smith et al. 1982, Dovel and Berggren 1983, Smith 1985, ASMFC 2009), and remain on the spawning grounds throughout the spawning season (Bain 1997). Females begin spawning migrations when temperatures are closer to 12°-13° C (54°-55° F) (Dovel and Berggren 1983,

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[20] Anadromous refers to a fish that is born in freshwater, spends most of its life in the sea, and returns to freshwater to spawn (NEFSC FAQ's, available at http://www.nefsc.noaa.gov/faq/fishfaq1a.html, modified June 16, 2011)

Smith 1985, Collins et al. 2000a), make rapid spawning migrations upstream, and quickly depart following spawning (Bain 1997).

The spawning areas for most Atlantic sturgeon DPSs are unknown. However, the habitat characteristics of spawning areas have been identified based on historical accounts of where fisheries occurred, tracking and tagging studies of spawning sturgeon, and physiological needs of early life stages. Spawning is believed to occur in flowing water between the salt front of estuaries and the fall line of large rivers, when and where optimal flows are 46-76 cm/s and depths are 3-27 m (Borodin 1925, Dees 1961, Leland 1968, Scott and Crossman 1973, Crance, 1987, Shirey et al. 1999, Bain et al. 2000, Collins et al. 2000a, Caron et al. 2002, Hatin et al. 2002, ASMFC 2009). Sturgeon eggs are deposited on hard bottom substrate such as cobble, coarse sand, and bedrock (Dees 1961, Scott and Crossman 1973, Gilbert 1989, Smith and Clugston 1997, Bain et al. 2000, Collins et al. 2000a, Caron et al. 2002, Hatin et al. 2002, Mohler, 2003, ASMFC 2009), and become adhesive shortly after fertilization (Murawski and Pacheco 1977, Van den Avyle 1984, Mohler 2003). Incubation time for the eggs increases as water temperature decreases (Mohler 2003). At temperatures of 18°-20° C, hatching occurs approximately 140 and 94 hours, respectively, after egg deposition (ASSRT 2007).

Larval Atlantic sturgeon (i.e. less than 4 weeks old, with total lengths (TL) less than 30 mm [Van Eenennaam et al. 1996]) are assumed to undertake a demersal existence and inhabit the same riverine or estuarine areas where they were spawned (Smith et al. 1980, Bain et al. 2000, Kynard and Horgan 2002, ASMFC 2009). Studies suggest that age-0 (i.e., YOY), age-1, and age-2 juvenile Atlantic sturgeon occur in low salinity waters of the natal estuary (Haley 1999, Hatin et al. 2007, McCord et al. 2007, Munro et al. 2007) while older fish are more salt tolerant and occur in higher salinity waters as well as low salinity waters (Collins et al. 2000a). Atlantic sturgeon remain in the natal estuary for months to years before emigrating to open ocean as subadults (Holland and Yelverton 1973, Dovel and Berggen 1983, Waldman et al. 1996, Dadswell 2006, ASSRT 2007).

After emigration from the natal estuary, subadults and adults travel within the marine environment, typically in waters less than 40 m in depth, using coastal bays, sounds, and ocean waters (Vladykov and Greeley 1963, Murawski and Pacheco 1977, Dovel and Berggren 1983, Smith 1985, Collins and Smith 1997, Welsh et al. 2002, Savoy and Pacileo 2003, Stein et al. 2004a, Laney et al. 2007, Dunton et al. 2010, Erickson et al. 2011, Wirgin and King 2011, D. Fox pers. comm., T. Savoy pers. comm.). Tracking and tagging studies reveal seasonal movements of Atlantic sturgeon along the coast. Satellite-tagged adult sturgeon from the Hudson River concentrated in the southern part of the Mid-Atlantic Bight at depths greater than 20 m during winter and spring, and in the northern portion of the Mid-Atlantic Bight at depths less than 20 m in summer and fall (Erickson et al. 2011). Shirey (Delaware Department of Fish and Wildlife, unpublished data reviewed in ASMFC 2009) found a similar movement pattern for juvenile Atlantic sturgeon based on recaptures of fish originally tagged in the Delaware River. After leaving the Delaware River estuary during the fall, juvenile Atlantic sturgeon were recaptured by commercial fishermen in nearshore waters along the Atlantic coast as far south as Cape Hatteras, North Carolina from November through early March. In the spring, a portion of the tagged fish re-entered the Delaware River estuary. However, many fish continued a northerly coastal migration through the Mid-Atlantic as well as into southern New England waters where they were recovered throughout the summer months. Movements as far north as

Maine were documented. A southerly coastal migration was apparent from tag returns reported in the fall. The majority of these tag returns were reported from relatively shallow near shore fisheries with few fish reported from waters in excess of 25 m (C. Shirey, Delaware Department of Fish and Wildlife, unpublished data reviewed in ASMFC 2009). Areas where migratory Atlantic sturgeon commonly aggregate include the Bay of Fundy (e.g., Minas and Cumberland Basins), Massachusetts Bay, Connecticut river estuary, Long Island Sound, New York Bight, Delaware Bay, Chesapeake Bay, and waters off of North Carolina from the Virginia/North Carolina border to Cape Hatteras at depths up to 24 m (Dovel and Berggren 1983, Dadswell et al. 1984, Johnson et al. 1997, Rochard et al. 1997, Kynard et al. 2000, Eyler et al. 2004, Stein et al. 2004a, Wehrell 2005, Dadswell 2006, ASSRT 2007, Laney et al. 2007). These sites may be used as foraging sites and/or thermal refuge. However, information is currently lacking to identify the use of marine aggregation areas by Atlantic sturgeon.

General Distribution/Abundance

Similar to other sturgeon species (Vladykov and Greeley 1963, Pikitch et al. 2005), Atlantic sturgeon experienced range-wide declines from historical abundance levels due to overfishing (for caviar and meat) and impacts to habitat (Taub 1990, Smith and Clugston 1997, Secor and Waldman 1999). An Atlantic States Marine Fisheries Commission (ASMFC) interstate fishery management plan for sturgeon (Sturgeon FMP) was developed and implemented in 1990 (Taub 1990). In 1998, the remaining Atlantic sturgeon fisheries in U.S. state waters were closed per Amendment 1 to the Sturgeon FMP. Complimentary regulations were implemented by NMFS in 1999 that prohibit fishing for, harvesting, possessing or retaining Atlantic sturgeon or its parts in or from the Exclusive Economic Zone in the course of a commercial fishing activity. Commercial fisheries for Atlantic sturgeon still exist in Canadian waters (DFO 2011).

It is clear that Atlantic sturgeon underwent significant range-wide declines from historical abundance levels due to overfishing in the mid to late 19th century when a caviar market was established (Scott and Crossman 1973, Taub 1990, Kennebec River Resource Management Plan 1993, Smith and Clugston 1997, Dadswell 2006, ASSRT 2007). Abundance of spawning-aged females prior to this period of exploitation was predicted to be greater than 100,000 for the Delaware, and at least 10,000 females for other spawning stocks (Secor and Waldman 1999, Secor 2002). Historical records suggest that Atlantic sturgeon spawned in at least 35 rivers prior to this period. Currently, only 16 U.S. rivers are known to support spawning based on available evidence (i.e., presence of YOY or gravid Atlantic sturgeon documented within the past 15 years) (ASSRT 2007). While there may be other rivers supporting spawning for which definitive evidence has not been obtained (e.g., in the Penobscot and York Rivers), the number of rivers supporting spawning of Atlantic sturgeon are approximately half of what they were historically. In addition, only four rivers are known to currently support spawning from Maine through Virginia where historical records support there used to be fifteen spawning rivers (ASSRT 2007). Thus, there are substantial gaps in the range of Atlantic sturgeon amongst northern and mid-Atlantic states.

There are no empirical population abundance estimates for any of the currently known spawning stocks. Therefore, there are no abundance estimates for any of the five DPSs of Atlantic sturgeon. An estimate of 870 spawning adults per year (~600 males and 270 females) was calculated for the Hudson River based on fishery-dependent data collected from 1985-1995

(Kahnle et al. 2007). An estimate of 343 spawning adults per year is available for the Altamaha River, Georgia, based on fishery-independent data collected in 2004 and 2005 (Schueller and Peterson 2006). Data collected from the Hudson River and Altamaha River studies cannot be used to estimate the total number of adults in either subpopulation, since mature Atlantic sturgeon may not spawn every year (Vladykov and Greeley 1963, Smith 1985, Van Eenennaam et al. 1996, Stevenson and Secor 1999, Collins et al. 2000a, Caron et al. 2002), and it is unclear to what extent mature fish in a non-spawning condition occur on the spawning grounds (Vladykov and Greeley 1963). The ASSRT presumed that the Hudson and Altamaha rivers had the most robust of the remaining U.S. Atlantic sturgeon spawning populations and concluded that the other U.S. spawning populations were likely less than 300 spawning adults per year (ASSRT 2007).

In general, measuring the abundance or relative abundance of sturgeons is difficult given their complex life histories, use of disparate habitats at different life stages, and long migrations between habitats (Munro et al. 2007). Sampling for estimates of Atlantic sturgeon was discussed at the symposium for anadromous sturgeon held in conjunction with the 2003 Annual Meeting of the American Fisheries Society (Munro et al. 2007). Participants at the symposium agreed that abundance should be measured at the juvenile life stage prior to emigration from the natal estuary (Munro et al. 2007). Participants did not recommend abundance sampling from aggregations of spawning adults because sampling, however cautious, still carries risks of unintended mortalities and generally does not yield adequate sample sizes for detection of population change (Munro et al. 2007). In addition, the spawning areas for many Atlantic sturgeon spawning populations is unknown (Munro et al. 2007). Studies investigating Atlantic sturgeon abundance and distribution are on-going in some river systems. Nevertheless, population estimates for each DPS are likely to require several years of data, and may be incomplete until each spawning river population is investigated.

Viability of the Atlantic Sturgeon DPSs

The concept of a viable population able to adapt to changing environmental conditions is critical to Atlantic sturgeon, and the low population numbers put them in danger of extinction throughout their range; none of the populations are large or stable enough to provide with any level of certainty for continued existence of Atlantic sturgeon. Although the impact most responsible for the precipitous decline of the species has been curtailed (directed fishing), the population sizes have remained relatively constant at greatly reduced levels (approximately 1-10 percent of historical population sizes) for 100 years. Small numbers of individuals resulting from drastic reductions in populations can remove the buffer against natural demographic and environmental variability provided by large populations (Berry 1971, Shaffer 1981, Soulé, 1980). Recovery of depleted populations is an inherently slow process for a late-maturing species such as Atlantic sturgeon, and they continue to face a variety of other threats that contribute to their risk of extinction. Their late age at maturity provides more opportunities for individual Atlantic sturgeon to be removed from the population before reproducing. While a long life-span also allows multiple opportunities to contribute to future generations, it also results increases the timeframe over which exposure to the multitude of threats facing can occur.

The viability of the Atlantic sturgeon DPSs depends on having self-sustaining riverine spawning populations and maintaining suitable habitat to support their various life functions (i.e., spawning, feeding, and growth). Because a DPS is a group of populations, the stability, viability, and persistence of individual populations affects the persistence and viability of the larger DPS. The loss of any population within a DPS will result in: (1) a long-term gap in the range of the DPS that is unlikely to be recolonized; (2) loss of reproducing individuals; (3) loss of genetic biodiversity; (4) potential loss of unique haplotypes; (5) potential loss of adaptive traits; and (6) reduction in total number. The loss of a population will negatively impact the persistence and viability of the DPS as a whole, as fewer than two individuals per generation spawn outside their natal rivers (Wirgin et al. 2000, King et al. 2001, Waldman et al. 2002). The persistence of individual populations, and in turn the DPS, depends on successful spawning and rearing within the freshwater habitat, the immigration into marine habitats to grow, and then the return of adults to natal rivers to spawn.

3.2.10.1 Carolina DPS

Distribution and Abundance

The Carolina DPS includes all Atlantic sturgeon that spawn or are spawned in the watersheds (including all rivers and tributaries) from Albemarle Sound southward along the southern Virginia, North Carolina, and South Carolina coastal areas to Charleston Harbor. The marine range of Atlantic sturgeon from the Carolina DPS extends from the Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida. The riverine range of the Carolina DPS and the adjacent portion of the marine range are shown in Figure 3.2. Sturgeon are commonly captured 40 miles offshore (D. Fox, DSU, pers. comm.). Records providing fishery bycatch data by depth show the vast majority of Atlantic sturgeon bycatch via gillnets is observed in waters less than 165 ft (50 meters) deep (Stein et al. 2004b, ASMFC 2007), but Atlantic sturgeon are recorded as bycatch out to 3,000 ft (915 meters).

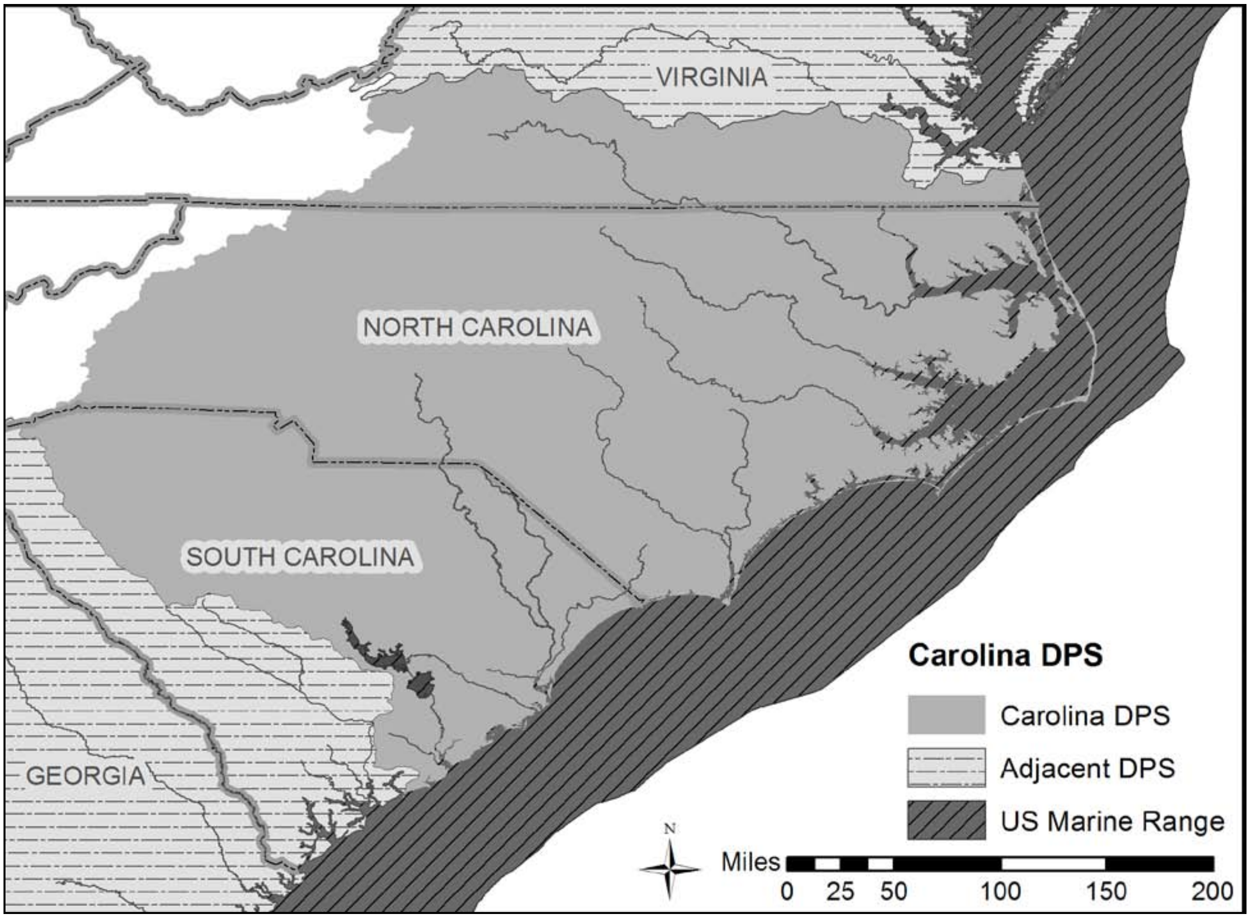

Figure 3.2 The Carolina DPS, Including the Marine Portion of the Range.

Rivers known to have current spawning populations within the range of the Carolina DPS include the Roanoke, Tar-Pamlico, Cape Fear, Waccamaw, and Pee Dee Rivers. However, in some rivers, spawning by Atlantic sturgeon may not be contributing to population growth because of lack of suitable habitat and the presence of other stressors on juvenile survival and development. There may also be spawning populations in the Neuse, Santee and Cooper Rivers, though it is uncertain. Historically, both the Sampit and Ashley Rivers were documented to have spawning populations at one time. However, the spawning population in the Sampit River is believed to be extirpated and the current status of the spawning population in the Ashley River is unknown. Both rivers may be used as nursery habitat by young Atlantic sturgeon originating from other spawning populations. Fish from the Carolina DPS likely use other river systems than those listed here for their specific life functions. Table 3.1 indicates the major rivers, tributaries, and sounds within the range of the Carolina DPS and currently available data on the presence of an Atlantic sturgeon spawning population in each system.

Table 3.1 Major Rivers, Tributaries, and Sounds with Atlantic Sturgeon Spawning Populations in the Carolina DPS

River/Estuary	Spawning Population	Data
Roanoke River, VA/NC; Albemarle Sound, NC	Yes	Collection of 15 YOY (1997-1998); single YOY (2005)
Tar-Pamlico River, NC; Pamlico Sound	Yes	One YOY (2005)
Neuse River, NC; Pamlico Sound	Unknown	
Cape Fear River, NC	Yes	Upstream migration of adults in the fall, carcass of a ripe female upstream in mid-September (2006)
Waccamaw River, SC; Winyah Bay	Yes	Age-1, potentially YOY (1980s)
Pee Dee River, SC; Winyah Bay	Yes	Running ripe male in Great Pee Dee River (2003)
Sampit, SC; Winyah Bay	Extirpated	N/A
Santee River, SC	Unknown	N/A
Cooper River, SC	Unknown	N/A
Ashley River, SC	Unknown	N/A

Historical landings data indicate that between 7,000 and 10,500 adult female Atlantic sturgeon were present in North Carolina prior to 1890 (Armstrong and Hightower 2002, Secor 2002). Secor (2002) estimates that 8,000 adult females were present in South Carolina during that same time-frame. Reductions from the commercial fishery and ongoing threats have drastically reduced the numbers of Atlantic sturgeon within the Carolina DPS. Currently, the Atlantic sturgeon spawning population in at least one river system within the Carolina DPS has been extirpated, with a potential extirpation in an additional system. The abundances of the remaining river populations within the DPS, each estimated to have fewer than 300 spawning adults, is estimated to be less than 3 percent of what they were historically (ASSRT 2007).

Threats

The Carolina DPS was listed as endangered under the ESA as a result of threats from a combination of habitat curtailment and modification, overutilization (i.e., being taken as bycatch) in commercial fisheries, and the inadequacy of regulatory mechanisms in ameliorating these impacts and threats.

Dams have curtailed Atlantic sturgeon spawning and juvenile developmental habitat by blocking over 60 percent of the historical sturgeon habitat upstream of the dams in the Cape Fear and Santee-Cooper River systems. The extent of available habitat on these rivers systems has been further curtailed by dredging in Atlantic sturgeon spawning and nursery grounds. Water quality (velocity, temperature, and dissolved oxygen (DO)) downstream of these dams, as well as on the Roanoke River, has been reduced, which also curtails the extent of spawning and nursery habitat for the Carolina DPS.

Water quality has also been reduced by terrestrial activities. In the Pamlico and Neuse systems, nutrient-loading and seasonal anoxia are occurring, associated in part with concentrated animal feeding operations (CAFOs). Heavy industrial development and CAFOs have degraded water quality in the Cape Fear River. In the Waccamaw and Pee Dee rivers industrialization has led to riverine sediment samples with high levels of various toxins, including dioxins. Threats from reductions in water quality are likely to be exacerbated in the future because of water allocation issues. Diverting large amounts of river water for water allocations activities (e.g., drinking water, industrial/agricultural uses, recreation, etc.) will alter flows, temperature, and DO. Existing water allocation issues will likely be compounded by population growth and potentially climate change. Climate change is also predicted to exacerbate existing stressors to the Carolina DPS by causing elevations in water temperatures, increase nutrient-loading, pollution inputs, and lower DO.

Overutilization of Atlantic sturgeon from directed fishing caused initial severe declines in Atlantic sturgeon populations in all DPSs, from which they have never recovered. Atlantic sturgeon bycatch in commercial fisheries is an ongoing impact to the Carolina DPS. Atlantic sturgeon from all DPSs are more sensitive to bycatch mortality because they are a long-lived species, have an older age at maturity, have lower maximum fecundity values, and a large percentage of egg production occurs later in life. Based on these life history traits, Boreman (1997) calculated that Atlantic sturgeon can only withstand the annual loss of up to five percent of their population to bycatch mortality without suffering population declines. Mortality rates of Atlantic sturgeon taken as bycatch in various types of fishing gear range between 0-51 percent, with the greatest mortality occurring in sturgeon caught by sink gillnets. Atlantic sturgeon are particularly vulnerable to being caught in sink gillnets, therefore fisheries using this type of gear account for a high percentage of Atlantic sturgeon bycatch. Little data exists on bycatch and high levels of bycatch underreporting are suspected. However, fisheries known to incidentally catch Atlantic sturgeon occur throughout the marine range of the species and in some riverine waters as well. Because Atlantic sturgeon mix extensively in marine waters and may access multiple river systems, they are subject to being caught in multiple fisheries throughout their range. In the absence of any specific data on what proportion of Atlantic sturgeon bycatch occurs in state fisheries versus federal fisheries we assume an even split (i.e., 50 percent of Atlantic sturgeon bycatch is from state fisheries and 50 percent is from federal fisheries). In addition, stress or injury to Atlantic sturgeon taken as bycatch but released alive may result in increased susceptibility to other threats, such as poor water quality (e.g., exposure to toxins or low DO). This may result in reduced foraging and spawning, or even post-release mortality.

The recovery of Atlantic sturgeon along the Atlantic Coast, especially in areas where habitat is limited and water quality is severely degraded, will require improvements in the following areas: (1) elimination of barriers to spawning habitat either through dam removal, breaching, or installation of successful fish passage facilities; (2) operation of water control structures to provide appropriate flows, especially during spawning season; (3) imposition of dredging restrictions including seasonal moratoriums and avoidance of spawning/nursery habitat; and, (4) mitigation of water quality parameters that are restricting sturgeon use of a river (i.e., DO). Additional data regarding sturgeon use of riverine and estuarine environments is needed.

3.2.10.2 South Atlantic DPS

Distribution and Abundance
The South Atlantic DPS includes all Atlantic sturgeon that spawn or are spawned in the watersheds (including all rivers and tributaries) of the Ashepoo, Combahee, and Edisto Rivers (ACE) Basin southward along the South Carolina, Georgia, and Florida coastal areas to the St. Johns River, Florida. The marine range of Atlantic sturgeon from the South Atlantic DPS extends from the Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida. The riverine

range of the South Atlantic DPS and the adjacent portion of the marine range are shown in Figure 3.2. Sturgeon are commonly captured 40 miles offshore (D. Fox, DSU, pers. comm.). Records providing fishery bycatch data by depth show the vast majority of Atlantic sturgeon bycatch via gillnets is observed in waters less than 50 meters deep (Stein et al. 2004b, ASMFC 2007), but Atlantic sturgeon are recorded as bycatch out to ca. 1,000 meters.

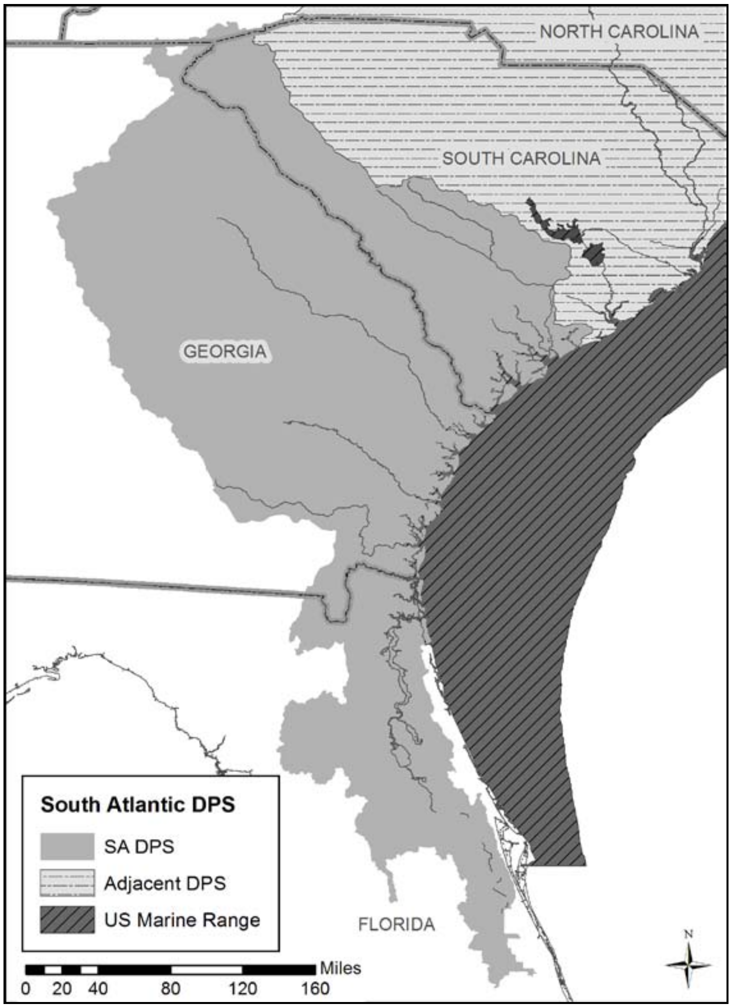

Figure 3.3 The South Atlantic DPS, Including the Marine Portion of the Range

Rivers known to have current spawning populations within the range of the South Atlantic DPS include the the Combahee, Edisto, Savannah, Ogeechee, Altamaha, and Satilla Rivers. However, in some rivers, spawning by Atlantic sturgeon may not be contributing to population growth because of lack of suitable habitat and the presence of other stressors on juvenile survival and development. Historically, both the Broad-Coosawatchie and St. Marys Rivers were documented to have spawning populations at one time; there is also evidence that spawning may have occurred in the St. Johns River or one of its tributaries. However, the spawning population in the St. Marys River, as well as any historical spawning population present in the St. Johns, is believed to be extirpated, and the status of the spawning population in the Broad-Coosawatchie is unknown. Both the St. Marys and St. Johns Rivers are used as nursery habitat by young Atlantic sturgeon originating from other spawning populations. The use of the Broad-Coosawatchie by sturgeon from other spawning populations is unknown at this time. The presence of historical and current spawning populations in the Ashepoo River has not been documented; however, this river may currently be used for nursery habitat by young Atlantic sturgeon originating from other spawning populations. Table 3.2 indicates the major rivers, tributaries, and sounds within the range of the South Atlantic DPS and currently available data on the presence of an Atlantic sturgeon spawning population in each system. However, fish from the South Atlantic DPS likely use other river systems than those listed here for their specific life functions.

Table 3.2 Major Rivers, Tributaries, and Sounds with Atlantic Sturgeon Spawning Population in the South Atlantic DPS

River/Estuary	Spawning Population	Data
ACE (Ashepoo, Combahee, and Edisto Rivers) Basin, SC; St. Helena Sound	Yes	1,331 YOY (1994-2001); gravid female and running ripe male in the Edisto (1997); 39 spawning adults (1998)
Broad-Coosawhatchie Rivers, SC; Port Royal Sound	Unknown	N/A
Savannah River, SC/GA	Yes	22 YOY (1999-2006); running ripe male (1997)
Ogeechee River, GA	Yes	age-1 captures, but high inter-annual variability (1991-1998); 17 YOY (2003); 9 YOY (2004)
Altamaha River, GA	Yes	74 captured/308 estimated spawning adults (2004); 139 captured/378 estimated spawning adults (2005)
Satilla River, GA	Yes	4 YOY and spawning adults (1995-1996)
St. Marys River, GA/FL	Extirpated	N/A
St. Johns River, FL	Extirpated	N/A

Secor (2002) estimates that 8,000 adult females were present in South Carolina prior to 1890. Prior to the collapse of the fishery in the late 1800s, the sturgeon fishery was the third largest fishery in Georgia. Secor (2002) estimated from U.S. Fish Commission landing reports that approximately 11,000 spawning females were likely present in the state prior to 1890. Reductions from the commercial fishery and ongoing threats have drastically reduced the numbers of Atlantic sturgeon within the South Atlantic DPS. Currently, the Atlantic sturgeon spawning population in at least two river systems within the South Atlantic DPS has been extirpated. The Altamaha River population of Atlantic sturgeon, with an estimated 343 adults spawning annually, is believed to be the largest population in the Southeast, yet is estimated to be only 6 percent of its historical population size. The abundances of the remaining river populations within the DPS, each estimated to have fewer than 300 spawning adults, is estimated to be less than 1 percent of what they were historically (ASSRT 2007).

Threats

The modification and curtailment of Atlantic sturgeon habitat in the South Atlantic DPS is resulting from dredging and degraded water quality is contributing to the status of the South Atlantic DPS. Dredging threatens the South Atlantic DPS by modifying the quality and availability of Atlantic sturgeon habitat. Maintenance dredging is modifying nursery habitat in the Savannah River and modeling indicates that the proposed deepening of the navigation channel will result in reduced DO and upriver movement of the salt wedge, curtailing spawning habitat. Dredging is also modifying nursery and foraging habitat in the St. Johns Rivers.

Reductions in water quality from terrestrial activities have also modified habitat utilized by the South Atlantic DPS. Dredging is causing low DO in the Savannah River, and non-point source inputs are causing low DO in the Ogeechee and St. Marys Rivers, which completely eliminates juvenile nursery habitat in summer. Low DO has also been observed in the St. Johns River in the summer. Sturgeon are more highly sensitive to low DO and the adverse effects (i.e., changes in metabolic, growth, and feeding) caused by low DO increase when water temperatures are concurrently high. Threats from reductions in water quality are likely to be exacerbated in the future because of water allocation issues. Known large water withdrawals of over 240 mgd of water may be removed from the Savannah River for power generation and municipal uses. However, permits for users withdrawing less than 100,000 gallons per day (gpd) are not required to get permits, so actual water withdrawals from the Savannah and other rivers within the range of the South Atlantic DPS are likely much higher. The removal of large amounts of water from the system will alter flows, temperature, and DO. Water shortages and "water wars" are already occurring in the rivers occupied by the South Atlantic DPS and will likely be compounded in the future by population growth and potentially by climate change. Climate change is also predicted to exacerbate existing stressors to the South Atlantic DPS by causing elevations in water temperatures, increase nutrient-loading, pollution inputs, and lower DO.

The effects from fisheries, both historically and currently, on Atlantic sturgeon from the South Atlantic DPS are the same as those discussed previously with the Carolina DPS (see Section 3.2.10.1). Likewise, because Atlantic sturgeon of the South Atlantic DPS also mix extensively in marine waters and may access multiple river systems, they are subject to being caught in multiple fisheries throughout their range.

For the South Atlantic DPS of Atlantic sturgeon to recover, improvements must occur in the same four areas (i.e., elimination of barriers to spawning, appropriate stream flow, dredging restrictions, and improved water quality) described in the Carolina DPS (see Section 3.2.10.1).

3.2.10.3 New York Bight DPS

Distribution and Abundance

The New York Bight DPS includes the following: all anadromous Atlantic sturgeon that spawn in the watersheds that drain into coastal waters from Chatham, Massachusetts, to the Delaware-Maryland border on Fenwick Island. Within this range, Atlantic sturgeon historically spawned in the Connecticut, Delaware, Hudson, and Taunton Rivers (Murawski and Pacheco 1977, Secor 2002, ASSRT 2007). Spawning still occurs in the Delaware and Hudson Rivers, but there is no recent evidence (within the last 15 years) of spawning in the Connecticut and Taunton Rivers (ASSRT 2007). Atlantic sturgeon that are spawned elsewhere continue to use habitats within the Connecticut and Taunton Rivers as part of their overall marine range (ASSRT 2007, Savoy 2007, Wirgin and King 2011).

Spawning in the Hudson River likely occurs in multiple sites within the river from approximately rkm 56 to rkm 182 (Dovel and Berggren 1983, Van Eenennaam et al. 1996, Kahnle et al. 1998, Bain et al. 2000). Selection of sites in a given year may be influenced by the position of the salt wedge (Dovel and Berggren 1983, Van Eenennaam et al. 1996, Kahnle et al. 1998). The area around Hyde Park (approximately river kilometer (rkm)134) has consistently been identified as a spawning area through scientific studies and historical records of the Hudson River sturgeon fishery (Dovel and Berggren 1983; Van Eenennaam et al. 1996, Kahnle et al. 1998, Bain et al. 2000). Habitat conditions at the Hyde Park site are described as freshwater year round with bedrock, silt and clay substrates and waters depths of 12-24 m (Bain et al. 2000). Bain et al. (2000) also identified a spawning site at rkm 112 based on tracking data. The rkm 112 site, located to one side of the river, has clay, silt and sand substrates, and is approximately 21-27 m deep (Bain et al. 2000).

Some YOY (i.e., natal sturgeon) in the Hudson River have been documented in brackish waters; however, larvae must remain upstream of the salt wedge because of their low salinity tolerance (Dovel and Berggren 1983, Kahnle et al. 1998, Bain et al. 2000). Catches of immature sturgeon (age 1 and older) suggest that juveniles utilize the estuary from the Tappan Zee Bridge through Kingston (Dovel and Berggren 1983, Bain et al. 2000). Seasonal movements of juveniles are apparent with juveniles upstream during summer months and then moving downstream as water temperatures decline in the fall (Dovel and Berggren 1983, Bain et al. 2000). Based on river-bottom sediment maps (Coch 1986) most juvenile sturgeon habitats in the Hudson River have clay, sand, and silt substrates (Bain et al. 2000). Newburgh and Haverstraw Bays in the Hudson River are areas of known juvenile sturgeon concentrations (Sweka et al. 2007). Sampling in spring and fall revealed that highest catches of juvenile Atlantic sturgeon occurred during spring in soft-deep areas of Haverstraw Bay even though this habitat type comprised only 25 percent of the available habitat in the Bay (Sweka et al. 2007). Overall, 90 percent of the total 562 individual juvenile Atlantic sturgeon captured during the course of this study (14 were captured more than once) came from Haverstraw Bay (Sweka et al. 2007). At around 3 years of age, Hudson River juveniles exceeding 70 cm total length begin to migrate to marine waters (Bain et al. 2000).

In general, Hudson River Atlantic sturgeons mature at approximately 11 to 21 years of age (Dovel and Berggren 1983, ASMFC 1998, Young et al. 1998). A sample of 94 pre-spawning adult Atlantic sturgeon from the Hudson River was comprised of males 12 to 19 years old, and females that were 14 to 36 years old (Van Eenennaam et al. 1996). The majority of males were 13 to 16 years old while the majority of females were 16 to 20 years old (Van Eenennaam et al. 1996). These data are consistent with the findings of Stevenson and Secor (1999) who noted that, amongst a sample of Atlantic sturgeon collected from the Hudson River fishery from 1992-1995, growth patterns indicated males grew faster and, thus, matured earlier than females. The spawning season for Hudson River Atlantic sturgeon extends from late spring to early summer (Dovel and Berggren 1983, Van Eenennaam et al. 1996).

The abundance of the Hudson River Atlantic sturgeon riverine population prior to the onset of expanded exploitation in the 1800’s is unknown but, has been conservatively estimated at 10,000 adult females (Secor 2002). Current abundance is likely at least one order of magnitude smaller than historical levels (Secor 2002, ASSRT 2007, Kahnle et al. 2007). An estimate of the mean annual number of mature adults (863 total; 596 males and 267 females) was calculated for the Hudson River riverine population based on fishery-dependent data collected from 1985-1995 (Kahnle et al. 2007). Kahnle et al. (1998, 2007) also showed that the level of fishing mortality from the Hudson River Atlantic sturgeon fishery during the period of 1985-1995 exceeded the estimated sustainable level of fishing mortality for the riverine population, and may have led to reduced recruitment. All available data on abundance of juvenile Atlantic sturgeon in the Hudson River Estuary indicate a substantial drop in production of young since the mid 1970's (Kahnle et al. 1998). A decline appeared to occur in the mid to late 1970's followed by a secondary drop in the late 1980's (Kahnle et al. 1998, Sweka et al. 2007, ASMFC 2010). Catch-per-unit-effort (CPUE) data suggest that recruitment has remained depressed relative to catches of juvenile Atlantic sturgeon in the estuary during the mid-late 1980's (Sweka et al. 2007, ASMFC 2010). From 1985-2007, there were significant fluctuations in CPUE. The number of juveniles appears to have declined between the late 1980s and early 1990s. While the CPUE is generally higher in the 2000s as compared to the 1990s, significant annual fluctuations make it difficult to discern any trend. The CPUEs from 2000-2007 are generally higher than those from 1990-1999. However, they remain lower than the CPUEs observed in the late 1980s. There is currently not enough information regarding any life stage to establish a trend for the Hudson River population (Sweka et al. 2007, ASMFC 2010).

Sturgeon from multiple DPSs congregate in the Delaware Estuary. Generally, non-natal late stage juveniles (sometimes also referred to as subadults) immigrate into the estuary in spring (Fisher 2011) Subadults establish home ranges in the river during the summer months, and emigrate from the estuary in the fall (Fisher 2011). Subadults tagged and tracked by Simpson (2008) entered the lower Delaware Estuary as early as mid-March but, more typically, from mid-April through May. Simpson (2008) reported sturgeon remained in the Delaware Estuary through the late fall, departing in November. Previous studies have found a similar movement pattern of upstream movement in the spring-summer and downstream movement to overwintering areas in the lower estuary or nearshore ocean in the fall-winter (Brundage and Meadows 1982, Lazzari et al. 1986, Shirey et al. 1997, 1999; Brundage and O'Herron 2009, Brundage and O'Herron in Calvo et al. 2010).

Brundage and O'Herron (in Calvo et al. 2010) tagged 26 juvenile Atlantic sturgeon, including 6 YOY. They detected most non-YOY fish, in the lower tidal Delaware River from the middle Liston Range (rkm 70) to Tinicum Island (rkm 141) (Brundage and O'Herron in Calvo et al. 2010). Brundage and O'Herron (in Calvo et al. 2010) also detected a relationship between the size of non-YOY individuals and their movement pattern in the fall. They report that the fork length of fish moving toward the lower bay and ocean averaged 815 mm (range 651-970 mm) while those that moved towards the bay but were not detected below Liston Range averaged 716 mm (range 505-947 mm), and those that appear to have remained in the tidal river into the winter averaged 524 mm (range 485-566 mm) (Brundage and O'Herron in Calvo et al. 2010). Researchers have also detected concentrations of Atlantic sturgeon in the Marcus Hook (rkm 123-129) and Cherry Island Flats (rkm 112-118) regions of the river, as well as near Artificial Island during the summer months (Simpson 2008, Calvo et al. 2010). Sturgeon have also been detected using the Chesapeake and Delaware Canal (Brundage 2007, Simpson 2008).

Fox and Breece (2010) tracked adult Atlantic sturgeon captured in marine waters off of Delaware Bay in the spring to try and locate spawning areas in the Delaware River. During two sampling seasons (2009-2010) four of the tagged sturgeon were detected in the Delaware River. The earliest detection was in mid-April while the latest departure occurred in mid-June (Fox and Breece 2010). The sturgeon spent relatively little time in the river each year, generally about 4 weeks, and used the area from New Castle, Delaware, (rkm 100) to Marcus Hook (rkm 130)

(Fox and Breece 2010). Fox and Breece (2010) also tracked a fifth sturgeon. It was tagged during a separate study, and while it followed a similar timing pattern, it traveled farther upstream (to rkm 165) before exiting the river in early June.

There is no abundance estimate for the Delaware River population of Atlantic sturgeon. Harvest records from the 1800s indicate that this was historically a large population (i.e., with an estimated 180,000 adult females prior to 1890) (Secor and Waldman 1999, Secor 2002). Fisher (2009) sampled the Delaware River in 2009 to target YOY Atlantic sturgeon. The effort captured 34 YOY, ranging in size from 178 to 349 mm TL (Fisher 2009). Brundage and O'Herron (in Calvo et al. 2010) also collected 32 YOY Atlantic sturgeon from the Delaware River in a separate study. Fisher (2011) reports that genetics information collected from 33 of the 2009 year class YOY indicates that at least 3 females successfully contributed to the 2009 year class. The capture of YOY in 2009 shows that successful spawning is still occurring in the Delaware River, but the relatively low numbers suggest the existing riverine population is limited in size. Similar to the Hudson River, there is currently not enough information to determine a trend for the Delaware River population.

Threats

Dredging and other in-water activities may be impacting riverine habitat by, disturbing spawning habitat and altering the benthic forage base. Both the Hudson and Delaware rivers have navigation channels that are maintained by dredging. Dredging is also used to maintain channels in the nearshore marine environment. Dredging outside of federal channels and in-water construction occurs throughout the New York Bight region. While some dredging projects operate with observers present to document fish mortalities many do not. We have reports of one Atlantic sturgeon entrained during hopper-dredging operations in Ambrose Channel, New Jersey. At this time, we do not have enough information to quantify the number of Atlantic sturgeon killed or disturbed during dredging or in-water construction projects. We also lack enough information to quantify any effects to habitat.

In the Hudson and Delaware Rivers, dams do not block access to historical habitat. The Holyoke Dam on the Connecticut River blocks further upstream passage; however, the extent that Atlantic sturgeon would historically have used habitat upstream of Holyoke is unknown. Connectivity may be disrupted by the presence of dams on several smaller rivers in the New York Bight region. Because no Atlantic sturgeon occur upstream of any hydroelectric projects in the New York Bight region, passage over hydroelectric dams or through hydroelectric turbines is not a source of injury or mortality in this area. The extent that Atlantic sturgeon are affected by operations of dams in the New York Bight region is currently unknown.

New York Bight DPS Atlantic sturgeon may also be affected by degraded water quality. In general, water quality has improved in the Hudson and Delaware over the past decades (Lichter et al. 2006, EPA 2008). Both the Hudson and Delaware rivers, as well as other rivers in the New York Bight region, were heavily polluted in the past from industrial and sanitary sewer discharges. While water quality has improved and most discharges are limited through regulations, many pollutants persist in the benthic environment. This can be particularly problematic if pollutants are present on spawning and nursery grounds as developing eggs and larvae are particularly susceptible to exposure to contaminants.

Vessel strikes occur on the Delaware River. From 2004-2008, 29 mortalities believed to be the result of vessel strikes were documented in the Delaware River, at least 13 of these fish were large adults. The time of year when these events occurred (predominantly May through July, with two in August), indicate the animals were likely adults migrating through the river to the spawning grounds. Because we do not know the percent of total vessel strikes that these observed mortalities represent, we are not able to quantify the number of individuals likely killed as a result of vessel strikes in the New York Bight DPS.

The effects from fisheries, both historically and currently, on Atlantic sturgeon from the New York Bight DPS are the same as those discussed previously with the Carolina DPS (see Section 3.2.10.1). In the marine range, New York Bight DPS Atlantic sturgeon are incidentally captured in federal and state managed fisheries, reducing survivorship of subadult and adult Atlantic sturgeon (Stein et al. 2004b, ASMFC 2007). Wirgin and King’s (2011) mixed stock analysis indicate over 40 percent of the Atlantic sturgeon bycatch interactions in the Mid Atlantic Bight region were sturgeon from the New York Bight DPS. Genetic sampling of individuals and mixed stock analysis of samples collected from sturgeon captured in Canadian fisheries in the Bay of Fundy indicated that approximately 1-2 percent were from the New York Bight DPS.

For the New York Bight DPS of Atlantic sturgeon to recover, improvements must occur in the same four areas (i.e., elimination of barriers to spawning, appropriate stream flow, dredging restrictions, and improved water quality) described in the Carolina DPS (see Section 3.2.10.1).

3.2.10.4 Chesapeake Bay DPS

Distribution and Abundance

The Chesapeake Bay DPS includes the following: all anadromous Atlantic sturgeons that are spawned in the watersheds that drain into the Chesapeake Bay and into coastal waters from the Delaware-Maryland border on Fenwick Island to Cape Henry, VA. Within this range, Atlantic sturgeon historically spawned in the Susquehanna, Potomac, James, York, Rappahannock, and Nottoway Rivers (ASSRT 2007). Spawning still occurs in the James River, and the presence of juvenile and adult sturgeon in the York River suggests that spawning may occur there as well (Musick et al. 1994, ASSRT 2007, Greene et al. 2009). However, conclusive evidence of current spawning is available for the James River, only. Atlantic sturgeon that are spawned elsewhere are known to use waters of the Chesapeake Bay for other life functions, such as foraging and as juvenile nursery habitat, before entering the marine system as subadults (Vladykov and Greeley1963, ASSRT 2007, Wirgin et al. 2007, Grunwald et al. 2008).

Hager (2011) report that environmental cues appear to play a strong role in use of the James River by adult, presumably Chesapeake Bay DPS, Atlantic sturgeon. Adult sturgeon enter the river in spring when water temperatures are around 17°C, and occur from river kilometer (rkm) 29 to rkm 108 before departing the river in June when water temperatures are around 24°C (Hager 2011). Tracking data for 2010 demonstrated a congregation of sturgeon in freshwater areas at rkm 77, suggesting the possibility of suitable spawning habitat in this area (Hager 2011).

Adult sturgeon appear in the James River appear during late summer-early fall (August-October), and fish ascend the river rapidly and congregate in upriver sites near Richmond, Virginia. As temperature declines in late September or early October, adults disperse through downriver sites and begin to move out of the river (Hager 2011). By November, adults occupy only lower river sites (Hager 2011). By December, adults are undetected on the tracking array and, thus, are presumed to be out of the river (Hager 2011).

The spawning season for Chesapeake Bay DPS Atlantic sturgeon is April–May. That estimate is based on: (1) records of large harvests near the mouth of the Chesapeake Bay and in the lower James River in April; (2) incidental observations of adult-sized carcasses and incidental capture of adult-sized live fish in April; (3) detection of sonically tagged sturgeon in current scientific studies; and, (4) capture of a large female sturgeon in spawning condition within the James River in April 2011 (Hildebrand and Schroeder 1928, Vladykov and Greeley 1963, Bushnoe et al. 2005, ASSRT 2007, Blakenship 2011). Balazik (unpublished data) reports the capture of another large female in post-spawning condition within the James River in September 2011, which suggests the possibility of a second late-summer spawning run. However, further analyses are needed.

Age to maturity for Chesapeake Bay DPS Atlantic sturgeon is unknown. However, Atlantic sturgeon riverine populations exhibit clinal variation with faster growth and earlier age to maturity for those that originate from southern waters, and slower growth and later age to maturity for those that originate from northern waters (75 FR 61872; October 6, 2010). Age at maturity is 5 to 19 years for Atlantic sturgeon originating from South Carolina rivers (Smith et al. 1982) and 11 to 21 years for Atlantic sturgeon originating from the Hudson River (Young et al. 1998). Therefore, age at maturity for Atlantic sturgeon of the Chesapeake Bay DPS likely falls within these values.

Threats

Several threats play a role in shaping the current status of Chesapeake Bay DPS Atlantic sturgeon. Historical records provide evidence of the large-scale commercial exploitation of Atlantic sturgeon from the James River and Chesapeake Bay in the 1800s (Hildebrand and Schroeder 1928, Vladykov and Greeley 1963, ASMFC 1998, Secor 2002, Bushnoe et al. 2005, ASSRT 2007) as well as subsistence fishing and attempts at commercial fisheries as early as the 1600s (Secor 2002, Bushnoe et al. 2005, ASSRT 2007, Balazik et al. 2010). All directed Atlantic sturgeon fishing as well as retention of Atlantic sturgeon bycatch is currently prohibited. Nevertheless, other threats remain. Habitat disturbance caused by in-river work such as dredging for navigational purposes is suspected of having reduced available spawning habitat in the James River (Holton and Walsh 1995, Bushnoe et al. 2005, ASSRT 2007).

Decreased water quality also threatens Atlantic sturgeon of the Chesapeake Bay DPS, especially since the Chesapeake Bay system is vulnerable to the effects of nutrient enrichment due to a relatively low tidal exchange and flushing rate, large surface to volume ratio, and strong stratification during the spring and summer months (Pyzik et al. 2004, ASMFC 1998, ASSRT 2007, EPA 2008). These conditions contribute to reductions in dissolved oxygen levels throughout the Bay. The availability of nursery habitat, in particular, may be limited given the recurrent hypoxia (low dissolved oxygen) conditions within the Bay (Niklitschek and Secor

2005, 2010). At this time we do not have sufficient information to quantify the extent that degraded water quality effects habitat or individuals in the James River or throughout the Chesapeake Bay.

Vessel strikes have been observed in the James River (ASSRT 2007). Eleven Atlantic sturgeon were reported to have been struck by vessels from 2005 through 2007. Several of these were mature individuals. Because we do not know the percent of total vessel strikes that the observed mortalities represent, we are not able to quantify the number of individuals likely killed as a result of vessel strikes in the New York Bight DPS.

For the Chesapeake Bay DPS of Atlantic sturgeon to recover, improvements must occur in the same four areas (i.e., elimination of barriers to spawning, appropriate stream flow, dredging restrictions, and improved water quality) described in the Carolina DPS (see Section 3.2.10.1).

3.2.10.5 Gulf of Maine DPS

Distribution and Abundance
The Gulf of Maine DPS includes the following: all anadromous Atlantic sturgeons that are spawned in the watersheds from the Maine/Canadian border and, extending southward, all watersheds draining into the Gulf of Maine as far south as Chatham, Massachusetts. Within this range, Atlantic sturgeon historically spawned in the Androscoggin, Kennebec, Merrimack, Penobscot, and Sheepscot Rivers (ASSRT 2007). Spawning still occurs in the Kennebec and Androscoggin Rivers, and it may still occur in the Penobscot River. Atlantic sturgeon continue to be present in the Kennebec River; in addition, they are captured in directed research projects in the Penobscot River, and are observed in rivers where they were unknown to occur or had not been observed to occur for many years (e.g., the Saco, Presumpscot, and Charles Rivers). These observations suggest that abundance of the Gulf of Maine DPS of Atlantic sturgeon is sufficient such that recolonization to rivers historically suitable for spawning may be occurring. However, there is not enough information to establish a trend for this DPS.

Spawning in the Androscoggin River was recently confirmed by the Maine Department of Marine Resources. There is no evidence of recent spawning in the remaining rivers. In the 1800s, construction of the Essex Dam on the Merrimack River blocked access to 58 percent of Atlantic sturgeon habitat in the river (Oakley 2003, ASSRT 2007). The accessible portions of the Merrimack seem to be suitable spawning and nursery habitat for Atlantic sturgeon (Keiffer and Kynard 1993) so the availability of spawning habitat does not appear to be the reason for the lack of observed spawning in the Merrimack River. Likewise, suitable spawning and nursery habitat appear to be accessible to Atlantic sturgeon in the Androscoggin, Sheepscot, and Penobscot Rivers. Studies are on-going to determine whether Atlantic sturgeon are spawning in these rivers. Atlantic sturgeons that are spawned elsewhere continue to use habitats within all of these rivers (ASSRT 2007). The movement of subadult and adult sturgeon between rivers, including to and from the Kennebec River and the Penobscot River, demonstrates that coastal and marine migrations are likely key elements of Atlantic sturgeon life history (ASSRT 2007, Fernandes et al. 2010).

All Atlantic sturgeon habitat in the Kennebec River is currently accessible. The construction of Edwards Dam in 1837, downstream of Ticonic Falls, blocked Atlantic sturgeon access to historic habitat until 1999 when the dam was removed (Squiers 2000). Capture of Atlantic sturgeon in spawning condition at the base of the dam in 1994 (ASMFC 1998) and numerous sightings of large Atlantic sturgeon upstream of the former dam site after 1999 (Squiers 2000) suggest that suitable spawning habitat exists within the newly accessible area.

Bigelow and Schroeder (1953) surmised that Atlantic sturgeon likely spawned in Gulf of Maine Rivers in May-July. More recent captures of Atlantic sturgeon in spawning condition within the Kennebec River suggest that spawning more likely occurs in June-July (Squiers et al. 1981, ASMFC 1998, NMFS and USFWS 1998d). Evidence for the timing and location of Atlantic sturgeon spawning in the Kennebec River includes: (1) the capture of five adult male Atlantic sturgeon in spawning condition (i.e., expressing milt) in July 1994 below the (former) Edwards Dam; (2) capture of 31 adult Atlantic sturgeon from June 15,1980, through July 26,1980, in a small commercial fishery directed at Atlantic sturgeon from the South Gardiner area (above Merrymeeting Bay) that included at least 4 ripe males and 1 ripe female captured on July 26,1980; and, (3) capture of nine adults during a gillnet survey conducted from 1977-1981, the majority of which were captured in July in the area from Merrymeeting Bay and upriver as far as Gardiner, Maine (NMFS and USFWS 1998d, ASMFC 2007). The low salinity values for waters above Merrymeeting Bay are consistent with values found in other rivers where successful Atlantic sturgeon spawning is known to occur.

Age to maturity for Gulf of Maine DPS Atlantic sturgeon is unknown. However, Atlantic sturgeon riverine populations exhibit clinal variation with faster growth and earlier age to maturity for those that originate from southern waters, and slower growth and later age to maturity for those that originate from northern waters (75 FR 61872; October 6, 2010). Age at maturity is 11 to 21 years for Atlantic sturgeon originating from the Hudson River (Young et al. 1998), and 22 to 34 years for Atlantic sturgeon that originate from the Saint Lawrence River (Scott and Crossman 1973). Therefore, age at maturity for Atlantic sturgeon of the Gulf of Maine DPS likely falls within these values. Of the 18 sturgeon examined from the commercial fishery that occurred in the Kennebec River in 1980, age estimates for the 15 males ranged from 17-40 years, and from 25-40 years old for the 3 females (Squiers et al. 1981).

Threats

All the threats to the Carolina DPS mentioned previously also play a role in shaping the current status of Gulf of Maine DPS Atlantic sturgeon. Historical records provide evidence of commercial fisheries for Atlantic sturgeon in the Kennebec and Androscoggin Rivers dating back to the 1600s (Squiers et al. 1979). In 1849, 160 tons of sturgeon was caught in the Kennebec River by local fishermen (Squiers et al. 1979). Following the 1880's, the sturgeon fishery was almost non-existent due to a collapse of the sturgeon stocks. All directed Atlantic sturgeon fishing as well as retention of Atlantic sturgeon bycatch has been prohibited since 1998. Nevertheless, mortalities associated with bycatch in fisheries occurring in state and federal waters still occurs. In the marine range, Gulf of Maine DPS Atlantic sturgeon are incidentally captured in federal and state managed fisheries, reducing survivorship of subadult and adult Atlantic sturgeon (Stein et al. 2004, ASMFC 2007). Habitat disturbance and direct mortality from anthropogenic sources are the primary concerns.

Riverine habitat may be impacted by dredging and other in-water activities, disturbing spawning habitat and altering the benthic forage base. Many rivers in the Gulf of Maine DPS have navigation channels that are maintained by dredging. Dredging outside of federal channels and in-water construction occurs throughout the Gulf of Maine DPS. To date we have not received any reports of Atlantic sturgeon killed during dredging projects in the Gulf of Maine region. However, only some dredging projects operate with observers present to document fish mortalities. At this time, we do not have any information to quantify the number of Atlantic sturgeon killed or disturbed during dredging or in-water construction projects are also not able to quantify any effects to habitat.

Connectivity is disrupted by the presence of dams on several rivers in the Gulf of Maine region. Because Atlantic sturgeon do not occur upstream of any hydroelectric projects in the Gulf of Maine region, passage over hydroelectric dams or through hydroelectric turbines is not a source of injury or mortality in this area. The extent that Atlantic sturgeon are affected by operations of dams in the Gulf of Maine region is currently unknown. However, Atlantic sturgeon larvae have been found downstream of the Brunswick Dam in the Androscoggin River. This suggests that Atlantic sturgeon spawning may be occurring in the vicinity of at least one hydroelectric project and may be affected by its operations.

Gulf of Maine DPS Atlantic sturgeon may also be affected by degraded water quality. In general, water quality has improved in the Gulf of Maine over the past decades (Lichter et al. 2006, EPA 2008). Many rivers in Maine, including the Androscoggin River, were heavily polluted in the past from industrial discharges from pulp and paper mills. While water quality has improved and most discharges are limited through regulations, many pollutants persist in the benthic environment. This can be particularly problematic if pollutants are present on spawning and nursery grounds as developing eggs and larvae are particularly susceptible to exposure to contaminants.

For the Gulf of Maine DPS of Atlantic sturgeon to recover, improvements must occur in the same four areas (i.e., elimination of barriers to spawning, appropriate stream flow, dredging restrictions, and improved water quality) described in the Carolina DPS (see Section 3.2.10.1).

4.0 Environmental Baseline

By regulation, environmental baselines for opinions include the past and present impacts of all state, federal, or private actions and other human activities in the action area, the anticipated impacts of all proposed federal projects in the action area that have already undergone formal or early Section 7 consultation, and the impact of state or private actions that are contemporaneous with the consultation in process (50 CFR 402.02).

This section contains a description of the effects of past and ongoing human factors leading to the current status of the species, their habitat, and ecosystem within the action area. The environmental baseline is a snapshot of the factors affecting the species and includes state, tribal, local, and private actions already affecting the species, or that will occur contemporaneously with the consultation in progress. Unrelated future federal actions affecting the same species that have completed consultation are also part of the environmental baseline, as are implemented and ongoing federal and other actions within the action area that may benefit listed species. The purpose of describing the environmental baseline in this manner is to provide context for the effects of the proposed action on the listed species.

4.1 Status of the ESA-Listed Large Whales in the Action Area

The North Atlantic right, humpback, and fin whales that occur in the action area are all highly migratory. Individual animals will make migrations into nearshore waters as well as other areas along the east coast of the United States. Therefore, the status of North Atlantic right, humpback, and fin whales in the Atlantic (see Section 3.2) most accurately reflects the species' status within the action area.

4.2 Factors Affecting North Atlantic Right, Humpback and Fin Whales, and Their Environment in the Action Area

4.2.1 Fisheries

The endangered North Atlantic right, humpback, and fin whale are adversely affected by fishing gears used throughout the action area. Gillnet and trap/pot gears are the primary types documented as interacting with large whales. Available information suggests large whales may interact with any of these gear types when the operation of fisheries utilizing them overlaps with the distribution of these species. 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 endangered large whales: American lobster, Atlantic bluefish, Atlantic sea scallop, monkfish, Northeast multispecies, red crab, skate, and spiny dogfish fisheries. A brief summary of each fishery is provided below, but more detailed information can be found in the respective biological opinions.

American Lobster Fishery
The pot/trap gear used in the American lobster fishery has been identified as causing injuries to and mortality of North Atlantic right whales (Johnson et al. 2005, Waring et al. 2010, Glass et al. 2010, 73 FR 73032, December 1, 2008). North Atlantic right, humpback, and fin whales are known to become entangled in lines associated with multiple gear types. For pot/trap gear, vertical lines attach buoys to the gear while groundline attach the pots/traps in series. Lines wrapped tightly around an animal can cut into the flesh and can lead to injuries, infection and death (Moore et al. 2004).

American lobster occurs within U.S. waters from Maine to Virginia. They are most abundant from Maine to New Jersey with abundance declining from north to south (ASMFC 1999). Most lobster trap effort occurs in the Gulf of Maine, constituting 76 percent of the U.S. landings between 1981 and 2007, and 87 percent since 2002. Lobster landings in the other New England states as well as New York and New Jersey account for most of the remainder of U.S. American lobster landings. However, declines in lobster abundance and landings have occurred from Rhode Island through New Jersey in recent years. The Mid-Atlantic States from Delaware through North Carolina have been granted *de minimus* status under the ASMFC's Interstate Fishery Management Plan (ISFMP). The ISFMP includes measures to constrain or reduce fishing effort in the lobster fishery. In fact, the ASFMC is currently evaluating additional management options to address a May 2010, technical committee report that determined there is a lobster recruitment failure in the SNE stock area. Potential management options under consideration could further reduce fishing effort in the SNE stock area by an additional 75 percent over current levels. Such measures are of benefit to large whales and sea turtles by reducing the amount of gear (specifically buoy lines) in the water where whales and sea turtles also occur.

A North Atlantic right whale entanglement in pot/trap gear used in the inshore lobster fishery resulting in death occurred in 2001 (Waring et al. 2007). A mortality of a humpback whale in pot/trap gear in the state lobster fishery occurred in 2002 (Waring et al. 2007). Other mortalities and serious injuries to ESA-listed large whales as a result of pot/trap gear consistent of that used in the lobster fishery have occurred as reported in Moore et al. (2004), Johnson et al. (2005), Glass et al. (2010). However, it cannot be determined in all cases whether the gear was set in state waters as part of a state lobster fishery or in federal waters. In all waters regulated by the ALWTRP, pot/trap gear set by the American lobster fishery is required to follow regulations set by the plan.

Formal consultations on the fishery have been conducted in 2001, 2002, 2010, and most recently in 2012. The October 2010 formal consultation determined no entanglements of fin whales could be directly associated with the American lobster fishery and any interactions between this species and the fishery were likely to only occur at an insignificant level approaching a zero mortality and serious injury rate. The opinion also concluded that from 2003-2007 at least one serious injury and one mortality had occurred to right and humpback whales, respectively. The opinion stated the American lobster fishery poses a risk of SI/M to right and humpback whales, but the continued implementation and development of ALWTRP measures, along with an overall reduction in American lobster fishery effort, led to the conclusion that the number of right and humpback whale entanglements in trap/pot gear should decline or, at least, not increase (NMFS 2010e).

In 2012, consultation was reinitiated to address the listing of Atlantic sturgeon. The opinion also included updated information on large whale entanglements in American lobster gear. From 2005-2009, one entanglement (not causing SI/M) of a North Atlantic right whale and seven entanglements (one causing SI/M) of humpback whales were documented; no fin whales were entangled. The opinion concluded that while the continued operation of the American Lobster fishery, acting in compliance with the requirements of the ALWTRP, is likely to adversely affect North Atlantic, humpback, and fin whales, it will not jeopardize the continued existence of these species (NMFS 2012b).

Atlantic Bluefish Fishery

The Atlantic bluefish fishery has been operating in the U.S. Atlantic 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 gears used include otter trawls, gillnets, and hook-and-line (MAFMC 2007). The commercial bluefish fishery does not typically operate in areas where or at times when large whales occur; however, interactions between the whales and bluefish fishery are possible. Because of the gear used in the fishery, participants are required to follow regulations set by the ALWTRP.

The most recent formal consultation on the fishery was completed in October 2010. The opinion concluded that North Atlantic right, humpback, and fin whales will not be affected by bottom otter trawl gear, and entanglements in hook-and-line gear were so rare any adverse affects were discountable. The opinion also concluded that while gillnet gear is known to entangle large whales, no gillnet gear entanglement from 1999-2008 could be definitively attributed to bluefish gillnet gear. With the recent and continued efforts of the ALWTRP and without specific entanglements attributable to the bluefish fishery, the opinion concluded the proposed action would likely result in the same rates of annual mean entanglements seen from 1999-2008 (Table 4.1) and was not likely to jeopardize the continued existence of large whales (NMFS 2010f). Because the number of incidental takes authorized for sea turtles in bluefish bottom otter trawl gear has been exceeded (see following sections), consultation has been reinitiated and is currently on going.

Table 4.1 Annual Large Whale Entanglements and Entanglements Causing SI/M, 1999-2008 (Adapted from: NMFS 2010f)

Gear	**No. Entanglements (% of Total Entanglements)**			**No. Entanglements Causing SI/M (% of Total Entanglements)**		
	North Atlantic right whale	Humpback	Fin	North Atlantic right whale	Humpback	Fin
Sink Gillnet	1 (2%)	11 (7%)	0	1 (10%)	2 (6%)	0
Unspecified Gillnet	1 (2%)	13 (8%)	0	1 (10%)	2 (6%)	0
American Lobster Gear	6 (12%)	13 (8%)	0	1 (10%)	2 (6%)	0
Other pot/trap gear	0	4 (2%)	0	0	0	0
Hook and Line	0	6 (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	42 (82%)	116 (70%)	21 (100%)	7 (70%)	28 (82%)	8 (100%)
Total	51	164	21	10	34	8
Mean Annual Total	5.1	16.4	2.1	1	3.4	0.8

Monkfish Fishery

The fishery occurs in all waters under federal jurisdiction from Maine to the North Carolina/South Carolina border. The current commercial fishery operates primarily in 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 meters with concentrations between 70 and 100 meters and at 190 meters. The directed monkfish fishery uses several gear types that may entangle protected species, including gillnet and trawl gear.

A Section 7 consultation conducted in 2001 concluded that the continued operation of the fishery would jeopardize the continued existence of North Atlantic right whales as a result of entanglement in gillnet gear used in the fishery, causing serious injury or death. The RPA issued to the monkfish fishery in the 2001 opinion implemented the seasonal area management (SAM) and dynamic area management (DAM) programs into the ALWTRP. In 2003, proposed changes to the Monkfish FMP led to reinitiation of consultation. The RPAs implemented in the 2001 opinion were reissued in the 2003 opinion. There have been no confirmed entanglements of North Atlantic right whales in gillnet gear set to target monkfish. However, right, humpback, and fin whale entanglements in gillnet gear of unidentified origin have occurred (Johnson et al. 2005; Waring et al. 2009).

In October 2007, NMFS published a final rule that revised the ALWTRP, which affected the SAM and DAM programs required under the 2003 opinion (72 FR 57104; October 5, 2007). NMFS determined these changes caused an effect to listed species not considered in the most recent opinion on the fishery, and consultation was reinitiated (NMFS 2010g).

In October 2010, the new formal consultation was completed. The opinion determined that monkfish bottom trawls would not affect ESA-listed large whales. The opinion also concluded that while gillnet gear is known to entangle large whales, no gillnet gear entanglement from 1999-2008 could be definitively attributed to monkfish gillnet gear. With the recent and continued efforts of the ALWTRP and without specific entanglements attributable to the monkfish fishery, the opinion concluded the proposed action would likely result in the same rates of annual mean entanglements seen from 1999-2008 (Table 4.1) and was not likely to jeopardize the continued existence of large whales (NMFS 2010g).

Northeast Multispecies Fishery

The Northeast multispecies fishery operates throughout the year, with peaks in the spring and from October through February. Multiple gear types are used in the fishery including sink gillnet, trawl, and pot/trap gear, which are known to be a source of injury and mortality to right, humpback, and fin whales as a result of entanglement and capture in the gear (NMFS 2001b). The Northeast multispecies sink gillnet fishery has historically occurred from the periphery of the Gulf of Maine to Rhode Island in water as deep as 360 feet. In recent years, more of the effort in the fishery has occurred in offshore waters and into the Mid-Atlantic. Participation in this fishery has declined since extensive groundfish conservation measures have been implemented; particularly since implementation of Amendment 13 to the Multispecies FMP. Additional management measures (i.e., Framework Adjustment 42) are expected to have further reduced effort in the fishery. The exact relationship between multispecies fishing effort and the number of endangered species interactions with gear used in the fishery is unknown. However, in general, less fishing effort results in less time that gear is in the water and therefore less opportunity for cetaceans to be captured or entangled in multispecies fishing gear.

In the June 2001 Northeast multispecies biological opinion, NMFS determined that the continued operation of the fishery would jeopardize the continued existence of North Atlantic right whales as a result of entanglement in gillnet gear used in the fishery, causing serious injury or death. The RPA issued in the 2001 opinion led to implementation of the SAM and DAM programs into the ALWTRP. In October 2007, NMFS published a final rule that revised the ALWTRP, which affected the SAM and DAM programs required under the 2001 opinion (72 FR 57104; October 5, 2007). NMFS determined these changes caused an effect to listed species not considered in the most recent opinion on the fishery, and consultation was reinitiated (NMFS 2010h).

In October 2010, the new formal consultation was completed. The opinion determined that multispecies bottom trawls would not affect ESA-listed large whales. The opinion stated that 6 large whale entanglements in hook-and-line gear had occurred over the least 10 years. The opinion indicated that it was possible this level of interaction could occur in the future, but that estimate was likely very conservative toward the species. The opinion also concluded that while gillnet gear is known to entangle large whales, no gillnet gear entanglement from 1999-2008 could be definitively attributed to multispecies gillnet gear. With the recent and continued efforts of the ALWTRP and without specific entanglements attributable to the multispecies fishery, the opinion concluded the proposed action would likely result in the same rates of annual mean entanglements seen from 1999-2008 (Table 4.1) and was not likely to jeopardize the continued existence of large whales (NMFS 2010h).

Red Crab Fishery

Section 7 consultation was completed on the red crab fishery during the proposed implementation of the Red Crab FMP (NMFS 2002a). The opinion concluded that the action was not likely to result in jeopardy to any ESA-listed species under NMFS' jurisdiction. 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 feet al.ong 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. Following concerns that red crab could be overfished, an FMP was developed and became effective on October 21, 2002. Right, humpback, and fin whales are also at risk of entanglement in gear used by the red crab fishery. Gear used by this fishery is required to be in compliance with the ALWTRP. One exemption from the ALWTRP that affects the red crab fishery is the deep water exemption. The sinking groundline requirement is not required for gear that is fished at depths greater than 280 fathoms. Whales and sea turtles in the action are not known to commonly dive to depths greater than 275 fathoms. Therefore, this exemption is unlikely to increase entanglement risks.

Skate Fishery

The skate fishery has typically been composed of both a directed fishery and an indirect fishery. The bait fishery is more historical and is a more directed skate fishery than the wing fishery. Vessels that participate in the bait fishery are primarily from southern New England and direct primarily on little (90 percent) and winter skate (10 percent). The wing fishery is primarily an incidental fishery that takes place throughout the region, primarily as bycatch in the fishery for Northeast multispecies.

In 2003, an opinion was conducted on the authorization of the fishery under the Skate FMP. The opinion concluded that the initial implementation of the Skate FMP would not jeopardize the continued existence of right, humpback, fin, sei, blue, and sperm whales, and was not likely to adversely modify North Atlantic right whale critical habitat (NMFS 2003b). However, the opinion determined interactions between these species and skate fishing gear (i.e., trawls, gillnets, longline, handline, rod and reel) were rare but possible.

In 1999, a right whale mortality in U.S. Atlantic waters was attributed to entanglement in gillnet gear. However, NMFS was unable to determine the origin of the gillnet gear (i.e., the fishery in which the gear was being fished). In addition, other entanglements of ESA-listed large whale species in gillnet gear were observed after completion of the original 2003 skate opinion. There was insufficient information to determine whether any of the entanglements, including the entanglement that caused the death of a right whale in 1999, were the result of effort in the skate fishery. Nevertheless, NMFS has concluded that the entanglements provide information that reveals effects of the action (the continued operation of the skate fishery) that may affect ESA-listed large whales in a manner or to an extent not previously considered.

In October 2010, the new formal consultation was completed. The opinion determined that skate bottom trawls would not affect ESA-listed large whales. The opinion also concluded that while gillnet gear is known to entangle large whales, no gillnet gear entanglement from 1999-2008 could be definitively attributed to skate gillnet gear. With the recent and continued efforts of the ALWTRP and without specific entanglements attributable to the multispecies fishery, the opinion concluded the proposed action would likely result in the same rates of annual mean entanglements seen from 1999-2008 (Table 4.1) and was not likely to jeopardize the continued existence of large whales (NMFS 2010i).

Spiny Dogfish Fishery

The spiny dogfish fishery in the U.S. EEZ is managed under the Spiny Dogfish FMP. 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 one gear type has varied over time (NEFSC 2003). In 2005, 62.1 percent of landings were taken by sink gillnet gear, followed by 18.4 percent by otter trawl gear, 2.3 percent by hook-and-line gear, and 17.1 percent in gear defined as “other” (excludes drift gillnet gear) (NEFSC 2006). ESA-listed whales are known to be seriously injured or killed from interaction with sink gillnet gear.

NMFS reinitiated Section 7 consultation on the Spiny Dogfish FMP on May 4, 2000, to reevaluate the effects of the spiny dogfish gillnet fishery on sea turtles and cetaceans following the death of a North Atlantic right whale in 1999 as a result of entanglement in gillnet gear that may have originated from the spiny dogfish fishery (NMFS 2001a). The FMP for spiny dogfish called for a 30 percent reduction in quota allocation levels for 2000 and a 90 percent reduction in 2001. Although there were delays in implementing the plan, the reduction in effort has likely benefited protected species by reducing the likelihood that gear interactions would occur. Nevertheless, the June 14, 2001, opinion on the fishery concluded that the continued operations of the spiny dogfish fishery would adversely affect and was likely to jeopardize North Atlantic right whales. The opinion provided RPAs that included components to minimize the overlap of North Atlantic right whales and spiny dogfish gillnet gear (e.g., SAM and DAM program introduced to the ALWTRP), expanded gear modifications to the Mid-Atlantic and southeastern U.S. waters, continued gear research, and monitored the implementation and effectiveness of the RPA. In October 2007, NMFS published a final rule that revised the ALWTRP, which affected the SAM and DAM programs required under the 2001 opinion (72 FR 57104; October 5, 2007). NMFS determined these changes caused an effect to listed species not considered in the most recent opinion on the fishery, and consultation was reinitiated (NMFS 2010j).

In October 2010, the new formal consultation was completed. The opinion determined that spiny dogfish bottom trawls would not affect ESA-listed large whales, and adverse affects from bottom longline gear to these species "…are rare events and unlikely to pose a considerable risk to large cetaceans". The opinion also concluded that while gillnet gear is known to entangle large whales, no gillnet gear entanglement from 1999-2008 could be definitively attributed to spiny dogfish gillnet gear. With the recent and continued efforts of the ALWTRP and without specific entanglements attributable to the multispecies fishery, the opinion concluded the proposed action would likely result in the same rates of annual mean entanglements seen from 1999-2008 (Table 4.1) and was not likely to jeopardize the continued existence of large whales (NMFS 2010j).

4.2.2 Federal Vessel Activity and Operations

Potential sources of adverse effects to large whales from federal vessel operations in the action area include operations of the U.S. Navy (USN), U.S. Coast Guard (USCG), Environmental Protection Agency (EPA), Army Corps of Engineers (COE), and NOAA. NMFS has previously conducted formal consultations with the USN, USCG, and NOAA on their vessel-based operations. NMFS has also conducted Section 7 consultations with the Minerals Management Service (MMS), Federal Energy Regulatory Commission (FERC), and Maritime Administration (MARAD) on vessel traffic related to energy projects in the Northeast Region and has implemented conservation measures. Through the Section 7 process, where applicable, NMFS has and will continue to establish conservation measures for all these agency vessel operations to avoid or minimize adverse effects to listed species.

Several opinions for the USN activities (NMFS 1996b, 1997b, 2006b, 2008a, 2009b, c) and USCG (NMFS 1995) contain details on the scope of vessel operations for these agencies and the conservation measures that are being implemented as standard operating procedures. In the U.S. Atlantic, the operation of USCG boats and cutters is not expected to jeopardize the continued existence of the ESA-listed species.

In June 2009, NMFS prepared an opinion on USN activities in each of their four training range complexes along the U.S. Atlantic coast: Northeast; Virginia Capes; Cherry Point; and Jacksonville (NMFS 2009b). That opinion determined that no whales are likely to die or be physically injured as a result of their exposure to USN training in the Atlantic Ocean. However, the Virginia Capes Range Complex was assigned potential take in the form of harassment of fin, sei, and humpback whales.

NMFS has also conducted more recent Section 7 consultations on USN explosive ordnance disposal, mine warfare, sonar testing (e.g., AFAST, SURTASS LFA), and other major training exercises (e.g., bombing, naval gunfire, combat search and rescue, anti-submarine warfare, and torpedo and missile exercises) in the Atlantic Ocean. These consultations have determined that the proposed USN activities may adversely affect but would not jeopardize the continued existence of ESA-listed marine mammals and sea turtles (NMFS 2008a, 2009b and c).

Similarly, operations of vessels by other federal agencies within the action area (NOAA, EPA, and COE) may adversely affect ESA-listed marine mammals. However, vessel activities of those agencies are often limited in scope, as they operate a limited number of vessels or are engaged in research/operational activities that are unlikely to contribute a large amount of risk.

4.2.3 Pollution

Anthropogenic sources of marine pollution, while difficult to attribute to a specific federal, state, local, or private action, may affect ESA-listed species in the action area. Sources of pollutants in coastal regions of the action area include atmospheric loading of pollutants such as PCBs, stormwater runoff from coastal towns, cities, and villages, runoff into rivers emptying into bays, groundwater discharges and sewage treatment effluent, and oil spills. Marine debris (e.g., discarded fishing line or lines from boats) can entangle large whales, causing serious injury or mortality.

Nutrient loading from land-based sources such as coastal community discharges is known to stimulate plankton blooms in closed or semi-closed estuarine systems. The effect to larger embayments is unknown. Contaminants could indirectly affect ESA-listed species if the pollution reduces the food available to marine animals.

Fuel oil spills could affect animals directly or indirectly through the food chain. Fuel spills involving fishing vessels are common events. However, these spills typically involve small amounts of material. No direct adverse effects on listed species resulting from fishing vessel fuel spills have been documented. No North Atlantic right, humpback, or fin whales were detected in the area of the DWH oil spills and no individuals are believed to have been affected by the spill.

4.2.4 Maritime Industry

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. It is important to note that minor vessel collisions may not kill an animal directly, but may weaken or otherwise affect it so it is more likely to become vulnerable to effects such as entanglements.

4.2.5 ESA Permits

Regulations developed under the ESA allow for the issuance of permits allowing take of certain ESA-listed species for the purposes of scientific research under section 10(a)(1)(a) of the ESA. In addition, Section 6 of the ESA allows NMFS to enter into cooperative agreements with states to assist in recovery actions of listed species. Prior to issuance of these permits, the proposal must be reviewed for compliance with Section 7 of the ESA.

North Atlantic right, humpback, and fin whales are the focus of research activities authorized by Section 10 permits under the ESA. As of November 2012, there were 22 active scientific research permits directed toward these species that are applicable to the action area of this biological opinion. Authorized activities range from acoustic playbacks, passive acoustic monitoring, biopsies, sloughed skin collection, photo identification, aerial and vessel surveys. The number of authorized takes varies widely depending on the research and species involved. 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, issuance of the permit by NMFS must also undergo an ESA Section 7 analysis to ensure the issuance of the permit does not result in jeopardy to the species.

4.3 Conservation and Recovery Actions Benefiting Large Whales

4.3.1 Atlantic Large Whale Take Reduction Plan

The ALWTRP reduces the risk of serious injury to or mortality of large whales due to incidental interactions with U.S. commercial fisheries. The ALWTRP focuses on the critically endangered North Atlantic right whale, but is also intended to reduce entanglement of endangered humpback and fin whales. The ALWTRP covers the U.S. Atlantic EEZ from Maine through Florida (26°46.5‘N lat.). The requirements are year-round in the Northeast, and seasonal in the Mid- and South Atlantic.

The plan has been developed in collaboration with the Atlantic Large Whale Take Reduction Team (ALWTRT), which consists of fishing industry representatives, environmentalists, state and federal officials, and other interested parties. The ALWTRP is an evolving plan that changes as NMFS and the ALWTRT learn more about why whales become entangled and how fishing practices might be modified to reduce the risk of entanglement. 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**.** Each component is discussed in more detail below.

4.3.1.1 Regulatory Measures to Reduce the Threat of Entanglement on Whales

The regulatory component of the ALWTRP includes a combination of broad fishing gear modifications and time-area restrictions supplemented by progressive gear research to reduce the chance that entanglements will occur, or that whales will be seriously injured or die as a result of an entanglement. The long-term goal of the ALWTRP, as set forth in the 1994 Amendments to the MMPA, is to reduce entanglement related serious injuries and mortality of right, humpback, and fin whales to insignificant levels approaching zero within five years of its implementation. The ALWTRP is an evolving plan, and revisions are made to the regulations as new information and technology become available. Because SI/M of right, humpback, and fin whales have continued to occur due to gear entanglements, new and revised regulatory measures have been issued since the original plan was developed. Despite these measures, entanglements some of which resulted in serious injuries or mortalities continue to occur.

The ALWTRT initially concluded that all parts of gillnet and trap/pot gear can, and have, caused entanglements. Initial measures in the ALWTRP addressed both parts of the gear. Research and testing is ongoing to identify risk reduction measures that are feasible. The most recent regulatory changes have focused on horizontal lines.

The ALWTRP measures vary by designated area that roughly approximate the Federal Lobster Management Areas (FLMAs) designated in the federal lobster regulations. The major requirements of the ALWTRP are:

- No buoy line floating at the surface.
- No wet storage of gear (all gear must be hauled out of the water at least once every 30 days).
- Surface buoys and buoy line need to be marked to identify the vessel or fishery.
- All buoys, floatation devices, and/or weights must be attached to the buoy line with a weak link. This measure is designed so that, if a large whale does become entangled, it could extert enough force to break the weak link and break free of the gear, reducing the risk of injury or mortality.
- All groundline must be made of sinking line.

In addition to gear modification requirements, the ALWTRP prohibits all trap/pot fishing in the Great South Channel from April 1-June 30.

In addition to the regulatory measures recently implemented to reduce the risk of entanglement in horizontal/ground lines, NMFS, in collaboration with the ALWTRT, has developed a strategy to further reduce risk associated with vertical lines.

It is anticipated that the final regulations implementing the vertical line strategy will prioritize risk reduction in areas where there is the greatest co-occurrence of vertical lines and large whales. There are two ways to achieve a reduced risk: (1) maintain the same number of active lines but decrease the risk from each one (not currently feasible), or (2) reduce the number of lines in the water column. A model is being developed and constructed to allow gear configurations to be manipulated and determine what level of risk reduction can be achieved from different gear configuration changes and/or effort reductions by area. This analysis is an integral component of the vertical line strategy that will further minimize the risk of large whale entanglement and associated serious injury and death. The actions and time frame for the implementation of the vertical line strategy are as follows:

- Vertical line model development over the next year for all areas to gather as much information as possible regarding the distribution and density of vertical line fishing gear. Time frame: Completed in 2011;
- Compile and analyze whale distribution and density data in a manner to overlay with vertical line density data. Time frame: Completed in 2011;
- Development of vertical line and whale distribution co-occurrence overlays. Time frame: Completed in 2011;
- Develop and publish proposed rule to implement risk reduction from vertical lines. Time frame: by April 2013;

- Develop and publish final rule to implement risk reduction from vertical lines. Time frame: by April 2014;
- Implement final rule to implement risk reduction from vertical lines.
  Time frame: by January 1, 2015;
- Develop an ALWTRP monitoring plan designed to track implementation of vertical line strategy, including risk reduction.
  Time frame: Completed in 2012.

4.3.1.2 Non-regulatory Components of the ALWTRP

Gear Research and Development

Gear research and development is a critical component of the ALWTRP. The purpose is to identify new ways of reducing the number and severity of protected species-gear interactions while still allowing for fishing activities. Initially, the gear research and development program followed two approaches: (1) work to reduce the number of lines in the water while still allowing fishing, and (2) devise lines that are simultaneously weak enough to allow whales to break free yet strong enough to be used for commercial fishing. Development of gear modifications are ongoing and are primarily used to minimize risk of large whale entanglement.

The ALWTRT has now moved into the next phase with the focus and priority being research to reduce risk associated with vertical lines. This aspect of the ALWTRP is important, because it encourages the participation of industry in the development and testing of modified and experimental gear. Currently, NMFS is developing a co-occurrence risk model to allow us to examine areas of overlap between locations with high whale and vertical line densities. Areas that appear to pose the greatest vertical line entanglement risk will be prioritized as areas needing management. The current schedule would result in a proposed rule for additional vertical line risk reduction to be published in 2013.

NMFS, in consultation with the ALWTRT, is currently developing a monitoring plan for the ALWTRP. While the number of serious injuries and mortalities caused by entanglements is higher than our goals, it is still a relatively small number which makes monitoring difficult. More specifically, a monitoring program would seek to determine if the management measures that became fully effective in April 2009 have resulted in a reduction in entanglement-related serious injuries and mortalities of right, humpback, and fin whales. The NEFSC has identified metrics that will be used to monitor progress and they project that five years of data would be required before a change may be able to be detected. Therefore, data from 2010-2014 would not be analyzed until 2016.

Large Whale Disentanglement Program

Entanglement of marine mammals in fishing gear and/or marine debris is a significant problem throughout the world’s oceans. Along the eastern seaboard of the United States, large-whale entanglement reports have been received of humpback whales and North Atlantic right whales, and, to a lesser extent, fin whales and sei whales. In 1984 the Provincetown Center for Coastal Studies (PCCS) in partnership with NMFS developed a technique for disentangling free-swimming large whales from life threatening entanglements. Over the next decade PCCS and NMFS continued working on the development of the technique to safely disentangle both anchored and free-swimming large whales. In 1995, NMFS issued a permit to PCCS to disentangle large whales.

NMFS and PCCS have established a large-whale disentanglement program, referred to as the Atlantic Large Whale Disentanglement Network (ALWDN). The ALWDN purchases equipment caches (e.g., telemetry equipment) that are located at strategic spots along the Atlantic coastline. These caches support training for fishermen and biologists. This has resulted in an expanded capacity for disentanglement along the Atlantic seaboard including offshore areas.

Memorandums of Agreement have also been issued between NMFS and other federal agencies to increase the resources available to respond to reports of entangled large whales anywhere along the Eastern Seaboard. NMFS has established agreements with many coastal states to collaboratively monitor and respond to entangled whales. As a result of the success of the disentanglement network, NMFS believes whales that may otherwise have succumbed to complications from entangling gear have been freed and survived.

Sighting Advisory System (SAS)
Although the Sighting Advisory System (SAS) was developed primarily as a method of locating North Atlantic right whales and alerting mariners to North Atlantic right whale sighting locations in a real-time manner, the SAS also addresses entanglement threats. Fishermen can obtain SAS sighting reports and make necessary adjustments in operations to decrease the potential for interactions with North Atlantic right whales. Some of these sighting efforts have resulted in successful disentanglement of North Atlantic right whales. The SAS is discussed in greater detail below.

Educational Outreach
Education and outreach activities are considered two of the primary tools to reduce the threats to all protected species from human activities, including fishing activities. Outreach efforts for fishermen under the ALWTRP are fostering a more cooperative relationship between all parties interested in the conservation of threatened and endangered species. NMFS has also been active in public outreach to educate fishermen regarding sea turtle handling and resuscitation techniques. NMFS has conducted workshops with longline fishermen to discuss bycatch issues, including protected species, and to educate them regarding handling and release guidelines. NMFS intends to continue these outreach efforts in an attempt to increase the survival of protected species through education on proper release techniques.

4.3.2 Ship Strike Reduction Program

The Ship Strike Reduction Program is currently focused on protecting North Atlantic right whales, but the operational measures are expected to reduce the incidence of ship strike on other large whales to some degree. The program consists of five 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) continuation of ongoing measures to reduce ship strikes of North Atlantic 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).

4.3.3 Regulatory Measures to Reduce Vessel Strikes to Large Whales

Restricting Vessel Approach to North Atlantic Right Whales
The Recovery Plan for the North Atlantic right whale identified anthropogenic disturbance as one of many factors which had some potential to impede North Atlantic right whale recovery (NMFS 2005a). In one recovery action aimed at reducing vessel-related impacts, including disturbance, NMFS published a proposed rule in August 1996 restricting vessel approach to North Atlantic right whales (61 FR 41116, August 7, 1996) to a distance of 500 yards. Following public comment, NMFS published an interim final rule in February 1997 codifying the regulations at 50 CFR § 224.103. With certain exceptions, the rule prohibits both boats and aircraft from approaching any North Atlantic right whale closer than 500 yards. If a vessel operator finds that he or she has unknowingly approached closer than 500 yards the rule requires that a course be steered away from the whale at slow, safe speed. In addition, all aircraft, except those involved in whale watching activities, are exempted from these approach regulations. This rule is expected to reduce the potential for vessel collisions and other adverse vessel-related effects in the environmental baseline.

Mandatory Ship Reporting System (MSR)
In April 1998, the USCG submitted, on behalf of the United States, a proposal to the International Maritime Organization (IMO) requesting approval of a MSR in the North Atlantic right whale feeding grounds in the Northeast, and the North Atlantic right whale calving grounds in the Southeast. The USCG worked closely with NMFS and other agencies on technical aspects of the proposal. The package was submitted to the IMO's Subcommittee on Safety and Navigation for consideration and submission to the Marine Safety Committee at IMO and approved in December 1998. The USCG and NOAA play important roles in helping to operate the MSR system, which was implemented on July 1, 1999. Ships entering the Northeast and Southeast MSR boundaries are required to report the vessel identity, date, time, course, speed, destination, and other relevant information. In return, the vessel receives an automated reply with the most recent North Atlantic right whale sightings or management areas in the area and information on precautionary measures to take while in the vicinity of North Atlantic right whales.

Vessel Speed Restrictions
A key component of NOAA's North Atlantic right whale ship strike reduction program is the implementation of speed restrictions for vessels transiting the Atlantic EEZ in areas and seasons where North Atlantic right whales predictably occur in high concentrations. The Northeast Implementation Team (NEIT)-funded "Recommended Measures to Reduce Ship Strikes of North Atlantic right whales" found that seasonal speed and routing measures could be an effective means of reducing the risk of ship strike along the U.S. East Coast. Based on these recommendations, NMFS published an Advance Notice of Proposed Rulemaking (ANPR) in June 2004 (69 FR 30857; June 1, 2004), and subsequently published a proposed rule on June 26, 2006 (71 FR 36299; June 26, 2006). NMFS published a final rule on October 10, 2008, to

implement a 10-knot speed restriction for all vessels 65 ft (19.8 m) or longer in SMAs along the East Coast at certain times of the year (73 FR 60173, October 10, 2008; 50 CFR § 224.105). The rule expires five years from the date of effectiveness. During the five years the rule is in effect, NOAA will analyze data on ship-whale interactions and review the economic consequences to determine potential further steps regarding the rule.

Vessel Routing Measures to Reduce the Co-occurrence of Ships and Whales
Another critical, non-regulatory component of NOAA's North Atlantic right whale ship strike reduction program involves the development and implementation of routing measures that reduce the co-occurrence of vessels and North Atlantic right whales, thus reducing the risk of vessel collisions. Recommended routes were developed for the Cape Cod Bay feeding grounds and Southeast calving grounds by overlaying North Atlantic right whale sightings data on existing vessel tracks and plotting alternative routes where vessels could expect to encounter fewer North Atlantic 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.

Through a joint effort between NOAA and the USCG, the United States also submitted a proposal to the IMO to shift the northern leg of the existing Boston Traffic Separation Scheme (TSS) 12 degrees to the north. Overlaying sightings of North Atlantic right whales and all baleen whales on the existing TSS revealed that the existing TSS directly overlaps with areas of high whale densities, while an area slightly to the north showed a considerable decrease in sightings. Separate analyses by the SBNMS and the NEFSC both indicated that the proposed TSS would overlap with 58 percent fewer North Atlantic right whale sightings and 81 percent fewer sightings of all large whales, thus considerably reducing the risk of collisions between ships and whales. The proposal was submitted to the IMO in April 2006, and was adopted by the Maritime Safety Committee in December 2006. The shift took effect on July 1, 2007. In 2009, this TSS was modified by narrowing the width of the north-south portion by one mile to reduce the threat of ship collisions with endangered North Atlantic right whales and other whale species.

In 2009, NOAA and the USCG established the Great South Channel as an Area to be Avoided (ATBA). This is a voluntary, seasonal, ATBA for ships weighing 300 gross tons or more. The ABTA will be in effect each year from April 1 to July 31, when North Atlantic right whales are known to congregate around the Great South Channel. Implementing this ATBA, coupled with narrowing the TSS by one nautical mile, will reduce the relative risk of North Atlantic right whale ship strikes by an estimated 74 percent during April-July (63 percent from the ATBA and 11 percent from the narrowing of the TSS).

Sighting Advisory System (SAS)
The North Atlantic right whale 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 North Atlantic right whales and to alert mariners to North Atlantic right whale sighting locations in a near real-time manner. The SAS surveys and opportunistic sightings reports document the presence of North Atlantic right whales and are provided to mariners via fax, e-

mail, NAVTEX, Broadcast Notice to Mariners, NOAA Weather Radio, several web sites, and the traffic controllers at the Cape Cod Canal. Fishermen and other vessel operators can obtain SAS sighting reports and make necessary adjustments in operations to decrease the potential for interactions with North Atlantic right whales. The SAS has also served as the only form of active entanglement monitoring in the Cape Cod Bay and Great South Channel feeding areas. Some of these sighting efforts have resulted in successful disentanglement of North Atlantic right whales. SAS flights have also contributed sightings of dead floating animals that can occasionally be retrieved to increase our knowledge of the biology of the species and effects of human impacts.

In 2009, with the implementation of the new ship strike regulations and the Dynamic Management Area (DMA) program (described below), the SAS alerts were modified to provide current SMA and DMA information to mariners on a weekly basis in an effort to maximize compliance with all active North Atlantic right whale protection zones.

Dynamic Management Area (DMA) Program

The DMA program was initiated in December 2008 as a supplement to the ship speed regulations discussed above. The program implements dynamic vessel traffic management zones in order to provide protection for unpredictable aggregations of North Atlantic right whales that occur outside of SMAs. When NOAA aerial surveys or other reliable sources report aggregations of three or more North Atlantic 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, e-mail distribution lists, and the North Atlantic right whale SAS. NOAA requests that mariners route around these zones or transit through them at 10 knots or less. Compliance with these zones is voluntary.

4.3.4 Marine Mammal Health and Stranding Response Program (MMHSRP)

NMFS was designated the lead agency to coordinate the MMHSRP which was formalized by the 1992 Amendments to the MMPA. The program consists of the following components:

- All coastal states established volunteer stranding networks and are authorized through Letters of Authority from NMFS regional offices to respond to marine mammal strandings.
- Biomonitoring to help assess the health and contaminant loads of marine mammals, but also to assist in determining anthropogenic impacts on marine mammals, marine food chains, and marine ecosystem health.
- The Analytical Quality Assurance was designed to ensure accuracy, precision, level or detection, and intercomparability of data in the chemical analyses of marine mammal tissue samples.
- NMFS established a Working Group on Marine Mammal UMEs to provide criteria to determine when a UME is occurring and how to direct responses to such events. The group meets annually to discuss many issues including recent mortality events involving endangered species both in the United States and abroad.

- The National Marine Mammal Tissue Bank provides protocols and techniques for the long-term storage of tissues from marine mammals for retrospective contaminant analyses. Additionally, a serum bank and long-term storage of histopathology tissue are being developed.

4.4 Status of Sea Turtles in the Action Area

The five species of sea turtles that occur in the action area are all highly migratory. NMFS believes that no individual members of any of the species are likely to be year-round residents of the action area. Individual animals will make migrations into nearshore waters as well as other areas of the North Atlantic Ocean, including the Gulf of Mexico and the Caribbean Sea. Therefore, the status of the five species of sea turtles in the Atlantic (see Section 3) most accurately reflects the species' status within the action area.

4.5 Factors Affecting Sea Turtles and Their Environment in the Action Area

In recent years, NMFS has undertaken several 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 takes in the fishing and shipping industries and other activities such as COE dredging operations. The summaries below address anticipated sources of incidental take of sea turtles and include only those federal actions in the U.S. Atlantic, Caribbean, and Gulf of Mexico EEZ, which have already concluded formal section 7 consultation.

4.5.1 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: American lobster, Atlantic bluefish, Atlantic herring, Atlantic mackerel/squid/butterfish, Atlantic sea scallop, Atlantic swordfish/tuna/shark/billfish, Caribbean reef fish, Caribbean spiny lobster, coastal migratory pelagic, dolphin/wahoo, Gulf of Mexico reef fish, Gulf of Mexico and South Atlantic spiny lobster, monkfish, Northeast multispecies, red crab, skate, South Atlantic snapper-grouper, Southeast shrimp trawl, spiny dogfish, summer flounder/scup/black sea bass, and tilefish fisheries. An ITS has been issued for the take of sea turtles in each of these fisheries (Appendix 4). A brief summary of each fishery is provided below, but more detailed information can be found in the respective biological opinions.

American Lobster Trap Fishery

The American lobster trap fishery has been identified as causing injuries to and mortality of loggerhead and leatherback sea turtles as a result of entanglement in buoy lines of the pot/trap gear (NMFS 2002b). Loggerhead or leatherback sea turtles caught/wrapped in the buoy lines of lobster pot/trap gear can die as a result of forced submergence or incur injuries leading to death as a result of severe constriction of a flipper from the entanglement. Given the seasonal distribution of loggerhead sea turtles in Mid-Atlantic and New England waters and the operation of the lobster fishery, loggerhead sea turtles are expected to overlap with the placement of lobster pot/trap gear in the fishery during the months of May through October in waters off of New Jersey through Massachusetts. Compared to loggerheads, leatherback sea turtles have a similar seasonal distribution in Mid-Atlantic and New England waters, but with a more extensive distribution in the Gulf of Maine (Shoop and Kenney 1992; James et al. 2005). Therefore, leatherback sea turtles are expected to overlap with the placement of lobster pot/trap gear in the fishery during the months of May through October in waters off of New Jersey through Maine.

Given the distribution of lobster fishing effort, leatherback sea turtles are the most likely sea turtle to be affected since this species occurs regularly in Gulf of Maine waters. The most recent biological opinion for this fishery, completed on August 13, 2012, concluded that operation of the federally-regulated portion of the lobster trap fishery may adversely affect loggerhead and leatherback sea turtles as a result of entanglement in the groundlines and/or buoy lines associated with this type of gear. An ITS was issued with the 2012 opinion, exempting the annual incidental take (lethal or non-lethal) of 1 loggerhead sea turtles and the annual incidental take (lethal or non-lethal) of 5 leatherback sea turtles (NMFS 2012b).

Atlantic Bluefish Fishery

The fishery been operating in the U.S. Atlantic 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 2005a). This fishery is known to interact with loggerhead sea turtles, given the time and locations where the fishery occurs. Gillnets and bottom otter trawls are the predominant gear types used in the commercial bluefish fishery (MAFMC 2009). In 2006, gillnet gear accounted for 32.4 percent of the total commercial trips targeting bluefish, and landed 72 percent of the commercial catch for that year (MAFMC 2007a). Bottom otter trawls accounted for 44 percent of the total commercial trips targeting bluefish and landed 20.4 percent of the catch (MAFMC 2007a).

The most recent formal consultation on the bluefish fishery was completed on October 29, 2010. An ITS was provided with the 2010 opinion along with non-discretionary RPMs to minimize the impacts of incidental take. For trawl gear, NMFS anticipated up to 3 loggerheads takes annually with up to 2 lethal takes, based on a 5-year average. For gillnet gear, NMFS anticipated up to 79 annual takes with up to 32 of those takes being lethal, based on a 5-year average. The ITS also exempted 4 leatherbacks, 4 Kemp’s ridleys, and 5 green sea turtles in bluefish gear (NMFS 2010f).

The incidental take estimates in the 2010 opinion were based on observed interactions from Sea Sampling data for gear types targeting or capable of catching bluefish (NMFS 1999b). The anticipated incidental take of loggerhead sea turtles was estimated from annual bycatch reports published by Murray (2006, 2008). At the time of the 2010 opinion, the bluefish fishery was believed to interact with these species given the time and locations where the fishery occurred. Although no incidental takes of ESA-listed sea turtles had been reported in bottom otter trawl gear for trips that were 'targeting' bluefish,[21] incidental takes of loggerhead and Kemp's ridley sea turtles were observed in bottom otter trawl gear where bluefish were caught but constituted less than 50 percent of the catch (NMFS 1999b).

Warden (2011) has produced a new estimate of loggerhead sea turtle bycatch in bluefish bottom otter trawl gear, based on Northeast Fisheries Observer Program (NEFOP) data from 1996-2008 and VTR days fished. The new estimate indicated the average annual bycatch of loggerhead sea turtles in bluefish bottom otter trawl gear between 2005-2008 was 4 per year (Warden 2011).

Although NMFS was not aware until 2003 that sea turtle interactions with fishing gear targeting bluefish were likely to occur, there is no information to suggest that sea turtle interactions with bluefish fishing gear are a new event or are occurring at a greater rate than what has likely occurred in the past. To the contrary, the methods used to detect any sea turtle interactions with bluefish fishing gear were insufficient prior to increased observer coverage in recent years. In addition, there have been no known changes to the seasonal distribution of loggerhead sea turtles in the U.S. Atlantic (CeTAP 1982, Lutcavage and Musick 1985, Keinath et al. 1987, Thompson 1988, Shoop and Kenney 1992, Burke et al. 1993, 1994) with the exception of recent studies (Morreale et al. 2005, Mansfield 2006), which suggest a decrease rather than an increase in the use of some Mid-Atlantic loggerhead foraging areas for unknown reasons. Regardless, the number of incidental takes anticipated in 2010 opinion for bluefish bottom otter trawl gear has been exceeded; this represents new information on the effects of the bluefish fishery on ESA-listed sea turtles. Formal consultation on the bluefish fishery was reinitiated on February 6, 2012, to reevaluate the effects of the fishery on ESA-listed whales and sea turtles, and the newly listed Atlantic sturgeon. The consultation is ongoing.

Atlantic Herring Fishery

Section 7 consultation was completed on the Atlantic herring fishery on September 17, 1999 (NMFS 1999c). This fishery is managed under the Northeast Atlantic Herring FMP, which was implemented on December 11, 2000. NMFS concluded that authorization of the federal herring fishery under the Atlantic Herring FMP may adversely affect green, Kemp's ridley, leatherback, and loggerhead sea turtles, but was not likely to jeopardize their continued existence. Purse seines, mid-water trawls (single), and pair trawls are the three primary gears involved in the Atlantic herring fishery (NEFMC 2006). Since 2000, pair trawl gear has accounted for the majority of herring landed each year (NEFMC 2006). Although there is no direct evidence of takes of ESA-listed species in this fishery from NMFS' sea sampling program, observer coverage of this fishery has been minimal. An ITS for sea turtles was provided with the biological opinion, based on the observed capture of sea turtles in other fisheries using comparable gear. Consultation on the Atlantic herring fishery was reinitiated on March 23, 2005, and concluded informally.

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[21] Bluefish trips were defined as trips were greater than 50% of the catch was bluefish

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, 2003). The fishery operates in areas and at times that it has traditionally operated and uses traditionally fished gear (NEFMC 1982, 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 2007). 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 recently completed a Section 7 consultation on the Atlantic sea scallop fishery (NMFS 2008b). 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. 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 that sea turtle interactions with scallop fishing gear were occurring, there is no information to suggest that sea turtle interactions with scallop fishing gear 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, while only quantified and recognized within the last few years, has been present for decades.

Formal Section 7 consultation on the continued operation of the scallop fishery was last reinitiated on April 3, 2007, with an opinion issued 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. The ITS anticipated incidental take of up to 929 loggerheads biennially (up to 595 may be lethal) in scallop dredge gear and 154 loggerheads annually (up to 20 may be lethal) in scallop trawl gear. The number of loggerhead sea turtles expected to be killed or suffer serious injuries because of interactions with scallop dredge gear is based on data collected in the 2003 fishing year, prior to the use of chain mats. Therefore, while the estimated 595 loggerhead incidental takes, biennially, resulting in immediate death or serious injury is based on the best currently available information, it is also likely a worst case scenario. RPMs to minimize the impact of these incidental takes are also included in the opinion, including an RPM to limit scallop dredge fishing effort in the Mid-Atlantic area (NMFS 2008b), to be in effect by FY 2010. Measures to minimize the impact of turtle takes were implemented for FY 2010 through Framework 21 to the Scallop FMP and will be re-evaluated in future Frameworks.

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 2004a) 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 RPAs were implemented allowing for the continued authorization of the pelagic longline fishing that would not jeopardize leatherback sea turtles.

HMS Atlantic Shark Fisheries
Section 2.1 provides an overview of the history of the existing Atlantic shark fisheries and there management by NMFS under the HMS Consolidated FMP. The current Atlantic shark fisheries and their proposed continued authorization is, in part, the subject of this consultation and so is not part of the environmental baseline. However, the past and current effects of shark fishing are part of the environmental baseline. 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 consulted formally twice on effects of HMS shark fisheries on sea turtles (i.e., NMFS 2003c and NMFS 2008c). Both bottom longline and gillnet are known to adversely affect sea turtles. From 2007-2011, the sandbar shark research fishery had 100 percent observer coverage and with 4-6 percent 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 five 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 percent observer coverage requirement those observed takes were not extrapolated (Carlson and Richards 2011).

The most recent ESA Section 7 consultation was completed on May 20, 2008, on the continued operation of those fisheries and Amendment 2 to the Consolidated HMS FMP (NMFS 2008c). The consultation concluded the proposed action was not likely to jeopardize the continued existence of sea turtles. An ITS was provided authorizing two takes (one of which could be lethal) of each species for green, hawksbill, and Kemp's ridley every three years. The opinion also authorized the take of 74 (47 of which could be lethal) leatherback and 679 (346 of which could be lethal) loggerhead sea turtles.

Caribbean Reef Fish Fishery
NMFS completed and ESA Section 7 consultation on the Caribbean reef fish fishery, on October 4, 2011. The reef fish fishery in waters around Puerto Rico and the USVI uses pots and traps, hook and line, longline, and spearguns. The fishery targets snapper and groupers, as well as

herbivorous fish (i.e., parrotfish and surgeonfish). The opinion concluded that the fishery was likely to adversely affect green, hawksbill, and leatherback sea turtles via vessel strikes and entanglements in fishing gear, but would not jeopardize their continued existence; an ITS was issued authorizing incidental take

Caribbean Spiny Lobster Fishery

The spiny lobster fishery in waters around Puerto Rico and the USVI occurs with pots and traps, and hand-harvest. Due to the predominance of fishable habitat in state waters, it is assumed that most of the commercial harvest occurs in state waters, but fishery statistics do not allow accurate separation of harvest in the EEZ from harvest in state waters (Matos-Caraballo 2002). NMFS completed a formal consultation on the fishery on December 12, 2011 (NMFS 2011b). The opinion concluded that the continued operation of the fishery was likely to adversely affect leatherback, green, and hawksbill sea turtles; those effects were not likely to jeopardize the continued existence of any species; an ITS for sea turtles was issued.

Coastal Migratory Pelagics Fishery

NMFS recently 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, hook-and-line, gillnet, and cast net gears are used. Gillnets are the primary gear type used by commercial fishermen in the South Atlantic regions as well, while the recreational sector uses hook-and-line gear. The hook-and-line effort is primarily trolling. The biological opinion concluded that green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles may be adversely affected by operation of the fishery. However, the proposed action was not expected to jeopardize the continued existence of any of these species and an ITS was provided.

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 percent 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 2003d). 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.

Gulf of Mexico Reef Fish Fishery

The Gulf of Mexico reef fish fishery uses two basic types of gear: spear or powerhead, and hook-and-line gear. Hook-and-line gear used in the fishery includes both commercial bottom longline and commercial and recreational vertical line (e.g., handline, bandit gear, rod-and-reel).

Prior to 2008, the reef fish fishery was believed to have relatively moderate level of sea turtle bycatch attributed to the hook-and-line component of the fishery (i.e., approximately 107 captures and 41 mortalities annually, all species combined, for the entire fishery) (NMFS 2005c). In 2008, SEFSC observer programs and subsequent analyses indicated that the overall amount and extent of incidental take for sea turtles specified in the incidental take statement of the 2005 opinion on the reef fish fishery had been severely exceeded by the bottom longline component of the fishery (approximately 974 captures and at least 325 mortalities estimated for the period July 2006-2007).

In response, NMFS published an emergency rule prohibiting the use of bottom longline gear in the reef fish fishery shoreward of a line approximating the 50-fathom depth contour in the eastern Gulf of Mexico, essentially closing the bottom longline sector of the reef fish fishery in the eastern Gulf of Mexico for six months pending the implementation of a long-term management strategy. The Gulf of Mexico Fishery Management Council (GMFMC) developed a long-term management strategy via a new amendment (Amendment 31 to the Reef Fish FMP). The amendment included a prohibition on the use of bottom longline gear in the Gulf of Mexico reef fish fishery, shoreward of a line approximating the 35-fathom contour east of Cape San Blas, Florida, from June through August; a reduction in the number of bottom longline vessels operating in the fishery via an endorsement program and a restriction on the total number of hooks that may be possessed onboard each Gulf of Mexico reef fish bottom longline vessel to 1,000, only 750 of which may be rigged for fishing.

On October 13, 2009, SERO completed an opinion that analyzed the expected effects of the continued operation of the Gulf of Mexico reef fish fishery under the changes proposed in Amendment 31 (NMFS-SEFSC 2009). The opinion concluded that sea turtle takes would be substantially reduced compared to the fishery as it was previously prosecuted, and that operation of the fishery would not jeopardize the continued existence of any sea turtle species. Amendment 31 was implemented on May 26, 2010. In August 2011, consultation was reinitiated to address the DWH oil release event and potential changes to the environmental baseline. Reinitiation of consultation was not related to any material change in the fishery itself, violations of any terms and conditions of the 2009 opinion, or an exceedance of the incidental take statement. The resulting September 30, 2011 opinion concluded the continued operation of the Gulf of Mexico reef fish fishery is not likely to jeopardize the continued existence of any listed sea turtles (NMFS 2011c).

Gulf of Mexico/South Atlantic Spiny Lobster Fishery

NMFS completed a section 7 consultation on the Gulf and South Atlantic Spiny Lobster FMP on August 27, 2009 [i.e., (NMFS 2009)]. The commercial component of the fishery consists of diving, bully net and trapping sectors; recreational fishers are authorized to use bully net and hand-harvest gears. Of the gears used, only traps are expected to result in adverse effects on sea turtles. The consultation determined the continued authorization of the fishery would not jeopardize any listed species. An ITS was issued for takes in the commercial trap sector of the fishery. Fishing activity is limited to waters off south Florida and, although the FMP does authorize the use of traps in federal waters, historic and current effort is very limited. Thus, potential adverse effects on sea turtles are believed to also be very limited (e.g., no more than a couple sea turtle entanglements annually).

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 MAFMC, under the Monkfish FMP (NEFSC 2005b). The current commercial fishery operates primarily in 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 meters with concentrations between 70 and 100 meters and at 190 meters. 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 of 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-inch (20.3 cm) stretched mesh, in federal waters (3-200 nautical miles) 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.

A Section 7 consultation conducted in 2001 concluded that the operation of the fishery may adversely affect sea turtles, but was not likely to jeopardize their continued existence. In 2003, proposed changes to the Monkfish FMP led to reinitiation of consultation to determine the effects of those actions on ESA-listed species. The resulting biological opinion concluded the continued operation of the fishery under the proposed changes was likely to adversely affect green, Kemp's ridley, loggerhead and leatherback sea turtles, but were not likely to jeopardize their continued existence (NMFS 2003e). Although the estimated capture of sea turtles in monkfish gillnet gear is relatively low, there is concern that much higher levels of interaction could occur.

In 2006, NEFSC released a reference document that reported on the annual estimated taking of loggerhead sea turtles in bottom-otter trawl gear fished in Mid-Atlantic waters during the period of 1996-2004 (Murray 2006). As a follow-up, and in response to a request from the NER, the bycatch rate identified in Murray 2006 was used to estimate the take of loggerhead sea turtles in all fisheries (by FMP group) using bottom otter trawl gear fished in Mid-Atlantic waters during the period of 2000-2004 (Murray 2008) This new report on the capture of loggerhead sea turtles in the monkfish fishery led to reinitiation of consultation. The resulting biological opinion, issued on October 29, 2010, concluded the continued operation of the monkfish fishery under the proposed changes was likely to adversely affect green, Kemp's ridley, loggerhead and leatherback sea turtles, but was not likely to jeopardize their continued existence. The ITS issued with the 2010 opinion exempted the annual incidental take of up to 2 loggerheads over a 5-year average in trawl gear, of which up to 1 per year may be lethal. The ITS also exempted 4 leatherbacks, 4 Kemp's ridleys, and 5 green sea turtles in monkfish gear (NMFS 2010g). Warden (2011) estimated the loggerhead sea turtle bycatch in monkfish bottom otter trawl gear between 2005-2008 has not exceeded the ITS for the species (Warden 2011). Information on loggerhead bycatch in monkfish gillnet gears for the same period is not currently available.

Northeast Multispecies Fishery

The Northeast multispecies fishery operates throughout the year, with peaks in the spring and from October through February. Multiple gear types are used in the fishery including sink gillnet, trawl, and pot/trap gear, which are known to be a source of injury and mortality loggerhead and leatherback sea turtles as a result of entanglement and capture in the gear (NMFS 2001a). The Northeast multispecies sink gillnet fishery has historically occurred from the periphery of the Gulf of Maine to Rhode Island in water as deep as 360 feet. In recent years, more of the effort in the fishery has occurred in offshore waters and into the Mid-Atlantic. Participation in this fishery has declined since extensive groundfish conservation measures have been implemented; particularly since implementation of Amendment 13 to the Multispecies FMP. Additional management measures (i.e., Framework Adjustment 42) are expected to have further reduced effort in the fishery. The exact relationship between multispecies fishing effort and the number of endangered species interactions with gear used in the fishery is unknown. However, in general, less fishing effort results in less time that gear is in the water and therefore less opportunity for sea turtles or cetaceans to be captured or entangled in multispecies fishing gear.

A June 14, 2001, biological opinion evaluated the impacts of the multiple gear types used in the Northeast multispecies fishery on ESA-listed species (NMFS 2001b). Data indicated that sink gillnet gear has taken loggerhead and leatherback sea turtles. In August 2007, NMFS received an estimate of loggerhead sea turtle takes in bottom otter trawl gear used in the Northeast multispecies fishery (Memo from K. Murray, NEFSC to L. Lankshear, NER, PRD). Using VTR data from 2000-2004 and the average annual bycatch of sea turtles as described in Murray (2006), the average annual bycatch of loggerhead sea turtles in bottom otter trawl gear used in the Northeast multispecies fishery was estimated to be 43 loggerhead sea turtles a year (Memo from K. Murray, NEFSC to L. Lankshear, NER, PRD). This information reveals effects of the multispecies fishery on sea turtles that were not previously considered in the June 2001 opinion and consultation was reinitiated (NMFS 2010h).

The resulting biological opinion, issued on October 29, 2010, concluded the continued operation of the NE multispecies fishery under the proposed changes was likely to adversely affect green, Kemp’s ridley, loggerhead and leatherback sea turtles, but was not likely to jeopardize their continued existence. The ITS issued with the 2010 opinion exempted the annual incidental take of up to 43 loggerheads over a 5-year average in trawl gear, of which up to 19 per year may be lethal. The annual take of up to three loggerheads over a 5-year average in gillnet gear, of which up to two per year may be lethal. The ITS also exempted four leatherbacks, four Kemp’s ridleys, and five green sea turtles in monkfish gear (NMFS 2010h). In 2011, Warden (2011) provided new information of the take loggerheads in NE multispecies bottom trawl gear. Warden (2011) used NEFOP data from 1996-2008 and VTR data on days fished to estimate the average annual bycatch of loggerhead sea turtles in bottom otter trawl gear used in the NE multispecies fishery. Warden (2011) estimated that from 2005-2008, 5 loggerhead sea turtles per year were taken by NE multispecies fishery otter trawl gear.

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 2002a). The opinion concluded that the action was not likely to result in jeopardy to any ESA-listed species under NMFS' jurisdiction. An ITS was provided for leatherback and loggerhead sea turtles. 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 feet al.ong 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.

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). 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. Section 7 consultation on the skate FMP was completed July 24, 2003 (NMFS 2003b), and concluded that authorization of the skate fishery may adversely affect ESA-listed sea turtles as a result of interactions with gillnet and trawl gear.

The anticipated incidental take of loggerhead, leatherback, Kemp's ridley, and green sea turtles in skate fishing gear authorized by the 2003 biological opinion was based on observed captures of sea turtles in analogous trawl and gillnet fisheries (NMFS 2003b). From 2006-2009, the NMFS Northeast Fisheries Science Center (NEFSC) released a number of reference documents and reports (i.e., Murray 2006, 2008, and 2009a) that allowed for an estimate of sea turtles takes that were specific to skate gillnet and trawl gears. NER considered these bycatch estimates to be new information on the effects of the skate fishery on ESA-listed sea turtles and reinitiated consultation to reconsider the effects of the skate fishery on ESA-listed species.

Reinitiation of consultation was completed on October 29, 2010, and concluded that operation of the skate fishery may adversely affect ESA-listed sea turtles as a result of interactions with (capture in) gillnet and trawl gear. The ITS issued with the 2010 opinion exempted the annual incidental take of up to 24 loggerheads over a 5-year average in trawl gear, of which up to 11 per year may be lethal. The annual take of up to 15 loggerheads over a 5-year average in gillnet gear, of which up to 6 per year may be lethal was also authorized via the ITS. The ITS also exempted four leatherbacks, four Kemp's ridleys, and five green sea turtles in skate gear (NMFS 2010i).

Subsequent to the completion of the 2010 opinion, new information estimating loggerhead bycatch in bottom trawl gear was published (i.e., Warden 2011). Using NEFOP data from 1996-2008 applied to VTR days fished, the average annual bycatch of loggerhead sea turtles bottom otter trawl gear used in the skate fishery between 2005-2008 was estimated to be 7 loggerhead sea turtles per year (Warden 2011).

South Atlantic Snapper-Grouper Fishery
A Section 7 consultation on the South Atlantic snapper-grouper fishery (NMFS 2006c) has also recently been completed by NMFS. 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 consultation found only hook-and-line gear likely to adversely affect, green, hawksbill, Kemp's ridley leatherback, and loggerhead sea turtles. The consultation concluded the proposed action was not likely to jeopardize the continued existence of any of these species, and an ITS was provided.

Southeastern Shrimp Trawl Fisheries
Southeast shrimp fisheries target primarily brown, white, and pink shrimp in inland waters and estuaries through the state-regulated territorial seas and in federal waters of the EEZ. As sea turtles rest, forage, or swim on or near the bottom, they are captured by shrimp trawls pulled along the bottom. In 1990, the National Research Council (NRC) concluded that the Southeast shrimp trawl fisheries affected more sea turtles than all other activities combined and was the most significant anthropogenic source of sea turtle mortality in the U.S. waters, in part due to the high reproductive value of turtles taken in this fishery (NRC 1990).

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 2002c).[22] TEDs approved for use have had to demonstrate 97 percent 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 percent 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 2002c) 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 percent for loggerheads and 97 percent for leatherbacks. In February 2003, NMFS implemented the revisions to the TED regulations.

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[22] 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.

On May 9, 2012, NMFS completed the new opinion which 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 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 would not jeopardize the continued existence of any sea turtle species. Sea turtle interactions and captures were estimated to be significantly higher than estimated in the 2002 opinion due to increases in Kemp's ridley and green sea turtle population abundance, incorporation of the TED compliance data and the effects those violations have on expected sea turtle captures rates, and incorporation of interactions in shrimp trawl gear types previously not estimated (i.e. skimmer trawls and try nets). An ITS was provided that used trawl effort and capture rates as proxies for sea turtle take levels. The new biological opinion requires NMFS to minimize the impacts of incidental takes through monitoring of shrimp effort and regulatory compliance levels, conducting TED training and outreach, and continuing to research the effects of shrimp trawling on listed species. NMFS is currently evaluating new skimmer trawl sea turtle bycatch observer data that has been collected since publishing the proposed amendment and will make a final decision on the proposed amendment this fall.

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 one gear type has varied over time (NEFSC 2003). In 2005, 62.1 percent of landings were taken by sink gillnet gear, followed by 18.4 percent in otter trawl gear, 2.3 percent in line gear, and 17.1 percent in gear defined as "other" (excludes drift gillnet gear) (NEFSC 2006). More recently, data from fish dealer reports in FY 2008 indicate that spiny dogfish landings came mostly from sink gill nets (68.2 percent), and hook gear (15.2 percent), bottom otter trawls (4.9 percent), as well as unspecified (7.7 percent) or other gear (3.9 percent) (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.

Section 7 consultation on the continued operation of the fishery under the Spiny Dogfish FMP was reinitiated by NMFS on April 2, 2008. Section 7 consultation on the Spiny Dogfish FMP was completed October 29, 2010, and concluded that operation of the spiny dogfish fishery may adversely affect ESA-listed sea turtles as a result of interactions with (capture in) gillnet and trawl gear. The ITS issued with the 2010 opinion exempted the annual incidental take of up to 1 loggerhead over a 5-year average in trawl gear, which may be lethal or non-lethal and the annual take of up to one loggerhead over a 5-year average in gillnet gear, which may be lethal or non-lethal. The ITS also exempted four leatherbacks, four Kemp's ridleys, and five green sea turtles in spiny dogfish gear (NMFS 2010j). Warden (2011) reports the average annual bycatch of loggerhead sea turtles in spiny dogfish bottom otter trawl gear between 2005-2008 was estimated to be zero loggerhead sea turtles per year. Information of loggerhead bycatch in gillnet gear for the same period is not currently available.

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.

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 on these federal fisheries was completed on October 29, 2010. The opinion concluded that the continued operation of the fishery under the FMP was likely to adversely affect sea turtles, but not jeopardize their continued existence. An ITS was provided with the 2010 opinion along with RPMs to minimize the impacts of incidental take. NMFS anticipates the annual take of up to 62 loggerheads over a 5-year average, of which up to 27 per year may be lethal. The ITS also exempted 2 leatherbacks, 2 Kemp’s ridleys, and 2 green sea turtles in squid/mackerel/butterfish gear (NMFS 2010k). NMFS has reinitiated Section 7 consultation on the continued operation of the mackerel, squid, butterfish fisheries under the Atlantic Mackerel/Squid/Butterfish FMP because of the listing of Atlantic sturgeon; that consultation is on-going.

Summer Flounder, Scup, and Black Sea Bass Fisheries
In the Mid-Atlantic, summer flounder, scup, and black sea bass are managed under one FMP because 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 three species (MAFMC 2007). Gillnets, handlines, dredges, and pots/traps are also occasionally used (MAFMC 2007).

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 fisheries for other species like scup and black sea bass). 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 black sea bass fisheries has also declined since the 1980s and since each fishery 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 black sea bass fishing gear.

In August 2007, NMFS received an estimate of loggerhead sea turtle takes in bottom otter trawl gear used in the summer flounder, scup, black sea bass fisheries (Memo from K. Murray, NEFSC to L. Lankshear, NER, PRD). Using VTR data from 2000-2004 and the average annual bycatch of sea turtles as described in Murray (2006), the average annual bycatch of loggerhead sea turtles in bottom otter trawl gear used in the summer flounder, scup, and black sea bass fisheries was estimated to be 200 loggerhead sea turtles a year (Memo from K. Murray, NEFSC to L. Lankshear, NER, PRD). This information revealed effects of the summer flounder, scup, black sea bass fisheries on sea turtles that were not previously considered (NMFS 2010l).

Section 7 consultation on the continued operation of the fishery under the Summer Flounder, Scup and Black Sea Bass FMP was reinitiated by NMFS on April 2, 2008, and completed October 29, 2010. The consultation concluded that operation of the summer flounder, scup and black sea bass fishery may adversely affect ESA-listed sea turtles as a result of interactions with (capture in) trawl gear. An ITS was provided for the anticipated capture of sea turtles in gear used in the summer flounder, scup, and black sea bass fisheries. It currently exempts the annual incidental take of up to 205 loggerheads over a 5-year average in trawl, pot/trap and gillnet gear, of which up to 85 may be lethal. The ITS also exempted six leatherbacks, four Kemp's ridleys, and five green sea turtles in summer flounder, scup, and black sea bass gear (NMFS 2010l).

Mid-Atlantic Tilefish Fishery

The effects of the Northeast and Mid-Atlantic tilefish fishery on ESA-listed species were considered during formal consultation on the implementation of a new tilefish FMP, concluded on March 13, 2001, with the issuance of a non-jeopardy biological opinion. The opinion included an ITS for leatherback and loggerhead sea turtles (NMFS 2001c). The management unit for the tilefish FMP is all golden tilefish under U.S. jurisdiction in the Atlantic Ocean north of the Virginia/North Carolina border. Tilefish have some unique habitat characteristics and are found in a warm water band (8º-18ºC) approximately 250 to 1,200 feet deep on the outer continental shelf and upper slope of the U.S. Atlantic coast. Because of their restricted habitat and low biomass, the tilefish fishery in recent years has occurred in a relatively small area in the Mid-Atlantic Bight, south of New England and west of New Jersey. Bottom longline gear equipped with circle hooks is the primary gear type used in the tilefish fishery.

4.5.2 Federal Vessel Activity and Operations

Potential sources of adverse effects from federal vessel operations in the action area include operations of the USN and USCG, the EPA, NOAA, and the COE. NMFS has conducted formal consultations with the USCG, the USN, and NOAA on their vessel operations. Through the Section 7 process, where applicable, NMFS has and will continue to establish conservation measures for all these agency vessel operations to avoid or minimize adverse effects to listed species. Currently, they present the potential for some level of interaction. Refer to the biological opinions for the USCG (NMFS 1995) and the USN (NMFS 1996b, 1997b) for details on the scope of vessel operations for these agencies and conservation measures being implemented as standard operating procedures.

The USN consultation only covered operations out of Mayport, Florida, and the potential exists for USN vessels to adversely affect sea turtles when they are operating in other areas within the range of these species. Similarly, operations of vessels by other federal agencies within the action area (NOAA, EPA, COE) may adversely affect sea turtles. However, the in-water activities of those agencies are limited in scope, as they operate a limited number of vessels or are engaged in research/operational activities that are unlikely to contribute a large amount of risk.

4.5.3 Additional Military Activities

Military ordnance detonation also affects listed species of sea turtles. Section 7 consultations were conducted for USN aerial bombing training in the ocean off the southeast U.S. coast, involving drops of live ordnance (500 and 1,000-lb bombs) (NMFS 1997b), and the operation of USCG's boats and cutters in the U.S. Atlantic (NMFS 1995). These consultations determined each activity was likely to adversely affect sea turtles but would not jeopardize their continued existence. An ITS was issued for each activity.

NMFS has also consulted on military training operations conducted by the U.S. Air Force (USAF) and U.S. Marine Corps (USMC). From 1995-2007, three consultations were completed that evaluated the impacts of ordnance detonation during gunnery training or aerial bombing exercises (NMFS 1998c, NMFS 2004b, NMFS 2005b). These consultations determined each activity was likely to adversely affect sea turtles but would not jeopardize their continued existence. An ITS was issued for each activity. A consultation evaluating the impacts from USAF search-and-rescue training operations in the Gulf of Mexico was completed in 1999 (NMFS 1999d). This consultation determined the training operations would adversely affect sea turtles but would not jeopardize their continued existence and an ITS was issued.

4.5.4 Dredging

The construction and maintenance of federal navigation channels and sand mining sites ("borrow areas") has been identified as a source of sea turtle mortality. Hopper dredges in the dredging mode are capable of moving relatively quickly (ca. 3-5 kt) compared to sea turtle swimming speeds) and can thus overtake, entrain, and kill sea turtles as the suction draghead of the advancing dredge overtakes the resting or swimming turtle. Entrained sea turtles rarely survive. NMFS completed regional biological opinions on the impacts of COE's hopper-dredging operation in 1997 for dredging along the South Atlantic (NMFS 1997a) and in 2003 (NMFS 2003f) for operations in the Gulf of Mexico. The Gulf of Mexico opinion determined that dredging there would not adversely affect leatherback sea turtles. That opinion did determine that Gulf of Mexico hopper dredging would adversely affect four sea turtle species (i.e., green, hawksbill, Kemp's ridley, and loggerheads) but would not jeopardize their continued existence. An ITS for those species was issued. The opinion on South Atlantic hopper dredging determined that dredging there would not adversely affect leatherback sea turtles. The opinion did determine hopper dredging in the South Atlantic would adversely affect four sea turtle species (i.e., green, hawksbill, Kemp's ridley, and loggerheads) but would not jeopardize their continued existence. An ITS for those species was issued.

The Sandbridge Shoal is an approved Bureau of Ocean Energy Management [(BOEM), formerly the Minerals Management Service] borrow site located approximately 3 miles off Virginia Beach. This site has been used in the past for both the USN's Dam Neck Annex beach renourishment project and the Sandbridge Beach Erosion and Hurricane Protection Project, and is likely to be used in additional beach nourishment projects in the future. The Sandbridge

Beach Erosion and Hurricane Protection Project involved hopper dredging of approximately 972,000 cubic yards (cy) of sand during the first year of the project and an anticipated 500,000 cy every two years thereafter. NMFS completed Section 7 consultation on this project in April 1993, and anticipated the take of 15 loggerhead turtles or one Kemp's ridley or green turtle throughout the duration of the project. Actual dredging did not begin until May 1998, and no sea turtle takes were observed during the 1998 dredge cycle. In June 2001, the COE indicated that the next dredge cycle, which was scheduled to begin in the summer of 2002, would require 1.5 million cy of sand initially, with an anticipated 1.1 million cy every two years thereafter. Although the volume of sand had increased from the previous cycle, NMFS reduced the ITS to five loggerheads and one Kemp's ridley or green turtle due to the lack of observed takes in the previous cycle, along with information on the levels of anticipated and observed take in hopper dredging projects in nearby locations.

NMFS completed Section 7 consultation on the USN's Dam Neck Annex beach nourishment project in January 1996, which involved the removal of 635,000 cy of material beginning in 1996 and continuing on a 12-year cycle thereafter. NMFS anticipated the take of ten loggerheads and one Kemp's ridley or green sea turtle during each dredge cycle. However, no takes were observed during the 1996 cycle. The USN reinitiated consultation on June 27, 2003, based on an accelerated dredge cycle (from 12 years to 8 years), an increase in the volume of sand required, and new information on the status of loggerhead sea turtles since the original opinion was issued in 1996. The consultation was concluded on December 12, 2003, and anticipated the take of four loggerheads and one Kemp's ridley or green sea turtle during each dredge cycle. NMFS concluded that this level of take was not likely to jeopardize the continued existence of any of these species.

4.5.5 Oil and Gas Exploration

The COE and BOEM issue permits for oil and gas exploration, well development, production, and abandonment/rig removal activities that also may adversely affect turtles. Both these agencies have consulted with NMFS on these activities which include the use of seismic arrays for oil and gas exploration in the Gulf of Mexico, and the explosive removal of offshore structures. Impacts are expected to continue to listed species from vessel strikes, noise, marine debris, and the use of explosives to remove oil and gas structures in the Gulf of Mexico. Following the DWH oil spill in the Gulf of Mexico, BOEM requested reinitiation of consultation on July 30, 2010, on lease sales in the Gulf of Mexico. NMFS and BOEM are coordinating to assess the effects of the spill to the environmental baseline in the Gulf of Mexico, and to evaluate the effects of oil and gas activities on listed species and their critical habitats in light of the DWH incident.

4.5.6 ESA Permits

Regulations developed under the ESA allow for the issuance of permits allowing take of certain ESA-listed species for the purposes of scientific research under section 10(a)(1)(a) of the ESA. In addition, section 6 of the ESA allows NMFS to enter into cooperative agreements with states to assist in recovery actions of listed species. Prior to issuance of these permits, the proposal must be reviewed for compliance with Section 7 of the ESA.

Sea turtles are the focus of research activities authorized by section 10 permits under the ESA. As of January 2012, there were 26 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 non-lethal. 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, issuance of the permit by NMFS must also undergo an ESA Section 7 analysis to ensure the issuance of the permit does not result in jeopardy to the species.

4.5.7 Maritime Industry

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 Sea Turtle Stranding and Salvage Network (STSSN) includes many records of vessel interaction (propeller injury) with sea turtles off Gulf of Mexico 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 minor vessel collisions may not kill an animal directly, but may weaken or otherwise affect it so it is 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.

4.5.8 Marine Pollution

DWH Oil Spill

There is no question that the unprecedented DWH spill and associated response activities (e.g., skimming, burning, and application of dispersants) have resulted in adverse effects on listed sea turtles. During the response phase to the DWH oil spill (April 26 – October 20, 2010) a total of 1,146 sea turtles were recovered, either as strandings (dead or debilitated generally onshore or nearshore) or were collected offshore during sea turtle search and rescue operations (Table 4.2). Subsequent to the response phase a few sea turtles with visible evidence of oiling have been recovered as strandings. While the number of strandings provides little insight into the potential sub-lethal impacts that could reduce long-term survival or fecundity of individuals, it does provide some insight into the potential relative scope of the impact among the sea turtle species in the area. Kemp’s ridley sea turtles may have been the most affected sea turtle species, as they accounted for almost 71 percent of all recovered turtles (alive and dead), and 79 percent of all dead turtles recovered. Green turtles accounted for 17.5 percent of all recoveries (alive and dead), and 4.8 percent of the dead turtles recovered. Loggerheads comprised 7.7 percent of total recoveries (alive and dead) and 11 percent of the dead turtle recovered. The remaining sea turtles were hawksbills and decomposed hardshell turtles that were not identified to species. No leatherbacks were among the sea turtles recovered in the spill response area. (Note: leatherbacks were documented in the spill area, but they were not recovered alive or dead).

Table 4.2. Sea Turtles Documented in the DWH Spill Area

Species	Alive	Dead	Total
Green sea turtle	172	29	201
Hawksbill sea turtle	16	0	16
Kemp's ridley sea turtle	328	481	809
Loggerhead sea turtle	21	67	88
Unknown sea turtle species	0	32	32
Total	537	609	1,146

(Source: http://www.nmfs.noaa.gov/pr/health/oilspill/turtles.htm)

The DWH event and the response to it (e.g., setting booms to protect beaches) may have had unintended effects, such as preventing females from reaching nesting beaches and thereby reducing nesting. However, booms were deployed primarily along the coastlines of Louisiana and Mississippi where little to no sea turtle nesting occurs. Additionally, the oil spill may also have adversely affected hatchling success. On an average nesting year, approximately 700 nests are laid in the Florida Panhandle and up to 80 nests are laid annually in Alabama. Most nests are made by loggerhead sea turtles; however, a few Kemp's ridley and green sea turtle nests were also documented in 2010. Visible nests were marked in an effort to avoid harming them during the response and clean-up activities. To improve nesting success, nests along the northern Gulf of Mexico coast were relocated to the Atlantic.

Other Sources of Marine Pollution

While other 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).

The development of marinas and docks in inshore waters can negatively impact nearshore habitats. Fueling facilities at marinas can sometimes discharge oil, gas, and sewage into sensitive estuarine and coastal habitats. Although these contaminant concentrations do not likely affect the more pelagic waters, the species of turtles analyzed in this biological opinion travel between nearshore and offshore habitats and may be exposed to and accumulate these contaminants during their life cycles.

Fuel oil spills could affect animals directly or indirectly through the food chain. Fuel spills involving fishing vessels are common events. However, 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.

Nutrient loading from land-based sources, such as coastal communities and agricultural operations stimulate plankton blooms in closed or semi-closed estuarine systems. The effects on larger embayments are unknown. An example is the large area of the Louisiana continental shelf with seasonally-depleted oxygen levels (< 2 mg/liter) is caused by eutrophication from both point and non-point sources. The oxygen depletion, referred to as hypoxia, begins in late spring, reaches a maximum in mid-summer, and disappears in the fall. Since 1993, the average extent of mid-summer, bottom-water hypoxia in the northern Gulf of Mexico has been approximately 16,000 km^2, approximately twice the average size measured between 1985 and 1992. The hypoxic zone attained a maximum measured extent in 2002, when it was about 22,000 km^2 which is larger than the state of Massachusetts. This zone was predicted to reach its largest area in 2011 (Rabalais 2010), between 22,253 to 26,515 km^2 (average 24,400 km2; 9,421 mi^2) of the bottom of the continental shelf off Louisiana and Texas. Data on the 2011 season is still being collated. The hypoxic zone negatively impacts sea turtles' habitats, prey availability, and survival and reproductive fitness.

There are studies on organic contaminants and trace metal accumulation in green and leatherback 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. 2008). 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 twelve 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. 1991). 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 on the short- and long-term health and fecundity effects of chlorobiphenyl, organochlorine, and heavy metal accumulation in sea turtles.

4.5.9 Coastal Development

Beachfront development, lighting, and beach erosion control all are ongoing activities along the Mid- and South Atlantic coastlines of the United States. These activities potentially reduce or degrade sea turtle nesting habitats or interfere with hatchling movement to sea. Nocturnal human activities along nesting beaches may also discourage sea turtles from nesting sites. The extent to which these activities reduce sea turtle nesting and hatchling production is unknown. However, more and more coastal counties are adopting stringent protective measures to protect hatchling sea turtles from the disorienting effects of beach lighting.

4.6 Conservation and Recovery Actions Benefiting Sea Turtles

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 and 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 and pound net 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.

4.6.1 Regulations Reducing Threats to Sea Turtles from Fisheries

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 the final rules to implement sea turtle release gear requirements and sea turtle careful release protocols in the Gulf of Mexico reef fish (August 9, 2006; 71 FR 45428) and South Atlantic snapper-grouper fisheries (November 8, 2011; 76 FR 69230). These measures require owners and operators of vessels with federal commercial or charter vessel/headboat permits for Gulf reef fish and 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 TEDs 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. NMFS has required the use of TEDs in southeast United States shrimp trawls since 1989. It has been estimated that TEDs exclude 97 percent 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 also been developed to reduce the take of sea turtles 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 black sea bass). Since 1992, TEDs have been required 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 larger TEDs that are used in the shrimp trawl fishery to exclude leatherbacks, as well as large benthic-immature and sexually mature loggerheads and green sea turtles.

NMFS has also been working to develop a TED that can be effectively used in a type of trawl known as a flynet, which is sometimes used in the Mid-Atlantic and Northeast fisheries to target sciaenids and bluefish. Limited observer data indicate that takes can be quite high in this fishery. A top-opening flynet TED was certified in the summer of 2007, but experiments are still ongoing to certify a bottom-opening TED.

Placement of Fisheries Observers to Monitor Sea Turtle Takes

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 takes, and to determine whether additional measures to address prohibited sea turtle takes may be necessary (72 FR 43176). This rule also extended the number of days NMFS observers could be placed aboard vessels, for 30 to 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-inch stretched mesh, in federal waters (3-200 nautical miles) 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-inch stretched mesh were not allowed in federal waters (3-200 nautical miles) 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. These measures are in addition to Harbor Porpoise Take Reduction Plan measures that prohibit the use of large-mesh gillnets in southern Mid-Atlantic waters (territorial and federal waters from Delaware through North Carolina out to 72º 30'W longitude) from February 15-March 15, annually.

Use of a Chain-Mat Modified Scallop Dredge in the Mid-Atlantic

In response to the observed capture of sea turtles in scallop dredge gear, including serious injuries and sea turtle mortality because of capture, NMFS proposed a modification to scallop dredge gear (70 FR 30660, May 27, 2005). The rule was finalized as proposed (71 FR 50361, August 25, 2006) and required federally permitted scallop vessels fishing with dredge gear to modify their gear by adding an arrangement of horizontal and vertical chains (hereafter referred to as a “chain mat”) between the sweep and the cutting bar when fishing in Mid-Atlantic waters south of 41°9’N from the shoreline to the outer boundary of the EEZ during the period of May 1-November 30 each year. In November 2007, NMFS re-proposed the chain-mat modified dredge requirements in the sea scallop fishery, with some modifications (72 FR 63537). The proposed action clarifies the regulatory text regarding the chain-mat modified gear and adds a transiting provision. The comment period has closed and NMFS is reviewing comments received on this proposed rule. The gear modification is expected to reduce the severity of some sea turtle interactions with scallop dredge gear. However, this modification is not expected to reduce the number of sea turtle interactions with scallop dredge gear.

4.6.2 Other Sea Turtle Conservation Efforts

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 hard-shelled turtles caught in fishing or scientific research gear.

Outreach and Education, Sea Turtle Entanglement, and Rehabilitation
There is an extensive network of STSSN participants along the Atlantic and Gulf of Mexico coasts 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)].

Other Actions
A revised recovery plan for the loggerhead sea turtle was issued January 16, 2009 (NMFS and USFWS 2008). A bi-national recovery plan for the Kemp's ridley sea turtle was completed in September 2011 (NMFS et al. 2011). Recovery teams comprised of sea turtle experts have been convened and are currently working towards revising these plans based upon the latest and best available information.

Five-year status reviews were completed for green, Kemp's ridley, leatherback, and hawksbill sea turtles in 2007 (NMFS and USFWS 2007b, NMFS and USFWS 2007e, NMFS and USFWS 2007c, NMFS and USFWS 2007d); NMFS has reinitiated 5-year status reviews for these species. The most recent status review for loggerhead sea turtles was completed in 2009 (Conant et al. 2009). These reviews were conducted to comply with the ESA mandate for periodic status evaluation of listed species to ensure that their threatened or endangered listing status remains accurate. Each review determined that no delisting or reclassification of a species status (i.e., threatened or endangered) was warranted at this time. However, further review of species data for the green, hawksbill, and leatherback sea turtles was recommended, to evaluate whether distinct population segments (DPS) should be established for these species.

TheServices published a final rule on September 22, 2011, listing loggerhead sea turtles as nine separate DPSs.

4.7 Status of Smalltooth Sawfish within the Action Area

Smalltooth sawfish are not highly migratory species, although some large mature individuals may engage in seasonal north/south movement. The United States DPS of smalltooth sawfish is confined to only a small portion of the action area; smalltooth sawfish greater than 200 cm TL may be found in the southern portion (primarily off Florida) of the action area intermittently throughout the year, spending the rest of their time in shallower waters. Individuals found in the action area can potentially be affected by activities both within the southeast portion of the action area and adjacent nearshore waters. Based on this information, the range-wide status of smalltooth sawfish described in Section 3 most accurately reflects the species' status within the action area.

4.8 Factors Affecting Smalltooth Sawfish within the Action Area

The following analysis examines actions that may affect these species' environment specifically within the action area. The environmental baseline for this opinion includes the effects of several activities affecting the survival and recovery of the smalltooth sawfish in 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, marine pollution, and coastal development.

4.8.1 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 these 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.

4.8.1.1 Federal Fisheries

Gulf of Mexico Reef Fish Fishery
NMFS completed a Section 7 consultation on the continued authorization of the fishery on October 13, 2009 (NMFS 2009c). The fishery uses three basic types of gear: spear and powerhead, trap, and hook-and-line gear. Hook-and-line gear used in the fishery includes both commercial bottom longline and commercial and recreational vertical line (e.g., handline, bandit gear, rod and reel). The biological opinion concluded that smalltooth sawfish may be adversely affected by operation of the fishery. However, the proposed action was not expected to jeopardize the continued existence of this species. An ITS has been provided.

Gulf of Mexico and the South Atlantic Shrimp Trawl Fisheries

NMFS has also conducted Section 7 consultations on the impacts to smalltooth sawfish of the shrimp fisheries in the Gulf of Mexico (NMFS 2006d) and the South Atlantic (NMFS 2005c). Both of these consultations found these fisheries likely to adversely affect smalltooth sawfish, but not likely jeopardize their continued existence. The ITS provided in those biological opinions anticipated the lethal take of up to one smalltooth sawfish annually in each of these two fisheries. 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 has 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. Unlike the previous approach that evaluated the effects of Gulf of Mexico and South Atlantic shrimp fisheries separately, the 2012 opinion evaluated the effects of both fisheries in one opinion. The opinion concluded that the proposed action would not jeopardize the continued existence of the smalltooth sawfish and an ITS was provided (NMFS 2012b).

Coastal Migratory Pelagic Fishery

NMFS completed a Section 7 consultation on the continued authorization of the coastal migratory pelagic fishery in the Gulf of Mexico and South Atlantic (NMFS 2007a). In the Gulf of Mexico, hook-and-line, gillnet, and cast net gears are used. Gillnets are the primary gear type used by commercial fishermen 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 action was not expected to jeopardize its continued existence and an ITS was provided.

HMS Atlantic Shark Fisheries

Section 2.1 provides an overview of the history of the existing Atlantic shark fisheries and there management by NMFS under the HMS Consolidated FMP. The current Atlantic shark fisheries and their proposed continued authorization is, in part, the subject of this consultation and so is not part of the environmental baseline. However, the past and current effects of shark fishing are part of the environmental baseline. 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 consulted formally twice on effects of HMS shark fisheries on sea turtles (i.e., NMFS 2003c and NMFS 2008c). Both bottom longline and gillnet are known to adversely affect smalltooth sawfish. From 2007-2011, the sandbar shark research fishery had 100 percent observer coverage and with 4-6 percent observer coverage in the remaining shark fisheries. During that period, 16 smalltooth sawfish takes were observed on bottom longline gear in the sandbar shark research fishery and 6 were taken outside the research fishery. The six non-research fishery takes were extrapolated to the entire fishery, providing an estimate of 33.3 smalltooth sawfish takes for non-sandbar shark research fishery from 2007-2011 (Carlson and Richards 2011).

The most recent ESA Section 7 consultation was completed on May 20, 2008, on the continued operation of those fisheries and Amendment 2 to the Consolidated HMS FMP (NMFS 2008c).

The consultation concluded the proposed action was not likely to jeopardize the continued existence of smalltooth sawfish. An ITS was provided authorizing 51 takes (one of which one could be lethal) every three years.

South Atlantic Snapper-Grouper Fishery
A Section 7 consultation on the fishery was completed by NMFS on June 7, 2006 (NMFS 2006c). The fishery uses: spear and powerhead, black sea bass pot, and hook-and-line gear. Hook-and-line gear used in the fishery includes both commercial bottom longline and commercial and recreational vertical line (e.g., handline, bandit gear, rod and reel). The consultation concluded the hook-and-line component of the fishery was likely to adversely affect smalltooth sawfish, but was not likely to jeopardize its continued existence. An ITS was issued for takes in the hook-and-line component of the fishery.

Spiny Lobster Fishery
NMFS completed a Section 7 consultation on the Gulf and South Atlantic Spiny Lobster FMP on August 27, 2009 (NMFS 2009d). The commercial component of the fishery consists of diving, bully net and trapping sectors; recreational fishermen are authorized to use bully net, and hand-harvest gears. Of the gears used, traps are expected to result in adverse effects on smalltooth sawfish. However, the consultation determined the continued authorization of the fishery would not jeopardize the species and ITS was issued.

4.8.1.2 ESA Permits

Regulations developed under the ESA allow for the taking of ESA-listed species for scientific research purposes. Prior to issuance of these authorizations for taking, the proposal must be reviewed for compliance with Section 7 of the ESA. There are currently two active research permits issued for the 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 injury of smalltooth sawfish, the activities are not expected to affect the reproduction of the individuals that are caught, nor result in mortality.

4.8.2 State or Private Actions

A significant proportion of the Florida coast has been degraded by inland hydrological projects, urbanization, agricultural activities, and other anthropogenic activities such as dredging, canal development, sea wall construction, and mangrove clearing. These activities have led to the loss and degradation of smalltooth sawfish habitat and may adversely affect their recovery.

The incidental capture of sawfish by private recreational fishermen has been documented in the action area and adjacent nearshore areas. Additionally, lost fishing gear such as line cut after snagging on rocks, or discarded hooks and line, can also pose an entanglement threat to smalltooth sawfish in the area.

4.8.3 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 (Gregg Poulakis pers. comm. 2007). The same sources of pollutants described previously for sea turtles (see Section 4.5.8) may also adversely affect smalltooth sawfish. The impacts of the DWH oil spill on smalltooth sawfish are unknown. Smalltooth sawfish may be adversely affected by oil, but at this time there is no evidence documenting effects on smalltooth sawfish from the DWH oil spill.

4.8.4 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 these gear types. 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). Florida’s ban of the use of shrimp trawls within three nautical miles of the Gulf coast may also aid recovery of this species.

Research, Monitoring, and Outreach

Research, monitoring, and outreach efforts on smalltooth sawfish are providing valuable information on which to base effective conservation management measures. Research on smalltooth sawfish is currently being conducted by NMFS SEFSC and the FWCC, Fish and Wildlife Research Institute, and the Florida Museum of Natural History (FLMNH) at the University of Florida. Surveys are conducted with longlines, gillnets, and seine nets in southwest Florida, as well as in South Florida and the northern Indian River Lagoon. Cooperating fishermen, guides, and researchers are also reporting smalltooth sawfish they encounter. Data collected are providing new insight on the species’ current distribution, abundance, and habitat use patterns.

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 Web sites of the FLMNH,[23] NMFS,[24] and the Ocean Conservancy.[25] Reliable information is also available at websites maintained by noted sawfish expert Matthew McDavitt.[26] These organizations and individuals also educate the public about sawfish status and conservation through regular presentations at various public meetings.

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[23] http://www.flmnh.ufl.edu/fish/Sharks/Sawfish/SRT/srt.htm

[24] http://www.sero.nmfs.noaa.gov/pr/SmalltoothSawfish.htm

[25] http://www.oceanconservancy.org/site/PageServer?pagename=fw_sawfish

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

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). Additionally, a 5-year review of the species status was published in October of 2010. The recovery plan and the 5-year review are available at http://sero.nmfs.noaa.gov/pr/SmalltoothSawfish.htm.

4.9 Status of Atlantic Sturgeon within the Action Area

The five DPSs of Atlantic sturgeon on the East Coast of the United States mix extensively in marine waters (Stein et al. 2004a, Erickson et al. 2011). During various seasons and portions of their life cycles, individual fish will make migrations into rivers, nearshore waters, and offshore waters in the North Atlantic Ocean. Adult and sub-adult (age 2 fish or older) spend a considerable portion of their lives in coastal and marine waters (Collins and Smith 1997, Stein et al. 2004a, ASSRT 2007, Laney et al. 2007, Munro et al. 2007) where they are subject to bycatch mortality by commercial fisheries (Collins et al. 1996, Armstrong and Hightower 2002, Trencia et al. 2002, Stein et al. 2004b, Spear 2007), poor water quality in certain estuaries (Collins et al. 2000b, Dadswell 2006) and other potential threats, such as dams, dredging, and alteration of spawning and foraging habitat (ASSRT 2007, Munro et al. 2007). Because the action area encompasses the entire marine range of Atlantic sturgeon in the United States, the statuses of the five DPSs presented in Section 3.0 of this opinion most accurately reflects the species status within the action area. Likewise, while the following discussion of factors affecting species reflects conditions both inside and outside of the immediate action area, this discussion most accurately reflects those factors acting on Atlantic sturgeon that may occur with the action area.

4.10 Factors Affecting Atlantic Sturgeon in the Action Area

The following analysis examines actions that may affect the species' environment specifically within the action area. The environmental baseline for this opinion includes the effects of several activities affecting the survival and recovery of ESA-listed Atlantic sturgeon in 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 dredging, research, marine pollution and debris, and acoustic impacts.

4.10.1 Federal Actions

NMFS issues federal permits for a number of fisheries and other federal actions, and has undertaken a number of Section 7 consultations to address the effects of those activities on other threatened and endangered species, such as sea turtles. Atlantic sturgeon were not included in those consultations because they were only recently listed; however, each of those consultations sought to minimize the adverse impacts of the action on listed species and some of those conservation measures may benefit Atlantic sturgeon (e.g., the use of TEDs). The summary below of federal actions and the effects these actions have had on Atlantic sturgeon includes only those federal actions in the action area that have already concluded or are currently undergoing formal Section 7 consultation.

4.10.1.1 Fisheries

Atlantic sturgeon are adversely affected by fishing gears used throughout the action area. While a number of different gears are utilized (e.g., gillnet, longline, other types of hook-and-line gear, trawl gear, and pot fisheries), Atlantic sturgeon bycatch mainly occurs in gillnets, with the greatest number of captures and highest mortality rates occurring in sink gillnets. Atlantic sturgeon are also taken in trawl fisheries, though recorded captures and mortality rates are low. For all fisheries for which there is an FMP or for which any federal action is taken to manage that fishery, impacts to listed species have been evaluated under Section 7. Since Atlantic sturgeon have only recently been listed, we are aware of only one federal fishery (Southeastern United States shrimp trawl fishery) that has undergone formal Section 7 consultation to analyze its impacts to the species. However, some estimates of Atlantic sturgeon bycatch in fisheries are available in Stein et al. (2004b), which analyzed 1989-2004 data from the NMFS Sea Sampling/Observer database, and a report on Atlantic sturgeon bycatch in coastal Atlantic commercial fisheries of New England and the mid-Atlantic (ASMFC 2007).

Appendix 5 lists the bycatch estimates from Stein et al. (2004b) for Atlantic sturgeon by FMP and target species taken, from highest bycatch rate to lowest. Similar data (bycatch, number of observed trips, and bycatch rate) were not available for all fisheries; therefore, some target species are not included in the table, though additional data on potential impacts of fisheries on Atlantic sturgeon are discussed below. The number of participants, level of observer coverage, and target species of gillnet and trawl fisheries that may interact with Atlantic Sturgeon are also provided in Appendix 5.

Atlantic Bluefish Fishery
The Atlantic bluefish fishery has been operating in the U.S. Atlantic 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 gears used include otter trawls, gillnets, and hook-and-line. The majority of commercial fishing activity in the North Atlantic and Mid-Atlantic occurs in the late spring to early fall, when bluefish are most abundant in these areas (NEFSC 2005a). Formal consultations on the fishery have been conducted in 1999 and most recently in October 2010. Since the last consultation was completed prior to the listing of Atlantic sturgeon, reinitiation of formal consultations is taking place to evaluate the impacts of the fishery. Observed trips indicate that bluefish trips occasionally interact with Atlantic sturgeon. For 257,215 pounds (lbs) of bluefish landed during observed fishing trips, 169 lbs of Atlantic sturgeon were landed, representing a bycatch rate of 0.000657 lbs of sturgeon/lb of bluefish landed. An additional 116 lbs of Atlantic sturgeon were landed during observed trips landing 11,163 lbs of weakfish and bluefish, for a bycatch rate of 0.010391 lbs of sturgeon/lb of bluefish and weakfish landed.

Atlantic Mackerel/Squid/Butterfish Fisheries
Atlantic mackerel/squid/butterfish fisheries are managed under a single FMP, which was first implemented on April 1, 1983. The most recent biological opinion on these federal fisheries was completed in October 2010. Trawl gear is the primary fishing gear for these fisheries, but several other types of gear may also be used, including hook-and-line, pot/trap, dredge, pound net, and bandit gear. Stein et al. (2004b) reports that during observed butterfish trips 331,064 lbs were landed, along with 265 lbs of Atlantic sturgeon; a bycatch rate of 0.0008 lbs of

sturgeon/lb of butterfish landed. Observer data also indicated 355 lbs of Atlantic sturgeon were taken as bycatch during long fin squid trips that landed 1,826,769 lbs of the target species; a bycatch rate of 0.000194 lbs of Atlantic sturgeon/lb of long fin squid landed. Observers also noted an additional 50 lbs of Atlantic sturgeon bycatch associated with 519,933 lbs of unidentified squid; a bycatch rate of 0.000096 lbs of Atlantic sturgeon/lb of unidentified squid landed. Since the last consultation was completed prior to the listing of Atlantic sturgeon, reinitiation of formal consultations is taking place to evaluate the impacts of the fishery.

Coastal Migratory Pelagic Resources Fisheries

NMFS completed a Section 7 consultation on the continued authorization of the coastal migratory pelagic resources fishery in the Gulf of Mexico and South Atlantic (NMFS 2007b). In the Gulf of Mexico and South Atlantic, commercial fishermen target king and Spanish mackerel with hook-and-line (i.e., handline, rod-and-reel, and bandit), gillnet, and cast net gears. Recreational fishermen in both areas use only rod-and-reel. Trolling is the most common hook-and-line fishing technique used by both commercial and recreational fishermen. Although run-around gillnets accounted for the majority of the king mackerel catch from the late 1950s through 1982, in 1986, and in 1993, handline gear has been the predominant gear used in the commercial king mackerel fishery since 1993 (NMFS 2007b). No Atlantic sturgeon bycatch estimate for this fishery is available. Since the last consultation was completed prior to the listing of Atlantic sturgeon, reinitiation of formal consultations is taking place to evaluate the impacts of 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 MAFMC, under the Monkfish FMP (NEFSC 2005b). The most recent biological opinion on the fishery was completed in October 2010. Monkfish are primarily caught with bottom trawls and gillnets. Dredges also account for a small percentage of landings. The majority (73 percent) of all Atlantic sturgeon bycatch mortality in New England and Mid-Atlantic waters is attributed to the monkfish sink gillnet fishery (ASMFC 2007). Observer data from 2001-2006 shows 224 recorded interactions between the monkfish fishery and Atlantic sturgeon, with 99 interactions resulting in death, a 44 percent mortality rate for Atlantic sturgeon that are taken as bycatch. Earlier data from Stein et al. (2004b) showed 7,975 lbs of Atlantic sturgeon were taken as bycatch during trips landing 1,599,948 lbs of goosefish (monkfish), with a bycatch rate of 0.004984 lbs of Atlantic sturgeon/lb of monkfish landed. Since the last consultation was completed prior to the listing of Atlantic sturgeon, reinitiation of formal consultations is taking place to evaluate the impacts of the fishery.

Northeast Multispecies Fishery

The most recent biological opinion on the Northeast Multispecies Fishery was completed in October 2010. The fishery includes the following species: American plaice, Atlantic cod, Atlantic halibut, Atlantic wolffish, haddock, ocean pout, offshore hake, pollock, redfish, red hake, silver hake, white hake, windowpane flounder, winter flounder, witch flounder, and yellowtail flounder. The Northeast multispecies sink gillnet fishery has historically occurred from the periphery of the Gulf of Maine to Rhode Island in water as deep as 360 feet. In recent years, more of the effort in the fishery has occurred in offshore waters and into the Mid-Atlantic.

Participation in this fishery has declined because extensive groundfish conservation measures have been implemented, the latest of these occurring under Amendment 13 to the Multispecies FMP. A significant reduction in effort in the fishery is expected because of the Amendment 13 measures. Of the species targeted in the Northeast Multispecies Fishery, the Atlantic sturgeon bycatch reported in Stein et al. (2004b) was much higher for red/silver hake and witch flounder than any of the other species. The bycatch rate for red/silver hake was 0.0171 of Atlantic sturgeon/lb of red/silver hake landed; witch flounder had a bycatch rate of 0.0165 of Atlantic sturgeon/lb of witch flounder landed. Appendix 5 lists the bycatch for each of the remaining species managed under the FMP. Since the last consultation was completed prior to the listing of Atlantic sturgeon, reinitiation of formal consultations is taking place to evaluate the impacts of the fishery.

Skate Fishery

The skate fishery has typically been composed of both a directed fishery and an incidental 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). For Section 7 purposes, NMFS considered the effects to ESA-listed species of the directed skate fishery. Fishing effort that contributes to landings of skate for the incidental fishery is considered during Section 7 consultation on the directed fishery in which skate bycatch occurs. The most recent Section 7 consultation on the skate FMP was completed in October 2010. Stein et al. (2004b) reported 105 lbs of Atlantic sturgeon taken as bycatch during observed trips landing 7,008 lbs of winter skate for a bycatch rate of 0.014983 lbs of Atlantic sturgeon/lb of winter skate landed. Since the last consultation was completed prior to the listing of Atlantic sturgeon, reinitiation of formal consultations is taking place to evaluate the impacts of the fishery.

Southeastern Shrimp Trawl Fisheries

On December 2, 2002, NMFS completed an opinion for shrimp trawling in the southeastern United States (NMFS 2002c) under proposed revisions to the TED regulations (68 FR 8456, February 21, 2003). On May 9, 2012, NMFS completed the new biological opinion on the southeastern shrimp fisheries, which included an evaluation of the potential impacts of the fisheries on Atlantic sturgeon. Information considered in the opinion included the North Carolina Division of Marine Fisheries reporting that no Atlantic sturgeon were observed in 958 observed tows conducted by commercial shrimp trawlers working in North Carolina waters (L. Daniel, NCDMF, pers. comm., via public comment on the proposed rule to list Atlantic sturgeon, 2010). In October 2008, six Atlantic sturgeon were reported captured by a shrimp trawler off South Carolina; one fish was dead and the other five were released alive (E. Scott-Denton, NMFS, to J. Lee, NMFS, pers. comm. 2010). An additional Atlantic sturgeon was reported captured by a shrimp trawler off South Carolina in December 2011. The fish passed through the TED and was released alive. Collins et al. (1996) did a study of commercial bycatch of shortnose and Atlantic sturgeon. Based on this and additional information, the 2012 biological opinion concluded that interactions between shrimp trawls and Atlantic sturgeon were likely but many of the animals were likely to survive the interactions. Ultimately, the biological opinion concluded that the proposed action was likely to adversely affect Atlantic sturgeon but would not jeopardize the continued existence of any Atlantic sturgeon DPS, and an ITS for animals from each DPS was issued.

Spiny Dogfish Fisheries
NMFS completed the most recent opinion for the spiny dogfish fishery in October 2010. The primary gear types for the spiny dogfish fishery are sink gillnets, otter trawls, bottom longline, and driftnet gear (NEFSC 2003). Stein et al. (2004b) reported that 3,910 lbs of Atlantic sturgeon were taken as bycatch in observed trips landing 4,126,878 lbs of spiny dogfish; a bycatch rate of 0.000947 lbs of Atlantic sturgeon/lb of landed spiny dogfish. They also reported 2,107 lbs of Atlantic sturgeon taken as bycatch in observed trips landing 1,320,843 lbs of unidentified dogfish; a bycatch rate of 0.001595 lbs of Atlantic sturgeon/lb of unidentified dogfish. More recent observer data from 2001-2006 shows 32 recorded interactions between the dogfish fishery and Atlantic sturgeon, with 5 interactions resulting in death, a 16 percent mortality rate for Atlantic sturgeon that are taken as bycatch (ASMFC 2007). Since the last consultation was completed prior to the listing of Atlantic sturgeon, reinitiation of formal consultations is taking place to evaluate the impacts of the fishery.

Summer Flounder, Scup, and Black Sea Bass Fisheries
The most recent opinion on the fishery was completed in 2010. In the Mid-Atlantic, summer flounder, scup, and black sea bass are managed under a single FMP since these species co-occur and are often caught together. Otter trawl gear is used in the commercial fisheries for all three species. Floating traps and pots/traps are used in the scup and black sea bass fisheries, respectively (MAFMC 2007). Stein et al. (2004b) reported that 1,196 lbs of Atlantic sturgeon were taken as bycatch during observed trip that landed 720,499 lbs of summer flounder; a bycatch rate of 0.001660 lbs Atlantic sturgeon/lb of summer flounder. They also reported 570 lbs of Atlantic sturgeon bycatch in observed trips landing 48,525 lbs of scup; a bycatch rate of 0.011747 lbs of Atlantic sturgeon/lb of scup (Stein et al. 2004b). Since the last consultation was completed prior to the listing of Atlantic sturgeon, reinitiation of formal consultations is taking place to evaluate the impacts of the fishery.

4.10.1.3 Dredging

The construction and maintenance of federal navigation channels has also been identified as a source of mortality of Atlantic sturgeon. 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 Atlantic sturgeon, presumably as the drag arm of the moving dredge overtakes the slower moving fish. Between 1990 and 2005, 10 Atlantic sturgeon were reported captured by hopper dredges (ASSRT 2007). On May 27, 1997, NMFS completed an opinion on the continued hopper dredging of channels and borrow areas in the southeast United States. Atlantic sturgeon were not listed at the time and were not included in the consultation, though it was determined hopper dredging would adversely affect sea turtles. NMFS is currently reinitiating consultation on dredging and beach renourishment activities of the COE, South Atlantic Region, which will address potential effects to Atlantic sturgeon. The new biological opinion is expected to be completed within the next year.

4.10.2 State Actions

4.10.2.1 Scientific Research

Twelve Section 10(a)(1)(A) scientific research permits are currently issued to study Atlantic sturgeon in the rivers of the United States (Table 4.3). Each permit approves sampling methodology and authorizes take. The specific stressors to fish subject to NMFS-issued ESA permit conditions are capture in nets; handling and restraint during examinations; tagging using passive integrated transponder (PIT), internal, and external tags; tissue sampling; anesthetizing; laparoscopy; blood sampling; and gonad biopsy.

Table 4.3 Existing ESA Section 10(a)(1)(A) Permits to Study Atlantic Sturgeon

Permit No.	Location	Authorized Take	Research Activity
16526 Expires: 4/5/2017	Gulf of Maine Rivers and Coastal Areas (GOM DPS)	975 adult/sub-adult & juveniles (2 lethal juv & 1 Adult)	Determine the degree of immigration and emigration and similarity or uniqueness of demographic parameters among Atlantic sturgeon in the Gulf of Maine.
16323 Expires: 4/5/2017	Connecticut Waters & Long Island Sound (New York Bight DPS)	200 adult/sub-adult	Determine abundance and specific habitat use of Atlantic sturgeon in Connecticut waters and correlate movement within and in/out of key areas in Connecticut with environmental variables (temperature, river flow, and dissolved oxygen).
16422 Expires: 4/5/2017	Coastal Waters off Long Island Sound and New Jersey to Delaware River (New York Bight DPS)	285 adult/sub-adult	Develop a multi-State program identifying movements of Atlantic sturgeon among and within marine aggregation areas in the New York Bight DPS.
16436 Expires: 4/5/2017	Hudson River Estuary: NY Harbor to Troy, NY (New York Bight DPS)	925 adult/sub-adult/juv	Development of annual juvenile abundance survey; comparison of diet preference of co-occurring Atlantic and shortnose sturgeon; and annual adult spawning stock survey for Hudson River Atlantic sturgeon.
16507 Expires: 4/5/2017	Delaware River and Delaware Coastal Waters (New York Bight DPS)	500 adult/sub-adult/juv 350 ELS	Provide information on where and when Atlantic sturgeon spawn in the Delaware River; provide a hydroacoustic assessment of their habitat requirements using side scan sonar; document habitat use, behavior and diet in a marine environment; and estimate a Delaware River Estuary vessel-strike carcass reporting rate
16431 Expires: 4/5/2017	Delaware River Estuary (New York Bight DPS)	230 juveniles (1 lethal juvenile)	Define juvenile Atlantic sturgeon abundance and habitat selectivity through telemetry and mark-recapture methods in the Delaware River and Estuary.
16438 Expires: 4/5/2017	Delaware River Estuary (New York Bight DPS)	284 juveniles 50 ELS (1 lethal juvenile	Characterize habitat use, abundance, reproduction, juvenile recruitment, temporal and spatial distribution, and reproductive health of Atlantic sturgeon in the Delaware River and Estuary.
16547 Expires: 4/5/2017	Chesapeake Bay and Rivers (MD & VA) (Chesapeake DPS)	600 adult/sub-adult/juv 25 ELS	Study life history requirements of Atlantic sturgeon in the Chesapeake Bay and tributaries, conduct stock and threat assessments, genetic identification, movement patterns, habitat preference, dredge and vessel interactions

Table 4.3 Existing ESA Section 10(a)(1)(A) Permits to Study Atlantic Sturgeon Con't

Permit No.	Location	Authorized Take	Research Activity
16375 Expires: 4/5/2017	North Carolina Albemarle Sound & Rivers & Cape Fear River (Carolina DPS)	200 adult/sub-adult/juv	Investigation of population dynamics and migration of Atlantic sturgeon captured in North Carolina rivers and coastal waters through mark-recapture and telemetry techniques.
16442 Expires: 4/5/2017	South Carolina Rivers (Carolina & South Atlantic DPS)	350 adult/sub-adult/juv 100 ELS	Investigation of population dynamics and migration of Atlantic sturgeon captured in South Carolina rivers and coastal waters through mark-recapture and telemetry techniques.
16482 Expires: 4/5/2017	Georgia Rivers and Coastal Waters (South Atlantic DPS)	3474 adult/sub-adult/juv (5 lethal juv/1 adult) 250 ELS	Study of abundance, population dynamics, seasonal movement, diet, general ecology and environmental tolerance of Atlantic sturgeon captured in Georgia rivers and coastal waters.
16508 Expires: 4/5/2017	Florida/Georgia Rivers (South Atlantic DPS)	60 adult/sub-adult/juv	Determine presence and population status of Atlantic sturgeon in Florida and Georgia coastal rivers, and through telemetry techniques, determine movement patterns and habitat use.

[a] Early life stage individuals

4.10.3 Other Factors Affecting the Environmental Baseline

Marine Debris and Acoustic Impacts
A number of activities that may indirectly affect listed species in the action area of this consultation include anthropogenic marine debris and acoustic impacts. The impacts from these activities are difficult to measure or even to attribute to federal, state, local, or private actions. Where possible, conservation actions are being implemented to monitor or study impacts from these sources.

Marine Pollution and Environmental Contamination
Anthropogenic sources of marine pollution, while difficult to attribute to a specific federal, state, local or private action, may indirectly affect Atlantic sturgeon in the action area. Sources of pollutants in the action area include atmospheric loading of pollutants such as PCBs; storm water runoff from coastal towns, cities, and villages; and runoff into rivers that empty into bays and groundwater.

Atlantic sturgeon may be particularly susceptible to impacts from environmental contamination due to their benthic foraging behavior and long-life span. Sturgeon using estuarine habitats near urbanized areas may be exposed to numerous suites of contaminants within the substrate. Contaminants, including toxic metals, polychlorinated aromatic hydrocarbons (PAHs), organophosphate and organochlorine pesticides, polychlorinated biphenyls (PCBs), and other chlorinated hydrocarbon compounds can have substantial deleterious effects on aquatic life. Effects from these elements and compounds on fish include production of acute lesions, growth retardation and reproductive impairment (Cooper 1989, Sindermann 1994).

Heavy metals and organochlorine compounds accumulate in sturgeon tissue, but their long-term effects are not known (Ruelle and Henry 1992, Ruelle and Keenlyne 1993). Elevated levels of contaminants, including chlorinated hydrocarbons, in several other fish species are associated with reproductive impairment (Cameron et al. 1992, Longwell et al. 1992, Hammerschmidt et al. 2002, Drevnick and Sandheinrich 2003), reduced egg viability (Von Westernhagen et al. 1981, Giesy et al. 1986, Mac and Edsall 1991, Matta et al. 1997, Billsson et al. 1998), reduced survival of larval fish (Berlin et al. 1981, Giesy et al. 1986), delayed maturity (Jorgensen et al. 2004) and posterior malformations (Billsson et al. 1998). Pesticide exposure in fish may affect antipredator and homing behavior, reproductive function, physiological development, and swimming speed and distance (Beauvais et al. 2000, Scholz et al. 2000, Moore and Waring 2001, Waring and Moore 2004). Moser and Ross (1995) suggested that certain deformities and ulcerations found in Atlantic sturgeon in North Carolina's Brunswick River might be due to poor water quality in addition to possible boat propeller inflicted injuries. It should be noted that the effect of multiple contaminants or mixtures of compounds at sub-lethal levels on fish has not been adequately studied. Atlantic sturgeon use marine, estuarine, and freshwater habitats and are in direct contact through water, diet, or dermal exposure with multiple contaminants throughout their range.

Sensitivity to environmental contaminants varies among fish species and life stages. Early life stages of fish seem to be more susceptible to environmental and pollutant stress than older life stages (Rosenthal and Alderdice 1976). In aquatic toxicity tests (Dwyer et al. 2000), Atlantic sturgeon fry were more sensitive to five contaminants (carbaryl, copper sulfate, 4-nonylphenol, pentachlorophenol, and permethrin) than fathead minnow (*Pimephales promelas*), sheepshead minnow (*Cyprinodon variegatus*), and rainbow trout (*Oncorhynchus mykiss*) - three common toxicity test species - and 12 other species of threatened and endangered fishes. The authors note, that Atlantic sturgeon were difficult to test and conclusions regarding chemical sensitivity should be interpreted with caution.

Another suite of contaminants occurring in fish are metals (mercury, cadmium, selenium, lead, etc.), also referred to as trace metals, trace elements, or inorganic contaminants. Post (1987) states that toxic metals may cause death or sub-lethal effects to fish in a variety of ways and that chronic toxicity of some metals may lead to the loss of reproductive capabilities, body malformation, inability to avoid predation, and susceptibility to infectious organisms.

Dioxin and furans were detected in ovarian tissue from shortnose sturgeon caught in the Sampit River/Winyah Bay system. Results showed that four out of seven fish tissues analyzed contained tetrachlorodibenzo-p-dioxin concentrations greater than 50 pg/g (parts-per-trillion), a level which can adversely affect the development of sturgeon fry (J. Iliff, NOAA, Damage Assessment Center, Silver Spring, MD, unpublished data).

The EPA published its second edition of the National Coastal Condition Report (NCCR II) in 2004, which is a "report card" summarizing the status of coastal environments along the coast of the United States (EPA 2004). The report analyzes water quality, sediment, coastal habitat, benthos, and fish contaminant indices to determine status. In contrast to the Northeast (Virginia-Maine), which received an overall grade of F, the Southeast region (North Carolina-Florida) received an overall grade of B-, which is the best rating in the nation with no indices below a grade of C. Areas of concern that had poor index scores within the action area include were Pamlico Sound and the ACE Basin for water quality, and St. Johns River for sediment. There was also a mixture of poor benthic scores scattered along Southeast region.

4.11 Conservation and Recovery Actions Benefitting Atlantic Sturgeon

State and Federal Moratoria on Atlantic Sturgeon
In 1998, the ASFMC instituted a coast-wide moratorium on the harvest of Atlantic sturgeon, which is to remain in effect until there are at least 20 protected age classes in each spawning stock (anticipated to take up to 40 or more years). NMFS followed the ASMFC moratorium with a similar moratorium on the harvest of Atlantic sturgeon in federal waters. Amendment 1 to ASMFC's Atlantic sturgeon FMP also includes measures for preservation of existing habitat, habitat restoration and improvement, monitoring of bycatch and stock recovery, and breeding/stocking protocols. The recent listing of four Atlantic sturgeon DPSs as endangered, makes harvest of Atlantic sturgeon from these DPSs unlawful regardless of the moratorium. However, the GOM DPS is listed as threatened. Since the DPS is only listed as threatened, taking of the species is lawful under the ESA unless Section 9 take prohibitions are established by NMFS. Thus, these moratoria continue to protect individuals from the GOM DPS.

Use of TEDs in Trawl Fisheries
Atlantic sturgeon benefit from the use of devices designed to exclude other species from trawl nets, such as TEDs. TEDs and bycatch reduction device requirements may reduce Atlantic sturgeon bycatch in Southeast trawl fisheries (ASSRT 2007). 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 to reduce the potential for incidental mortality of sea turtles in commercial trawl fisheries. These regulations have been refined over the years to ensure that TED effectiveness is maximized through more widespread use, and proper placement, installation, floatation, and configuration (e.g., width of bar spacing). NMFS has also been working to develop a TED, which can be effectively used in a type of trawl known as a flynet, which is sometimes used in the Mid-Atlantic and Northeast fisheries to target sciaenids and bluefish. A top-opening flynet TED was certified in the summer of 2007, but experiments are still ongoing to certify a bottom-opening TED. All of these changes may lead to greater conservation benefits for Atlantic sturgeon.

5.0 Effects of the Action

In this section, we assess effects of the proposed action on threatened and endangered species. The analyses in this section form the foundation for our jeopardy analysis in Section 7.0. A jeopardy determination is reached if the proposed action will result in reductions in numbers, reproduction, and/or distribution that would appreciably reduce a listed species' likelihood of surviving and recovering in the wild.

The analyses of the effects of the proposed action in this section are based upon the best available commercial and scientific data. 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 dataset. In cases where uncertainty exists regarding the effects of an action on listed species, the uncertainty is resolved in favor of the species (House Rep. 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 a listed species. This approach provides the “benefit of the doubt” to threatened and endangered species.

Effects of the proposed action on threatened and endangered species include the capture, injury, and/or death of an individual because of interactions with fishing gear. The operation of the smoothhound and Atlantic shark fisheries (i.e., vessel operations, gear deployment, and retrieval) is not expected to affect 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 these fisheries are either suspended in the water column or essentially stationary on the bottom, so they do not affect water column or benthic habitat characteristics. Sea turtles, smalltooth sawfish, large whales, and Atlantic sturgeon do not forage on the fishery’s target species or species commonly caught as bycatch, so prey competition is also not a factor. Based on this information, it is our judgment that sea turtles, smalltooth sawfish, large whales, and Atlantic sturgeon are not likely to be adversely affected by a gear type unless they interact with it. We also assume the potential effects of each gear type are proportional to the number of interactions between the gear and each species.

The operation of fishing vessels used in the smoothhound and Atlantic shark fisheries will have discountable effects on these species. Fishing vessels operate at relatively slow speeds, particularly when towing or hauling gear. Thus, large whales and sea turtles in the path of a fishing vessel would be more likely to have time to move away before being struck. Smalltooth sawfish and Atlantic sturgeon are benthic species spending the vast majority of their time either laying on the bottom, or swimming close to it while in the action area. These behaviors make it extremely unlikely that a smalltooth sawfish or Atlantic sturgeon would be struck by a vessel. Based on this information, it is our judgment that sea turtles, smalltooth sawfish, large whales, and Atlantic sturgeon are not likely to be adversely affected by fishing vessels.

Basic Approach to Assessment

The smoothhound fishery will ultimately be managed as a component of the Atlantic shark fisheries. This biological opinion evaluates the impacts of the existing components of the Atlantic shark fisheries (i.e., bottom longlines and gillnets), as well as the impacts of the new smoothhound fishery (i.e., gillnet gear). Since the effects of smoothhound gear have never been evaluated prior to this opinion, our analysis generally evaluates the potential impacts of this fishery separately from other Atlantic shark fishing. To make this distinction clear our analysis will refer to effects from the “smoothhound fishery” and the “other Atlantic shark fisheries” or “non-smoothhound fisheries.” However, our jeopardy analysis and, if applicable, our ITS, considers both of these fisheries together.

The primary gear types used to directly target smoothhound and Atlantic sharks are bottom longline, gillnets (drift, strike, and sink nets), rod-and-reel, and handline gear (recreational use only). Section 2 describes these gears and how recreational or commercial fishermen use them to target Atlantic sharks and smoothhounds. The type of fishing gear, the area, and the manner in which it is used all affect the likelihood of sea turtle, smalltooth sawfish, large whales, and Atlantic sturgeon interactions. For this reason each gear type is evaluated separately.

In the first part of our effects analysis, we discuss the types of Atlantic shark fishing gear that are not likely to adversely affect ESA-listed species (Section 5.1). Next, we review the potential routes of effect to an individual sea turtle, smalltooth sawfish, large whale, or Atlantic sturgeon if it interacted with Atlantic shark and/or smoothhound fishing gear (Sections 5.2-5.4). Sections 5.2-5.4 also review the factors affecting the likelihood of exposure.

The second part of our analysis quantifies the impact of authorization of the smoothhound fishery and the continued authorization of the other Atlantic shark fisheries on protected species. We used the best available information to estimate the number of ESA-listed species likely captured in the past by the smoothhound and the other Atlantic shark fisheries. In Section 5.5, we use those data to estimate the number of sea turtles and smalltooth sawfish likely captured in the past on shark bottom longline gear. Our focus shifts to the number of sea turtles captures in Atlantic shark (i.e., non-smoothhound) gillnet gear in the past in Section 5.6. In Section 5.7, we estimate the number of smalltooth sawfish captured in the past during recreational fishing for Atlantic sharks. In Sections 5.8-5.10, our analysis estimates the likely number of sea turtles, smalltooth sawfish, Atlantic sturgeon, and large whales captured by smoothhound gillnet gear in the past.

In the third part of the analysis (Section 5.11), we analyze what effect, if any, the federal management of the smoothhound fishery and the continued authorization of the other Atlantic shark fisheries will have on future levels of take; i.e., whether the estimated past take and mortality levels would increase or decrease and by how much, or whether the same levels would continue in the future.

5.1 Shark Fishing Gears Not Likely to Adversely Affect ESA-Listed Species

5.1.1 Effects of Bottom Longline Gear on Large Whales and Atlantic Sturgeon

Shark bottom longline gear is not likely to adversely affect large whales. The shark bottom longline fishery is listed as a Category III fishery under the LOF (76 FR 73912; November 29, 2011). This means the likelihood of interactions with marine mammals is remote [MMPA Section 118 (c)(1)(A)(iii)]. Table 5.19 documents one non-SI/M entanglement of a North Atlantic right whale in bottom longline gear, but it occurred in 2006, off the coast of Canada. Since the inception of the LOF in 1996, no large whale interactions have ever been documented with bottom longline gear, including shark bottom longlines in U.S. waters. For this reason, we believe the likelihood of future entanglements is also extremely unlikely to occur and any possible adverse effects are discountable.

NMFS believes the use of bottom longline gear is not likely to adversely affect Atlantic sturgeon. Because of their diet and feeding mechanism, ESA-listed sturgeons are not likely to feed on baited hooks. Atlantic sturgeon are described generally as eating both plants and animals off the surface of the water bottom. In the marine environment, Atlantic sturgeon feed on mollusks, polychaete worms, gastropods, shrimps, amphipods, isopods, and small fish (Scott and Crossman 1973). These species are not used as bait in the shark bottom longline fishery meaning Atlantic sturgeon are unlikely to be attracted to the gear, minimizing the likelihood of hooking and/or entanglement. For these reasons, we believe adverse effects from this gear are extremely unlikely to occur and are discountable.

5.1.2 Effects of Recreational Shark/Smoothhound Fishing on Large Whales, Sea Turtles, Smalltooth Sawfish, and Atlantic Sturgeon

Effects of Recreational Fishing for Smoothhound on All ESA-Listed Species
In general, smoothhound are considered a nuisance fish by most recreational anglers and very few intentionally target the species. The information available indicates that what little recreational effort there is for the species overwhelmingly occurs in state waters. From 2000-2011, 91 percent of the total number of recreationally landed smoothhound were from state and inland waters; that number increased to over 96 percent from 2007-2011 (MRFSS unpublished data). There is no information to suggest that smoothhound are directly targeted by recreational anglers in federal waters. Based on this information, we believe a federal recreational fishery for smoothhound does not exist and therefore, will not affect ESA-listed species.

Effects of Recreational Fishing for Other Atlantic Sharks on Large Whales
NMFS believes hook-and-line gear used to recreationally target sharks in the EEZ is not likely to adversely affect humpback, fin, or North Atlantic right whales. There has never been a documented interaction between shark recreational fishing gear and a large whale. Recreational fishermen targeting sharks do not use baits that are considered part of a large whale’s diet. The LOF does not classify recreational fisheries, but it does indicate that the “Atlantic Ocean, Gulf of Mexico, Caribbean commercial passenger fishing vessel” (i.e., charter/headboats) are a Category III fishery with no documented interactions with large whales. Additionally, all vessels (including recreational shark fishing vessels) are prohibited from approaching or remaining within 500 yards of a North Atlantic right whale. If underway, a vessel must steer a course away from the North Atlantic right whale and immediately leave the area at a slow safe speed (50 CFR 224.103(c)). While these prohibitions are not required for other large whale species, they are recommended. For all these reasons, we believe the likelihood of adverse effects occurring to humpback, fin, and North Atlantic right whales from recreational fishing for sharks is discountable.

Effects of Recreational Fishing for Other Atlantic Sharks on Sea Turtles
Most sea turtle captures on rod-and-reel are reported to have occurred at fishing piers. Fishing piers are suspected to attract sea turtles that learn to forage there for discarded bait and fish carcasses. Recreational anglers are also known to target sharks from fishing piers. The presence of sea turtles around fishing piers suggests that interactions between recreational shark fishermen and sea turtles are possible. However, the proposed action pertains to the continued authorization of recreational shark fishing in federal waters and we have no data indicating that sea turtles are captured by recreational anglers fishing for sharks, apart from pier fishing and nearshore shark fishing tournaments in state waters.

Most directed shark fishing effort in the action area takes place by trolling or drifting for pelagic sharks. Sea turtles are unlikely to be caught during recreational fishing involving trolled bait, or by drifting through a chum slick. It is especially unlikely that a sea turtle of any size would pursue and capture the bait while it is being trolled behind a vessel.

The 2008 shark opinion discounted effects on sea turtles from recreational shark fishing. A review of the best available information since the completion of that opinion revealed no new records of interactions between recreational shark fishermen and sea turtles fishing in federal waters. Additionally, there is no anecdotal information suggesting that shark fishermen have incidentally captured a sea turtle since the completion of the 2008 opinion. Based on this, we have no basis for changing our 2008 determination that effects on sea turtles from recreational sharking in federal waters are discountable.

Effects of Recreational Fishing for Atlantic Shark on Atlantic Sturgeon
NMFS believes hook-and-line gear used to recreationally target sharks in the EEZ is not likely to adversely affect Atlantic sturgeon. Most directed shark fishing effort in the action area takes place by trolling or drifting for pelagic sharks. Atlantic sturgeon are generally considered a benthic species and not likely to be in the water column where anglers targeting pelagic sharks would set their gear. Additionally, recreational fishermen targeting sharks do not use Atlantic sturgeon prey species as bait (see Section 5.1.1). The feeding habits and prey preferences of the Atlantic sturgeon lead us to believe adverse effects from this gear are discountable.

5.1.3 Bottom Fish Otter Trawl Incidental Harvest of Smoothhound

Smoothhound are occasionally captured incidentally to the harvest of other federally managed species in bottom fish otter trawl gear (BFOT). Since some incidental harvest of smoothhound does occur, the proposed action would allow for the retention of some incidentally caught smoothhound. However, trip limits are likely to be imposed to ensure that any trawl catch of smoothhound remains incidental. The 10 species most frequently landed by BFOT gear are all federally managed species, each managed under a fishery having its own biological opinion. Since the harvest of smoothhound in BFOT gear is incidental to other federally managed fisheries with their own biological opinions, we do not believe the proposed action will cause new adverse effects not previously considered. Therefore, we do not consider the effects of the BFOT gear on ESA-listed species in this opinion.

5.2 Sea Turtle and Smalltooth Sawfish Interactions with Shark Bottom Longline Gear

5.2.1 Shark Bottom Longline Gear Interactions with Sea Turtles

Bottom longline gear is commonly used in the commercial Atlantic shark fisheries and can adversely affect sea turtles via entanglement, hooking, trailing line, and forced submergence. Some sea turtles are still alive at the time of capture and can be released. Others may be dead upon retrieval of the gear as a result of forced submergence. Sea turtles released alive may later succumb to injuries sustained at the time of capture or from exacerbated trauma from fishing hooks or lines that were ingested, entangled, or 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, altered migratory behavior, and altered breeding or reproductive patterns. The following discussion summarizes in greater detail the available information on how individual sea turtles are likely to respond to interactions with bottom longline gear. Most data on sea turtle interactions with longline gear comes from pelagic longline fisheries. However, a small but expanding data pool now exists regarding sea turtle interactions with bottom longline gears.

Entanglement

Sea turtles are particularly prone to entanglement as a result of their body configuration and behavior. Records of stranded or entangled sea turtles reveal that hook-and-line gear can wrap around the neck, flipper, or body of a sea turtle and severely restrict swimming or feeding. 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.

Sea turtles have been found entangled in branchlines (gangions), mainlines, and float lines of longline gear. Observer data from the shark bottom longline fishery indicate sea turtles entangled in longline are most often entangled around the neck and foreflippers (NMFS unpublished data). Entangling gear can interfere with a sea turtle's ability to swim or impair its feeding, breeding, or migration and prevent its surfacing, causing it to drown.

Hooking

In addition to being entangled in hook-and-line gear, sea turtles are also injured and killed by being hooked. Hooking can occur as a result of a variety of scenarios, some depend on the foraging strategies and diving and swimming behavior of the various species of sea turtles. Sea turtles are either hooked externally in the flippers, head, shoulders, armpits, or beak or internally inside the mouth or when the animal has swallowed the bait (E. Jacobson in Balazs et al. 1995). Observer data from the shark bottom longline fishery indicate 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 hard-shelled sea turtles, especially loggerheads (NMFS unpublished data). Internal hooking of leatherback sea turtles is much rarer. For loggerheads, almost all interactions result from taking the bait and hook; only a very small percentage of loggerheads are entangled or foul-hooked externally.

Hooks swallowed by sea turtles are of the greatest concern. Their esophagus is lined with strong conical papillae directed towards the stomach (White 1994). The presence of these papillae in combination with an S-shaped bend in the esophagus make it difficult to see hooks when looking through a sea turtle's mouth, especially if the hooks have been deeply ingested. Because of a sea turtle's digestive structure, deeply ingested hooks are also very difficult to remove without seriously injuring the turtle. A sea turtle's esophagus 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 esophagus or stomach and can pull organs from their connective tissue. These injuries can cause the sea turtle to bleed internally or can result in 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 (E. Jacobson in Balazs et al. 1995, Aguilar 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 to 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 trailing from an ingested hook, poses a serious risk to sea turtles. Line trailing from an ingested hook is likely to be swallowed, which may irritate the lining of the gastrointestinal tract and may ultimately cause death by torsion or intussusception (Watson et al. 2005). It may also prevent or hamper foraging, eventually leading to death. Sea turtles that swallow monofilament still attached to an embedded hook may suffer from the "accordion effect" which is often fatal. In this condition the intestine, perhaps by its peristaltic action in attempting to pass the unmoving monofilament line through the alimentary canal, coils and wraps upon itself (Pont pers. comm. 2001). 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 trailing gear that has been snagged on the bottom, or has the potential to snag, thus anchoring them in place (Balazs 1985, Hickerson pers. comm. 2001). Long lengths of trailing gear are likely to entangle the sea turtle, eventually, leading to impaired movement, constriction wounds, and potentially death.

Forcible Submergence

Sea turtles that are forcibly submerged undergo respiratory and metabolic stress that can lead to severe disturbance of the pH level of the blood. Most voluntary dives by sea turtles appear to be an aerobic metabolic process, showing little if any increases in blood lactate and only minor changes in pH level. In contrast, sea turtles that are stressed as a result of being forcibly submerged due to entanglement, eventually consume all their oxygen stores. This oxygen consumption triggers anaerobic glycolysis, which can significantly alter their pH level, sometimes leading to death (Lutcavage and Lutz 1997).

Numerous factors affect the survival rate of forcibly submerged sea turtles. It is likely that the rapidity and extent of the physiological changes that occur during forced submergence are functions of the intensity of struggling, as well as the length of submergence (Lutcavage and Lutz 1997). Other factors influencing the severity of effects from forced submergence include the size, activity level, and condition of the sea turtle; the ambient water temperature; and if multiple forced submergences have recently occurred. 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 juveniles may be more vulnerable to the stress from forced submergence. During the warmer months, routine metabolic rates are higher. Increased metabolic rates lead to faster consumption of oxygen stores, which triggers anaerobic glycolysis. Subsequently, the onset of impacts from forced submergence may occur more quickly during these months. With each forced submergence event, lactate levels increase and require a long (up to 20 hours) time to recover to normal levels. Sea turtles are probably more susceptible to lethal metabolic acidosis if they experience multiple forced submergence events in a short period of time. Recurring submergence does not allow sea turtles sufficient time to process lactic acid loads (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. The rate of pH stabilization depends on the physiological condition of the turtle (e.g., overall health, age, size), time of last breath, time of submergence, environmental conditions (e.g., sea surface temperature, wave action, etc.), and the nature of any sustained injuries at the time of submergence (NRC 1990).

5.2.2 Shark Bottom Longline Gear Interactions with Smalltooth Sawfish

Hooking and Entanglement

Bottom longline gear can adversely affect smalltooth sawfish via hooking and entanglement. Based on hooking observation data from Mote Marine Laboratory (MML) bottom longline research surveys and reported recreational rod-and-reel fishing encounters, the vast majority of smalltooth sawfish are hooked in the mouth (Simpfendorfer pers. comm. 2003, Burgess pers. comm. 2003, Seitz and Poulakis pers. comm. 2003, NSED 2011). Foul-hooking reports are not nearly as frequent, but do occasionally occur. There is only one report of a smalltooth sawfish being deeply hooked (NSED, May 2009). Once hooked, the gangion or leader frequently becomes wrapped around the animal's saw (Burgess, pers. comm. 2003; Seitz and Poulakis, pers. comm. 2003). This may be 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 the vast majority of smalltooth sawfish caught on bottom longline gear survive the encounter. Between 2007 and 2011, 22 smalltooth sawfish have been observed caught in shark bottom longline gear in the Atlantic and Gulf of Mexico. One of the captured animals died as a result of becoming 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 (Carlson and Richards 2011, NMFS unpublished data). Soak times do not seem to be a factor for smalltooth sawfish mortality. Simpfendorfer speculates this is because the animal's natural habit consists of lying on the seafloor, using its spiracles to breathe (Simpfendorfer, pers. comm. 2003). Thorson (1982) reports that largetooth sawfish caught by fishermen 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 comes from Dr. Colin Simpfendorfer and Tonya Wiley, who conducted smalltooth sawfish surveys from 2000-2008 for MML, using bottom longline, nets, and rod and reel. Dr. Simpfendorfer and Ms. Wiley captured and handled over 130 individuals ranging in size from 62 cm to 496 cm, which were caught on bottom longlines (T. Wiley, pers. comm. 2009). All of these fish were alive upon capture and safely released with no apparent harm to the fish.

There are no studies on the post-release mortality of smalltooth sawfish. Based on their lively condition at capture and MML tagging recapture data, post-release mortality is expected to be extremely rare. However, temporary sub-lethal effects on smalltooth sawfish may occur. Rare reports from recreational fishermen indicate a smalltooth sawfish can damage its rostrum by hitting it against the vessel or other nearby objects (e.g., piling, bridge) while the fishermen are preparing to release the fish. Reported damage ranges from broken rostral teeth to broken rostrums. Smalltooth sawfish have been caught missing their entire rostrum, otherwise appearing healthy, so they appear to be able to survive without it. However, given the rostrum's role in smalltooth sawfish feeding activities, damage to their rostrum, depending on the extent, could hinder their ability to feed and ultimately impact the affected animal's growth.

5.2.3 Factors Affecting the Likelihood of Sea Turtle and Smalltooth Sawfish Interactions with Shark Bottom Longline Gear

A variety of factors may affect the likelihood of protected resource interactions with shark bottom longline gear. The spatial overlap between fishing effort and sea turtle and smalltooth sawfish abundance is the most noteworthy variable involved in anticipating entanglement events. Other important factors for determining hooking, entanglement, and forced submergence include the types of gear used (i.e., floats, mainlines, baits, hooks) and their configurations, as well as the fishing techniques employed.

5.2.3.1 Gear Characteristics and Fishing Technique

Spatial/Temporal Overlap Between Fishing Effort and Sea Turtle and Smalltooth Sawfish
A factor affecting the likelihood of sea turtle and smalltooth sawfish hooking and/or entanglement in shark bottom longline gear is the spatial and temporal overlap between where they occur and fishing effort. The more abundant that these species are in a given area where fishing occurs, the greater the probability that they will interact with gear. The temporal distribution of fishing effort and species abundance may also be a factor. For example, from 2007-2011, of the 15 loggerheads observed incidentally captured on shark bottom longline gear, six takes occurred during Quarter 1 (40 percent), five during Quarter 2 (33 percent), and two for both Quarter 3 and Quarter 4 (13 percent for each quarter) (Carlson and Richards 2011, NMFS unpublished data).[27] For smalltooth sawfish, seven takes occurred in Quarter 1 (32 percent), nine in Quarter 2 (41 percent), four in Quarter 3 (18 percent), and two in Quarter 4 (9 percent) (Carlson and Richards 2011, NMFS unpublished data).

Soak Time/Number of Hooks
Bottom longline gear interactions with sea turtles and smalltooth sawfish are likely correlated to both soak time and the number of hooks fished. The longer the soak time, the longer a sea turtle or smalltooth sawfish is 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) used may also impact the probability and severity of interactions with sea turtles. The bottom longline component of the HMS Atlantic shark fisheries uses both circle (primarily size 16.0 & 18.0) and J-hooks (primarily size 12.0). The circle hooks employed by shark fishermen tend to be the same sized used in the HMS pelagic longline fishery. The point of a circle hook is turned toward the shank, while the point of a J-hook is not. 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. Circle hook configuration can also reduce the severity of interactions with sea turtles because it has a tendency to hook in the animal's mouth instead of

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[27] Quarter 1 = January-March; Quarter 2 = April-June; Quarter 3 = July-September; Quarter 4= October-December.

its pharynx, esophagus, or stomach (Prince et al. 2002, Skomal et al. 2002). Wider circle hooks may actually prevent hooking of some sea turtles if the sea turtle cannot get its mouth around the hook (Gilman et al. 2006). However, we believe once an animal is hooked the severity of the injury and its impact on the animal's survival is generally similar for all hook types and the post-release mortality criteria from the pelagic longline fishery can be validly applied to this action.

Since the point of a circle hook is turned toward the shank, while the point of a J-hook is not, the type of hook (size and shape) also likely affects the probability and severity of interactions with smalltooth sawfish. Thus, a circle hook may reduce the likelihood of foul-hookings because the point of the hook is less likely to accidentally become embedded in the smalltooth sawfish's mouth. Circle hooks are also expected to reduce gut-hookings.

Bait

Skates, sharks, or various finfishes are commonly used as bait in the shark bottom longline fishery. Some sea turtles may be attracted to the bait used on bottom longline gear. Pelagic and benthic juveniles are omnivorous and forage on crabs, mollusks, jellyfish, and vegetation at or near the surface (Dodd 1988). Sub-adult and adult loggerheads are primarily coastal dwelling and typically prey on benthic invertebrates such as mollusks and decapod crustaceans in hardbottom habitats. Leatherbacks feed primarily on cnidarians (medusae, siphonophores) and tunicates. Given leatherbacks' prey, it is less likely their interactions with shark bottom longline gear are a result of these species pursuing the bait.

Smalltooth sawfish feed primarily on fish; mullet, jacks, and ladyfish are believed to be their primary food resources (Simpfendorfer 2001). There is currently no data available on the attraction of smalltooth sawfish to bait used in the shark bottom longline fishery; however, as sawfish are caught on bottom longlines at least some of the baits used in these fisheries appear to attract to smalltooth sawfish.

5.2.3.2 Environmental Conditions

Environmental conditions may also play a large part in whether or not a sea turtle or smalltooth sawfish interacts with longline 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, sea turtles and smalltooth sawfish can become entangled in the gear. Sea turtles in the open ocean are often found associated with oceanographic features such as fronts and driftlines, areas often indicating high productivity. In addition, sea turtles also appear to associate with particular sea surface temperatures. For example, species such as loggerheads have been tracked moving along convergent ocean fronts, in waters with sea surface temperatures of 17°C and 20°C (Polovina et al. 2000). Longliners often fish frontal zones where ocean currents or water masses meet creating turbulence and sharp gradients of temperature and salinity. When gear is set across these temperature gradients ("breaks"), and when sea turtles are associated with these fronts, interactions are more likely.

5.2.3.3 Life Stage

Different life stages of sea turtles and smalltooth sawfish are associated with different habitat types and water depths. For example, pelagic stage loggerheads are found offshore closely associated with *Sargassum* rafts. As loggerheads mature they begin to live in coastal inshore and nearshore waters foraging over hard- and soft-bottom habitats of the continental shelf (Carr 1986, Witzell 2002). Therefore, gear set closer to these areas is more likely to encounter adult loggerheads: Leatherbacks and juvenile loggerheads are more likely to be found further offshore in deeper, colder water. Bottom longline gear deployed here is more likely to encounter these species and age classes. Nine of the 15 loggerheads observed captured on bottom longline gear from 2007-2011 have size data associated with them; all of them were adults (NMFS unpublished data).[28]

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 and are often closely associated with muddy or sandy substrates, and shorelines containing red mangroves (Simpfendorfer 2001, 2003). Juveniles spend a majority of their time within approximately 350 ft of mangrove shorelines and in waters less than 13 ft deep (Simpfendorfer et al. 2010); they are seldom found in depths greater than 32 ft (Poulakis and Seitz 2004). 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 (2004) noted that nearly half of the encounters with adult-sized smalltooth sawfish in Florida Bay and the Florida Keys occurred in depths from 200 to 400 ft of water. Similarly, Simpfendorfer and Wiley (2005) reported encounters in deeper waters off the Florida Keys and observations from commercial longline fishing vessels and fishery-independent sampling in the Florida Straits report large smalltooth sawfish in depths up to 130 feet (NSED 2012).

5.3 Protected Species Interactions with Shark/Smoothhound Gillnet Gear

5.3.1 Large Whales

Entanglements of large whales in fishing gear most commonly occur as wraps of rope around the tail, body, flippers, or through the mouth and baleen; gillnet gear is commonly found wrapped over the head (Johnson et al. 2007). The types of injury are similar to those listed for sea turtles. The severity of injury depends on the type of entangling gear. For example, heavy, anchored gear may actually cause more damage as the animals tries to free itself, because the animal’s movements actually cause the gear to cinch tighter and cut deeper into the skin. Progressive constriction of this type can lead to tissue damage and, in extreme cases, amputation. These sorts of injuries are commonly seen with gear entangled around the upper jaw, flippers, and tail (Moore et al. 2007). There is even evidence that entanglement can lead to developmental defects in young animals. In January 2009, a stranded North Atlantic right whale with apparent acquired scoliosis was discovered in North Carolina. The animal appears to have

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[28] For loggerheads, hatchlings generally range from 4.5-15 cm SCL; “oceanic juveniles” range from 15-63 cm SCL; “oceanic/neritic juveniles” range from 41-82 cm SCL; and adults range from 82-100+ cm SCL (Conant et al. 2009).

become entangled in fishing gear at an age when its spinal cord was still developing. The entanglement ultimately caused the distortion of the spinal column as the animal grew, leading to scoliosis (UNC Wilmington 2011).

5.3.2 Sea Turtles

Entanglement/Forced Submergence
Gillnets can adversely affect sea turtles via entanglement and forced submergence. While the mechanism of capture is different between bottom longline and gillnet gears, many of the effects are the same. See Section 5.2.1 for the previous discussion on the effects of entanglement and forced submergence on sea turtles.

5.3.3 Smalltooth Sawfish

Entanglement
Smalltooth sawfish are particularly vulnerable to entanglement in gillnets. Early publications document their frequent capture in this gear type and gillnets are believed to be one of the primary causes for the species' decline. As previously mentioned in Section 3.2.9, the long, toothed rostrum of the smalltooth sawfish easily penetrates netting, causing entanglement when the animal attempts to escape. The monofilament mesh can inflict abrasions and cuts, cause bleeding, and hinder feeding behavior. Even a few strands of monofilament can cause significant damage (C. Simpfendorfer pers. comm.) (Figure 5.1).

Figure 5.1 Example of an Injury from Gillnet Gear (Photo credit: C. Simpfendorfer)

The toothed rostrum also makes it very difficult to disentangle a smalltooth sawfish without harming the animal. Entangled animals frequently have to be cut free, causing extensive damage to nets. The entangled smalltooth sawfish can also endanger fishermen if brought onboard a vessel. For these reasons, many historical records of smalltooth sawfish catches note they were either killed or released after their saws had been removed (e.g., Henshall 1895, Evermann and Bean 1897, Bigelow and Schroeder 1953).

Effects on smalltooth sawfish from incidental capture in gillnets today likely depend on fishermen's handling practices. For example: (1) the amount of gear and time fishermen are willing to sacrifice to carefully remove an animal; (2) whether or not the animal is restrained while being handled to avoid damage to the rostrum and rostral teeth; (3) the length of time an animal is out of the water while being disentangled; and (4) the amount of gear left on the animal when released, are all likely to impact the overall severity of the event.

5.3.4 Atlantic Sturgeon

The adverse effects of gillnets on Atlantic sturgeon are likely similar to those experienced by sea turtles and smalltooth sawfish. However, Atlantic sturgeon are morphologically unique. Their cone-shaped snout rapidly transfers meshes over the head and along the body and can cause rapid gilling or wedging. Atlantic sturgeon are also at increased risk of entanglement because their skin is covered in bony scutes. These protrusions increase the likelihood of entanglement and wedging, as the fish attempts to pass through or around gillnets. Larger fish may become wrapped in nets once entangled while they struggle to free themselves. Smaller fish may be entangled by a single monofilament strand hung around a scute (Damon-Randall et al. 2010).

5.4 Factors Affecting the Likelihood of ESA-Listed Species Interactions with Shark/Smoothhound Gillnet Gear

5.4.1 Gear Characteristics and Fishing Technique

5.4.1.1 Spatial Overlap of Fishing Effort and ESA-Listed Species Abundance

Large Whales
Atlantic large whales are at risk of becoming entangled in fishing gear because the whales feed and breed in, as well as migrate through, many of the same areas we believe the smoothhound and Atlantic shark fisheries operate. As described in detail in Sections 3.2.1-3.2.3, North Atlantic right whales, humpback whales, and fin whales occur up and down the eastern seaboard of the United States over the continental shelf. All three species follow a similar, general pattern of foraging at high latitudes (e.g., southern New England and Canadian waters) in the spring and summer months and calving in lower latitudes (i.e., off of Florida for North Atlantic right whales and in the West Indies for humpback whales) in the winter months (CeTAP 1982, Hain et al. 1992, Clark 1995, Perry et al. 1999, Horwood 2002, Kenney 2002).

Fishing effort for smoothhound exhibits seasonal peaks (see Figure 2.15). Of the six states with the majority of landings, North Carolina had the highest landings from November through April, and represents almost all landings from January through March. Beginning in May, landings in New Jersey, New York, and Maryland eclipse North Carolina landings, and remain higher through September. Virginia landings are clustered in April, May, and June, with some landings reported again in November, December, and January. Interestingly, Virginia's landings from July through October drop to a few thousand pounds, with no landings at all in March (ACCSP unpublished data).

From 2008-2010, data from the coastal fisheries and HMS logbooks, which exclude landings from state fishermen without a federal permit, indicated that landings of SCS, LCS, and sandbar sharks also show seasonal peaks. SCS landings were relatively low in January, February, and March, hovering around 15,000-20,000 lbs dw. Beginning in April, landings increased each month from April (~50,000 lbs dw) through October (~200,000 lbs dw) before declining to ~90,000 lbs dw in November and December (Coastal Fisheries Logbook, unpublished data; HMS Pelagic Fisheries Logbook, unpublished data).

The LCS (excluding sandbar sharks) showed three peaks in landings. Landings were low in January (~59,000 lbs dw), but increased in February (~162,000 lbs dw) and peaked in March with ~190,000 (lbs dw). Landings declined over the next three months (April-June) to a low in June (~95,000 lbs dw). Landings increased again in July with another peak in August (~150,000 lbs dw), followed by declines in September (~130,000 lbs dw) and October (~104,000 lbs dw). Another peak in landings was recorded in November (~148,000 lbs dw), but landings declined December (~112,000 lbs dw) (Coastal Fisheries Logbook, unpublished data; HMS Pelagic Fisheries Logbook, unpublished data).

Landings of sandbar sharks were far lower than those of the SCS or LCS and showed only one peak in landings (April, ~62,000 lbs dw). Landings declined from January (~20,000 lbs dw) to February (~13,000 lbs dw) but increased in March (~48,000 lbs dw) to peak in April. Landings decreased in May and June and then oscillated around 17,000 lbs dw from July through November, followed by a slight increase in landings in December (~24,000 lbs dw) (Coastal Fisheries Logbook, unpublished data; HMS Pelagic Fisheries Logbook, unpublished data).

Humpback and fin whales utilize the Mid-Atlantic waters during October-March with seemingly increasing frequency, and low numbers of whales reside in New England waters through the winter. Likewise, North Atlantic right whales migrate down the East Coast during autumn, arriving in the southern calving areas in November. These migrations mean large whales may overlap spatially and temporally with the smoothhound and Atlantic shark fisheries. Given their seasonal distribution and the times and areas when the smoothhound fishery operates, North Atlantic right, humpback, and fin whales are most likely to overlap with the operation of the fishery from October through May in the Mid-Atlantic waters.

Sea Turtles, Smalltooth Sawfish, and Atlantic Sturgeon

The spatial and temporal overlap of sea turtles, smalltooth sawfish, and Atlantic sturgeon with fishing effort is also a factor that affects the likelihood of these species becoming entangled in shark/smoothhound gillnet gear. The more abundant that animals are in a given area where fishing occurs, the greater the probability that one of them will interact with gear. The temporal distribution of fishing effort and sea turtle, smalltooth sawfish, and Atlantic sturgeon abundance may also be a factor. From 2007-2010, 4 sea turtles were observed incidentally captured on shark gillnet gear, 3 (75 percent) were captured in August, and the other (25 percent) was captured in March (Baremore et al. 2007, Passerotti et al. 2010). No smalltooth sawfish were observed captured in shark gillnet gear during that four year period; though three previous captures were observed in 2003.

Specific information on interactions between Atlantic sturgeon and shark gillnet gear is not available. The best information available on Atlantic sturgeon bycatch in gillnet gear appears to indicate a greater likelihood for interactions during specific times of year. ASMFC (2007) reports that Atlantic sturgeon bycatch across all sink gillnet fisheries was greatest during April and May and lowest during August to October. However, it is important to remember that specific fisheries often operate during certain times of year and in certain regions, so this seasonal bycatch trend could be affected by fishery operations, not necessarily seasonality.

5.4.1.2 Net Profile

Large Whales
The actual mechanism for entanglement of large whales is unknown. There is no evidence that North Atlantic right whales become entangled because they are curious about the fishing gear and get too close and consequently become entangled (Kraus et al. 2007). With sink gillnets, it is most likely that large whales become entangled while swimming near the bottom with their mouths open as they feed. This view is supported by the large number of animals that appear with gear in their mouths or around their heads. Therefore, the greater the net profile, the greater the chance an animal will encounter it during a dive.

Sea Turtles and Smalltooth Sawfish
Both length and profile (i.e., the percentage of the water column spanned by the net) of gillnets in the water column affect the likelihood of sea turtle and smalltooth sawfish exposure to gillnets. Gillnets spanning the entire water column (i.e., surface to bottom) are more likely to catch sea turtles than low-profile gillnets spanning only a narrow portion of the water column. For example, drift gillnet gear is generally fished at the surface, while strike gillnet gear generally spans the entire water column to reduce fish loss from fish swimming under or over the net (Carlson and Bethea 2007).

Since smalltooth sawfish are predominately a benthic species, they are more likely to encounter sink gillnets or gillnets set on or near the bottom. Prior to the 2003 observed capture of a smalltooth sawfish in Atlantic shark gillnet gear (NMFS 2003c), some people speculated that because these gillnets are set above the seafloor they may not catch smalltooth sawfish. However, smalltooth sawfish do feed on small schooling fish and could occur higher in the water column when engaged in this feeding behavior.

Atlantic Sturgeon
The use of tie-downs, which create a “pocket” or “bag” effect in gillnets, is also believed to increase the potential for entanglement. Atlantic sturgeon mortality is more likely when tie-downs are in use (ASMFC 2007). From 2008-2012, the shark gillnet observer program never observed the use of tie-downs in Atlantic shark or smoothhound gillnet gear (SEFSC unpublished data). From 1994-2010, NEFOP observed 1,274 directed smoothhound trips; tie-downs were only used in 0.86 percent of trips (NEFOP unpublished data).

5.4.1.3 Mesh Size

Large Whales, Sea Turtles, and Smalltooth Sawfish
Due to the size of large whales relative to gillnet mesh, mesh size likely plays less of a role in large whale entanglements. However, all mesh sizes are known to entangle sea turtles, but entanglement risks appear to increase with increasing mesh size. Smaller sea turtles may be more susceptible to entanglement in gillnets with smaller mesh sizes than are larger sea turtles.

Smalltooth sawfish may become entangled when their saw penetrates the netting and they try to escape. Smalltooth sawfish can become entangled in any sized mesh, but large mesh is likely particularly problematic. Larger mesh may allow for easier penetration into the gillnetting, thus increasing entanglement potential.

Atlantic Sturgeon
Atlantic sturgeon bycatch appears to be relatively closely associated with mesh size. ASMFC (2007) reports ~41 percent of Atlantic sturgeon bycatch was observed in mesh sizes of 5-9.9 inches, ~47 percent of observed Atlantic sturgeon bycatch was in 10-inch mesh or greater; only ~12 percent observed Atlantic sturgeon bycatch was in mesh less than 5 inches. Atlantic sturgeon mortality rates and percent of total mortalities are higher in large mesh fisheries (7-inches or greater) (36 percent incidence of mortality)[29] but ASMFC (2007) cautions that it is hard to separate the effect of large mesh, tie-downs, and soak time. More specifically, it states tie-downs were used with large mesh nets 74 percent of the time, and soak times of over 24 hours occurred 79 percent of the time when tie-downs were used with large mesh. Since both tie-downs and soak time are believed to affect mortality rates in their own right, the extent to which mesh size influence can be attributed to cause of death is limited (ASMFC 2007).

5.4.1.4 Soak Times

Large Whales, Sea Turtles, and Smalltooth Sawfish
The length of time gillnet gear is left in the water is another important consideration. The longer the soak time, the higher the likelihood large whales, sea turtles, and smalltooth sawfish may encounter the gillnet gear and become entangled. Incidental captures of sea turtles are most frequently documented in long sets, and in lost or broken-off gear presumed to have been soaking for a long time. Since forced submergence is not a concern for smalltooth sawfish, soak times do not appear to impact mortality rates for incidentally caught animals.

The SEFSC Panama City Laboratory administers the SGOP. The program deploys trained observers aboard selected gillnet vessels; observers record data on gear and effort characteristics and collect biological information on the catch. Currently, the SGOP covers all anchored (sink and stab), strike, or drift gillnet fishing regardless of target by vessels that fish from Florida to North Carolina and the Gulf of Mexico, year-round (Carlson and Richards 2011). From 2008-2012, the SGOP observed 28 smoothhound gillnet trips. The vast majority of trips (i.e., 93 percent) had soak times less than 10 hours. Only two trips were longer than 10 hours and only one of those trips was longer than 24 hours.[30]

From 1994-2010, the NEFOP observed 1,274 directed trips for smoothhound. NEFOP observers documented a wide range of soak times during those 1,274 trips. Approximately 22 percent of trips had total soak times between 0 and 5 hours; 0.74 percent of trips soaked gear between 5.1 and 10 hours; 64.2 percent soaked between 10.1 and 24 hours; while 13 percent soaked gear 24 hours or longer. These data indicate the majority of trips (i.e., 87 percent) have a total soak time of less than 24 hours (NEFOP unpublished data).

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[29] Medium-mesh fisheries (>5- to 7-inch mesh) had a 20 percent incidence of mortality; small mesh fisheries (≤ 5-inch mesh) had a 2 percent incidence of mortality (ASFMC 2007).

[30] 57% of trips (16 of 28) had soak times less than 5 hours; 36% of trips (10 of 28) had soak times between 5.1 to 10.0 hours; 7% of trips (2 of 28) had soak times longer than 10.1 hours; one was greater than 24 hours.

Atlantic Sturgeon
Soak times appear to have a significant impact on the mortality of Atlantic sturgeon. One of the principal findings in the 2006 Sturgeon Technical Committee Workshop on sturgeon bycatch was that soak times greater than 24 hours were associated with substantially higher mortality rates (ASFMC 2007). Numerous scientists have described this relationship, at least in part, finding that increased soak times and increased water temperatures result in higher mortality rates (Collins et al. 1996, Buchanan et al. 2002, Bettoli and Scholten 2006). Observer data bear out the effects of soak time on Atlantic sturgeon mortality as well. However, ASMFC (2007) cautions that focusing only on soak time ignores the effect of, or interaction between, other gear variables. This is a concern because some factors like extended soak time and tie-downs are essentially inseparable in observer data (ASMFC 2007).

5.4.1.5 Species Morphology

Sea turtles and large whales are prone to entanglement as a result of their body configuration and behavior. Records of stranded or entangled sea turtles reveal gear can wrap around the neck, flipper, or body of a sea turtle. Entanglement records show large whales are most commonly entangled around the tail stock, flippers, and through the mouth and baleen. These entanglements can severely restrict swimming or feeding. Smalltooth sawfish and Atlantic sturgeon have unique species morphology that makes them prone to entanglement. See the previous Sections 5.3.3 and 5.3.4 for a description of the morphological features of these species that make them prone to entanglement.

5.4.2 Environmental Conditions

Environmental conditions may also play a large part in whether or not ESA-listed species interact with gillnet 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, ESA-listed species may become entangled in the gear.

Large Whales
North Atlantic right whales generally follow an annual pattern of migration between low latitude winter (e.g. November – April) calving grounds and high latitude summer (e.g. May – October) foraging grounds (Perry et al. 1999, Kenney 2002). Likewise, humpback whales calve and mate in the West Indies during the winter months and migrate to feeding areas in the northwestern Atlantic during the summer months. Like North Atlantic right and humpback whales, fin whales are believed to use North Atlantic waters primarily for feeding, and more southern waters for calving. However, it is still unclear where the majority of fin whales overwinter, calve, and mate. This information indicates that certain times of year and certain locations increase the potential likelihood for interactions.

Sea Turtles and Smalltooth Sawfish
Sea turtles also appear to associate with particular sea surface temperatures. From 1995-2006, observers aboard vessels fishing with gillnet gear in the Mid-Atlantic observed the incidental capture of 41 loggerhead, 5 green, 8 Kemp's ridley, and 5 leatherback sea turtles. The average

sea surface temperature of loggerhead, green, and Kemp's ridley sea turtles observations was approximately 17°C; leatherbacks were found in cooler waters, averaging approximately 15°C (Murray 2009a). This distribution indicates fishing effort in cooler waters is more likely to take leatherback sea turtles and fishing in warmer waters increases the likelihood of interactions with loggerhead, green, and Kemp's ridley sea turtles. There is currently no information on the water temperature preferences of smalltooth sawfish within the action area.

Atlantic Sturgeon
Water temperature plays a primary role in triggering the timing of spawning migrations of Atlantic sturgeon (ASMFC 2009). Male sturgeon begin upstream spawning migrations when waters reach approximately 6°C (43°F) (Smith et al. 1982, Dovel and Berggren 1983, Smith 1985, ASMFC 2009); females begin spawning migrations when temperatures are closer to 12°-13°C (54°-55°F) (Dovel and Berggren 1983, Smith 1985, Collins et al. 2000a). These migrations move Atlantic sturgeon out of the marine environment, reducing the potential for entanglement. While in the marine environment Atlantic sturgeon inhabit a wide-range of temperatures. Erickson et al. (2011) reported that for 13 tracked fish the average monthly water temperatures ranged from 8.3-21.6°C in February and August, respectively. However, two other tracked fished showed much higher (up to 23.9°C) and much lower (down to 5.3°C) temperature ranges (Erickson et al. 2011). This information suggests that the potential for interactions with Atlantic sturgeon in the marine zone exists across a wide range of water temperatures.

5.4.3 Life Stage and Species Sex

Large Whales
From 2006-2010, 33 North Atlantic right whale entanglements were confirmed. Of the 33 confirmed entanglements, 4 were confirmed to be entanglement mortalities (1 female calf, 1 male calf, 2 adult males) and 5 led to serious injury involving (1 adult female, 1 adult male, 1 juvenile male, 1 juvenile female, and 1 juvenile of unknown sex) (Henry et al. 2011). From 1980-2004, a review of 493 photo-identified individuals found 625 separate entanglement interactions. The number of male and female North Atlantic right whales bearing entanglement scars was nearly equivalent (142/202 females, 71.8 percent; 182/224 males, 81.3 percent), indicating that North Atlantic right whales of both sexes are equally vulnerable to entanglement.

Between 2006 and 2010 there were 101 confirmed humpback whales entanglements (Henry et al. 2012). Over the five-year period, humpback whales were the most commonly observed entangled whale species. Of the confirmed entanglements, 9 were mortalities and 20 led to serious injuries (Henry et al. 2012). Based on composite scar patterns, Robbins and Matilla (2004) hypothesize that male humpback whales were more vulnerable to entanglement than females. They also suggest males may be subject to other sources of injury that could affect scar pattern interpretation. Robbins and Matilla (2004) obtained images from a humpback whale breeding ground; 24 percent exhibited raw injuries, presumably a result of aggressive interactions. However, current evidence suggests that breeding ground interactions alone cannot explain the higher frequency of healed scar patterns among Gulf of Maine stock male humpback whales (Robbins and Matilla 2004).

Henry et al. (2012) report that from 2006-2010, 31 mortalities were confirmed involving fin whales. Fifteen of those events were confirmed entanglements, two resulted in fatalities, which was the highest percentage for any of the whale species; two resulted in serious injury.[31] The two confirmed mortalities involved a juvenile male and an animal of unknown sex and age. The animals involved in the entanglements causing serious injury were both of unknown sex and age (Henry et al. 2012).

Sea Turtles

Different life stages of sea turtles are associated with different habitat types and water depths. For example, pelagic stage loggerheads are found offshore, closely associated with *Sargassum* rafts. As loggerheads mature, they begin to live in coastal inshore and nearshore waters foraging over hard- and soft-bottom habitats of the continental shelf (Carr 1986, Witzell 2002). Gear set closer to these areas is more likely to encounter adult loggerheads.

Four sea turtles takes were observed in non-smoothhound shark gillnet gear from 2007-2011. Two of the three loggerheads were likely oceanic/neritic juveniles, with sizes of 70.5 and 75.5 cm curved carapace lengths (CCL); the third was likely an adult (86.8 cm CCL) (NMFS unpublished data). [32] The Kemp's ridley measured 19.4 cm CCL and was most likely a juvenile.[33]

The loggerheads observed captured in Murray (2009a) in Mid-Atlantic sink gillnet gear were generally of a size consistent with juvenile size classes. Of the 12 loggerheads captured by Mid-Atlantic sink gillnet gear and subsequently measured, 10 (83 percent) were juveniles. The sizes of all 12 animals ranged from 52 to 101 cm CCL, with an average CCL of 65.3 cm. All observed and measured Kemp's ridley sea turtles ranged from 28 to 44 cm CCL; green sea turtles observed and measured ranged from 28 to 38 cm CCL (Murray 2009a).[34]

5.5 Sea Turtle and Smalltooth Sawfish Captures by Shark Bottom Longline Gear

Observations of the shark-directed bottom longline fishery in the Atlantic and Gulf of Mexico have been conducted since 1994. From 1994 through 2001, observer coverage was voluntary but beginning with the 2002 fishing season, observer coverage became mandatory. Observer coverage from 1994 through the 1st trimester of 2005 was coordinated by the CSFOP, Florida Museum of Natural History, University of Florida, Gainesville, Florida (Morgan et al. in press). Starting with the 2nd trimester season of 2005, responsibility for the fishery observer program was transferred to NMFS, SEFSC, Panama City Laboratory (Hale et al. 2009).

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[31] Of the 15 confirmed fin whale entanglements, 2 resulted in mortality (13.3%); of 101 confirmed humpback whale entanglements, 9 resulted in mortality (8.9%); of 33 confirmed North Atlantic right whale entanglements, 4 resulted in mortality (12%) (Henry et al. 2012).

[32] For loggerheads, hatchlings generally range from 4.5-15 cm SCL; "oceanic juveniles" range from 15-63 cm SCL; "oceanic/neritic juveniles" range from 41-82 cm SCL; and adults range from 82-100+ cm SCL (Conant 2009). The information we use to assign an age class is based on an animal's SCL; an animal's CCL is longer than its SCL. Since the estimated lengths of the entangled animals fell well within the size range of each age class, we feel comfortable assigning them to age classes even though the data provided was in CCL.

[33] Kemp's ridley sea turtles are considered adults at 60+ cm SCL (Ogren 1989); CCLs are longer than SCLs.

[34] Across 22 populations of green sea turtles, reproductive females had a CCL of 99.1 cm, on average (Miller 1997).

Updated stock assessments in 2007 led to changes in the Consolidated Atlantic HMS FMP that eliminated the major directed shark fishery in the U.S. Atlantic (NMFS 2007a). Those changes implemented a shark research fishery, which allows NMFS to select a limited number of commercial shark vessels on an annual basis to collect catch data and life history data for future stock assessments. The changes also led to reduced quotas and retention limits, and changes to which species could be kept by commercial fishermen. Specifically, only commercial fishermen participating in the sandbar shark (*Carcharhinus plumbeus*) research fishery are allowed to land this species, and those vessels selected to participate in the research fishery are required to carry an observer on 100 percent of all trips. Because of this 100 percent observer coverage requirement, the sea turtle captures observed in the research fishery do not require extrapolation (Carlson and Richards 2011). Outside the research fishery, fishermen are permitted to land 33 non-sandbar LCS per vessel per trip. Vessels not participating in the research fishery are also required to carry observers if selected; the target coverage rate for non-research shark vessels is 4-6 percent (Carlson and Richards 2011). Captures in the non-research fishery were extrapolated.

The SEFSC estimated the level of protected resource take from 2007-2010 in the shark bottom longline fishery (Carlson and Richards 2011). In the following sections, we describe the text estimates calculated in that report. We also describe how we used the data in those reports, in conjunction with NMFS' revised post-release mortality estimates, to calculate the number of lethal and non-lethal protected species takes from 2007-2010. Carlson and Richards (2011) include more detailed discussion of the data sources used, calculation methods, constraints of those methods, and the assumptions under which those calculations were made.

5.5.1 Observer Data Summary

From January 2007 to December 2010 in the Gulf of Mexico, six loggerhead sea turtles were observed caught on bottom longline gear; four were observed caught in the shark research fishery, two were captured outside the research fishery. Of the six observed captures, three were dead and three were released alive (Carlson and Richards 2011). During the same period, 20 smalltooth sawfish captures were observed (6 on the non-research fishery, 14 in the research fishery); all but one was released alive. In 2011, one loggerhead was captured in the Gulf of Mexico by the research fishery; the animal was released alive. No captures in the non-research fishery were observed in 2011 (NMFS unpublished data).

From 2007-2010, five loggerheads were captured in the South Atlantic, four by the shark bottom longline research fishery and one in the non-research bottom longline fishery. Two of the animals captured in the research fishery were released alive, two were dead. In the non-research fishery, the animal was dead. In 2011, three loggerhead captures were observed in the research fishery in the South Atlantic; all three animals were dead. No captures in the non-research fishery were observed in 2011.

No smalltooth sawfish were observed captured in the South Atlantic (Carlson and Richards 2011) from 2007-2010, but in 2011, two captures were observed in the shark bottom longline research fishery; both animals were released alive (NMFS unpublished data).

In total, 15 sea turtles (all loggerheads) and 22 smalltooth sawfish captures were observed in the Gulf of Mexico and South Atlantic regions from 2007-2011(Table 5.1). No trips were observed in the North Atlantic region (Hale et al. 2009, Hale et al. 2010, and Hale et al. 2011, NMFS unpublished data).

Of the 15 loggerheads captured on shark bottom longline gear from 2007-2011, size information was available for 9 records. All of the records for which size information was available indicated the animal was an adult (NMFS unpublished data).

Table 5.1 Observed Captures of Sea Turtles and Smalltooth Sawfish by Region, 2007-2011: Gulf of Mexico (GOM) or South Atlantic (SA)

Fishery	Year	Quarter	Species	Area	Condition
SHX BLL - Non-Research Fishery	2007	1	Loggerhead	GOM	Dead
SHX BLL - Non-Research Fishery	2007	1	Loggerhead	GOM	Dead
SHX BLL - Non-Research Fishery	2007	1	Loggerhead	GOM	Alive
SHX BLL - Non-Research Fishery	2007	1	Loggerhead	GOM	Alive
SHX BLL - Research Fishery	2008	4	Loggerhead	SA	Alive
SHX BLL - Research Fishery	2009	2	Loggerhead	SA	Dead
SHX BLL - Research Fishery	2009	2	Loggerhead	GOM	Dead
SHX BLL - Research Fishery	2010	2	Loggerhead	SA	Dead
SHX BLL - Research Fishery	2010	4	Loggerhead	SA	Alive
SHX BLL - Non-Research Fishery	2010	1	Loggerhead	SA	Dead
SHX BLL - Research Fishery	2010	3	Loggerhead	GOM	Alive
SHX BLL - Research Fishery	2011	1	Loggerhead	GOM	Alive
SHX BLL - Research Fishery	2011	2	Loggerhead	SA	Dead
SHX BLL - Research Fishery	2011	2	Loggerhead	SA	Dead
SHX BLL - Research Fishery	2011	3	Loggerhead	SA	Dead
SHX BLL - Non-Research Fishery	2007	2	Smalltooth Sawfish	GOM	Alive
SHX BLL - Non-Research Fishery	2007	2	Smalltooth Sawfish	GOM	Dead
SHX BLL - Non-Research Fishery	2007	2	Smalltooth Sawfish	GOM	Alive
SHX BLL - Non-Research Fishery	2008	3	Smalltooth Sawfish	GOM	Alive
SHX BLL - Non-Research Fishery	2008	4	Smalltooth Sawfish	GOM	Alive
SHX BLL - Research Fishery	2009	1	Smalltooth Sawfish	GOM	Alive
SHX BLL - Research Fishery	2009	1	Smalltooth Sawfish	GOM	Alive
SHX BLL - Research Fishery	2009	2	Smalltooth Sawfish	GOM	Alive
SHX BLL - Research Fishery	2009	2	Smalltooth Sawfish	GOM	Alive
SHX BLL - Research Fishery	2009	2	Smalltooth Sawfish	GOM	Alive
SHX BLL - Research Fishery	2010	1	Smalltooth Sawfish	GOM	Alive
SHX BLL - Research Fishery	2010	1	Smalltooth Sawfish	GOM	Alive
SHX BLL - Research Fishery	2010	1	Smalltooth Sawfish	GOM	Alive
SHX BLL - Research Fishery	2010	1	Smalltooth Sawfish	GOM	Alive
SHX BLL - Non-Research Fishery	2010	1	Smalltooth Sawfish	GOM	Alive
SHX BLL - Research Fishery	2010	2	Smalltooth Sawfish	GOM	Alive
SHX BLL - Research Fishery	2010	2	Smalltooth Sawfish	GOM	Alive
SHX BLL - Research Fishery	2010	3	Smalltooth Sawfish	GOM	Alive
SHX BLL - Research Fishery	2010	3	Smalltooth Sawfish	GOM	Alive
SHX BLL - Research Fishery	2010	4	Smalltooth Sawfish	GOM	Alive
SHX BLL - Research Fishery	2011	2	Smalltooth Sawfish	SA	Alive
SHX BLL - Research Fishery	2011	3	Smalltooth Sawfish	SA	Alive

5.5.2 Estimated Sea Turtle Takes in the Shark Bottom Longline Fishery

Extrapolated Sea Turtle Takes in the Shark Bottom Longline Fishery
Carlson and Richards (2011) estimated sea turtle takes from 2007-2010; data on 2011 captures were not available at the time they conducted their analysis. Because all trips were observed in the shark research fishery, the protected resources captures observed in that fishery do not require extrapolation (Carlson and Richards 2011). Thus, the extrapolated take estimates and the approach used to calculate them (discussed in the subsequent sections) only refers to effort from the non-shark research fishery. Since only loggerhead sea turtles were observed captured, the estimates that follow only refer to loggerhead sea turtles.

To remain consistent with bycatch estimation approach used in the 2008 HMS shark opinion (NMFS 2008c) a delta lognormal approach (Pennington 1983) was used to estimate the mean and variance of catch rates based on observations of protected resource interactions for the non-research shark fishery. This method combines a binomial model (frequency of occurrence) for the total observations with the average density for the non-zero CPUE data, which were assumed to be lognormally distributed (Carlson and Richards 2011). Because the incidental capture of sea turtles in shark bottom longlines is considered a rare event, the assumptions of the delta-lognormal method (e.g., that $n \geq 5$ and catch rates were lognormally distributed) are violated. Under this condition the delta-lognormal model reduces the estimated mean to a simple ratio estimator (captures observed on a set/hooks on the set), but the variance estimate is based on a lognormal model (although unsupported in this case) (Carlson and Richards 2011). While not ideal, given the relative rarity of sea turtle incidental captures and the other data available, this approach is the best available to estimate sea turtle captures by the non-research shark bottom longline fishery.

Total bycatch per strata with observed captures of loggerhead sea turtles was estimated by multiplying the estimated bycatch CPUE by the total fishery effort in hooks obtained from effort data reported to the Logbook Program by all permitted fishermen (see Carlson and Richards (2011) for further discussion of data filtering). Total bottom longline effort reported to the Logbook Program was compiled by species targeted. Trips targeting shark were defined as trips by those vessels that have a commercial directed shark permit and landed 66 percent or more shark species, by weight. The data were further stratified by region and season as defined by the observer program.

Carlson and Richards (2011) estimated that the mean number of loggerheads captured in the non-shark research fishery from 2007-2010 was 36.8 in the Gulf of Mexico and 2.8 in the South Atlantic. An additional six loggerhead sea turtles were observed captured in the research fishery during the same period; two were captured in the Gulf of Mexico, four were captured in the South Atlantic (Carlson and Richards 2011). In 2011, four loggerheads were captured in the shark research fishery (NMFS unpublished data). In total, 49.6 loggerhead sea turtles were likely captured by shark bottom longline gear in the Gulf of Mexico and South Atlantic from 2007-2011.

Table 5.2 Estimated Loggerhead Captures, 2007-2011: Shark Bottom Longline Fishery

(Carlson and Richards 2011, NMFS unpublished data)

Year	Region	Species	Mean*
Estimated Captures for Non-Research Fishery			
2007	GOM	Loggerhead	36.8
2008	GOM	N/A	0
2009	GOM	N/A	0
2010	SA	Loggerhead	2.8
2011	GOM	N/A	0
Captures Observed in Shark Research Fishery			
Year	**Region**	**Species**	**Number**
2008	SA	Loggerhead	1
2009	SA	Loggerhead	1
2009	GOM	Loggerhead	1
2010	SA	Loggerhead	2
2010	GOM	Loggerhead	1
2011	SA	Loggerhead	3
2011	GOM	Loggerhead	1
Total Estimated and Observed (2007-2011)			**49.6**

*Carlson and Richards (2011) also provides the 95% CIs and CVs for the estimated captures in the non-research shark fishery

Estimated Non-Loggerhead Sea Turtle Takes in the Shark Bottom Longline Fishery

Since no leatherback, green, Kemp's ridley or hawksbill sea turtles captures were observed in shark bottom longline gear there are no extrapolated take estimates in Carlson and Richards (2011). However, these species are known to be vulnerable to capture in analogous bottom longline fisheries. Since we believe these species sea turtles could be captured in shark bottom longline gear we also estimated takes of these species.

We used the estimated mean annual loggerhead take reported by Carlson and Richards (2011) and species abundance estimates calculated from the STSSN to estimate the number of green, leatherback, Kemp's ridley, and hawksbill sea turtle takes in the fishery. Since the shark bottom longline fishery may occur in the Gulf of Mexico and Atlantic regions, we used STSSN data from 2006-2011 on the number of sea turtle strandings from these areas to calculate species abundance. We chose this time period because we believe it more accurately reflects changes in species abundance (e.g. increasing Kemp's ridley populations). Appendix 6 describes the steps used to calculate those takes. We have summarized our estimates in Table 5.3. Since our estimates for leatherbacks and hawksbills were each less than one, we combined those takes.

Table 5.3 Estimated Annual Sea Turtle Takes in Shark Bottom Longline Gear

Species	Estimated Annual Take
Loggerhead	10[a]
Kemp's Ridley	3[b]
Green	7[b]
Leatherback	1[b,c]
Hawksbill	
Total	21

[a] Estimated by Carlson and Richards (2011)

[b] Estimated in Appendix 6

[c] This take is for these species are in combination, not one of each species

5.5.3 Estimating Sea Turtle Mortality in the Shark Bottom Longline Fishery

Estimated Immediate and Post-Release Mortality of Sea Turtles
Carlson and Richards (2011) reported the final condition (i.e., alive or dead) of the observed bycatch events, but did not calculate mortalities when estimating the total number of loggerhead captures across the entire non-research shark fishery. Identifying the number of individuals that may die as a result of interactions with shark bottom longline gear is necessary to better assess the impacts of the action on the species when we conduct our jeopardy analysis. The information provided on the non-research shark fishery indicates that 60 percent (3 of 5) of sea turtles suffer an immediate mortality (i.e., are dead when gear is retrieved or die shortly after). The information from the shark research fishery indicates that 40 percent (4 of 10) of bycaught loggerheads were released alive; 60 percent were dead upon release (6 of 10). Since 100 percent of shark research fishery trips are observed, we believe this rate of mortality accurately reflects the number of animals that suffered immediate mortalities after interactions with the shark research fishery from 2007-2010. Both sets of data indicate a 60 percent immediate mortality rate.

Applying that mortality rate to our sea turtle take estimates, we estimate that a total of six loggerheads, two Kemp's ridley, and four green sea turtles may suffer immediate mortality annually after interacting with shark bottom longline gear. Since we estimated only one leatherback or hawksbill sea turtle take would occur we assumed that take could be either an immediate mortality or a non-mortality. Table 5.4 summarizes those calculations and estimates.

Table 5.4 Estimated Annual Sea Turtle Takes in Shark Bottom Longline Gear

<table>
<tr><th>Species</th><th>Estimated Annual Take</th><th>No. Immediate Mortalities</th><th>No. Non-Moralities</th></tr>
<tr><td>Loggerhead</td><td>10</td><td>6</td><td>4</td></tr>
<tr><td>Kemp's Ridley</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td>Green</td><td>7</td><td>4</td><td>3</td></tr>
<tr><td>Leatherback</td><td rowspan="2">1</td><td rowspan="2" colspan="2">1</td></tr>
<tr><td>Hawksbill</td></tr>
<tr><td>Total</td><td>21</td><td>13</td><td>9</td></tr>
</table>

Post-Release Mortalities
Most, if not all, sea turtles released alive from bottom longline gear will have experienced a physiological injury from forced submergence and/or traumatic injury from hooking and entanglement, and many may still carry penetrating or entangling gear. Thus, in addition to the mortality observed at the time of release, some level of post-release mortality is expected.

In January 2004, NMFS developed draft 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. In 2006, those criteria were revised and finalized (Ryder et al. 2006). Under the revised criteria, overall mortality ratios are dependent upon the type of interaction (i.e., hooking, entanglement, etc.); the location of hooking, if applicable (i.e., hooked externally, hooked in the mouth, etc.); the amount/type of gear remaining on the animal at the time of release (i.e., hook remaining, amount of line remaining, entangled or not); and species (i.e., hardshells versus leatherbacks). Therefore, the experience, ability, and willingness of the crew to remove the gear, and the availability of gear-removal equipment, are very important factors influencing post-release mortality. During real world application of these criteria (e.g., Epperly and Boggs 2004) it became clear that not every hooking scenario encountered could be categorized using the criteria. In August 2011, the SEFSC updated the 2006 criteria by adding three additional hooking scenarios. Consequently, those updates modified the layout of the post-release mortality table appearing in Ryder et al. (2006); a revised table can be found in NMFS SEFSC (2012).[35]

We used these criteria to estimate the likely level of post-release mortality in shark bottom longline fisheries. We reviewed the individual observer reports of each sea turtle released alive to determine the type of injury it had received, using the post-release mortality criteria in NMFS SEFSC (2012). Applying the appropriate post-release mortality percentages from NMFS SEFSC (2012), we used observer reports to determine the number of animals that likely died of their injuries following their release. We estimated that the average post-release mortality rate for animals released from the non-research fishing was 45 percent; 15 percent in the research fishery.[36] To act conservatively toward species, we used the former to estimate the number of animals released alive that ultimately succumbed to their injuries. Table 5.5 includes our estimates of the animals we believe survived their interaction with the fishery, the animals that died immediately following the interaction, and those that were released alive but later died as a result of injury (i.e., post-release mortality).

Table 5.5 Estimated Annual Immediate and Post-Release Sea Turtle Mortalities: Shark Bottom Longline Fishery

Species	Estimated Annual Take	No. Immediate Mortalities	No. Post-Release Mortalities	No. Non-Moralities
Loggerhead	10	6	2	2
Kemp's Ridley	3	2	0	1
Green	7	4	1	2
Leatherback	1	1		
Hawksbill				
Total	21	13	4	5

5.5.4 Extrapolated Smalltooth Sawfish Captures and Estimated Mortality in the Shark Bottom Longline Fishery

Extrapolated Smalltooth Sawfish Captures in Bottom Longline Gear

Carlson and Richards (2011) report estimated the mean number of smalltooth sawfish captured in the non-shark research fishery in the Gulf of Mexico from 2007-2010 was 17.3; no captures were observed (or estimated) in the South Atlantic. An additional 14 smalltooth sawfish were observed captured in shark research fishery during the same period; all from the Gulf of Mexico (Carlson and Richards 2011). In 2011, two smalltooth sawfish captures were observed in the South Atlantic shark research fishery; both animals were released alive (NMFS unpublished

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[35] Available at: http://www.sefsc.noaa.gov/turtledocs/UPR_SEFSC_PHMortality_2012.pdf

[36] Average post-release mortality for non-research fishery: (85% mortality rate + 5% mortality rate) ÷ 2 records = 45%; Average post-release mortality for research fishery: (10% mortality rate + 35% mortality rate + 5% mortality rate + 10% mortality rate) ÷ 4 records = 15% (NMFS unpublished data).

data). In total, 33.3 smalltooth sawfish were likely captured by shark bottom longline gear in the Gulf of Mexico and South Atlantic from 2007-2011.

Table 5.6 Estimated Smalltooth Sawfish Captures: Shark Bottom Longline Fishery
(Carlson and Richards 2011, NMFS unpublished data)

Year	Region	Species	Mean*
Estimated Captures for Non-Research Fishery			
2007	GOM	Smalltooth Sawfish	5.9
2008	GOM	Smalltooth Sawfish	9.2
2009	N/A	Smalltooth Sawfish	0
2010	GOM	Smalltooth Sawfish	2.2
2011	N/A	Smalltooth Sawfish	0
Observed Captures in Shark Research Fishery			
Year	**Region**	**Species**	**Number**
2007	N/A	Smalltooth Sawfish	0
2008	N/A	Smalltooth Sawfish	0
2009	GOM	Smalltooth Sawfish	5
2010	GOM	Smalltooth Sawfish	9
2011	SA	Smalltooth Sawfish	2
Total Estimated and Observed (2007-2011)			33.3
Annual Average (2007-2011)			6.7
*Carlson and Richards (2011) also provides the 95% CIs and CVs for the estimated captures in the non-research shark fishery			

Estimated Smalltooth Sawfish Mortality

Carlson and Richards (2011) reports that 19 out of the 20 smalltooth sawfish observed captures from 2007-2010 were released alive. Two additional smalltooth sawfish were captured in 2011, both were also released alive. The only observed mortality was in the non-research shark fishery. Unlike sea turtles, there are no criteria for assessing the post-release mortality of smalltooth sawfish. However, given the species' biology and the high survival rate of other bottom dwelling shark species (i.e., nurse sharks) caught on bottom longline gear,[37] we believe it is very likely that 95 percent of these animals did survive. Using that mortality rate, we estimate that up to two smalltooth sawfish captured from 2007-2011 may have suffered mortality, or 0.3 annually.[38]

5.5.5 Discussion of Assumptions and Factors Influencing Accuracy Extrapolated Take Estimate

The small sample size of observed incidental takes in the non-research shark fishery constrained the extrapolation of fishery-wide take estimates. The rarity of capture events was a problem because estimates are based on only one or a few captures. NMFS has wrestled with this problem before (see Appendix A, NMFS 2004c), and although NMFS recommended using bycatch estimates with a CV of 20 or 30 percent, NMFS also noted that in many rare event cases this might require 80-90 percent observer coverage (Richards 2007).[39] Additionally, sparse data

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[37] Of 504 nurse sharks (*Ginglymostoma cirratum*) observed taken from 2007-2009 on bottom longline, 499 (99 percent) were released alive (Hale et al. 2009, Hale et al. 2010, Hale et al. 2011).

[38] 33.3 smalltooth sawfish takes x 0.05 mortality rate = 1.66 mortalities; 6.7 average annual take x 0.05 mortality rate = 0.335 annual mortality

[39] The capture of ESA-listed species are considered rare events because relative to other fisheries resources, the bycatch of listed species is relatively rare.

may not fit a critical assumption of the delta lognormal model (Pennington 1983) that the non-zero CPUE's are drawn from a lognormal distribution (Carlson and Richards 2011). Nonetheless, with the current levels of observer coverage, these estimates represent the best available information regarding ESA-listed species interactions with the fleet and provide the best picture of the likely interactions that occurred over the last five years.

5.6 ESA-listed Species Captures by Atlantic Shark Gillnet Gear

The shark drift gillnet fishery developed off the east coast of Florida and Georgia in the late 1980s and its history and observer requirements are described (Trent et al. 1997, Passerotti et al. 2011 and references therein, Carlson and Richards 2011). Since the implementation of Amendment 2 to the Consolidated Atlantic HMS FMP (NMFS 2007a), the directed large coastal LCS gillnet fishery has been greatly reduced. The LCS trip limit of 33 sandbar sharks has essentially ended the strikenet fishery and limited the number of fishermen targeting LCS with drift gillnet gear. The SCS fishery was also limited by Amendment 2, but was more directly impacted by Amendment 3 to the Consolidated FMP (NMFS 2010a) which significantly reduced the SCS quota and established an individual quota for blacknose sharks. As a result, many gillnet fishermen that historically targeted sharks are now targeting finfish species such as Spanish mackerel, king mackerel, and bluefish with varying types of gillnet gear (Passerotti et al. 2010).

5.6.1 Observer Data Summary

Drift and Sink Gillnet Fisheries
Table 5.7 summarizes the sea turtle captures observed from 2007-2010 by all gillnet gears. In the sink gillnet fishery, three loggerhead sea turtle captures were observed in 2007 (Baremore et al. 2007). In 2009, one Kemp's ridley sea turtle was observed captured in drift gillnet gear (Carlson and Richards 2011). No sea turtle interactions were observed in 2008 (Passerotti and Carlson 2009), 2010 (Carlson and Richards 2011), or 2011 (NMFS unpublished data). No smalltooth sawfish or marine mammal interactions were observed from 2007-2011 (Carlson and Richards 2011; NMFS unpublished data).

As noted previously, new quotas implemented in Amendment 2 have greatly reduced the use of strike gillnet gear. From 2007 to 2010, only one year (2009) appeared to have any strike gillnet effort targeting sharks. However, even for 2009 it is unclear if the strike gillnet effort was targeting sharks, or simply landed sharks incidental to other catch. Confidentiality requirements do not allow for the level of analysis required to determine if the strike gillnet effort was directly targeting sharks (Passerotti et al. 2010). The information reported below on estimated and observed incidental takes is only for sink and drift gillnets.

Table 5.7 Observed Past Sea Turtle Captures: Shark Gillnet Fishery

(Carlson and Richards 2011)

Fishery	Year	Species	Area	Condition
SHX - Sink	2007	Loggerhead	SA	Dead
SHX - Sink	2007	Loggerhead	SA	Alive
SHX - Sink	2007	Loggerhead	SA	Alive
SHX - Drift	2009	Kemp's ridley	GOM	Alive

Size data is available for all three loggerheads observed captured by gillnet gear from 2007-2011. Two of the three loggerheads were likely oceanic/neritic juveniles with sizes of 70.5 and 75.5 cm CCL; the third was likely an adult (86.8 cm CCL) (NMFS unpublished data).[40] The Kemp's ridley measured 19.4 cm CCL and was most likely a juvenile.[41]

5.6.2 Estimated Takes of Sea Turtles in Atlantic Shark Gillnet Gear

Extrapolated Sea Turtle Captures in Non-Smoothhound Shark Gillnet Gear

Carlson and Richards (2011) employed a simple ratio estimator to represent bycatch rates (i.e., CPUE) of protected species in shark gillnet gear. More specifically, CPUE was calculated by dividing the sum of all observed sea turtles caught by species by the sum of the observed sets by gear type (i.e., sink, strike, or drift) (Snedecor and Cochran 1967). All observer data was combined (2007-2010) and stratified to the South Atlantic and Gulf of Mexico. Uncertainty in these estimates was derived from bootstrap re-sampling of the calculated CPUE data set (see Carlson and Richards 2011 for further discussion of the methods used to calculate uncertainty).

The incidental take estimates were calculated by multiplying the CPUE from the observer database by the total number of reported sets. Estimates were calculated for the Gulf of Mexico and South Atlantic regions and also for each gillnet gear type used in each region. An incidental take estimate for the entire shark gillnet fishery (i.e., both regions and all gear type combined) was also calculated by using the CPUE average for all areas combined multiplied by the total effort determined for all areas (Carlson and Richards 2011).

The total effort data used reflects all 2007-2010 gillnet trip reports received by the Coastal Fisheries Logbook Program (CFLP).[42] The target species for each trip was determined by using the proportion of shark catch to relative to the rest of the species landed for a trip. When sharks comprised 66.6 percent or more of a trip's total catch it was considered a shark directed trip. When sharks accounted for less than 33.3 percent of the total catch it was considered "other"; shark landings between 33.3 and 66.6 percent of the total catch were considered "mixed." Dogfish were included with all other sharks for trip target determination (Carlson and Richards 2011). Carlson and Richards (2011) estimate that from 2007-2010, across all gillnet gear types

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[40] Loggerheads hatchlings generally range from 4.5-15 cm SCL; "oceanic juveniles" range from 15-63 cm SCL; "oceanic/neritic juveniles" range from 41-82 cm SCL; and adults range from 82-100+ cm SCL (Conant 2009).

[41] Kemp's ridley sea turtles are considered adults at 60+ cm SCL (Ogren 1989).

[42] In 2007, the CFLP began using an updated trip report form that provided gillnet fishermen a place to note the type of gillnet used (strike, drift, anchor, or other) as well as space to provide the number of sets. These fields were unavailable on logbook forms prior to 2007. There are some instances where fishermen have submitted a 2007 or later trip on a pre-2007 form (Carlson and Richards 2011).

(i.e., sink and drift), a total of 35.6 loggerhead interactions and 11.8 Kemp's ridley interactions occurred. By gear type, 23.7 loggerhead interactions occurred in sink gillnets and 11.9 occurred in drift gillnets. All Kemp's ridley captures occurred in drift gillnets (Carlson and Richards 2011). Table 5.8 summarizes these calculations.

Table 5.8 Estimated Sea Turtle Captures: Atlantic Shark Gillnet Fishery
(Carlson and Richards 2011, NMFS unpublished data)

Species	Gear Type	Estimated Take
Loggerhead	Sink Gillnet	23.7
	Drift Gillnet	11.9
	Total Estimated Takes (2007-2011)	35.6
	Average Annual Takes (2007-2011)	7.1
Kemp's Ridley	Drift Gillnet	11.8
	Total Estimated Takes (2007-2011)	11.8
	Average Annual Takes (2007-2011)	2.4

Estimated Green, Leatherback, and Hawksbill Sea Turtle Takes in the Shark Gillnet Fishery
Since no leatherback, green, or hawksbill sea turtles takes were observed in shark gillnet gear, from 2007-2010 there are no extrapolated take estimates in Carlson and Richards (2011). However, previous captures of these species in this gear type have been documented (see Carlson 2001, Carlson and Baremore 2002, Garrison 2007). Since we believe these species sea turtles could be captured in shark gillnet gear we also estimated takes of these species.

We used the same approach discussed in Section 5.5.2 and described in more detail in Appendix 6 to calculate the number of green, leatherback, and hawksbill sea turtle takes in the fishery. We have summarized our estimates in Table 5.9. Since our estimates for leatherbacks and hawksbills were each less than one, we combined those takes.

Table 5.9 Estimated Annual Sea Turtle Takes in Atlantic Shark Gillnet Gear

Species	Estimated Annual Take
Loggerhead	7[a]
Kemp's Ridley	2[a]
Green	5[b]
Leatherback	1[b,c]
Hawksbill	
Total	15

[a] Estimated by Carlson and Richards (2011)
[b] Estimated in Appendix 6
[c] This take is for these species are in combination, not one of each species

Estimated Immediate and Post-Release Mortality of Sea Turtles
Carlson and Richards (2011) reported the final condition (i.e., alive or dead) of the observed bycatch events, but did not calculate mortalities when estimating the total number of sea turtle gillnet captures. Identifying the number of individuals that may die as a result of interactions with shark gillnet gear is necessary to better assess the impacts of the action on the species when we conduct our jeopardy analysis. The information provided on the shark gillnet fishery indicates that 25 percent of sea turtles captured suffer an immediate mortality (i.e., are dead

when gear is retrieved or die shortly after).[43] With no other information on the mortality rates of incidentally captured sea turtles in the shark gillnet fishery, we believe it is reasonable to use this rate.

In theory, animals interacting with drift gillnets may have a lower rate of mortality. By definition, drift gillnets are not anchored and this configuration is likely more conducive to sea turtles being able to reach the surface to breathe. Because sink gillnets are weighted, entangled sea turtles may have a more difficult time reaching the surface to breathe. Thus, sea turtles entangled in drift gillnet gear may be more likely to survive an entanglement than one entangled in a sink gillnet. On its face, the data on the observed interactions with sea turtles and shark gillnet gear bear this out. The only mortality observed was in the sink gillnet fishery, no mortalities were observed with drift gillnet gear. However, because the sample size for shark drift gillnet interactions is so small, and we know that sea turtle mortalities have occurred as a result of drift gillnet entanglements in other fisheries (see Carlson 2000, Carlson 2001, Carlson and Baremore 2002, Garrison 2003, Carlson and Bethea 2006, and Garrison 2007) we believe it is appropriate to act conservatively and apply our estimated mortality rate to those captures estimated for the drift gillnet fishery.

Multiplying a mortality rate of 25 percent by the total number of estimated sea turtle interactions from Table 5.9 yields an annual estimate of 7 loggerhead (5 non-lethal, 2 lethal), 2 Kemp’s ridley (1 non-lethal, 1 lethal), 5 green (4 non-lethal, 1 lethal), and 1 leatherback or hawksbill sea turtle takes. Since we only estimated one hawksbill or leatherback take annually, multiplying the percentages and rounding indicated that take would be non-lethal. However, since we know that hawksbills and leatherbacks are vulnerable to gillnet mortality, we believe it is more prudent to assume the take could be lethal or non-lethal. Our estimates of lethal and non-lethal takes by species, based on immediate mortality, are summarized in Table 5.10.

Table 5.10 Estimated Annual Lethal and Non-Lethal Takes of Sea Turtles in Atlantic Shark Gillnet Gear

<table>
<tr><th>Species</th><th>Non-Lethal Take</th><th>Lethal Take Due to Immediate Mortality</th><th>Total Estimated Take</th></tr>
<tr><td>Loggerhead</td><td>5</td><td>2</td><td>7</td></tr>
<tr><td>Green</td><td>4</td><td>1</td><td>5</td></tr>
<tr><td>Leatherback</td><td colspan="2" rowspan="2">1</td><td rowspan="2">1</td></tr>
<tr><td>Hawksbill</td></tr>
<tr><td>Kemp’s ridley</td><td>1</td><td>1</td><td>2</td></tr>
<tr><td>Total</td><td>11</td><td>5</td><td>16*</td></tr>
<tr><td colspan="4">*This number is greater than our total estimated take because it assumes the hawksbill or leatherback take was both lethal and non-lethal, not one or the other.</td></tr>
</table>

Most, if not all, sea turtles released alive from gillnet gear will have experienced a physiological injury from forced submergence and/or traumatic injury from entanglement. Thus, in addition to the mortality observed at the time of release, some level of post-release mortality is expected for sea turtles released alive.

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[43] Table 5.6 shows 1 of 3 sink gillnet entanglements resulted in immediate mortality and the single drift gillnet entanglement did not result in an immediate mortality.

Snoddy and Williard (2010) estimated that post-release mortality for sea turtles released from gillnet gear was likely between 7-29 percent. While the study was conducted inshore and used soak times less that those likely used in the Atlantic shark fishery, this study represents the best available data on sea turtle post-release mortality following interactions with gillnet gear and we believe it is prudent to use those data here. Thus, we applied the mortality estimates for Snoddy and Williard (2010) to our estimates of non-lethal takes. To act conservatively we applied the 29 percent mortality estimate. The results of those calculations are in Table 5.11.

Table 5.11 Estimated Annual Immediate Mortalities, Post-Release Mortalities, and Non-Lethal Takes of Sea Turtles in Non-Smoothhound Gillnet Gear

<table>
<tr><th>Species</th><th>Non-Lethal Take</th><th>Lethal Take Due to Immediate Mortality</th><th>Lethal Take Due to Post-Release Mortality</th></tr>
<tr><td>Loggerhead</td><td>4</td><td>2</td><td>1</td></tr>
<tr><td>Green</td><td>3</td><td>1</td><td>1</td></tr>
<tr><td>Leatherback</td><td colspan="2" rowspan="2">1</td><td rowspan="2">0</td></tr>
<tr><td>Hawksbill</td></tr>
<tr><td>Kemp’s ridley</td><td>1</td><td>1</td><td>0</td></tr>
<tr><td>Total*</td><td>9</td><td>5</td><td>2</td></tr>
<tr><td colspan="4">*This number is greater than our estimated total takes because it assumes the hawksbill or leatherback take was both lethal and non-lethal.</td></tr>
</table>

5.6.3 Estimated Captures Smalltooth Sawfish and Atlantic Sturgeon Takes in Non-Smoothhound Gillnet Gear

Since no smalltooth sawfish or Atlantic sturgeon takes were observed in shark gillnet gear, there are no extrapolated take estimates in Carlson and Richards (2011) and no further discussion of those species will occur in this section. However, in Section 5.11 (Analysis of Potential Future Impacts from the Continued Authorization of the Atlantic Shark Fisheries, Including the Smoothhound Fishery), additional consideration is given to the effect of shark gillnet gear on these species.

5.6.4 Discussion of Factors Potentially Influencing the Accuracy of Extrapolated Past Non-Smoothhound Shark Gillnet Take Estimates

Carlson and Richards (2011) identified a few assumptions and factors that could influence the accuracy of the past take estimates. For example, the total effort data used in Carlson and Richards’ (2011) gillnet take estimates used all gillnet trip reports received by the CFLP from 2007-2010. However, in 2007 the CFLP began using an updated trip report form that provided gillnet fishermen a place to note the type of gillnet used (strike, drift, anchor, or other) as well as space to provide the number of sets. These fields were unavailable on logbook forms prior to 2007 and there are some instances where fishermen have submitted a 2007 or later trip on a pre-2007 form. Trips reported on these earlier forms are recorded in the logbook data as having one set, for ‘GILLNETS, OTHER’ (gear code 425). In an effort to provide a more accurate effort measure, a particular vessel’s reports on the newer forms were examined and their most common gear type and number of sets was applied based on trip target. Where a matching trip target was not found in the newer reports, the most common number of sets and gillnet type were used (Carlson and Richards 2011).

There were also a number of shark directed trips without a directed shark permit. Carlson and Richards (2011) suggest this situation is likely attributable to two primary reasons. First, some of those trips may have been targeting spiny dogfish and the possession of a directed shark permit is not required to fish for dogfish. Second, some vessels that fish for sharks solely in state waters are not required to have Federal shark permits. These state fishermen may have reported on the CFLP because they possessed a logbook from another permit they held (e.g., Gulf of Mexico Reef Fish, King Mackerel, South Atlantic Snapper/Grouper, etc.) (Carlson and Richards 2011).

Observer effort was also not spatially and temporally equal in many years and sample sizes are small. While considerable effort was made to distinguish logbook data by gillnet type, 4-10 percent of records were reported as gillnet “other” which makes it difficult to assign to a specific category. Additionally, fishermen also reported strikenet fishing for sharks (in some cases up to 44 percent of total effort by year); however, the SGOP indicates this activity has significantly decreased (Carlson and Richards 2011). Carlson and Richards (2011) stress that in the absence of more reliable effort data, their estimates should be considered uncertain and refinement of effort data could change the past sea turtle take estimates.

5.7 Effects of the Recreational Shark Fishery on Smalltooth Sawfish

Smalltooth sawfish are occasionally hooked with rod-and-reel and/or handline during recreational fishing. These captures occur most frequently in the vicinity of the Everglades National Park and Florida Bay, where the current population is concentrated. North of this area, the number of reported captures declines greatly. The National Park Service monitors fishing activity and harvest in Everglades National Park, in part by conducting interviews with anglers and fishing guides at local boat ramps. Most anglers do not report targeting a particular fish species. The target species of the few anglers indicating they do target a particular fish species include snook, spotted sea trout, red drum, and tarpon. All these records are from fishing within state waters, where smalltooth sawfish and sharks are more likely to co-occur.

From 1999-2011, the NSED includes 1,399 smalltooth sawfish captures on recreational rod-and-reel gear. Only 15 of those captures occurred in federal waters and none of those 15 captures occurred during trips that reported targeting sharks. Most commonly, no target species was listed (n=10), followed by trips targeting snappers and groupers (n=5) (NSED unpublished data). The only known smalltooth sawfish capture on rod-and-reel in federal waters while targeting sharks was by an aquaria collector (T. Wiley, pers. comm.).

Both recreational shark fishing effort and smalltooth sawfish abundance are much higher in state waters than in federal waters. We believe it is the reduced effort and smalltooth sawfish abundance in federal waters that make incidental capture of smalltooth sawfish by recreational shark anglers fishing in federal waters so rare. Recreational fishing for sharks in the EEZ appears unlikely to capture smalltooth sawfish. However, since 10 of the 15 trips that captured smalltooth sawfish in the EEZ did not indicate a target species, we believe an incidental capture could happen. Even if all 10 of the trips that did not record a target species had been targeting sharks, smalltooth sawfish captures would still be no more than one annually. Based on this information, we will assume that up to one smalltooth sawfish may be captured annually by recreational fishermen who target sharks in the EEZ. Based on the release conditions reported via the NSEF, we believe the animal is likely to survive the interaction.

5.8 Sea Turtle Captures by Smoothhound Gillnet Gear

In the following sections, we describe the approach used by Murray (2009a and b) to estimate the number of loggerheads captured by smoothhound gillnet gear. At present, these reports contain the best information available to determine the likely impacts of the smoothhound fishery on loggerhead sea turtles. This section also describes how we determined the number of non-loggerhead species captured by smoothhound gillnet gear, as well as our process for determining the number of lethal and non-lethal captures for all species. Murray (2009a and b) includes a more detailed discussion of the data sources used, the calculation methods, the constraints of those methods, and the assumptions under which those calculations were made.

The gears used to target smoothhound in federal and state waters are the same. The time of year when the fishery operates is also generally the same across state and federal waters. The species of sea turtles that occur in the action area are all highly migratory and found in both state and federal waters. The vast majority of both state and federal fishing effort likely occurs in the depth range 0-120 ft where sea turtles are known to occur most frequently. Since the gear, timing, and distribution of effort with respect to sea turtle abundance are essentially the same in both state and federal waters, neither fishery is likely to have a disproportionate rate of entanglement of sea turtles.

Estimated Loggerhead Sea Turtle Captures
Murray (2009a) reported that from 1995-2006, the NEFOP documented 59 sea turtles identified to species captured in Mid-Atlantic gillnet gear.[44] The observed loggerhead captures were used to develop a Generalized Additive Model (GAM) that described loggerhead bycatch rates in Mid-Atlantic gillnet fisheries. Murray (2009b) applied the GAM to adjusted VTR landings data to estimate total loggerhead bycatch on each individual VTR trip. The estimated bycatch of each trip was then summed to estimate the total loggerhead bycatch in the Mid-Atlantic sink gillnet fisheries.[45] To apportion the estimated loggerhead bycatch per trip for each target species, Murray (2009b) apportioned the landings of each target species by weight. For example, “if a vessel landed 800 pounds of monkfish, 150 pounds of skate, and 50 pounds of bluefish, the estimated number of loggerheads for that trip would be apportioned among these three species, with monkfish receiving 80 percent of the total estimated loggerhead bycatch” (Murray 2009b). Summing the bycatch values for each trip yielded an estimate of the number of loggerheads captured annually from 2002-2006 in state and federal Mid-Atlantic gillnet gear (Murray 2009b). The loggerhead take estimate provided in Murray (2009b) represents the best available data for estimating the impact of smoothhound gillnet fishing.

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[44] Observed sea turtles: 41 loggerhead, 5 green, 5 leatherback, and 8 Kemp’s ridley sea turtles (Murray 2009a).

[45] All federally-permitted vessels fishing in federal fisheries and operating in the Northeast are required to use the VTR system. However, examination of dealer weigh-out data, and North Carolina Department of Marine Fisheries (NCDMF) landings data, found landings were underreported in the VTR system. To account for these discrepancies, Murray (2009a) calculated an adjustment factor to allow the VTR data to be compared more easily.

Murray (2009b) estimated that from 2002-2006, 159 loggerhead sea turtles were captured by smoothhound gillnet gear in state and federal waters combined. The number of estimated annual takes ranged from a low of 10 (in 2006) to a high of 53 (in 2003), with an annual average of 32. Since data indicates that landings of smoothhound have been on the rise recently, we chose to act conservatively and use the highest estimate of 53 when quantifying the impact of smoothhound fishing on loggerhead and non-loggerhead sea turtle species. The sample size for non-loggerheads was too small for models to be developed for these species (K. Murray, Northeast Fisheries Science Center, pers. comm. 2009).

Estimated Green, Leatherback, Hawksbill, and Kemp's Ridley Sea Turtle Takes

Murray (2009b) did not estimate takes of the green, leatherback, hawksbill or Kemp's ridley sea turtles. These species are known to become entangled in gillnet gear, and the observed takes reported in Murray (2009a) (other than hawksbills) are evidence of the presence and susceptibility of these species to gillnet gear in the Mid-Atlantic region. Since we believe non-loggerhead sea turtles could be captured in smoothhound gillnet gear we also estimated takes of these species for that same time period.

To calculate the number of green, leatherback, hawksbill, and Kemp's ridley sea turtle takes in the fishery we followed a similar approach to the one described in Section 5.6.2 and Appendix 6. However, in this case we used the estimated mean annual loggerhead take reported by Murray (2009b) and STSSN data on the number of sea turtle strandings from North Carolina to Massachusetts from 2005-2011 were used to calculate species abundance. We chose to use the STSSN ratios to from North Carolina to Massachusetts because this is the primary area where the smoothhound fishery is currently occurring. As with our estimated takes in the non-smoothhound gillnet fishery, Appendix 6 describes the steps we used to calculate non-loggerhead species.

Murray (2009b) estimated the loggerhead take for both state and federal waters. VTR data often includes information on the distance from shore where smoothhound were caught.[46] Since the subject of the consultation is the smoothhound fishing in federal waters, we used the distance from shore information provided by the VTR data to estimate smoothhound fishing effort in federal waters. From 2004-2011, the proportion of smoothhound landings coming from federal waters was the highest in 2004 at 47 percent; the lowest in 2007, 27 percent; and the mean was 36 percent (VTR Database, unpublished data). We acted conservatively and used 47 percent in our calculations to estimate smoothhound effort in federal waters. Applying that 47 percent fishing effort rate to our take calculations yielded an estimate of the annual number of sea turtles likely captured during smoothhound fishing in federal waters. Table 5.12 displays the estimated number of annual takes in federal waters for each species.

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[46] Distance from shore categories for the Atlantic include: inland, inshore (0-3 miles), EEZ (3-200 miles), and international (200+ miles).

Table 5.12 Estimated Annual Sea Turtle Takes in Federal Smoothhound Gillnet Gear

Species	Estimated Annual Take
Loggerhead	25
Green	7
Leatherback	2
Kemp's ridley	7
Hawksbill	1
Total	42

Estimating Immediate and Post-Release Mortality of Sea Turtles

Murray (2009b) did not estimate immediate or post-release mortality for loggerhead takes. This ultimate fate of animals incidental captured is needed to conduct an effective jeopardy analysis. Murray (2009a) reported 52 percent of observed entanglements were non-lethal, 40 percent were lethal, and observers could not determine 8 percent. To act conservatively, we assumed the eight percent of entanglements that could not be determined were ultimately lethal leading to a mortality ratio of 52 percent non-lethal to 48 percent lethal. We used this ratio to estimate 25 loggerhead (13 non-lethal, 12 lethal), 7 green (4 non-lethal, 3 lethal), 2 leatherback (1 non-lethal, 1 lethal), and 7 Kemp's ridley (4 non-lethal, 3 lethal) sea turtles would be taken annually. Since we only estimated one hawksbill take annually, multiplying the percentages and rounding indicated the hawksbill take would be non-lethal. However, since we know that hawksbills are vulnerable to gillnet mortality, we believe it is more prudent to assume the take could be lethal or non-lethal. Our estimates of lethal and non-lethal takes by species, based on immediate mortality, are summarized in Table 5.13.

Table 5.13 Estimated Annual Lethal and Non-Lethal Takes of Sea Turtles

<table>
<tr><th>Species</th><th>Non-Lethal Take</th><th>Lethal Take Due to Immediate Mortality</th><th>Total Estimated Take</th></tr>
<tr><td>Loggerhead</td><td>13</td><td>12</td><td>25</td></tr>
<tr><td>Green</td><td>4</td><td>3</td><td>7</td></tr>
<tr><td>Leatherback</td><td>1</td><td>1</td><td>2</td></tr>
<tr><td>Hawksbill</td><td colspan="2">1</td><td>1</td></tr>
<tr><td>Kemp's ridley</td><td>4</td><td>3</td><td>7</td></tr>
<tr><td>Total</td><td>23</td><td>20</td><td>43*</td></tr>
<tr><td colspan="4">*This number is greater than our total estimated take because it assumes the hawksbill take was both lethal and non-lethal, not one or the other.</td></tr>
</table>

Most, if not all, sea turtles released alive from gillnet gear will have experienced a physiological injury from forced submergence and/or traumatic injury from entanglement. Thus, in addition to the mortality observed at the time of release, some level of post-release mortality is expected for sea turtles released alive.

Snoddy and Williard (2010) estimated that post-release mortality for sea turtles released from gillnet gear was likely between 7-29 percent. While the study was conducted inshore and used soak times less that those likely used in the smoothhound fishery, this study represents the best available data on sea turtle post-release mortality following interactions with gillnet gear and we believe it is prudent to use those data here. Thus, we applied the mortality estimates for Snoddy and Williard (2010) to our estimates of non-lethal takes. To act conservatively we applied the 29 percent mortality estimate. The results of those calculations are in Table 5.14.

Table 5.14 Estimated Annual Lethal and Non-Lethal Sea Turtle Takes

Species	Non-Lethal Take	Lethal Take Due to Immediate Mortality	Lethal Take Due to Post-Release Mortality
Loggerhead	9	12	4
Green	3	3	1
Leatherback	1	1	0
Kemp's ridley	3	3	1
Hawksbill	1		
Total*	17	20	7
*This number is greater than our estimated total takes because it assumes the hawksbill take was both lethal and non-lethal.			

5.9 Atlantic Sturgeon Takes by Smoothhound Gillnet Gear

5.9.1 Summary of Information on Atlantic Sturgeon Bycatch in Commercial Fisheries

Atlantic Sturgeon Marine Bycatch and Mortality on the Continental Shelf of the Northeast United States – Stein et al. (2004b)

Stein et al. (2004b) provided Atlantic sturgeon bycatch and mortality estimates for the Mid-Atlantic region, based on data from 1989-2000. The analysis focused on three gear types: otter trawl gear, sink gillnets, and drift gillnets. Atlantic sturgeon bycatch was recorded by observers and bycatch rates were calculated as ratios of sturgeon weight to catch weight of all landed species, per trip (Stein et al. 2004b). Atlantic sturgeon were observed caught from Maine to North Carolina, with a total of 25,035 lbs of sturgeon caught from 1989-2000. Seasonal trends indicated that Atlantic sturgeon bycatch rates were highest in the winter and spring. Interestingly, bycatch rates were the lowest in the summer when fishing effort was highest. The highest bycatch rates were associated with landings in Maryland, Virginia, and North Carolina. However, 64 percent of the total Atlantic sturgeon catch was observed in Massachusetts, New Jersey, and North Carolina. Stein et al. (2004b) also reported that target species influenced Atlantic sturgeon bycatch and bycatch rates. Gears targeting monkfish (*Lophius americanus*) (identified as "goosefish" in Stein et al. 2004b) and spiny dogfish (*Squalus acanthias*) accounted for over 60 percent of observed Atlantic sturgeon bycatch, catching 7,975 and 3,910 animals from 1989-2000, respectively. Stein et al. (2004b) estimated bycatch rates for a number of target species including smoothhound. For all gears landing smoothhound, they estimated 0.003086 lb of Atlantic sturgeon were caught for each pound of smoothhound landed. Stein et al. (2004b) also calculated an Atlantic sturgeon bycatch by gear type. For otter trawl gear, overall, the mean bycatch rate was 0.00085 pounds of sturgeon per monitored pound landings in this gear type. For sink gillnets overall, the mean bycatch rate was 0.00144 and the mean overall drift gillnet bycatch rate was estimated at 0.0059 (Stein et al. 2004b). The baseline mortality rates of bycaught Atlantic sturgeon for sink and drift gillnets were estimated at 22 and 10 percent, respectively (Stein et al. 2004b). Based on the bycatch and mortality rates estimated for sink gillnets, Stein et al. (2004b) reported that from 1989-2000 this gear killed an estimated 1,000 individual Atlantic sturgeon (236,292 lbs) annually, based on the mean weight from the individual fish records. During the same period, drift gillnets were estimated to have killed approximately 385 individual Atlantic sturgeon (70,604 lbs) (Stein et al. 2004b).

Estimation of Atlantic Sturgeon Bycatch in Coastal Atlantic Commercial Fisheries of New England and the Mid-Atlantic – ASMFC (2007)

In 2007, the ASMFC and NMFS sponsored a workshop to provide an updated assessment on the impacts of commercial otter trawl, sink gillnet, and anchored gillnet fishing on Atlantic sturgeon from 2001-2006 (ASMFC 2007). The workshop participants opted to model bycatch, as opposed to estimating it via interpolation and a ratio method as done by Stein et al. (2004b). The bycatch models indicated that between 2,752 and 7,906 (mean of 5,143) Atlantic sturgeon were incidentally caught in coastal gillnet and otter trawl from 2001-2006, with mortalities ranging from 352 to 1,286 (mean of 649) animals during the same period. The estimated mortality rate of bycaught animals was 13.8 percent (ASMFC 2007).

Observed Atlantic sturgeon bycatch from 2001-2006 showed a temporal trend with most animals being caught in April and May and the fewest being caught in August and September (ASMFC 2007). These trends are similar to those noted in Stein et al. (2004b). Atlantic sturgeon bycatch in sink gillnet gear occurred almost entirely in waters shallower than 40 m (ASMFC 2007).

The ASMFC report also evaluated how a number of specific factors (e.g., mesh size, twine material, tie-down use, etc.) can affect bycatch rates and bycatch mortality in sink gillnet gear (ASMFC 2007). As part of this larger analysis, the “dogfish” fishery was specifically addressed and included all records for trips targeting both smoothhounds and spiny dogfish. ASMFC (2007) reported that the dogfish fishery used mesh sizes ranging between 5-6.83 inches, used tie-downs only 6 percent of the time, and had soak times longer than 24 hours 31 percent of the time. From 2001-2006, the dogfish fishery incidentally took 32 Atlantic sturgeon, 5 of which died, indicating a mean mortality rate of 16 percent (ASMFC 2007).

Summary of Observer Data on Fishing Characteristics Collected During Smoothhound Trips

From 1994-2010, the NEFOP observed 1,274 trips targeting smoothhound. During that period observers confirmed the use of tie-downs on 0.8 percent of trips (n=11). It was unclear if tie-downs were used on an additional 0.4 percent of other trips (n=5). During 9 of the 11 trips where tie-downs were confirmed, observers documented their use in all the nets fished. In the other two trips, tie-downs were only used in some of the nets fished. NEFOP observers documented a wide range of soak times during those 1,274 trips. Approximately 22 percent of trips had total soak times between 0 and 5 hours; 0.74 percent of trips soaked gear between 5.1 and 10 hours; 64.2 percent soaked gear between 10.1 and 24 hours, while 13 percent soaked gear 24 hours or longer. These data indicate the majority of trips (i.e., 87 percent) have a total soak time of less than 24 hours (NEFOP unpublished data).

Between 2008 and 2012, the SGOP, overseen by the SEFSC, observed 28 trips targeting smoothhounds. Observers never documented the use of tie-downs during these trips. Like the trips observed by the NEFOP, SGOP observers also documented a wide range of soak times. The SGOP observer data indicates approximately 57 percent of trips had a soak time between 0 and 5 hours; 35.7 percent of trips soaked gear between 5.1 and 10 hours; 3.6 percent soaked between 10.1 and 24 hours, while 3.4 percent of trips had a soak time of 24 hours or longer. These data indicate the majority of trips (i.e., 96 percent) have a soak time of less than 24 hours (SEFSC unpublished data).

Summary of Discard Estimates for Atlantic Sturgeon – NEFSC (2011a)

NEFSC (2011a) explored two approaches to estimate Atlantic sturgeon bycatch in sink gillnet and otter trawl fisheries in the Mid-Atlantic and Northeast. They first evaluated a design-based ratio estimator that used a ratio of total observed sturgeon takes to landings. NEFSC (2011a) concluded this approach would require relying upon a set of assumptions that were to difficult to satisfy given the data available.

NEFSC (2011a) decided to use a generalized linear model to produce a model based estimator instead. A number of models, each evaluating different predictor variables and mesh sizes, were run to identify the model that best fit the available data. NEFSC (2011a) includes models for both otter trawl and sink gillnet gear. However, since the smoothhound fishery only uses gillnet gear, we only provide a description of the model's outcome for this gear type.

NEFSC (2011a) only used observer data from federal waters, north of Cape Hatteras, North Carolina. Sturgeon included in the analysis included any animal identified by federal observers as Atlantic sturgeon, as well as any unidentified sturgeon (NEFSC 2011a).

The model-based estimates for sink gillnet gear in NEFSC (2011a) indicated that between 858 and 2,216 Atlantic sturgeon were incidentally caught annually from 2006-2010, with mortalities ranging from 30 to 309 animals during the same period. The estimated average mortality rate of Atlantic sturgeon bycaught in sink gillnet gear was 20.6 percent from 2006-2010 (NEFSC 2011a).

NEFSC (2011a) reports that of the observed Atlantic sturgeon bycatch from 2006-2010, most animals were caught in April and May and the fewest were caught in September and October (NEFSC 2011). These trends are similar to those noted in Stein et al. (2004b) and ASMFC (2007). NEFSC (2011a) also provided an estimate of the total number of Atlantic sturgeon likely captured each year in sink gillnet fisheries, and what proportion of those takes could be attributed to specific federally-managed fisheries. NER-Protected Resources Division (NER-PRD) and NER-Sustainable Fisheries Division discussed the estimates and reallocated some takes based on the knowledge of how certain fisheries operate. However, after the reallocation the estimates of the total number of animals captured annually and the average number of animals caught did not change. Table 5.15 lists the Atlantic sturgeon takes by FMP from 2006-2010, including the reallocated takes. Since smoothhound is not a federally-managed species, NEFSC (2011a) did not provide an estimate of Atlantic sturgeon takes for that fishery. However, Atlantic sturgeon takes in smoothhound gear are represented as part of the "other" category.

Table 5.15 Estimated Average Atlantic Sturgeon Takes in Sink Gillnet Gear by FMP

Federal FMP	Avg. Annual Gillnet Takes (2006-2010)	Avg. Annual Mortalities* (2006-2010)
Monkfish	719	194
Groundfish	189	38
Bluefish	160	32
Summer Flounder, Scup, & Black Sea Bass	9	2
Spiny Dogfish	107	21
Skate	20	4
Squid, Mackerel, & Butterfish	7	2
Scallop	2	0
All FMPs	1,213	293
Others**	356	71
*NER-PRD indicates gillnet mortality rates are assumed to be 20%, except in the case of monkfish where the mortality rate is assumed to be 27%		
**"Others" include: smoothhound, croaker, weakfish, striped bass, northern kingfish, and southern kingfish		

5.9.2 Estimated Atlantic Sturgeon Takes in Smoothhound Gillnet Gear

Estimated Atlantic Sturgeon Takes
Stein et al. (2004b) provide an actual Atlantic sturgeon bycatch rate in smoothhound fishing gear. Unfortunately, that rate was estimated as the number of pounds of Atlantic sturgeon caught by smoothhound gear. Converting the number of pounds of Atlantic sturgeon into number of individuals is problematic. Stein et al. (2004b) were able to make that conversion because they were able to review the information on animals observed caught to estimate mean weights. We do not have that information, making a similar conversion difficult. Additionally, since an animal's weight increases as it ages, estimating the number of individuals based on a total bycatch weight would depend on the assumptions we make about which life stages make up the bycatch. For these reasons, we believe it is imprudent to use the bycatch rates presented in Stein et al. (2004b) to estimate the past takes of Atlantic sturgeon by smoothhound gear fishing in federal waters.

The ASMFC (2007) report does provide information that would allow us to calculate Atlantic sturgeon takes in number of animals. However, the data provided in that report is dated and does not include specific information about the smoothhound fishery. Instead, we chose to use the data from NEFOP on actual interactions between the smoothhound gillnet fishery and Atlantic sturgeon. Those records indicated that of the Atlantic sturgeon captured by fisheries listed in the NEFSC (2011a)'s "other" category, smoothhound trips accounted for 30.4 percent of those takes, or 108 animals.[47]

Estimated Atlantic Sturgeon Captures by Life Stage
In the previous section we estimated total capture numbers. It is also important to consider what life stage is being affected and what the impact is to the overall life stage of the species. In general, impacts to adults (i.e., sexually mature animals) are more likely to affect population growth rates than impacts to sub-adults. The NEFSC conducted an analysis of the Atlantic sturgeon takes observed by the NEFOP, categorizing them by length. From 2006-2010, there

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[47] 356 average annual sink gillnet takes by "other" fisheries x 30.34% of "other" fishery captures were on smoothhound trips = 108 Atlantic sturgeon captures on smoothhound trips.

were 726 observations that could be categorized in this way. Of these, 75 percent (545) were subadults and 25 percent (182) were adults; we multiplied our take estimate by these percentages. Using this approach, we estimate that 81 subadults and 27 adults will be captured by smoothhound fishing in federal waters annually.[48]

Estimated Atlantic Sturgeon Mortality

The ASMFC (2007) report indicates a mortality rate in dogfish (both smoothhound and spiny dogfish) gillnet gear of 16 percent. The report also describes mortality rates by mesh size. The ASMFC (2007) report categorizes the dogfish fishery as a medium-mesh fishery (greater than 5-inch and less than 7-inch) category. Mortality rates for medium mesh gillnets were slightly higher, 20 percent. NEFSC (2011a) reports the average Atlantic sturgeon mortality rate in federal sink gillnet fisheries from 2006-2010 was approximately 20 percent. The NEFSC (2011a) report does not provide specific information about Atlantic sturgeon mortality in dogfish fisheries. From 1989-2004, Stein et al. (2004b) estimated the Atlantic sturgeon mortality rate in sink gillnet gear was 22 percent. These reports support an estimate of Atlantic sturgeon mortality in sink gillnet gear of 16-22 percent annually. We chose to use the mortality estimate from NEFSC (2011a) because it was estimated based on the most recent data available.

In the previous section we estimate the likely number of Atlantic sturgeon that were incidentally captured during smoothhound fishing in federal waters (i.e., 81 subadults and 27 adults). To estimate mortality we multiplied those numbers by the 20 percent mortality rate. That calculation indicates that of the estimated 81 subadult takes, 16 will be lethal,[49] and of the estimated 27 adult takes, 5 will be lethal.[50] Table 5.16 describes the number of likely Atlantic sturgeon takes during smoothhound fishing in federal waters annually, by life stage.

Table 5.16 Numbers of Adult and Subadult Atlantic Sturgeon (ATS) Taken Annually

Adults			Subadults			Total Takes (Adults and Subadults)
# of Non-Lethal Takes	# of Lethal Takes	Total Adult ATS Takes	# of Non-Lethal Takes	# of Lethal Takes	Total Subadult ATS Takes	
22	5	27	65	16	81	108

Assigning Captures to the Five Atlantic Sturgeon DPSs

Atlantic sturgeon mix extensively in the marine environment, and individuals from all five Atlantic sturgeon DPSs could interact with the smoothhound fishery. NER-PRD conducted a Mixed Stock Analysis (MSA) to determine the composition of Atlantic sturgeon stocks along the East Coast. The MSA used tag-recapture data and genetic samples to trace captured fish back to their DPS of origin (NER-PRD 2012). Atlantic sturgeon can be assigned to their DPS based on genetic analyses with 92-96 percent accuracy (ASSRT 2007), though not all of the fish whose data was used in the MSA could be assigned to a DPS (NER-PRD 2012). Data from the NEFOP and the At Sea Monitoring programs were used in the MSA to determine the percentage of fish from each of the DPSs at the selected locations along the coast (NER-PRD 2012).

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[48] The smoothhound fishery likely takes 108 Atlantic sturgeon annually x 75% likely sub-adults = 81 and 25% adults = 27.

[49] 81 estimated sub-adult Atlantic sturgeon takes annually x 20% mortality rate = 16.2 Atlantic sturgeon mortalities

[50] 27 estimated adult Atlantic sturgeon takes annually x 20% mortality rate = 5.4 Atlantic sturgeon mortalities

NER-PRD examined the raw results of the genetic analyses to determine if natural geographic boundaries emerged. Given the relatively small number of samples, boundaries were not obvious from the genetics data alone (NER-PRD 2012). The results of the MSA for the coastal samples indicated groupings of animals that coincided with three "marine ecoregions." These marine ecoregions were defined by The Nature Conservancy (TNC) and refined in 2007. Within a marine ecoregion, the composition of marine species is relatively homogenous and clearly distinct from adjacent ecoregions. TNC focused on features such as population isolation,[51] upwelling, nutrient inputs, freshwater influx, temperature regimes, ice regimes, exposure, sediments, currents, and bathymetric or coastal complexity, when defining ecoregions. Along the east coast of the United States, there are three marine ecoregions (Figure 5.2). The smoothhound fishery operates primarily in the Virginian marine ecoregion, which extends from approximately Chatham, Massachusetts, to approximately Cape Hatteras, North Carolina.

Figure 5.2 Three Marine Ecoregions off the East Coast of the United States

NER-PRD adapted these marine ecoregions using the boundaries for existing fisheries statistical areas and known Atlantic sturgeon migratory pathways (NER-PRD 2012). According to the MSA, the Virginian marine ecoregion falls into Marine Mixing Zone 2 (Figure 5.3). The MSA provides estimates of the composition of Atlantic sturgeon residing in Marine Mixing Zone 2 as

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[51] Isolation in the marine environment may be caused by "deep water, narrow straits, or rapid changes in shelf conditions." (Spalding et al. 2007)

a range around a mean value, with a five-percent confidence interval on either side. The mean composition estimates are listed below with the range in parenthesis.

- 2% St. John (Canadian population) (0%-7%)
- 11% Gulf of Maine DPS (6%-16%)
- 49% New York Bight DPS (44%-54%)
- 14% Chesapeake Bay DPS (9%-19%)
- 20% South Atlantic DPS (15%-25%)

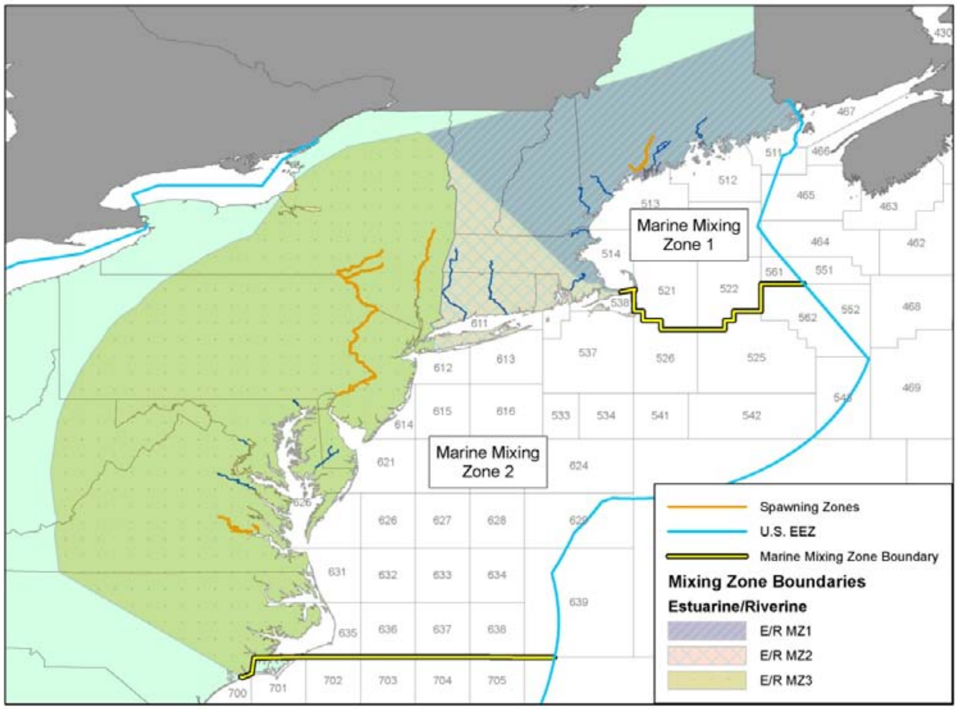

Figure 5.3 Map of Mixing Zones (NER-PRD 2012)

Fish from the Carolina DPS were not detected in the NEFOP observer program. Of six projects that captured or collected Atlantic sturgeon and provided genetic samples, only one detected fish originating from the Carolina DPS; even then the animals only accounted for 0.5 percent (estimate ranged from 0-5.5%). Animals from the Carolina DPS appear rare based on the genetic information currently available. However, since the NEFOP database for Marine Mixing Zone 2 is the best currently available, and because four percent of the DPS composition remains unallocated, we chose to act conservatively and assume that those four percent were Carolina DPS fish. We calculated the number of takes attributable to each DPS based on the following mean percent composition estimate for each DPS.

- 2% St. John (Canadian population)
- 11% Gulf of Maine DPS
- 49% New York Bight DPS
- 14% Chesapeake Bay DPS
- 20% South Atlantic DPS
- 4% Carolina DPS

It important to note that we estimate 0.54 adult and 1.62 sub-adult Atlantic sturgeon takes are likely from the population in St. John, Canada. Since these animals are from a population outside the United States, which was not listed under the ESA, we do not consider the takes of these animals further in this biological opinion. Likewise, since the mean composition estimates do not add to 100, the take estimates in Table 5.17 are slightly less than those estimated above.

Table 5.17 Estimated Number of Atlantic Sturgeon (ATS) Takes and Mortalities with Smoothhound Gear in Federal Waters by DPS

DPS*	Adults			Subadults			Total Takes (Adults and Subadults)
	# of Non-Lethal Takes	# of Lethal Takes	Total Takes	# of Non-Lethal Takes	# of Lethal Takes	Total Takes	
GOM	2.42	0.55	2.97	7.15	1.76	8.91	11.88
NYB	10.78	2.45	13.23	31.85	7.84	39.69	52.92
CB	3.08	0.70	3.78	9.10	2.24	11.34	15.12
Carolina	0.88	0.20	1.08	2.60	0.64	3.24	4.32
SA	4.40	1.00	5.40	13.00	3.20	16.20	21.60
Total	21.56	4.90	26.46	63.70	15.68	76.14	105.84

GOM = Gulf of Maine DPS, NYB = New York Bight DPS, CB = Chesapeake Bay DPS, and SA = South Atlantic DPS.

*NOTE: Takes estimated for animals from the St. John, Canada, population are not considered here because they were not listed under the ESA. Because these takes are not considered here, our total take numbers presented in this table are slightly less than the total estimated in Table 5.16.

Converting Subadults to "Adult Equivalent"

Adult Atlantic sturgeon are generally considered more important to the species than subadults because of their ability to breed. This is an important factor to consider when we evaluate the impacts of the proposed action on Atlantic sturgeon reproduction in our jeopardy analysis (Section 7.0). Thus, we wish to consider not only how the proposed action will affect adults, but also how it would affect subadults that may have lived to become adults ("adult equivalents"). NER-PRD developed an approach for estimating "adult equivalents." They calculated the proportion of subadults likely to survive to be adults by first adding up the total number of Atlantic sturgeon subadults (i.e., fish ages 2-10) in any year. Then they added up all the adults (i.e., fish ages 11-20). They then divided these sums to get the number of adults per sub-adult. When using the age-variable natural mortality, they estimated that each subadult equates to 0.48 adults. By applying that calculation to our estimates of subadult takes for each DPS from Table 5.17, we can calculate the likely number of adult equivalents that may be captured in smoothhound gear. Since the potential loss of reproduction is an important concern in our jeopardy analysis, and we believe animals suffering non-lethal effects will survive the interaction and could potentially reproduce in the future, we only converted the subadults we anticipate may be lethally taken. Table 5.18 displays the number of adult equivalents for each DPS calculated from the number of lethal subadults takes (rounded).

Table 5.18 Number of Lethal Subadults Takes Converted to Adult Equivalents

DPS	Estimated No. of Lethal Subadult Takes	No. Subadults Surviving to Adulthood	Estimated No. of Lethal Adult Equivalents Takes
GOM	2	0.48	0.96
NYB	8	0.48	3.84
CB	2	0.48	0.96
Carolina	1	0.48	0.48
SA	3	0.48	1.44

5.9.3 Discussion of Factors Potentially Influencing the Accuracy of Estimated Past Atlantic Sturgeon Takes in Smoothhound Gillnet Gear

NEFSC (2011a) identified a few assumptions and factors that could influence the accuracy of the past take estimates we used as the basis for our take estimates in the smoothhound fishery. For example, NEFSC (2011a) states the spatial coverage of observed trips is not sufficient to support precise estimation of discards at the level of 3-digit Statistical Area and monthly resolution, but is sufficient to support discard estimation at the level of 2-digit Statistical Areas.[52] The report also indicated that observer coverage for Mid-Atlantic species was generally lower than coverage rates on Georges Bank and in the Gulf of Maine (NEFSC 2011a). NEFSC (2011a) also considered any observer records where sturgeons were unidentified as Atlantic sturgeon. This means a non-Atlantic sturgeon may have erroneously been counted as one. However, this approach is conservative and appropriate since a number of Atlantic sturgeon captures likely go unobserved.

NEFSC (2011a) also states that partitioning incidental takes to FMPs or "others" has limited use because of the high likelihood that incidental takes may be incorrectly attributed to a particular fishery. NEFSC (2011a) reports most trips capture one or more FMP species and the specific gear or deployment patterns within a trip may change. For example, the first half of a trip may have been targeting monkfish and the second half may have been targeting spiny dogfish. If an Atlantic sturgeon was captured on that trip, it may be difficult to tell what the target species was when the incidental take occurred. Additionally, NEFSC (2011a) points out that most of the FMPs manage multiple species. In some cases, the bycatch of Atlantic sturgeon may be more closely associated with one species than the other (e.g., fluke, scup, sea bass) yet they all fall under the same FMP. Regardless, because NER-PRD and NER-Sustainable Fisheries Division discussed the estimates and reallocated some captures based on the knowledge of how certain fisheries operate, we believe these estimates are appropriate for calculating the smoothhound takes.

5.10 Estimated Large Whale Takes by Atlantic Shark and Smoothhound Gillnet Gear

No large whale entanglements were documented or reported in Atlantic shark gillnet gear from 2007-2011. No previous large whale entanglements can be definitively attributed to the smoothhound fishery operating in federal waters. However, as described in Section 3.2.2.2, a humpback whale was recently entangled in smoothhound gillnet gear deployed in North Carolina state waters. Large whale captures have been documented in smoothhound gear

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[52] Data available would not support discard estimation at the level of 3 digit Statistical Areas, (i.e., statistical zone 531, 532, or 626, 627), but allow for discard estimation at the level of 2 digit Statistical Areas (i.e., 53X or 62X).

deployed in state waters, and in the past (i.e., prior to 2007) in shark gillnet gear. For these reasons, NMFS believes the proposed action may adversely affect North Atlantic right whales, humpbacks, and fin whales if the animals come into physical contact with smoothhound or Atlantic shark gillnet gear. Documented gear interactions between large whales and gear from 1999-2009 are summarized in Table 5.19. The table includes the number of documented entanglements, and how many of those caused SI/M. Serious injury has been defined in 50 CFR §229.2 as an injury that is likely to lead to mortality.

Table 5.19 Documented Annual Large Whale Entanglements 1999-2009

Gear	**Documented Entanglements (% of Total Entanglements)**			**Documented Entanglements Causing SI/M (% of Total SI/M Entanglements)**		
	N.A right whale	Humpback	Fin	N.A. right whale	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: NMFS 2010f, Morin et al. 2011

Since we only anticipate smoothhound and Atlantic shark gillnet gear will adversely affect large whales, our estimates of possible interactions between the fisheries and large whales considers only gillnet gear entanglements, which include “sink gillnet” and “unspecified gillnet” in Table 5.19. Since many entanglements go unobserved our list is assumed to be a minimum estimate. There is currently no accepted method for extrapolating observed entanglement to estimate the total number of entanglements. As reported in Table 5.19, unknown gear accounts for 70 percent or more of entanglements noted for each species. To reduce the likelihood that we are underestimating the potential effects of the fisheries on large whales, we developed an approach that considers some of the documented entanglements in fishing gear that could not be identified (i.e., “unknown gear” row 8 in Table 5.19).

Estimating Large Whale Entanglements in All Gillnet Gear

In the first step of our approach we used the data in Table 5.19 to calculate the percentage of known entanglements caused by each gear type.[53] North Atlantic right whales were most

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[53] We calculated each percentage by dividing the number of entanglements for each gear type by the total number of entanglements with identified fishing gear. For example, 1 North Atlantic right whale sink gillnet entanglement

frequently entangled in American lobster trap gear (64 percent), followed by sink gillnets (9 percent), unspecified gillnets (9 percent), other pot/trap gear (9 percent) and bottom longline (9 percent) gear. Humpbacks were most frequently entangled in American lobster trap gear (29 percent) and unspecified gillnets (27 percent) followed by sink gillnets (21 percent). Humpback whale entanglements were also documented in hook-and-line, other trap/pot gear, and purse seines. No specific gear types could be identified in fin whale entanglements. Table 5.20 summarizes these results.

Table 5.20 Percentage of Total Entanglements and Entanglements Causing SI/M by Known Gear Type, 1999-2009

Gear	Documented Entanglements (% of All Entanglements)		Documented Entanglements Causing SI/M (% of All Entanglements Causing SI/M)	
	N.A. right whale	Humpback	N.A. right whale	Humpback
Sink Gillnet	1 (9%)	11 (21%)	1 (25%)	2 (29%)
Unspecified Gillnet	1 (9%)	14 (27%)	1 (25%)	3 (43%)
American Lobster Gear	7 (64%)	15 (29%)	1 (25%)	2 (29%)
Other Pot/Trap Gear	1 (9%)	4 (8%)	1 (25%)	0
Hook and Line	0	7 (13%)	0	0
Bottom Longline	1 (9%)	0	0	0
Purse Seine	0	1 (2%)	0	0
Total	11	52	4	7

Next we multiplied the percentages of known gear interactions for sink gillnet and unspecified gillnet by the number of "unknown gear" gear entanglements in Table 5.19. For example, we assumed that since nine percent of documented North Atlantic right whale entanglements could be attributed to sink gillnet gear, nine percent of the "unknown gear" might also have been sink gillnet gear. This approach yielded an estimate of the number of unknown gear entanglements that might have actually been sink gillnet or unspecified gillnet gear (Table 5.21). We followed the same approach to estimate the number of "unknown gear" entanglements that might cause SI/M. Those calculations are summarized in Table 5.22. Our estimates of the number of "unknown gear" entanglements that might have actually been gillnet gear were then added to the documented gillnet entanglements for each species. This produced a revised estimate of the total number of entanglements potentially caused by gillnet gear from 1999-2009 (Table 5.23).

Table 5.21 Number of Unknown Gear Entanglements Possibly Attributable to Gillnet Gear

Species	Gear	% of Known Entanglements	# Entanglements in Unknown Gear	# Estimated Entanglements from Unknown Gear
N.A. right whale	Sink Gillnet	9%	47	4
	Unspecified Gillnet	9%	47	4
Humpback whale	Sink Gillnet	21%	128	27
	Unspecified Gillnet	27%	128	35

÷ 11 total right whale entanglements attributable to specific fishing gear = 9% of North Atlantic right whale entanglements in identifiable fishing gear were attributable to sink gillnet gear.

Table 5.22 Number of Estimated Gillnet Entanglements That May Have Caused SI/M

Species	Gear	# Entanglements in Unknown Gear Causing SI/M	% of Entanglements Causing SI/M	# Entanglements in Unknown Gear Causing SI/M
N.A. right whale	Sink Gillnet	4	25%	1
	Unspecified Gillnet	4	25%	1
Humpback whale	Sink Gillnet	27	29%	8
	Unspecified Gillnet	35	43%	15

Table 5.23 Total Entanglements and Entanglements Causing SI/M by Gear Type, 1999-2009

Gear	North Atlantic Right Whales			Humpback Whales		
	Non-SI/M Entanglements	Entanglements Causing SI/M	Total Entanglements	Non-SI/M Entanglements	Entanglements Causing SI/M	Total Entanglements
Sink Gillnet	0	1	1	9	2	11
Estimated Sink Gillnet*	3	1	4	19	8	27
Unspecified Gillnet	0	1	1	11	3	14
Estimated Unspecified Gillnet*	3	1	4	20	15	35
Total	6	4	10	59	28	87
Annual Average	0.5	0.4	0.9	5.4	2.5	7.9

*Estimated gillnet indicates additional entanglements added from “unknown gear” records

Based on these revised estimates, we believe that from 1999 through 2009, 10 North Atlantic right whales and 87 humpback whales may have been entangled in gillnet gear. We estimate five of the North Atlantic right whale entanglements were caused by sink gillnet gear (1 documented, 4 estimated), and the other five were caused by unspecified gillnet gear (1 documented, 4 estimated). Of the 10 total entanglements, we estimate sink gillnets may have caused two SI/M (1 observed, 1 estimated) and unspecified gillnets may have also caused two SI/M (1 observed, 1 estimated), for a total of four. Taken together, we anticipated sink gillnets and unspecified gillnets are likely to cause 0.5 non-SI/M entanglements for North Atlantic right whales annually, on average. Likewise, we anticipated sink gillnets and unspecified gillnets are likely to cause 0.4 SI/M[54] entanglements each year on average.

Our calculations also indicate that humpbacks may have been entangled in sink gillnet gear 38 times from 1999-2009, with 10 of those entanglements likely causing SI/M. An additional 49 humpback entanglements may have occurred in unspecified gillnet gear during the same period; 18 likely caused SI/M. Taken together, we estimated, on average, there were a total of 5.4 non-SI/M entanglements of humpbacks in gillnet gear annually and 2.5 entanglements causing SI/M.

Data for fin whales indicate that from 1999-2009 only 24 entanglements were documented; all of them were in unknown fishing gear. Fin whales are less concentrated in the nearshore environment than North Atlantic right and humpback whales, which likely reduces their

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[54] These estimates are not specific to Atlantic shark or smoothhound gear. These estimates may capture fishing in those fisheries, but may also include other fisheries.

exposure to fishing gear. While we have no observed entanglements of fin whales in gillnet gears, we believe it is prudent to assume at least some number of the 24 entanglements documented in unknown gear may have occurred in gillnet gear. To estimate the possible number of entanglements in gillnet gear we used the available information on entanglements of North Atlantic right whales and humpback whales. From 1999-2009, fishing gear could be identified in 63 documented entanglement events for North Atlantic and humpback whales. Of those 63 entanglements, 12 were documented in sink gillnet gear and 15 were documented for unspecified gillnet gear. Thus, gillnets accounted for 43 percent of all documented entanglements of North Atlantic right whales and humpback whales from 1999-2009. By multiplying 43 percent by the documented 24 entanglements of fin whales from 1999-2009, we estimate that up to 10 fin whales may have been entangled in gillnet gear; an annual average of 0.9 fin whale. Since we are using estimates from North Atlantic right and humpback whales, which are more common nearshore than fin whales, our approach may overestimate the number of gillnet gear interactions.

Using a similar process we estimated the number of gillnet entanglements that may have caused SI/M to fin whales from 1999-2009.[55] Our previous calculations (see Table 5.23) indicated that of 97 possible North Atlantic right and humpback whale entanglements in gillnet gear during the period, 32 likely resulted in SI/M, or 33 percent. Applying that 33 percent rate of SI/M in gillnet gears to our estimate of 10 fin whales that may have been entangled in gillnet gear from 1999-2009, we calculate three fin whales may have suffered SI/M after interacting with gillnet gear. Our calculations indicate an average of 0.9 fin whale gillnet entanglements may have occurred annually from 1999-2009; with 0.3 resulting in SI/M and 0.6 not, on average.

Based on the annual averages provided in Table 5.23, we anticipate that 0.5 North Atlantic right whales, 5.4 humpback whales, and 0.6 fin whales could become entangled in gillnet gear annually, but those entanglements will not cause SI/M. However, we also anticipate that 0.4 North Atlantic right whales, 2.5 humpback whales, and 0.3 fin whales could become entangled in gillnet gear annually, and those entanglements may cause SI/M.

Estimating Large Whale Entanglements in Sink Gillnet Gear

Of the entanglements estimated for all U.S. fisheries, we assumed that the risk posed by any particular gillnet fishery is proportional to its level of effort. Because fishing effort is expressed in duration and quantity of gear fished is not available, we estimated the proportional effort of a fishery based on its proportional landings.

The best available information on the proportion of smoothhound landings in the sink gillnet fisheries comes from Murray (2009b). Murray (2009b) reported that the adjusted average annual landings from all fisheries by sink gillnet gear in the Mid-Atlantic from 2002-2006 was 26,944 tons.[56] Smoothhound landings from state and federal waters accounted for 5.89 percent

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[55] From 1999-2009, two documented North Atlantic right whale gillnet entanglements caused SI/M, and five documented humpback gillnet entanglements caused SI/M; a total of seven gillnet entanglements cause SI/M. Of 27 documented humpback/North Atlantic right whale entanglements in gillnet gear, seven caused SI/M, or 26% of documented entanglements.

[56] Landings included monkfish, bluefish, sandbar sharks, smooth dogfish, croaker, skates, black-tipped sharks, summer flounder, striped bass, Spanish mackerel, dusky shark, black drum, thresher shark, kind mackerel, spot, albacore tuna, spiny dogfish, weakfish, and other species.

(1,589 tons) of that total. Since Murray (2009b) included both state and federal information, we used the distance from shore information provided by the VTR data to estimate smoothhound fishing effort federal waters. From 2004-2011, the proportion of smoothhound landings coming from federal waters was the highest in 2004 at 47 percent, the lowest in 2007, 27 percent, and the mean was 36 percent (VTR Database, unpublished data). We acted conservatively and used 47 percent in our calculations to estimate smoothhound effort in federal waters. Murray (2009b) also reported 193 tons of other Atlantic sharks (0.72 percent), which could have been landed in association with the existing HMS FMP. Therefore, we also included these landings in our takes estimates. However, because the overall percentage of other sharks was so small, we did not bother to estimate what percentage of those landings occurred in federal versus state waters.

To estimate the potential impact of federally-fished smoothhound sink gillnet gear on large whales, we multiplied that 5.89 percent by our annual estimates of large whale entanglements likely caused by gillnet gear. This calculation indicated that on average annually, 0.01 entanglements of North Atlantic right whales in federally-fished smoothhound gear would cause SI/M and 0.01 entanglements would not. Similar calculations for humpback whales indicated that on average annually, 0.15 non-SI/M entanglements would occur in federally-fished smoothhound gear; an additional 0.07 entanglements causing SI/M are also expected. For fin whales, we anticipate 0.02 non-SI/M entanglements would occur in federally-fished smoothhound gear; an additional 0.01 entanglements causing SI/M are also expected. Table 5.24 summarizes these estimates.

Table 5.24 Estimated Large Whale Takes in Federally-Fished Smoothhound Gear

Species	Avg. Annual Entanglements	% of All Sink Gillnet Effort	% of Smoothhound Effort in Federal Waters	Avg. Annual Entanglements in Federally-Fished Smoothhound Gear
N.A. Right whale	0.5 (Non-SI/M Entanglements)	5.89% (Smoothhound)	47%	0.01 (Non-SI/M Entanglements)
	0.4 (SI/M Entanglements)	5.89% (Smoothhound)	47%	0.01 (SI/M Entanglements)
Humpback whale	5.4 (Non-SI/M Entanglements)	5.89% (Smoothhound)	47%	0.15 (Non-SI/M Entanglements)
	2.5 (SI/M Entanglements)	5.89% (Smoothhound)	47%	0.07 (SI/M Entanglements)
Fin whale	0.6 (Non-SI/M Entanglements)	5.89% (Smoothhound)	47%	0.02 (Non-SI/M Entanglements)
	0.3 (SI/M Entanglements)	5.89% (Smoothhound)	47%	0.01 (SI/M Entanglements)

To account for the potential impacts from sink gillnet fishing for other Atlantic sharks, we multiplied the percentage of those species landings by our annual estimate of large whale entanglements likely caused by gillnet gear. This calculation indicated that 0.003 entanglements of North Atlantic right whales would occur in other Atlantic shark sink gillnet gear and those entanglements would cause SI/M; an additional 0.004 non-SI/M entanglements are also expected. Similar calculations for humpback whales indicated that 0.04 entanglements in other Atlantic shark sink gillnet gear would not cause SI/M, while 0.02 would. For fin whales, we anticipate 0.004 non-SI/M entanglements would occur annually in other Atlantic shark sink gillnet gear with an additional 0.002 entanglements causing SI/M. Table 5.25 summarizes our estimates.

Table 5.25 Estimated Large Whale Takes in Atlantic Shark Sink Gillnet Gear

Species	Avg. Annual Entanglements	% of All Sink Gillnet Effort	Avg. Annual Entanglements in Atlantic Shark Sink Gillnet Gear
N.A. Right whale	0.5 (Non-SI/M Entanglements)	0.72% (Atl. Shark)	0.004(Non-SI/M Entanglements)
	0.4 (SI/M Entanglements)	0.72% (Atl. Shark)	0.003 (SI/M Entanglements)
Humpback whale	5.4 (Non-SI/M Entanglements)	0.72% (Atl. Shark)	0.04 (Non-SI/M Entanglements)
	2.5 (SI/M Entanglements)	0.72% (Atl. Shark)	0.02 (SI/M Entanglements)
Fin whale	0.6 (Non-SI/M Entanglements)	0.72% (Atl. Shark)	0.004 (Non-SI/M Entanglements)
	0.3 (SI/M Entanglements)	0.72% (Atl. Shark)	0.002 (SI/M Entanglements)

Together, we anticipate 0.014 North Atlantic right whales, 0.19 humpback whales, and 0.024 fin whales may experience an entanglement not causing SI/M each year as a result of the proposed action (see Table 5.26). We also anticipate 0.013 North Atlantic right whales, 0.09 humpback whales, and 0.012 fin whales may experience SI/M each year as a result of entanglement associated with the proposed action.

Estimating Large Whale Entanglements in Atlantic Shark Drift Gillnet Gear

Since our current understanding of the smoothhound fishery indicates fishers do not use drift gillnets to directly target them, this analysis only focuses of Atlantic shark drift gillnets. The available information indicates the shark drift gillnet fishery is likely in decline. Amendment 2 to the Consolidated FMP required that fins remain attached to all sharks until landed. Anecdotal evidence from fishermen has indicated that this has significantly increased their processing time, while also reducing meat quality in some cases. Amendment 2 also implemented a trip limit of 33 LCS. "The 33-head LCS trip limit has essentially ended the strike net fishery and limited the number of fishers targeting LCS with drift gillnet gear" (Passerotti et al. 2011). The establishment of a blacknose shark specific quota and significant reductions in the non-blacknose SCS quota implemented under Amendment 3 to the Consolidated FMP (NMFS 2010) has further limited the gillnet fishery, including drift nets, for SCS (Passerotti et al. 2011). As a result of these regulatory changes, many gillnet fishers that historically targeted sharks are now targeting finfish such as Spanish mackerel, king mackerel, and bluefish, with varying types of gillnet gear (Passerotti et al. 2011).

F/SF1 is also currently developing Amendment 5 to the Consolidated FMP. The amendment considers lower quotas for certain species currently managed via quotas (i.e., Atlantic and Gulf of Mexico blacknose, dusky, and sandbar sharks), as well as new species specific quotas for other species (e.g. hammerheads). The current proposed fishing limits for these species would likely further reduce fishing effort in the gillnet sector of the fishery. In addition to the regulatory measures being implemented, a number of large whale specific conservation measures are in place via the ALWTRP that further protect large whales from interactions with shark gillnet gear, including drift nets.

This information suggests the potential impacts from shark drift gillnets on large whales is likely diminishing, however; we chose to act conservatively and assume some level of future interaction between the gear and large whales was still possible. Similar to the process described previously, we assumed that the risk posed by the Atlantic shark drift gillnet fishery is proportional to its level of effort. Because fishing effort data were not readily available, we estimated the proportional effort of a fishery based on its proportional landings.

The U.S. commercial fisheries landings summaries indicate that drift gillnets catches of non-smoothhound sharks accounted for only 0.56 percent of all drift gillnet landings from 2007-2011 (NMFS Fisheries Statistics Division 2012). To estimate the potential impact of Atlantic shark drift gillnets on large whales, we multiplied that 0.56 percent by our annual estimates of large whale entanglements likely caused by gillnet gear. This calculation indicated that on average annually, shark drift gillnets may cause 0.002 SI/M entanglements of North Atlantic right whales and 0.003 entanglements that would not cause SI/M. Similar calculations for humpback whales indicated that on average annually, 0.03 non-SI/M entanglements would occur in shark drift gillnet gear; an additional 0.01 entanglements causing SI/M are also expected. For fin whales, we anticipate 0.003 non-SI/M entanglements would occur; an additional 0.002 entanglements causing SI/M are also expected. Table 5.26 summarizes these estimates.

Table 5.26 Estimated Large Whale Takes in Shark Drift Gillnet Gear

Species	Avg. Annual Entanglements	% of All Drift Gillnet Effort	Avg. Annual Entanglements Shark Drift Gillnet Gear
N.A. Right whale	0.5 (Non-SI/M Entanglements)	0.56%	0.003 (Non-SI/M Entanglements)
	0.4 (SI/M Entanglements)	0.56%	0.002 (SI/M Entanglements)
Humpback whale	5.4 (Non-SI/M Entanglements)	0.56%	0.03 (Non-SI/M Entanglements)
	2.5 (SI/M Entanglements)	0.56%	0.01 (SI/M Entanglements)
Fin whale	0.6 (Non-SI/M Entanglements)	0.56%	0.003 (Non-SI/M Entanglements)
	0.3 (SI/M Entanglements)	0.56%	0.002(SI/M Entanglements)

Together, we anticipate 0.017 North Atlantic right whales, 0.22 humpback whales, and 0.027 fin whales may experience an entanglement that does not cause SI/M each year as a result of the proposed action (see Table 5.27). We also anticipate 0.015 North Atlantic right whales, 0.10 humpback whales, and 0.014 fin whales may experience an entanglement that causes SI/M each year as a result of the proposed action. Put a different way, the proposed action is anticipated to cause a non-SI/M entanglement of a North Atlantic right whale once every 59 years, with an entanglement causing SI/M approximately every 67 years. For humpback whales, we anticipate the proposed action may cause a non-SI/M entanglement onve every five years, with an entanglement causing SI/M occurring once every 10 years. With fin whales, we anticipate a non-SI/M entanglement may occur once every 37 years, with an entanglement causing SI/M once every 71 years.

Table 5.27 Estimated Annual Large Whale Takes by the Proposed Action

Species	Non-SI/M Entanglements	Entanglements Causing SI/M
N.A. Right whale	0.017	0.015
Humpback whale	0.220	0.100
Fin whale	0.027	0.014

5.11 Analysis of Potential Future Impacts From the Continued Authorization of the Atlantic Shark Fisheries, Including the Smoothhound Fishery

In the preceding subsections, we analyzed the effects of the Atlantic shark fisheries as they are currently authorized, and the likely effects of smoothhound gillnet fishing as we believe it has been operating. We now consider what effect, if any, bringing the smoothhound fishery under federal management and continuing to authorize the Atlantic shark fisheries would have on future levels of take. In other words, we evaluate whether the proposed action is likely to cause the numbers of estimated past takes and mortalities to increase, decrease, or remain the same in the future.

5.11.1 Shark Gillnet Fishery

Since the proposed action is intended to continue authorizing the Atlantic shark fisheries as they currently operate, we believe it is likely the past levels of take estimated in the previous sections are likely to continue in the future. Below is our evaluation of the potential impacts to ESA-listed species not considered in the take extrapolation estimates in Section 5.6.

Smalltooth Sawfish Captures

Only one smalltooth sawfish non-lethal take in a shark gillnet has been documented over the last 15 years (Carlson and Richards 2011, NMFS unpublished data). The animal was released in good condition and likely survived the interaction. No smalltooth sawfish captures in shark gillnet gear were observed from 2004-2011 (Carlson and Richards 2011, NMFS unpublished data). While we believe smalltooth sawfish captures in shark gillnet gear are rare events, this past take leads us to believe another take is possible in the future. Thus, we conservatively estimate one smalltooth sawfish take by the non-smoothhound shark gillnet component of the fishery may occur annually. Since the only known shark gillnet take of a smalltooth sawfish was non-lethal, we believe the one take that may also occur in the future, will also be non-lethal.

Atlantic Sturgeon Captures

From 2007-2011, no Atlantic sturgeon incidental captures have been observed in shark gillnets. However, in 2002, one Atlantic sturgeon take was observed in shark gillnet gear; the animal was released alive. In 2011, four Atlantic sturgeon captures were documented by observers from the SGOP. Those incidental captures occurred during sets targeting finfish, not sharks. Two of these animals were released alive, two were dead. This information indicates that Atlantic sturgeon captures in shark directed gillnet sets are uncommon but they do occur and have occurred recently in similar gears. The available information paints a murky picture of the potential future impacts of shark gillnet gear on Atlantic sturgeon. For example, estimating the average number of Atlantic sturgeon takes from the number of observed takes in shark gillnet gear from 2002-2011 indicates 0.1 animals would be taken annually. Conversely, the information on observed takes in other gillnet fisheries indicates Atlantic sturgeon takes could be as high as four a year. Because of this uncertainty we acted conservatively and estimated that two Atlantic sturgeon may be taken annually by shark gillnet gear.

Since approximately 2005, no Atlantic shark gillnet effort has occurred north of Virginia (A. Van Atten, pers. comm. 2012). The vast majority of the shark gillnet fishing effort occurs in what is defined as Marine Mixing Zone 3 and the southern part of Marine Mixing Zone 2 (see Section 5.9.2 for discussion of how mixing zones were defined). NER-PRD (2012) determined that Atlantic sturgeon from the New York Bight and South Atlantic DPSs comprised the greatest proportion of animals in Marine Mixing Zone 2.[57] NER-PRD (2012) concluded that there was not enough information available to estimate the proportions of animals in Marine Mixing Zone 3. NER-PRD (2012) recommends using the information from the observer program to describe the likely proportion in Marine Mixing Zone 3; those data are the same described in Marine Mixing Zone 2. As noted previously, fish from the Carolina DPS appeared very rarely, if ever, in observer datasets. However, we believe that since most shark gillnet fishing occurs in the waters adjacent to the Carolina DPS, it is reasonable to conclude that an Atlantic sturgeon from this DPS could be captured during Atlantic shark gillnet fishing. Therefore, we estimate that of the two Atlantic sturgeon takes that may occur each year in shark gillnet gear, one is likely to be an individual from the Carolina DPS and one is likely to be from the South Atlantic DPS.

The available information indicates shark gillnet mortality rates range from 0 to 50 percent. However, NEFSC 2011 indicates that sink gillnets mortality rates are much lower, between 20 and 27 percent. ASMFC (2007) reports mortality rates for sink gillnet gear with mesh sizes of 5 inches or greater to be 20-36 percent. Since incidental take mortality rates may be as high 50 percent, we conservatively estimate that one of those takes may be lethal. We believe this is conservative because it is much higher than the annual estimated Atlantic sturgeon takes estimated from the observed interactions with shark gillnet gear. We have no reason to believe an animal from the Carolina DPS would be more prone to mortality in a shark gillnet than an animal from the South Atlantic DPS. Meaning we have no way of determining whether the lethal take is likely to affect the South Atlantic DPS or the Carolina DPS. Therefore, we will act conservatively and assume each take is lethal.

The estimated ratio of subadults to adults is 3 to 1. This would suggest that, all things being equal, these takes are three times more likely to be subadults than adults. However, we have chosen to act conservatively and will assume that these lethal takes will be adults. Thus, we anticipate the Atlantic shark gillnet fisheries may take one adult Atlantic sturgeon from the South Atlantic DPS and one from the Carolina DPS each year.

5.11.2 Smoothhound Fishery

Since the intent of the action to manage the smoothhound fishery is to collect information without changing the fishery's operation, we anticipate future fishing under Amendment 3 will likely have take levels similar to those occurring before implementation of the amendment. Fishermen will be required to obtain a permit but the fishery will be open-access. The proposed

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[57] The NER-PRD MSA (NER-PRD 2012) estimated the following DPS composition for Atlantic sturgeon in Marine Mixing Zone 2: 2% St. John (Canadian population); 11% Gulf of Maine DPS, 49% New York Bight DPS, 14% Chesapeake Bay DPS, and 20% South Atlantic DPS.

quota was selected to allow fishing to continue at historic levels of effort. All other landing and reporting requirements are not anticipated to have any impact on overall fishing effort or fishery practices. Based on our analysis of Amendment 3, it will likely have no effect on the current level of federal effort.

Smalltooth Sawfish Captures

Currently, the smoothhound fishery operates in the Mid-Atlantic and Northeast regions; north of the range of smalltooth sawfish. No smalltooth sawfish takes have ever been documented in the fishery. However, because of the species' susceptibility to entanglement in gillnet gear and because no regulatory measures are being proposed to prohibit smoothhound fishing from occurring within the range of smalltooth sawfish, we believe future takes are possible, albeit rare. Therefore, we anticipate only one smalltooth sawfish would be taken every three years. Because conducting a jeopardy analysis on 0.33 smalltooth sawfish take is not very useful, we will act conservatively and use one annual smalltooth sawfish take for that analysis. However, if we determine that authorizing incidental take for smalltooth sawfish is appropriate, we will only authorize the take of one smalltooth sawfish during consecutive three-year periods. We anticipate this take could be lethal or non-lethal.

5.12 Summary

After evaluating the likely effects of bringing the smoothhound fishery under federal management and continuing to authorize the Atlantic shark fisheries, we believe the proposed action will adversely affect large whales, sea turtles, smalltooth sawfish, and Atlantic sturgeon to the extent estimated in the previous section. We anticipate these estimated levels of take are likely to continue into the future. Table 5.27 summarizes the anticipated take we expect on an annual basis, for affected species. Our Atlantic sturgeon take estimates from Section 5.9 have been rounded to the nearest whole number and includes both adults and subadults, not adult equivalents. Because some of our take estimates included species takes in combination (i.e., one hawksbill or one green sea turtle) or stated a take might be lethal or non-lethal, the numbers in Table 5.26 indicate the highest number of takes possible. For example, if we anticipated one take of a green sea turtle or one take of a hawksbill sea turtle, and that take might be lethal or non-lethal, that scenario would be reflected as four takes below: one for a lethal green take, one for a non-lethal green take, and so on for hawksbills.

Table 5.27 Anticipated Future Annual Take

Sea Turtles	Non-Lethal Take	Lethal Take	Total Estimated Take
Loggerhead	16	26	42
Green	8	11	17
Leatherback	3	3	6
Kemp's ridley	5	7	12
Hawksbill	3	3	6
Marine Fish	**Non-Lethal Take**	**Lethal Take**	**Total Estimated Take**
Smalltooth sawfish	9	3	12
Atlantic sturgeon	GOM DPS = 9	GOM DPS = 3	GOM DPS = 12
	NYB DPS = 43	NYB DPS = 10	NYB DPS = 53
	CB DPS = 12	CB DPS = 3	CB DPS = 15
	SA DPS = 17	SA DPS = 4	SA DPS = 21
	Carolina DPS = 4	Carolina DPS = 2	Carolina DPS = 6
Marine Mammals	**Non-SI/M Entanglements**	**Entanglements Causing SI/M**	**Total Entanglements**
N.A. Right whale	0.017	0.015	0.032
Humpback whale	0.220	0.100	0.320
Fin whale	0.027	0.014	0.041

GOM = Gulf of Maine, NYB = New York Bight, CB = Chesapeake Bay, and SA = South Atlantic.

6.0 Cumulative Effects

Cumulative effects include the effects of future state, tribal, local, or private actions that are reasonably certain to occur in the action area of this opinion. Future, unrelated federal actions are not considered here because they require separate consultation pursuant to Section 7 of the ESA.

Human-induced mortality, injury, and/or harassment of large whales, sea turtles, smalltooth sawfish, and Atlantic sturgeon occurring in the action area are reasonably certain to occur in the future. The sources of those incidental takes include vessel collisions, ingestion of marine debris, pollution, global climate change, and coastal development. While the combination of these activities may prevent or slow the recovery of populations of ESA-listed marine mammals, sea turtles, smalltooth sawfish, and Atlantic sturgeon, the magnitude of these effects is currently unknown.

6.1 State Fisheries

During this consultation, we searched for information on future state, tribal, local, or private actions that were reasonably certain to occur in the action area. The action area includes only federal waters, which would preclude the possibility of reasonably certain to occur, future state fishery actions from occurring in the action area. Thus, state fisheries effects are not considered here. The one exception is the State of Florida's stone crab fishery. 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 sea turtles and smalltooth sawfish, but 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. 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 those ESA-listed species.

6.2 Vessel Interactions

NMFS' 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). However, it is not always clear whether the collision occurred pre- or post-mortem. NMFS believes that sea turtle takes 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. Since Atlantic sturgeon and smalltooth sawfish are benthic species, vessel strikes are not considered a threat to them in the action area.

Collisions between large vessels and ESA-listed North Atlantic right, humpback, and fin whales are known to occur, and are a source of SI/M for these species. As described in Sections 4.3.2 and 4.3.3, NMFS has implemented a ship strike reduction program to reduce the number of North Atlantic right whale strikes by large vessels causing serious injuries and death. The program consists of both regulatory and non-regulatory components, such as requiring vessels to reduce speed in certain areas at certain times when North Atlantic right whales are likely to be present. The program is not specific to areas or times when other species of large whales are likely to be present in the vicinity of large ports of shipping lanes. The program does not require reduced speeds in all areas where North Atlantic right whales may occur. Although these measures are designed to reduce take of ESA-listed whales as a result of vessel interaction, the risk of takes has not been fully removed since interactions may still occur at times when large whales and vessels occur occupy the same areas.

6.3 Pollution

Human activities in the action area causing pollution are reasonably certain to continue in the future, as are impacts from them on large whales, sea turtles, smalltooth sawfish, and Atlantic sturgeon. 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 turtles and hinder their capability to forage, eventually they would tend to leave or avoid these areas (Ruben and Morreale 1999).

Contaminant studies have confirmed that North Atlantic right whales are exposed to and accumulate contaminants. 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 for their effects on North Atlantic right whales (Kraus et al. 2007). Recent data also support a hypothesis that chromium, an industrial pollutant, may be a concern for the health of the North Atlantic right whales and that inhalation may be an important exposure route (Wise et al. 2008).

Noise pollution has been raised primarily as a concern for marine mammals (including ESA-listed large whales) but may be a concern for other marine organisms, including sea turtles, smalltooth sawfish, and Atlantic sturgeon. The potential effects of noise pollution on marine mammals, sea turtles, smalltooth sawfish, and Atlantic sturgeon range from minor behavioral disturbance to injury and death. The noise level in the ocean is thought to be increasing at a substantial rate due to increases in shipping and other activities, including seismic exploration, offshore drilling, and sonar used by military and research vessels. While there is no hard evidence of a whale population being adversely effected by noise, masking could interfere with marine mammals' ability to feed and to communicate for mating.[58] Masking is a major concern about shipping, but only a few species of marine mammals have been observed to demonstrate behavioral changes to low-level sounds. Concerns about noise in the action area of this consultation include increasing noise due to increasing commercial shipping and recreational vessels.

6.4 Global Climate Change

Global climate change is likely adversely affecting sea turtles, large whales, smalltooth sawfish, and Atlantic sturgeon. Some of the likely effects commonly mentioned are sea-level rise, increased frequency of severe weather events, and change in air and water temperatures. The effects on ESA-listed species are unknown at this time. There are multiple hypothesized effects to ESA-listed sea turtles, large whales, smalltooth sawfish, and Atlantic sturgeon 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 which 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 internesting intervals, 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 may affect the range of these species. Ocean acidification may have an adverse impact on the prey for baleen whales which may result in serious consequences for the marine food web. A decline in reproductive fitness as a result of global climate change could have profound effects on the abundance and distribution of sea turtles and large whales in the Atlantic.

Sea levels and water temperatures are expected to rise, and levels of precipitation are likely to fluctuate. Drought and inter- and intra-state water allocations and their associated impacts to Atlantic sturgeon will continue and may intensify. A rise in sea level may drive the salt wedge

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[58] "Masking" refers to one sound covering or interfering with another.

upriver on river systems inhabited by Atlantic sturgeon, potentially constricting Atlantic sturgeon habitat. NMFS will continue to work with states to implement ESA Section 6 agreements, and with researchers holding Section 10 permits, to enhance programs to quantify and mitigate these takes and effects.

6.5 Coastal Development

Within the action area, beachfront development, lighting, and beach erosion potentially reduce or degrade sea turtle nesting habitats or interfere with hatchlings movement to sea. Nocturnal human activities along nesting beaches may also discourage sea turtles from nesting sites. Coastal counties are presently adopting stringent protective measures to protect hatchling sea turtles from the disorienting effects of beach lighting. Some of these measures were drafted in response to lawsuits brought against the counties by concerned citizens who charged the counties with failing to uphold the ESA by allowing unregulated beach lighting that results in takes of hatchlings.

Beyond the threats noted above, NMFS is not aware of any proposed or anticipated changes in other human-related actions (e.g., poaching, habitat degradation) or natural conditions (e.g., overabundance of land or sea predators, changes in oceanic conditions, etc.) that would substantially change the impacts that each threat has on the sea turtles, large whales, smalltooth sawfish, and Atlantic sturgeon covered by this opinion.

7.0 Jeopardy Analyses

Section 5 outlined how interactions with the existing Atlantic shark and proposed smoothhound fisheries could affect large whales, sea turtles, smalltooth sawfish, and Atlantic sturgeon. That section also estimated the number of each species likely to be captured and killed annually. Now we assess each species' response to this impact. The assessment considers the effect on the entire population from these anticipated takes, and whether those effects, in the context of the status of the species (Section 3), the environmental baseline (Section 4), and the cumulative effects (Section 6), will jeopardize the continued existence of any ESA-listed species likely to interact with these fisheries.

"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 conclusion for each species, we first look at whether there will be a reduction in the reproduction, numbers, or distribution. Then, if there is a reduction in one or more of these elements, we explore whether it will cause an appreciable reduction in the likelihood of both the survival and the recovery of the species.

The NMFS and USFWS' ESA Section 7 Handbook (USFWS and NMFS 1998) provides further definitions for *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.

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 each species globally. Nine DPSs for loggerheads have been identified. The DPS potentially affected by the proposed action is the Northwest Atlantic DPS, listed as threatened. Therefore, for loggerhead sea turtles, a jeopardy determination must find the proposed action will appreciably reduce the likelihood of survival and recovery of the Northwest Atlantic DPS. Humpback and fin whales are also listed as single species with global distributions and a jeopardy determination must find the proposed action will appreciably reduce the likelihood of survival and recovery for the species throughout their ranges. The North Atlantic right whale is endangered in the North Atlantic and a jeopardy determination must find the proposed action will appreciably reduce the likelihood of survival and recovery for the species in this region. Only the United States DPS of smalltooth sawfish is listed; therefore, a jeopardy determination must find the proposed action will appreciably reduce the likelihood of survival and recovery of the smalltooth sawfish United States DPS. Five DPSs of Atlantic sturgeon have been listed, all of which are anticipated to be affected by the proposed action. Our jeopardy determinations must consider whether the proposed action will appreciably reduce the likelihood of survival and recovery of each DPS.

When discussing impacts to sea turtles, smalltooth sawfish, and Atlantic sturgeon we describe takes as lethal or non-lethal. When discussing marine mammals we refer to takes as those causing serious injuries/mortalities and those that do not. Serious injury/mortality (SI/M) is a term used in the MMPA and defined in 50 CFR § 229.2 as an injury that is likely to lead to mortality. To remain consistent with the language of the MMPA, our discussion uses SI/M. When analyzing the effects to species from entanglements causing SI/M, we assume those takes caused mortality.

7.1 North Atlantic Right Whale

The proposed action may cause 0.017 non-SI/M and 0.015 SI/M entanglements of North Atlantic right whales annually. Put a different way, the proposed action may cause the non-SI/M entanglement of a North Atlantic right whale once approximately every 59 years, with an entanglement causing SI/M every 67 years. Thus, our jeopardy analysis will assume that up to 0.015 SI/M entanglements may occur annually, or once every 67 years.

A reduction in the distribution of North Atlantic right whales is not expected from an SI/M entanglement every 67 years. North Atlantic right whales generally occur from the southeast United States to Canada (e.g., Bay of Fundy and Scotian Shelf) (Kenney 2002, Waring et al. 2009). North Atlantic right whales frequent Cape Cod Bay, the Great South Channel, Stellwagen Bank, Jeffrey's Ledge, and Canadian waters including the Bay of Fundy and Browns and Baccaro Banks. Animals also travel to coastal waters off of Georgia and Florida (Kraus et al. 1988). Given the large range of area used by North Atlantic right whales an entanglement resulting in SI/M every 67 years is not expected to change the overall distribution of North Atlantic right whales. No North Atlantic right whales were observed to be affected by the DWH oil release event. We have no reason to believe that event would cause an impact to North Atlantic right whales on a population level.

A potential entanglement causing SI/M every 67 years would reduce the number of North Atlantic right whales, compared to their numbers in the absence of the proposed action, assuming all other variables remained the same. SI/M could also result in a potential reduction in future reproduction, assuming the individual was a female and would have survived otherwise to reproduce. Whether this reduction in numbers and possibly reproduction would appreciably reduce the likelihood of survival of the North Atlantic right whale depends on the probable effect the changes in numbers and reproduction would have relative to current population sizes and trends.

The best available data on the mean annual growth rate for the population is from 1990-2009. That information states the population increased at a rate of 2.6 percent annually during that period (Waring et al. in review). From 1990-2005, the population growth rate was estimated to be 2.1 percent annually. The Draft 2012 SAR estimates the current minimum population is 444 individuals. Applying the mean annual population growth rate to the current population estimate indicates the population would likely increase by 11.5 individuals next year. The proposed action may potentially remove 0.015 animals annually, reducing that number to 11.49. This reduction corresponds to a projected growth rate of 2.58 percent instead of 2.6 percent. We believe the proposed action will have only a minor impact on the estimated annual growth rate and the population will likely continue to increase.

We also anticipate the proposed action will have minor impacts on reproduction. We have no reason to believe that the anticipated takes would affect one sex disproportionately to another; the sex ratio is 50:50 (Brown et al. 1994). The best available information on entanglements by sex comes from a review of 493 photo-identified individuals, taken from 1980-2004, which found 625 separate entanglement interactions. The number of male and female North Atlantic right whales bearing entanglement scars during that time was nearly equivalent (142/202 females, 71.8 percent; 182/224 males, 81.3 percent), indicating that North Atlantic right whales of both sexes are equally vulnerable to entanglement. A review of confirmed fishing-related entanglements causing SI/M from 2006-2010 (n=9) indicated that adults accounted for 44 percent of those entanglements (n=4) and juveniles accounted for 55 percent (n=5) (Henry et al. 2012). Hamilton et al. (1998b) report juveniles comprise between 26 and 31 percent of the total population. These records indicate that juvenile animals are being entangled at a disproportionately high rate relative to their composition in the total population.

An entanglement causing SI/M every 67 years could cause a reduction in numbers, but may not cause a reduction in reproduction. Based on the sex ratio estimated by Brown et al. (1994), we anticipate a 50 percent chance that female would be involved in the entanglement causing SI/M occurring every 67 years. Additionally, the removal of sexually mature animals that cannot reproduce has relatively little impact on a population as a whole because those animals were not contributing to future generations. Kraus et al. (2007) report that 12 percent of sexually mature North Atlantic right whales appeared to have never produced a calf. Even if we assume that 78 percent of the female population are contributing or could contribute to future generations, there is still only a 39 percent chance that the proposed action would affect reproduction every 67 years.[59]

Based on all this information, we believe the proposed action could cause a reduction in numbers and possibly reproduction. However, we do not believe those reductions will appreciably reduce the likelihood of North Atlantic right whale survival in the wild. We anticipate that the reductions in numbers and reproduction will have only a minor impact on the mean annual growth rate for the species, and it will remain positive. Consequently, we believe under the proposed action the population is likely to continue to increase. We do not believe the proposed action is appreciably reducing the likelihood of the species' survival in the wild.

The ultimate goal of the recovery plan for North Atlantic right whales is to recover the species to a level sufficient to warrant their removal from the List of Endangered and Threatened Wildlife and Plants under the ESA. Its intermediate goal is to reclassify ("downlist") the species from endangered to threatened. The revised recovery plan states that consideration of downlisting may occur when all of the following have been met: (1) the population ecology (range, distribution, age structure, gender ratios, etc.) and vital rates (age-specific survival, age-specific reproduction, and lifetime reproductive success) of North Atlantic 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 percent per year; (3) none of the known threats to North Atlantic right whales (summarized under each of the listing factors) are known to limit the population's growth rate[60]; and (4) given current and projected threats and environmental conditions, the North Atlantic right whale population has no more than a 1 percent chance of quasi-extinction in 100 years.

The proposed action does not impede the progress of carrying out any aspect of the recovery program or achieving the overall recovery strategy. The actual population is increasing at a rate

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[59] 50% of the population are females x 78% of females that are contributing or could contribute of future generations = 39% chance that SI/M would occur to a female capable of contributing or currently contributing to future generations.

[60] The recovery plan for North Atlantic right whales indicates that the species may be ready for reclassification as threatened when: habitat degradation from oil spills, noise pollution, dredging, and contaminants are not limiting recovery; recreational and educational activities are adequately regulated by the permitting process; no North Atlantic right whales are allowed for commercial harvest; disease is not appreciably affecting recovery and is not likely to do so in the foreseeable future; adequate regulations or other means to minimize ship strikes are in place and being implemented; adequate regulations, gear, or other means to minimize entanglement in fishing gear exist and are being implemented and the criterion set forth under Factor E is met; and human-caused mortality and serious injury from ship strikes and fishery interactions result in a level of mortality considered to be biologically insignificant.

that is approaching the growth rate targeted for downlisting as identified in the recovery plan. While the authorization of the smoothhound fishery is a new federal action, all evidence indicates the fishery has been occurring unregulated in federal waters for many years. Even in the presence of this unregulated fishery, the population is increasing and is projected to do so into the future.

As noted above, we believe the proposed action is unlikely to have any impact on North Atlantic right whale range or distribution. While entanglements of juveniles appear more likely than adults, we do not anticipate that the potential entanglement of a juvenile once every 67 years would skew the population age structure such that the species' population ecology would be adversely affected. Thus, we believe the proposed action is unlikely to change the population ecology for the species such that it no longer reflects an increasing population. Additionally, the proposed action is not likely to cause the mean annual estimated population growth rate to drop below 2.0 percent.

Only the threats related to adequate regulations, gear, or other means to minimize entanglement in fishing gear, and reducing human-caused SI/M from fishery interactions to a level considered to be biologically insignificant apply to the proposed action. The proposed action will continue to regulate an existing fishery with measures designed specifically to reduce adverse affects to marine mammals, as well as manage a previously unmanaged fishery. For these reasons, we believe it will improve the regulatory environment for minimizing entanglement in fishing gear. Because the smoothhound and Atlantic shark fisheries are only a few of many fisheries that may be affecting North Atlantic right whales, even if all impacts from these fisheries were removed, it is unlikely human-caused SI/M from fishery interactions could be reduced to a biologically insignificant level. However, we do believe that by managing a previously unmanaged fishery NMFS will be able to implement measures that will likely help reduce the potential impacts to North Atlantic right whales. Those efforts, in conjunction with actions taken in other fisheries, may cumulatively reduce human-caused SI/M from fishery interactions to a level considered to be biologically insignificant.

Conclusion
Based on the information of this section, we believe the effects from proposed action are not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of the North Atlantic right whale.

7.2 Humpback Whales

The proposed action may result in 0.22 non-SI/M humpback whale entanglements annually and 0.10 SI/M entanglements annually. Put a different way, the proposed action is likely to entangle a humpback whale approximately every 5 years and will likely to cause SI/M every 10 years.

A reduction in the distribution of humpback whales is not expected from the anticipated entanglements. Humpback whales forage in the Gulf of Maine and visit Stellwagen Bank and the waters of Massachusetts and Cape Cod Bays. They also travel to the Gulf of St. Lawrence, Newfoundland/Labrador, western Greenland, Iceland, and northern Norway and travel to West Indies to breed and calve. Given the large range of area used by humpback whales, an entanglement causing a SI/M once every 10 years is not expected to change the overall distribution of humpback whales. No humpback whales were observed to be affected by the DWH oil release event. We have no reason to believe that event would cause an impact to humpback whales on a population level.

We anticipate the proposed action may cause an entanglement causing SI/M once every 10 years (0.10 annually). These entanglements could cause a reduction in numbers and possibly reproduction. If this entanglement involved a female, there may also be a reduction in future reproductive potential. Whether or not a reduction in humpback whale numbers, and possibly reproductive potential, would appreciably reduce its likelihood of survival depends on what effect these reductions would have on overall population sizes and trends. Specifically, are the estimated reductions, when viewed within the context of the environmental baseline and status of the species, so great that adverse effects on population dynamics are appreciable?

The potential biological removal (PBR) for the Gulf of Maine humpback whale stock is 2.7 whales annually (Waring et al. in review). "Potential biological removal level" refers to the maximum number of animals, not including natural mortalities that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population (OSP). As indicated above, the proposed action is anticipated to remove a humpback whale every 10 years (0.10 annually). The annual rate of documented humpback SI/M events with all commercial fishing gear types in the United States is 5.2, which exceeds the PBR value of 2.7. It is important to note that OSP is an MMPA standard and references a population level that is significantly higher than survival and recovery and not the standard we must apply to our analysis. Instead, we must focus on whether the proposed action will appreciably reduce the survival and recovery of humpback whales range wide.

The 2011 SAR indicates that photographic mark-recapture analyses estimate an ocean-basin-wide population of 11,570 animals during 1992-1993 (CV=0.068, Stevick et al. 2003), and an additional genotype-based analysis yielded a similar but less precise estimate of 10,400 whales (CV=0.138, 95% CI=8,000 to 13,600) (Smith et al. 1999). Additionally, the best available information for the North Atlantic population of humpback whales is an estimated average population increase of 3.1 percent over the time period 1979-1993 (Stevich et al. 2003, Fleming and Jackson 2011).

We estimate that the proposed action will cause the mortality of a humpback whale once every 10 years (0.10 annually). However, as noted previously, the best available information indicates the mean annual growth rate for the population was 3.1 percent (Fleming and Jackson 2011). Applying that growth rate to the current estimates for the North Atlantic population of humpback whales produces an estimate of 10,722 to 11,929 animals the following year. The proposed action may potentially remove 0.10 animals annually, reducing that number to 10,721.90 or 11,928.90). This reduction corresponds to a projected growth rate of 3.09 percent instead of 3.1 percent. We believe the proposed action will have only a minor impact on the estimated annual growth rate and the population will likely continue to increase.

The best available information indicates the North Atlantic humpback population appears to consist of several thousand animals, is increasing in size, and the effects of the proposed action are likely to have only a small impact of the mean population growth rate. Additionally, since we believe the smoothhound fishery has been in existence for many years, it is likely that any adverse effects from the fishery have also been operant for many years. Even with these adverse effects potentially affecting humpbacks, their population continues to be increasing. Consequently, we believe under the proposed action the population is likely to continue to increase.

The goal of the recovery plan for the humpback whale is to increase humpback populations and allow the species to reoccupy its historic range. The long-term numerical goal of the recovery plan is to increase the humpback whale populations to at least 60 percent of historical environmental carrying capacity. An intermediate goal was specified as a "doubling of extant populations within the next 20 years" (NMFS 1991b).

The recovery plan used the 1986 population estimate for the Gulf of Maine feeding aggregation of 240 humpbacks (95% CI = 147 to 333) (NMFS 1991b) for estimating a "doubling of the extant populations within 20 years." The current minimum population estimate is 823 animals (Warning et al. in review). Based on these numbers, it does appear that the Gulf of Maine stock of humpback whales has more than doubled in the past 20 years. While specific downlisting criteria for humpback whales have not been developed, the estimated increases in the Gulf of Maine stock and the North Atlantic populations of humpback whales indicate that these populations are recovering despite continued interactions with commercial fisheries inside the U.S. EEZ. Additionally, there are indications of increasing abundance for the eastern and central North Pacific stocks (Waring et al. 2009). Based on the population estimates it appears the humpback whale population may be recovering.

An entanglement causing SI/M every 10 years would result in a reduction in numbers and possibly reproduction. However, we do not believe this will appreciably reduce the likelihood of survival and recovery. Our estimate of future take is based on our belief that the same rate of interaction occurred in the past and it is worth noting that this level of take has already occurred in the past, yet we have still seen positive trends in the status of this species.

Conclusion
Based on the information of this section, we believe the effects from proposed action are not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of humpback whales.

7.3 Fin Whales

The proposed action may result in 0.014 entanglements that may cause SI/M annually and 0.027 non-SI/M entanglements annually. Put a different way, the proposed action is likely to cause a non-SI/M entanglement of a fin whale approximately every 37 years and will likely cause SI/M every 71 years.

A reduction in the distribution of fin whales is not expected from an entanglement every 71years that could cause SI/M. Any SI/M is expected to occur at random throughout the proposed action area. Fin whales are ubiquitous in the North Atlantic and occur from the Gulf of Mexico and

Mediterranean Sea northward to the edges of the arctic ice pack (NMFS 1998b). The overall pattern of fin whale movement is complex, consisting of a less obvious north-south pattern of migration than that of right and humpback whales. Given the large range of area used by fin whales any entanglement resulting in SI/M is not expected to change their overall distribution. No fin whales were observed to be affected by the DWH oil release event. We have no reason to believe that event would cause an impact to fin whales on a population level.

Although no change in distribution of fin whales is anticipated because of the proposed action, an entanglement causing SI/M every 71 years (0.014 annually) could cause a reduction in numbers and possibly reproduction. The PBR threshold estimated for fin whales is 5.6 animals annually (Waring et al. in review). The Draft 2012 SAR estimates 2.0 fin whales are removed annually from the population as a result of anthropogenic SI/M (Waring et al. in review). We believe the proposed action could cause a reduction in numbers and possibly reproduction. However, we do not believe those reductions will appreciably reduce the likelihood of fin whale survival in the wild. We anticipate that the reductions in numbers and potential reproduction caused by the proposed action will not cause the PBR threshold to be exceeded. Additionally, the OSP threshold associated with PBR is significantly higher than the survival standard we must apply to our analysis. Thus, since the proposed action is not likely to cause the PBR threshold to be exceeded, we believe it is reasonable to assume that the action is also not appreciably reducing the likelihood of the species' survival in the wild.

The recovery plan for the fin whale provides an explanation of the vision and goals for recovery (NMFS and USFWS 2010b). The plan's goals are "to promote the recovery of fin whales to the point at which they can be downlisted from endangered to threatened status, and ultimately to remove them from the list of Endangered and Threatened Wildlife and Plants, under the provisions of the ESA. The intermediate goal is to reclassify the species from endangered to threatened" (NMFS 2010c). The plan places interactions with fishing gear into the lowest threat category. The plan also provides a recovery action outline with broad categories of actions and specific sub-actions that are to be implemented as a part of the recovery strategy. Of the nine broad recovery actions listed, the proposed action directly relates to the actions to "investigate causes and reduce the frequency and severity of human-caused injury and mortality" (NMFS 2010c). In support of this action, the recovery plan recommends the following six specific sub-actions to reduce injure and mortality caused by fisheries and fishing equipment:

> *Objective: Conduct a systematic review of data on fin whale interactions with fishing operations.*
>
> *Objective: Review existing photographic databases for evidence of injuries to fin whales caused by encounters with fishing gear to better characterize and understand fishing gear interactions.*
>
> *Objective: Investigate the development of a deterrence system to non-lethally deter fin whales from fishing gear.*
>
> *Objective: Conduct studies of gear modifications that reduce the likelihood of entanglement, mitigate the effects of entanglements, and enhance the possibility of disentanglement. Determine whether measures to reduce entanglements are effective.*

> *Objective: Develop and implement schemes to reduce the rate at which gear is lost, and improve the reporting of lost gear, in conjunction with studies in described in other recovery objectives.*
>
> *Objective: Continue to review, evaluate, and act upon reports from fisherman and fishery observers of fishery interactions with fin whales.*

No aspect of the proposed action conflicts with any of these actions. Thus, we do not believe the proposed action impedes the progress of the recovery or achieving the overall recovery strategy.

The lethal take of a fin whale every 71 years would result in a reduction in numbers and possibly reproduction. However, we do not believe this will appreciably reduce the likelihood of survival and recovery. Our estimate of future take is based on our judgment that the same rate of interaction occurred in the past. It is worth noting that this level of take has already occurred in the past, yet we have still seen positive trends in the status of this species.

Conclusion
Based on the information of this section, we believe the effects from proposed action are not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of fin whales.

7.4 Loggerhead Sea Turtles

The proposed action is anticipated to result in the take of up to 42 loggerhead sea turtles annually, of which 26 are expected to be lethal. The potential non-lethal take of 16 loggerhead sea turtles is not expected to have any measurable impact on the reproduction, numbers, or distribution of the species. The individuals are expected to fully recover such that no reductions in reproduction or numbers of green sea turtles are anticipated. Since the takes may occur anywhere in the action area and would be released within the general area where caught, no change in the distribution of green sea turtles is anticipated.

The lethal interactions associated with the proposed action represent 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 to 4 years, with 100 to 130 eggs per clutch. 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. 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 and status of the species, are to such extent that adverse effects on population dynamics are appreciable. In Section 3.2.4, we reviewed the status of the species in terms of nesting and female population trends and several recent assessments based on population modeling (i.e., Conant et al. 2009 and NMFS SEFSC 2009). Below we synthesize what that information means in general terms and also 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 is slow, population modeling studies suggest even small increased mortality rates in adults and sub-adults could substantially impact population numbers and viability (Crouse et al. 1987, Crowder et al. 1994, Heppell et al. 1995, Chaloupka and Musick 1997).

All of the results of population models in both NMFS SEFSC (2009) and Conant et al. (2009) indicated western North Atlantic loggerheads were likely to continue to decline in the future unless action was taken to reduce anthropogenic mortality. However, this trend has changed in recent years thanks to several years of record nesting. As previously described in the Status of the Species section, in 2008 nesting numbers were high, but not enough to change the negative trend line. Nesting dipped again in 2009, but rose substantially in 2010 and declined slightly in 2011. Nesting in 2012, was the second highest ever recorded, surpassing 2010 nesting levels. With the recent nesting increase through 2012, the negative trend seen post-1998 has been reversed, with analysis showing no demonstrable trend. Additionally, there is now an overall increase in nest count from 1989 through 2012 (FWRI nesting database; http://myfwc.com/research/wildlife/sea-turtles/nesting/loggerhead-trends/).

Given this information, we must determine whether the estimated lethal takes from the proposed action, when viewed within the context of the environmental baseline, cumulative impacts, and status of the species, will have an appreciably adverse effect on the species' ability to persist beyond the conditions leading to its endangerment, and retain sufficient resilience to allow for recovery.

Murray (2009a) reported that 83 percent of observed and measured loggerheads takes in Mid-Atlantic sink gillnets were juveniles. TEWG (2009) reports the male/female ratio for animals of this age class reported is approximately 30:70, while the ratio for adults is approximately 50:50. Thus, our anticipated 26 lethal takes annually would likely be comprised of 4 adults (2 females) and 22 juveniles (15 females). However, the newest estimate of loggerhead abundance (i.e., NMFS NEFSC (2011b) does not differentiate between the juveniles and adult loggerheads.

NMFS NEFSC (2011b) preliminarily estimated the loggerhead population in 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 regional population estimate increased to approximately 801,000 individuals when including data on unidentified sea turtles that were likely loggerheads. Both point estimates are considered underestimates of the total population in the western Atlantic Ocean, because they do not include areas such as south Florida, the Gulf of Mexico, the Caribbean, or oceanic habitats of the North Atlantic Ocean (NEFSC 2011b).

Fortuitously, Richards et al. (2011) has recently produced a new estimate of adult female loggerheads in western North Atlantic. That study ultimately estimates that approximately 38,000 adult female loggerheads exist in the western North Atlantic, based on data from 2001-2010. Based on this new estimate of adult female loggerheads, the anticipated mortalities resulting from the Atlantic shark and smoothhound fisheries (i.e., 2 females annually) represent the removal of approximately 0.005 percent of the estimated adult loggerhead female population.

NMFS SEFSC (2009) also produced a less robust estimate for total benthic juvenile females in the western North Atlantic, with a likely range of approximately 60,000 to 700,000, up to less than one million. The estimate of overall benthic juvenile females is considered less robust because it is model-derived, assumes a stable age/stage distribution, and is highly dependent upon the life history input parameters. Relative to the more robust estimate of adult females, this estimate of the total benthic juvenile female population is consistent with our knowledge of loggerhead life history and the relative abundance of adults and benthic juveniles. Therefore, we believe female benthic juvenile loggerheads number in the hundreds of thousands. For benthic juvenile females, the anticipated deaths of 13 annually represent a maximum of 0.02 percent to a minimum of 0.002 percent of the estimated total population annually.

The anticipated mortalities resulting from this action are very small and contribute only minimally to the overall mortality on the population. For adult females, the incremental effect on annual mortality rates is less than one-ten-thousandth of the range of possible mortality values for the species. Because this contribution to mortality is a tiny part of our range of uncertainty across what total mortality might be, we do not believe that the small effect posed by the lethal takes in this fishery will be detectable or appreciable.

We believe that the incidental take and resulting mortality of loggerhead sea turtles associated with the proposed action are not reasonably expected to cause an appreciable reduction in the likelihood of survival of the NWA DPS of loggerhead sea turtles. We believe the current population is large (i.e., several hundred thousand individuals) and is showing encouraging signs of stabilizing. Over at least the next several decades, we expect the western North Atlantic population to remain large (i.e., hundreds of thousands of individuals) and to retain the potential for recovery. The effects of the proposed action will most directly affect the overall size of the population, which we believe will remain large for several decades to come, and the action will 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. Therefore, we do not believe the proposed action will cause an appreciable reduction in the likelihood of survival.

The Services' recovery plan for the northwest Atlantic population of the loggerhead sea turtle (NMFS and USFWS 2008) anticipates that with implementation of the recovery plan, the western North Atlantic population will recover within 50 to 150 years. 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.

The objectives of the recovery plan most pertinent to the threats posed by the proposed action are:

> *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: Minimize bycatch in domestic and international commercial and artisanal fisheries.*
>
> Sub-objective*:*
>
> - Describe and characterize domestic commercial gillnet fisheries.
> - Implement measures to minimize bycatch in large mesh gillnet fisheries
>
> *Objective: Minimize trophic changes from fishery harvest and habitat alteration*.

The first recovery objective, "Ensure that the number of nests in each recovery unit is increasing…," is the plan's overarching objective and has associated demographic criteria. Currently, none of the plan's criteria are being met, but the plan acknowledges that it will take 50-150 years to do so. Further reduction of multiple threats throughout the North Atlantic, Gulf of Mexico, and Greater Caribbean will be needed for strong, positive population growth, following implementation of more of the plan's actions. Although any continuing mortality in an already declining population can affect the potential for population growth, we believe the magnitude of the effect posed by the incidental take and mortality of loggerhead sea turtles resulting from the proposed action is so small that it will not impede or delay achieving this recovery objective.

The proposed action will also not conflict with next recovery objective "Minimize bycatch in domestic and international commercial and artisanal fisheries." That objective recommends two sub-objectives particularly relevant to the proposed action. The first is to describe and characterize domestic commercial gillnet fisheries. Specifically, "the geographic and temporal distribution of gillnet fisheries should documented along the U.S. Atlantic coast..." (NMFS and USFWS 2008); details such as mesh sizes, target species, etc. should be included. The second sub-objective is to implement measures to minimize bycatch in large-mesh gillnet fisheries.

The management measures of the proposed action directly support these actions. The smoothhound fishery has been in existence for many years but has not been under federal management (see Section 2.0) and little is known about the operation of the fishery as a result. The primary purpose of establishing a federal smoothhound fishery is gain a better understanding of the operation of the smoothhound fishery by collecting fishery relevant data, including geographic and temporal distribution data. For the Atlantic shark gillnet fisheries, the information recommended for collection is already being collected via the shark observer program and will continue to be collected under the proposed action.

Measure to minimize gillnet bycatch in the existing Atlantic shark gillnet fisheries include: requiring fishermen to check their nets every two hours; requiring nets to be attached to the vessel at all times, except during net checks; requiring all fishermen to attend sea turtle safe handling and release workshops and post the sea turtle safe release placard. While the portion of the proposed action pertaining to the smoothhound fishery does not specifically implement measures to minimize bycatch, all smoothhound fishermen will be required to adhere to similar net check requirements. Additionally, the proposed action will bring the smoothhound fishery under federal management, establishing NMFS' authority to implement future regulations to minimize the bycatch of loggerhead sea turtles.

Finally, the proposed action will not conflict with recovery objective "Minimize trophic changes from fishery harvest and habitat alteration." That recovery objective seeks to "minimize trophic changes from fishery harvest and habitat alteration." The continued authorization of the Atlantic shark fishery and authorization of the smoothhound fishery is not counter to this objective because loggerhead sea turtles do not prey on smoothhounds or sharks. Likewise, the use of gillnets or bottom longlines to target smoothhounds and other sharks is not expected to impact the water column or benthic habitat in any measurable manner. Unlike mobile trawls and dredges that physically disturb habitat as they are dragged along the bottom, the gears used to target smoothhounds and sharks are suspended in the water column or are relatively stationary on the bottom and do not affect water column or benthic habitat characteristics. Therefore, we do not believe the proposed action will cause an appreciable reduction in the likelihood of recovery.

Conclusion
The lethal and non-lethal takes of loggerhead sea turtles 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.

7.5 Green Sea Turtles

The proposed action may result in 17 green sea turtle takes (11 lethal, 8 non-lethal) annually. The potential non-lethal take of eight green sea turtles annually is not expected to have any measurable impact on the reproduction, numbers, or distribution of these species. The individuals are expected to fully recover such that no reductions in reproduction or numbers of green sea turtles are anticipated. Since the takes may occur anywhere in the action area and would be released within the general area where caught, no change in the distribution of green sea turtles is anticipated.

The potential lethal take of 11 green sea turtles annually 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 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 to 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 is expected from these takes.

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. The 5-year status review for green sea turtles states that of the seven green sea turtle nesting concentrations in the Atlantic Basin for which abundance trend information is available, all were either stable or increasing (NMFS and USFWS 2007a). That review also states that the annual nesting female population in the Atlantic basin ranges from 29,243-50,539 individuals; green sea turtle nesting patterns also show a biennial peaks in abundance, with a generally positive trend during the last ten years of regular monitoring. An average of 5,039 green turtle nests were laid annually in Florida between 2001 and 2006 with a low of 581 in 2001 and a high of 9,644 in 2005 (NMFS and USFWS 2007a). Data from the index nesting beaches program in Florida substantiate the dramatic increase in nesting. Nesting increased from 2007-2011. An average of 11,004 green sea turtle nests were laid annually in Florida during the period with a low of 4,462 in 2009 and a high of 15,352 in 2011 (FWRI 2012). Modeling by Chaloupka et al. (2008) using data sets of 25 years or more resulted in an estimate of the Tortuguero, Costa Rica, population growing at 4.9 percent annually.

In the absence of any total population estimates for green sea turtles nesting trends are the best proxy we have for estimating population changes. The 5-year status review estimated between 29,000 and 50,000 adult females existed in the Atlantic basin at the time of its writing in 2007 (NMFS and USFWS 2007a). Since the nesting has increased every year since 2007, and the initial estimate only included adult females, we believe the population is likely much larger than that estimate and increasing. Additionally, of the 26 green sea turtle rookeries for which trend information is available, 12 show an increasing trend, 10 show a stable trend, 4 show a decreasing trend. This is significant because regardless of the size of these rookeries, each contributes to species' genetic diversity and since only few show evidence of decline, we believe the species is maintaining genetic heterogeneity. We also 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 lethal take of up to 11 green sea turtles annually 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 Atlantic Recovery Plan for the population of Atlantic green sea turtles (NMFS and USFWS 1991) 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:*
>
> - Green sea turtle nesting in Florida between 2001-2006 was documented as follows: 2001 – 581 nests, 2002 – 9,201 nests, 2003 – 2,622, 2004 – 3,577 nests, 2005 – 9,644 nests, 2006 – 4,970 nests. This averages 5,039 nests annually over those 6 years (2001-2006) (NMFS and USFWS 2007a). Subsequent nesting has shown even

higher average numbers (i.e., 2007 – 12,751 nests, 2008 – 9,228, 2009 – 4,462, 2010 – 13,225 nests, 2011 – 15,352 (FWRI 2012)) thus this recovery criterion continues to be met.

Objective: A reduction in stage class mortality is reflected in higher counts of individuals on foraging grounds.

- 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 11 green sea turtles annually will result in a reduction in numbers when takes occur but it is unlikely to have any detectable influence on the trends noted above. Non-lethal takes of sea turtles would not affect the adult female nesting population or number of nests per nesting season. Additionally, our estimate of future take is based on our belief that the same level of take occurred in the past. Yet we have still seen positive trends in the status of this species. 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 green sea turtles' recovery in the wild.

Conclusion
The lethal and non-lethal takes of green sea turtles associated with the proposed action are not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of the green sea turtle in the wild.

7.6 Hawksbill Sea Turtles

The proposed action may result in six hawksbill sea turtle takes (3 lethal, 3 non-lethal) annually. The potential non-lethal takes are not expected to have any measurable impact on the reproduction, numbers, or distribution of these species. The individuals are expected to fully recover such that no reductions in reproduction or numbers of hawksbill sea turtles are anticipated. Since the takes may occur anywhere in the action area and would be released within the general area where caught, no change in the distribution of hawksbill sea turtles is anticipated.

The potential lethal take of up to three hawksbill sea turtles annually 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. Potential lethal interactions could also result in a reduction in future reproduction, assuming one or more individuals would be female and would otherwise survive 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 1980). Thus, the loss of any females 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 these takes.

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 5-year status review estimated between 21,000 and 28,000 adult females existed in the Atlantic basin at the time of its writing in 2007 (NMFS and USFWS 2007e); this estimate does not include juveniles of either sex or mature males. The potential loss of three hawksbill sea turtles annually would equal only 0.014-0.010 percent of the estimated adult female population, which is only a portion of the entire population. Hawksbill nesting trends also indicate an increase over the last 20 years. A survey of historical nesting trends (i.e., 20 to 100 years ago) for the 33 nesting sites in the Caribbean found declines at 25 of those sites and data were not available for the remaining 8. However, in the last 20 years, nesting trends appear to be improving. Of those 33 sites, 9 sites now show an increase in nesting, where before there were none; 11 sites show a decrease, and data for the remaining 13 were not available (NMFS and USFWS 2007e). Because of the small impact we believe the proposed action may have on the hawksbill population and because we believe increases in nesting indicate improving population numbers, we do not anticipate the potential loss of up to three hawksbill sea turtle annually will have any detectable effect on the total population of hawksbills.

Additionally, we do not anticipate the proposed action will have any measurable effect on genetic diversity. Up to three hawksbill sea turtle lethal captures are anticipated annually. Based on the sex ratio of hawksbill sea turtles, there is only a 50 percent chance that a female would be captured. Furthermore, we have no reason to believe that the proposed action would disproportionately affect females from one rookery over another. This is significant because regardless of the size of these rookeries, each contributes to species' genetic diversity. Because we believe only three lethal captures may occur during any given year, and those takes could be individuals from any one of these rookeries, we do not believe the proposed action will have a measurable effect on the species' overall genetic diversity. Nor do we believe the anticipated takes of hawksbill sea turtles will have any noticeable effect on the number of sexually mature individuals producing viable offspring.

We do not anticipate the proposed action will have any noticeable impact of the population overall, and the action will not cause the population to lose genetic diversity, or the capacity to successfully reproduce. 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 at five index beaches, including Mona Island and Buck Island Reef National Monument.*
>
> - Of the rookeries regularly monitored: Jumby Bay (Antigua/Barbuda), Barbados, Mona Island, and Buck Island Reef National Monument all show increasing trends in the annual number of nests (NMFS and USFWS 2007b).

Objective: The numbers of adults, subadults, and juveniles are increasing, as evidenced by a statistically significant trend on at least five key foraging areas within Puerto Rico, USVI, and Florida.

- In-water research projects at Mona Island, Puerto Rico, and the Marquesas, Florida, which involve the observation and capture of juvenile hawksbill turtles, are underway. Although there are 15 years of data for the Mona Island project, abundance indices have not yet been incorporated into a rigorous analysis or a published trend assessment. The time series for the Marquesas project is not long enough to detect a trend (NMFS and USFWS 2007b).

Objective: The recovery plan lists six major actions that are needed to achieve recovery, including:

- Provide long-term protection to important nesting beaches.
- Ensure at least 75 percent hatching success rate on major nesting beaches.
- Determine distribution and seasonal movements of turtles in all life stages in the marine environment.
- Minimize threat from illegal exploitation.
- End international trade in hawksbill products.
- Ensure long-term protection of important foraging habitats

Unlike for other sea turtle species, none of the major actions specified for recovery are specific to fishery bycatch. While incidental capture in commercial and recreational fisheries is listed as one of the threats to the species, the only related action, “Monitor and reduce mortality from incidental capture in fisheries” is ranked as a priority 3. The potential effects on hawksbill sea turtles from the proposed action are not likely to reduce overall population numbers over time due to current population sizes and expected recruitment. Our estimate of potential future mortalities is also based our belief that the same level of take occurred in the past and with that level we have still seen some positive trends in the status of the species. 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 lethal or non-lethal take of a hawksbill turtle associated with the proposed action is not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of the hawksbill sea turtle in the wild.

7.7 Leatherback Sea Turtles

The proposed action may result in up to six leatherback sea turtle takes (3 lethal, 3 non-lethal) annually. The non-lethal take of three leatherback sea turtles annually 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 takes 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 three leatherback sea turtles annually would reduce their respective populations by three. Lethal takes 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 percent) 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. Thus, 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 offshore portion of the action area. Given these sea turtles generally have large ranges in which they disperse, no reduction in the distribution of leatherback sea turtles is expected from the proposed action.

The Leatherback Turtle Expert Working Group estimates 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. The potential loss of up to three leatherback sea turtles annually accounts for only 0.009 to 0.003 percent of those population estimates. We do not believe these potential loses will have any detectable impact on these population numbers.

Of the five leatherback populations or groups of populations in the North Atlantic, three show an increasing or stable trend (Florida, Northern Caribbean, and Southern Caribbean). This includes the largest nesting population, located in the Southern Caribbean at Suriname and French Guiana. Of the remaining two populations (West Africa and Western Caribbean), there is not enough information available on the West African population to conduct a trend analysis, and, for the two nest populations in the Western Caribbean, a slight decline in annual population growth rate was detected (TEWG 2007). An annual growth rate of 1.0 is considered a stable population; the growth rates of two nesting populations in the Western Caribbean were 0.98 and 0.96 (TEWG 2007).

We also believe these nesting trends are indicative of a species with a number of sexually mature individuals. Assuming a 50:50 sex ratio, there is only a 50 percent chance that a female would be captured. We have no reason to believe that the proposed action would disproportionately affect females from one nesting population or group of populations over another. This is significant because regardless of the size of these nesting populations, each contributes to species' genetic diversity. Because we believe only three lethal captures may occur during any given year, and those takes could be individuals from anyone of these rookeries, we do not believe the proposed action will have a measurable effect on the species' overall genetic diversity. Likewise, we do not believe the potential removal of up to three leatherback sea turtles annually will have any noticeable effect on the number of sexually mature individuals producing viable offspring. Based on the current nesting trends, we believe the potential lethal takes attributed to the proposed action will not have any measurable effects on those trends.

We do not anticipate the proposed action will have any detectable impact on the population overall, and the action will not cause the population to lose genetic diversity, or the capacity to successfully reproduce. Therefore, 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 1992b) includes two recovery actions, directly related to the proposed action of this opinion:

> *Objective: Evaluate the extent of incidental catch due to hook and line, drift net, gillnetting, and other fisheries related mortality,*
>
> *Objective: Promulgate and enforce appropriate regulations to reduce hook-and-line, drift net, gillnetting and other fisheries related mortality.*

The proposed action will continue to require the use of sea turtle release equipment, and bring a previously unmanaged gillnet fishery under federal authority. Both of these actions support the continued implementation of these recovery tasks. Thus, we believe the proposed action is not impeding the progress of recovery objectives above.

Conclusion

The lethal or non-lethal take of a leatherback sea turtle associated with the proposed action is not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of the leatherback sea turtle in the wild.

7.8 Kemp’s Ridley Sea Turtles

The proposed action may result in up to 12 Kemp’s ridley sea turtle takes (5 non-lethal, 7 lethal), annually. The non-lethal takes of up to five Kemp’s ridley sea turtles annually 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 takes may occur anywhere in the action area and 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 seven Kemp’s ridley sea turtles annually 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 proposed action 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. The annual loss of adult females could preclude the production of thousands of eggs and hatchlings, of which a small 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 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 Kemp’s ridley sea turtles is expected from the take 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 percent per year and that the population could attain at least 10,000 females nesting on Mexico beaches by 2015. NMFS et al. (2011) contains an updated model which predicts that the population is expected to increase 19 percent per year and 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 (13,302), deviating from the NMFS et al. (2011) 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, (Gladys Porter Zoo 2012) and 209 nests in were reported in Texas as of August 2012.

We believe this increasing trend in nesting is evidence of an increasing population, as well as a population that is maintaining (and potentially increasing) its genetic diversity. We also believe these nesting trends are indicative of a species with a number of sexually mature individuals. Assuming a 50:50 sex ratio, there is only a 50 percent chance that any given take would actually involved a female. We do not believe the anticipated takes of Kemp's ridley associated with the proposed action will have a measurable effect on the increasing nesting trends seen over the last several years. Furthermore, we have no reason to believe that the proposed action would disproportionately affect females from one nesting beach over another. This is significant because regardless of the size of these nesting beaches, each contributes to species' genetic diversity. Because we believe seven lethal captures may occur during any given year, and those takes could be individuals from any nesting beach, we do not believe the proposed action will have a measurable effect on the species' overall genetic diversity, particularly in light of the increasing population trends. Nor do we believe the anticipated takes will cause a change in the number of sexually mature individuals producing viable offspring to an extent that changes in nesting trends will occur.

We do not anticipate the proposed action will have any detectable impact of the population overall, and the action will not cause the population to lose genetic diversity, or the capacity to successfully reproduce. Therefore, we do not believe the proposed action will cause an appreciable reduction in the likelihood of survival.

The recovery plan for the Kemp's ridley sea turtle (NMFS et al. 2011) lists the following relevant recovery objective:

> *Objective*: *Attain a population of at least 10,000 females nesting 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. Methodology and capacity to implement and ensure accurate nesting female counts have been developed.*

The recovery plan states the average nests per female is 2.5 and recovery goal of 10,000 nesting females is associated with 25,000 nest. The 2012 nesting season recorded approximately 22,000 nests.

The lethal take of up to seven Kemp's ridley sea turtles annually will result in reduction in numbers when takes occur but it is unlikely to have any detectable influence on the trends noted above. Non-lethal takes of sea turtles would not affect the adult female nesting population or number of nests per nesting season. Additionally, our estimate of future take is based on our belief that the same level of take occurred in the past. Yet we have still seen positive trends in the status of these species. Thus, we believe the proposed action is not in opposition to the recovery objectives above and will not result in an appreciable reduction in the likelihood of Kemp's ridley sea turtles' recovery in the wild.

Conclusion

The lethal or non-lethal take of a Kemp's ridley sea turtle associated with the proposed action is 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.

7.9 Smalltooth Sawfish - United States DPS

The proposed action may result in up to 12 smalltooth sawfish takes (9 non-lethal, 3 lethal), annually. The non-lethal takes of up to nine smalltooth sawfish annually 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 takes may occur anywhere in the action area and would be released within the general area where caught, no change in the distribution of smalltooth sawfish is anticipated.

The loss of three smalltooth sawfish annually will reduce the number of smalltooth sawfish as compared to the number of smalltooth sawfish that would have been present in the absence of the proposed action assuming all other variables remained the same. These lethal takes could also result in the loss of reproduction value as compared to the reproductive value in the absence of the proposed action, if a female taken. An adult female smalltooth sawfish may have a litter of approximately 10 pups probably every two years. The loss of three adult female smalltooth sawfish, on average, could preclude the production of 30 pups every three years. Because smalltooth sawfish produce more well-developed young it is likely that some portion of these pups would have survived. Thus, the death of a female eliminates an individual's contribution to future generations, and the proposed action would result in a reduction in future smalltooth sawfish reproduction. The loss of two animals from the population annually will have no impact of the distribution of the species.

While there is currently no accurate smalltooth sawfish population estimate, a trend analysis of their abundance in the Everglades National Park, considered within the species core range, shows a slightly increasing population abundance trend since 1972 (Carlson et al. 2007). From 1989-2004, smalltooth sawfish relative abundance has increased 5 percent annually (NMFS 2010c, Carlson and Osborne 2012). Using a demographic approach and life history data from similar species, Simpfendorfer (2000) estimates the most likely range for the intrinsic rate of increase is 0.08 per year to 0.13 per year with population doubling times of 10.3 to 13.5 years. Although this rate is very slow, the lethal take of three adult smalltooth sawfish annually is not expected to have any measureable impact on this rate of population doubling-time. Even with the ongoing fishing activities associated with the proposed action, the smalltooth sawfish population still remains stable or increasing (Carlson and Osborne 2012). Although the anticipated mortality of three smalltooth sawfish annually would result in an instantaneous reduction in absolute population number, we do not believe these mortalities will have any measurable effect on these trends. Therefore, we believe the anticipated lethal and non-lethal take of smalltooth sawfish associated with the proposed action are not reasonably expected to cause, directly or indirectly, an appreciable reduction in the likelihood of survival of the species in the wild.

Although we believe no change in distribution of smalltooth sawfish will occur as a result of the proposed action, we concluded the lethal take would result in an instantaneous reduction in absolute population numbers that may also reduce reproduction, but the short-term reductions are not expected to appreciably reduce the likelihood of survival of the species in the wild. The following analysis considers the effects of that take on the likelihood of recovery in the wild. We consider the recovery objectives in the recovery plan prepared for the species that relate to population numbers or reproduction that may be affected by the predicted reductions in the numbers or reproduction of smalltooth sawfish resulting from the proposed action.

The recovery plan for the smalltooth sawfish (NMFS 2009a) lists three main objectives as recovery criteria for the species. The two objectives and the associated sub-objectives relevant to the proposed action are:

Objective - Minimize Human Interactions and Associated Injury and Mortality

Sub-objective:

- Minimize human interactions and resulting injury and mortality of smalltooth sawfish through public education and outreach targeted at groups that are most likely to interact with sawfish (e.g., fishermen, divers, boaters).
- Develop and seek adoption of guidelines for safe handling and release of smalltooth sawfish to reduce injury and mortality associated with fishing.
- Minimize injury and mortality in all commercial and recreational fisheries.

Objective - Ensure Smalltooth Sawfish Abundance Increases Substantially and the Species Reoccupies Areas From Which it had Previously Been Extirpated

Sub-objective:

- Sufficient numbers of juvenile smalltooth sawfish inhabit several nursery areas across a diverse geographic area to ensure survivorship and growth and to protect against the negative effects of stochastic events within parts of their range.
- Adult smalltooth sawfish (> 340 cm) are distributed throughout the historic core of the species' range (both the Gulf of Mexico and Atlantic coasts of Florida). Numbers of adult smalltooth sawfish in both the Atlantic Ocean and Gulf of Mexico are sufficiently large that there is no significant risk of extirpation (i.e., local extinction) on either coast.
- Historic occurrence and/or seasonal migration of adult smalltooth sawfish are reestablished or maintained both along the Florida peninsula into the South-Atlantic Bight, and west of Florida into the northern and/or western Gulf of Mexico.

NMFS is currently funding several actions identified in the Recovery Plan for smalltooth sawfish; adult satellite tagging studies, the NSED, and monitoring take in commercial fisheries. Additionally, NMFS has developed safe-handling guidelines for the species. Despite the ongoing threats from the proposed action, we have still seen a stable or slightly increasing trend in the status of this species. Thus, the proposed action is not likely to impede the recovery objectives above and will not result in an appreciable reduction in the likelihood of the United States DPS of smalltooth sawfish's recovery in the wild. NMFS must continue to monitor the status of the population to ensure the species continues to recover.

Non-lethal takes of smalltooth sawfish will not affect the population of reproductive adult females. The potential lethal take of three smalltooth sawfish annually will result in a reduction in overall population numbers in any given year. We have already determined that while these takes would likely result in an instantaneous reduction in absolute population numbers, we do not believe those reductions will have any measurably effects on the species increasing population trends. Additionally, we believe the proposed action will not impede the achievement of the relevant recovery objectives or sub-objectives. HMS shark fishermen are required to attend a class that provides instruction on the proper technique and use of equipment designed to release smalltooth sawfish with minimal injury. The HMS shark fisheries also do not occur in areas currently believed to be juvenile nursery areas. The loss of three smalltooth sawfish annually is not likely to have any discernible effect on the distribution of smalltooth sawfish or the ability for the species to re-establish its historical occurrence or seasonal migrations. Thus, the effects of the proposed action will not result in an appreciable reduction in the likelihood of smalltooth sawfish recovery in the wild.

Conclusion

Based on the information of this section, we believe the effects from proposed action are not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of smalltooth sawfish.

7.10 Atlantic Sturgeon – Gulf of Maine DPS

The proposed action may result in 12 Atlantic sturgeon takes from the Gulf of Maine (GOM) DPS annually. We estimate those takes would be three adults (2 non-lethal, 1 lethal take) and nine subadults (7 non-lethal, 2 lethal take).

The potential non-lethal takes of nine Atlantic sturgeon annually are not expected to have any measurable impact on the reproduction, numbers, or distribution of animals from the GOM DPS. The individuals are expected to fully recover such that no reductions in reproduction or numbers of Atlantic sturgeon are anticipated.

Atlantic sturgeon travel extensively throughout the marine environment and have large ranges over which they disperse. Because the anticipated takes (both lethal and non-lethal) could occur anywhere within the range of the species, no change in the distribution of the GOM DPS Atlantic sturgeon is anticipated.

The potential lethal take of three Atlantic sturgeon (1 adult, 2 subadults) annually would reduce the population of Atlantic sturgeon in the GOM DPS by that amount. Adult Atlantic sturgeon are generally considered more important to the species because of their ability to breed. For this reason, we believe the best way to evaluate the true impacts of the proposed action on Atlantic sturgeon reproduction is to consider not only how it is likely to affect adults, but also how it would affect subadults that may have lived to become adults ("adult equivalents"). In Section 5.9, we estimated the number of lethal adult equivalents for the GOM DPS was one. Thus, we anticipate the proposed action is likely to result in two (1 adult, 1 adult equivalent) lethal adult Atlantic sturgeon annually from the GOM DPS. In Appendix 7 we estimated 215 adults and 645 subadults may exist in the GOM DPS. If we converted those sub-adults to "adult equivalents" it would increase the number of adults in the DPS by 310 individuals.[61] However, we have chosen to act conservatively and only evaluate our anticipated takes against our estimated adult population.

Whether the reduction in numbers and reproduction from the loss of two adult Atlantic sturgeon from the GOM DPS attributable to the proposed action would appreciably reduce the species' likelihood of survival and recovery depends on how the changes in numbers and reproduction would affect the population's growth rate, and whether the growth rate would allow the species to recover.

For the population of GOM DPS Atlantic sturgeon to remain stable over generations, a certain amount of spawning must occur across the entire DPS to offset deaths within the population. Two ways to measure spawning production are spawning stock biomass per recruit (SSB/R) and eggs per recruit (EPR). EPR_{max} refers to the maximum number of eggs produced by a female Atlantic sturgeon over the course of its lifetime assuming, no fishing mortality. Similarly, SSB/R_{max} is the expected contribution a female Atlantic sturgeon would make to the total weight of the fish in a stock that are old enough to spawn during its lifetime over the course of its lifetime, assuming no fishing mortality. In both cases, as fishing mortality increases, the expected lifetime production of a female decreases from the theoretical maximum (i.e., SSB/R_{max} or EPR_{max}) due to an increased probability the animal will be caught and therefore unable to achieve its maximum potential (Boreman 1997). Since the EPR_{max} or SSB/R_{max} for each individual within a population is the same, it is appropriate to talk about these parameters not only for individuals but for populations as well.

Goodyear (1993) suggests that maintaining a SSB/R of at least 20 percent of SSB/R_{max} would allow a population to remain stable (i.e., retain the capacity for survival). Boreman et al. (1984) indicated that maintaining a SSB/R of at least 50 percent of SSB/R_{max} would be an appropriate target for rebuilding (i.e., recovery). Boreman (1997) indicates that since stock biomass and egg production are typically linearly correlated[62] it is appropriate to apply the 20 percent (Goodyear 1993) and 50 percent (Boreman et al. 2007) thresholds directly to EPR estimates. Boreman (1997) reports adult female Atlantic sturgeon in the Hudson River could likely sustain a total fishing mortality of 14 percent and still retain enough spawners for the population to remain stable (i.e., maintain an EPR of at least 20 percent of EPR_{max}). This total fishing mortality rate

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[61] 645 estimated subadults in the GOM DPS x 0.48 proportion of subadults likely to survive to be adults = 310 subadults that may survive to become adults (i.e., "adult equivalents").

[62] Larger females generally produce more eggs than smaller individuals.

is specific to adult female spawners. Since estimates of total fishing mortality rates that would equal 20 percent of EPR_{max} are not available for the GOM DPS, the information on the Hudson River is the best available. We do not know the sex ratio for adult sturgeon in the GOM DPS. In the absence of this information, we chose to evaluate our anticipated takes of all adults against this female specific fishing mortality rate because we believe doing so is conservative toward the species.

As noted previously (see Section 3.2.10.1), we believe 50 percent of Atlantic sturgeon bycatch may occur in federal fisheries. Based on this assumption, we would anticipate GOM DPS Atlantic sturgeon could sustain a federal fishing mortality of approximately 7 percent and still retain enough spawners for the population to remain stable (i.e., maintain at least 20 percent of EPR_{max}). We anticipated two adults may be taken by the proposed action. The biological opinion for the Southeastern United States shrimp trawl fishery estimated one lethal take of an adult from the GOM DPS annually. Together, we anticipate that three adult Atlantic sturgeon may be taken annually in federal fisheries, or 1.4 percent of the adult population in the GOM DPS.[63] This 1.4 percent is below the estimated 7 percent federal fishing mortality rate we believe the population could likely withstand and still maintain 20 percent of EPR_{max}. Based on this information, we believe the proposed action's removal of up to two adults annually will cause a reduction in numbers and reproduction. However, we do not believe these reductions are likely to reduce the population's ability to persist into the future.

Now our analysis considers whether the proposed action is likely to impede the recovery of Atlantic sturgeon from the GOM DPS. Because the GOM DPS of Atlantic sturgeon has only recently been listed, a recovery plan for this segment of the population has not yet been developed. However, the first step in recovering a species is to reduce identified threats; only by alleviating threats can lasting recovery be achieved.

The final listing rule noted several potential threats to Atlantic sturgeon. Major threats affecting the GOM DPS include:

1) Dredging that can displace sturgeon while it is occurring and affect the quality of the habitat afterwards by changing the depth, sediment characteristics, and prey availability.
2) Degraded water quality in areas as a result of withdrawals for public use, runoff from agriculture, industrial discharges, and the alteration of river systems by dams and reservoirs.
3) Impeded access to historical habitat by dams and reservoirs.
4) Bycatch of Atlantic sturgeon in commercial fisheries.
5) Inadequacy of regulatory mechanisms to control bycatch and the modification and curtailment of Atlantic sturgeon habitat.

Nothing about the authorization of the smoothhound fishery or the continued authorization of the Atlantic shark fisheries will affect the habitat or water quality. The proposed action has no

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[63] (1 shrimp trawl take + 2 takes associated with the proposed action) ÷ 215 estimated adults in the GOM DPS = 1.3 percent of the GOM DPS taken.

relationship to the blockage of access to historical habitats by dams or reservoirs. The proposed action will actually improve the inadequacy of regulatory mechanisms to control bycatch.

The bycatch of Atlantic sturgeon in commercial fisheries will continue to be a threat under the proposed action. As noted previously, Boreman (1997) suggested maintaining an EPR of at least 50 percent of EPR_{max} would be appropriate to rebuild a species with life history characteristics like Atlantic sturgeon. Boreman (1997) estimated an EPR of at least 50 percent of EPR_{max} could be maintained for the Hudson River population if fishing mortality remained at or below 5 percent. If we follow the same assumptions noted previously regarding a 50:50 split between Atlantic sturgeon bycatch in state and federal fisheries, the Atlantic sturgeon bycatch from the proposed action and other federal fisheries would have to remain below 2.5 percent to maintain enough spawners for the population to rebuild. Previously we estimated that proposed action, in conjunction with other federal fisheries, likely removes only 1.4 percent of adults in the GOM DPS. This estimate is below the 2.5 percent threshold we believe is necessary to maintain an EPR of at least 50 percent of EPR_{max}.

Recovery is a process. It is the process by which the ecosystems of the Atlantic sturgeon in GOM DPS are restored and the threats to the species are removed. These recovery actions support self-populating and self-regulating populations so they can become persistent members of the native biological communities (USFWS and NMFS 1998). As discussed previously, the proposed action is not likely to impede the Atlantic sturgeon of the GOM DPS from continuing to self-populate or self-regulate (i.e., survive). The proposed action will not impede the process of restoring the ecosystems that affect Atlantic sturgeon of the GOM DPS of Atlantic sturgeon and will not impede progress toward removing the other threats. The proposed action will actually bring the smoothhound fishery under federal management for the first time, establishing NMFS' authority to implement future regulations to minimize the bycatch of Atlantic sturgeon in the GOM DPS. Ultimately, we believe the likely fishing mortality of Atlantic sturgeon in the GOM DPS is below both the estimated thresholds for survival and recovery.

Conclusion

Based on the information of this section, we believe the effects from proposed action are not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of Atlantic sturgeon originating from the GOM DPS.

7.11 Atlantic Sturgeon – New York Bight DPS

The proposed action may result in 53 Atlantic sturgeon takes from the New York Bight (NYB) DPS annually. We estimate those takes would be 13 adults (11 non-lethal, 2 lethal) and 40 subadults (32 non-lethal, 8 lethal).

The potential non-lethal takes of 43 Atlantic sturgeon annually (11 adults, 32 subadults) are not expected to have any measurable impact on the reproduction, numbers, or distribution of these animals from the NYB DPS. The individuals are expected to fully recover such that no reductions in reproduction or numbers of Atlantic sturgeon are anticipated.

Atlantic sturgeon travel extensively throughout the marine environment and have large ranges over which they disperse. Because the anticipated takes (both lethal and non-lethal) could occur anywhere within the range of the species, no change in the distribution of the NYB DPS Atlantic sturgeon is anticipated.

The potential lethal take of 10 Atlantic sturgeon annually (2 adults, 8 subadults) would reduce the population of Atlantic sturgeon in the NYB DPS by that amount. Because of the importance of breeding adults to a population, we will use the same approach described above and consider the proposed actions likely effects on subadults that may have lived to become adults ("adult equivalents"). In Section 5.9, we estimated the number of adult equivalents for the NYB DPS affected by the proposed action was four. Thus, we anticipate the proposed action is likely to result in six lethal adult Atlantic sturgeon (2 adult, 4 adult equivalents) takes annually from the NYB DPS. In Appendix 7 we estimated 951 adults and 2,843 subadults may exist in the NYB DPS. If we converted those subadults to "adult equivalents" it would increase the number of adults in the DPS by 1,369 individuals.[64] However, we have chosen to act conservatively and only evaluate our anticipated takes against our estimated adult population.

We believe the six lethal adult takes could occur anywhere within the range of the animals from the DPS. Because these takes are likely to occur at random we do not anticipate any change in the distribution of Atlantic sturgeon in the DPS. Whether the reduction in number and reproduction we anticipate as a result of proposed action would appreciably reduce the species' likelihood of survival and recovery depends on how those changes would affect the population's growth rate, and whether the growth rate would allow the species to recover.

To determine what those reductions will mean we will follow the same approach and assumptions we discussed previously in Sections 3.2.10.1 and 7.10. Boreman (1997) reports adult female Atlantic sturgeon in the Hudson River could likely sustain a total fishing mortality of 14 percent and still retain enough spawners for the population to remain stable (i.e., maintain an EPR of at least 20 percent of EPR_{max}). For our analysis we will evaluate the impact of the proposed action in conjunction with other federal fishing against this 14 percent (and ultimately 7 percent) fishing mortality. We also evaluate these effects against the five percent (and ultimately 2.5 percent) fishing mortality threshold needed to maintain an EPR of at least 50 percent of EPR_{max}. Boreman (1997) indicates this threshold could be enough to help rebuild a species with life history characteristics like Atlantic sturgeon.

Our analysis here also assumes 50 percent of Atlantic sturgeon bycatch occurs in federal fisheries and the NYB DPS population could sustain a total fishing mortality of 14 percent and still maintain at least 20 percent of EPR_{max}. Based on these assumptions, we would anticipate NYB DPS Atlantic sturgeon could sustain a federal fishing mortality of approximately 7 percent and still maintain at least 20 percent of EPR_{max}.[65] We anticipated six adults may be taken by the proposed action. The biological opinion for the Southeastern United States shrimp trawl fishery estimated three lethal takes of adults from the NYB DPS annually. Together, we anticipate that

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[64] 2,853 estimated subadults in the NYB DPS x 0.48 proportion of subadults likely to survive to be adults = 1,369 subadults that may survive to become adults (i.e., "adult equivalents").

[65] 50% of Atlantic sturgeon bycatch occurs in federal fisheries x the 14% total fishing morality = 7% fishing mortality could occur in federal fisheries.

nine adult Atlantic sturgeon may be taken annually in federal fisheries, or 0.9 percent of the adult population in the NYB DPS.[66] This 0.9 percent is below the estimated seven percent federal fishing mortality rate we believe the population could likely withstand and still maintain 20 percent of EPR_{max}. Based on this information, we believe the proposed action's removal of up to six adults annually will cause a reduction in numbers and reproduction. However, we do not believe these reductions are likely to reduce the population's ability to persist into the future.

Now our analysis considers whether the proposed action is likely to impede the recovery of Atlantic sturgeon from the NYB DPS. Because the NYB DPS of Atlantic sturgeon has only recently been listed, a recovery plan for this segment of the population has not yet been developed. However, the first step in recovering a species is to reduce identified threats; only by alleviating threats can lasting recovery be achieved.

The final listing rule noted several potential threats to Atlantic sturgeon. Major threats affecting Atlantic sturgeon in the NYB DPS were summarized in the final listing and include:

1) Dredging that can displace sturgeon while it is occurring and affect the quality of the habitat afterwards by changing the depth, sediment characteristics, and prey availability.
2) Degraded water quality in areas throughout the range of the five DPSs as a result of withdrawals for public use, runoff from agriculture, industrial discharges, and the alteration of river systems by dams and reservoirs.
3) Impeded access to historical habitat by dams and reservoirs.
4) Bycatch of Atlantic sturgeon in commercial fisheries.
5) Vessel strikes within the riverine portions of the range of the New York Bight.
6) Inadequacy of regulatory mechanisms to control bycatch and the modification and curtailment of Atlantic sturgeon habitat.

Nothing about the authorization of the smoothhound fishery or the continued authorization of the Atlantic shark fisheries will affect the habitat or water quality; obviously, these actions have no relationship with the blockage of access to historical habitats by dams or reservoirs. Likewise, the authorization of the federal fisheries for Atlantic shark and smoothhound in the marine portion of the range is likely to have little impact on the number of vessel strikes occurring on the riverine portions of the NYB DPS. The proposed action is actually likely to improve the inadequacy of regulatory mechanisms to control bycatch by bringing the smoothhound fishery under federal management for the first time.

The bycatch of Atlantic sturgeon in commercial fisheries will continue to be a threat under the proposed action. As noted previously, Boreman (1997) suggested maintaining an EPR of at least 50 percent of EPR_{max} would be appropriate to rebuild a species with life history characteristics like Atlantic sturgeon. Boreman (1997) estimated an EPR of at least 50 percent of EPR_{max} could be maintained for the Hudson River population if the total fishing mortality remained at or below 5 percent. If we follow the same assumptions noted previously regarding

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[66] (3 shrimp trawl take + 6 takes associated with the proposed action) ÷ 951 estimated adults in the NYB DPS = 0.9 percent of the NYB DPS taken.

a 50:50 split between Atlantic sturgeon bycatch in state and federal fisheries, the Atlantic sturgeon bycatch from the proposed action and other federal fisheries would have to remain below 2.5 percent to maintain an EPR of at least 50 percent of EPR_{max}. Previously, we estimated that proposed action, in conjunction with other federal fisheries, likely removes only 0.9 percent of adults in the NYB DPS. This estimate is below the 2.5 percent threshold we believe is necessary to maintain an EPR of at least 50 percent of EPR_{max}.

Recovery is a process. It is the process by which the ecosystems of the Atlantic sturgeon in NYB DPS are restored and the threats to the species are removed. These recovery actions support self-populating and self-regulating populations so they can become persistent members of the native biological communities (USFWS and NMFS 1998). As discussed previously, the proposed action is not likely to impede the NYB DPS from continuing to self-populate or self-regulate (i.e., survive). The proposed action will not impede the process of restoring the ecosystems that affect Atlantic sturgeon of the NYB DPS and will not impede progress toward removing the other threats. The proposed action will actually bring the smoothhound fishery under federal management for the first time, establishing NMFS' authority to implement future regulations to minimize the bycatch of Atlantic sturgeon in the NYB DPS. Ultimately, we believe recovery is a process and the likely fishing mortality of Atlantic sturgeon in the NYB DPS is below both the estimate thresholds for survival and recovery.

Conclusion

Based on the information of this section, we believe the effects from proposed action are not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of Atlantic sturgeon originating from the NYB DPS.

7.12 Atlantic Sturgeon – Chesapeake Bay DPS

The proposed action may result in 15 Atlantic sturgeon takes from the Chesapeake Bay (CB) DPS annually. We estimate those takes would be 4 adults (3 non-lethal, 1 lethal) and 11 subadults (9 non-lethal, 2 lethal).

The potential non-lethal takes of 12 Atlantic sturgeon annually (3 adults, 9 subadults) are not expected to have any measurable impact on the reproduction, numbers, or distribution of these animals from the CB DPS. The individuals are expected to fully recover such that no reductions in reproduction or numbers of Atlantic sturgeon are anticipated.

Atlantic sturgeon travel extensively throughout the marine environment and have large ranges over which they disperse. Because the anticipated takes (both lethal and non-lethal) could occur anywhere within the range of the species, no change in the distribution of the CB DPS Atlantic sturgeon is anticipated.

The potential lethal take of three Atlantic sturgeon annually (1 adult, 2 subadults) would reduce the population of Atlantic sturgeon in the CB DPS by that amount. Adult Atlantic sturgeon are generally considered more important to the species because of their ability to breed. For this reason, we believe the best way to evaluate the true impacts of the proposed action on Atlantic sturgeon reproduction is to consider not only how it is likely to affect adults, but also how it would affect subadults that may have lived to become adults ("adult equivalents"). In Section 5.9, we estimated the number of adult equivalents for the CB DPS was one. Thus, we anticipate the proposed action is likely to result in two (1 adult, 1 adult equivalent) lethal adult Atlantic sturgeon annually from the CB DPS. In Appendix 7 we estimated 273 adult and 825 subadults may exist in the CB DPS in addition to the adults we believe occur there. If we convert those individuals to "adult equivalents" it would increase the number of adults in the DPS by 396 individuals.[67] However, we have chosen to act conservatively and only evaluate our anticipated takes against our estimated adult population.

We believe the two lethal adult takes could occur anywhere within the range of the animals from the DPS. Because these takes are likely to occur at random we do not anticipate any change in the distribution of Atlantic sturgeon in the DPS. Whether the reduction in number and reproduction we anticipate as a result of proposed action would appreciably reduce the species' likelihood of survival and recovery depends on how those changes would affect the population's growth rate, and whether the growth rate would allow the species to recover.

To determine what those reductions will mean we will follow the same approach and assumptions we discussed previously in Sections 3.2.10.1 and 7.10. Boreman (1997) reports adult female Atlantic sturgeon in the Hudson River could likely sustain a total fishing mortality of 14 percent and still retain enough spawners for the population to remain stable (i.e., maintain an EPR of at least 20 percent of EPR_{max}). This total fishing mortality rate is specific to adult female spawners. Since estimates of total fishing mortality rates that would equal 20 percent of EPR_{max} are not available for the CB DPS, the information on the Hudson River is the best available. We do not know the sex ratio for adult sturgeon in the CB DPS. In the absence of this information, we chose to evaluate our anticipated takes of all adults against this female specific fishing mortality rate because we believe doing so is conservative toward the species.

For our analysis we will evaluate the impact of the proposed action in conjunction with other federal fishing against this 14 percent (and ultimately 7 percent) fishing mortality. We also evaluate these effects against the five percent (and ultimately 2.5 percent) fishing mortality threshold needed to maintain an EPR of at least 50 percent of EPR_{max}. Boreman (1997) indicates this threshold could be enough to help rebuild a species with life history characteristics like Atlantic sturgeon.

Our analysis here also assumes 50 percent of Atlantic sturgeon bycatch occurs in federal fisheries and the CB DPS population could sustain a total fishing mortality of 14 percent and still maintain at least 20 percent of EPR_{max}. Based on these assumptions, we would anticipate CB DPS Atlantic sturgeon could sustain a federal fishing mortality of approximately 7 percent and still maintain at least 20 percent of EPR_{max}. We anticipated two adults may be taken by the proposed action. The biological opinion for the Southeastern United States shrimp trawl fishery estimated two lethal takes of adults from the CB DPS annually. Together, we anticipate that four adult Atlantic sturgeon may be taken annually in federal fisheries, or 1.4 percent of the

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[67] 825 estimated subadults in the CB DPS x 0.48 proportion of subadults likely to survive to be adults = 396 subadults that may survive to become adults (i.e., "adult equivalents").

adult population in the CB DPS.[68] This 1.4 percent is below the estimated 7 percent federal fishing mortality rate we believe the population could likely withstand and still maintain 20 percent of EPR_{max}. Based on this information, we believe the proposed action's removal of up to two adults annually will cause a reduction in numbers and reproduction. However, we do not believe these reductions are likely to reduce the population's ability to persist into the future.

Now our analysis considers whether the proposed action is likely to impede the recovery of Atlantic sturgeon from the CB DPS. Because the CB DPS of Atlantic sturgeon has only recently been listed, a recovery plan for this segment of the population has not yet been developed. However, the first step in recovering a species is to reduce identified threats; only by alleviating threats can lasting recovery be achieved.

The final listing rule noted several potential threats to Atlantic sturgeon. Major threats affecting Atlantic sturgeon in the CB DPS were summarized in the final listing and include:

1) Dredging that can displace sturgeon while it is occurring and affect the quality of the habitat afterwards by changing the depth, sediment characteristics, and prey availability.
2) Degraded water quality in areas throughout the range of the five DPSs as a result of withdrawals for public use, runoff from agriculture, industrial discharges, and the alteration of river systems by dams and reservoirs.
3) Bycatch of Atlantic sturgeon in commercial fisheries.
4) Vessel strikes in within the riverine portions of the range of CB DPS.
5) Inadequacy of regulatory mechanisms to control bycatch and the modification and curtailment of Atlantic sturgeon habitat.

Nothing about the authorization of the smoothhound fishery or the continued authorization of the Atlantic shark fisheries will affect the habitat or water quality. Likewise, the authorization of the federal fisheries for Atlantic shark and smoothhound in the marine portion of the range is likely to have little impact on the number of vessel strikes occurring on the riverine portions of the CB DPS. The proposed action is actually likely to improve the inadequacy of regulatory mechanisms to control bycatch by bringing the smoothhound fishery under federal management for the first time.

The bycatch of Atlantic sturgeon in commercial fisheries will continue to be a threat under the proposed action. As noted previously, Boreman (1997) suggested maintaining an EPR of at least 50 percent of EPR_{max} would be appropriate to rebuild a species with life history characteristics like Atlantic sturgeon. Boreman (1997) estimated an EPR of at least 50 percent of EPR_{max} could be maintained if the total fishing mortality remained at or below 5 percent. Assuming the 50:50 split between Atlantic sturgeon bycatch in state and federal fisheries, the Atlantic sturgeon bycatch from the proposed action and other federal fisheries would have to remain below 2.5 percent to maintain an EPR of at least 50 percent of EPR_{max}. Previously, we estimated that proposed action, in conjunction with other federal fisheries, likely removes only

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[68] (2 shrimp trawl take + 2 takes associated with the proposed action) ÷ 273 estimated adults in the CB DPS = 1.4 percent of the NYB DPS taken.

1.4 percent of adults in the CB DPS. This estimate is below the 2.5 percent threshold we believe is necessary to maintain an EPR of at least 50 percent of EPR_{max}.

Recovery is a process. It is the process by which the ecosystems of the Atlantic sturgeon in CB DPS are restored and the threats to the species are removed. These recovery actions support self-populating and self-regulating populations so they can become persistent members of the native biological communities (Section 7 Handbook). As discussed previously, the proposed action is not likely to impede the CB DPS from continuing to self-populate or self-regulate (i.e., survive). The proposed action will not impede the process of restoring the ecosystems that affect Atlantic sturgeon of the CB DPS and will not impede progress toward removing the other threats. The proposed action will actually bring the smoothhound fishery under federal management for the first time, establishing NMFS' authority to implement future regulations to minimize the bycatch of Atlantic sturgeon in the CB DPS. Ultimately, we believe recovery is a process and the likely fishing mortality of Atlantic sturgeon in the CB DPS is below both the estimate thresholds to for survival and recovery.

Conclusion

Based on the information of this section, we believe the effects from proposed action are not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of Atlantic sturgeon originating from the CB DPS.

7.13 Atlantic Sturgeon – South Atlantic DPS

The proposed action may result in 21 Atlantic sturgeon takes from the South Atlantic (SA) DPS annually. We estimate those takes would be 5 adults (4 non-lethal, 1 lethal) and 16 subadults (13 non-lethal, 3 lethal).

The potential non-lethal takes of 17 Atlantic sturgeon annually (4 adults, 13 subadults) are not expected to have any measurable impact on the reproduction, numbers, or distribution of these animals from the SA DPS. The individuals are expected to fully recover such that no reductions in reproduction or numbers of Atlantic sturgeon are anticipated.

Atlantic sturgeon travel extensively throughout the marine environment and have large ranges over which they disperse. Because the anticipated takes (both lethal and non-lethal) could occur anywhere within the range of the species, no change in the distribution of the CB DPS Atlantic sturgeon is anticipated.

The potential lethal take of four Atlantic sturgeon annually (1 adult, 3 subadults) would reduce the population of Atlantic sturgeon in the SA DPS by that amount. Adult Atlantic sturgeon are generally considered more important to the species because of their ability to breed. For this reason, we believe the best way to evaluate the true impacts of the proposed action on Atlantic sturgeon reproduction is to consider not only how it is likely to affect adults, but also how it would affect subadults that may have lived to become adults ("adult equivalents"). In Section 5.9, we estimated the number of adult equivalents for the SA DPS was one. Thus, we anticipate the proposed action is likely to result in two (1 adult, 1 adult equivalent) lethal adult Atlantic sturgeon takes annually from the SA DPS. In Appendix 7 we estimated 390 adult and 1,170 subadults may exist in the SA DPS in addition to the adults we believe occur there. If we convert those individuals to "adult equivalents" it would increase the number of adults in the DPS by 562 individuals.[69] However, we have chosen to act conservatively and only evaluate our anticipated takes against our estimated adult population.

We believe the two lethal adult takes could occur anywhere within the range of the animals from the DPS. Because these takes are likely to occur at random we do not anticipate any change in the distribution of Atlantic sturgeon in the DPS. Whether the reduction in number and reproduction we anticipate as a result of proposed action would appreciably reduce the species' likelihood of survival and recovery depends on how those changes would affect the population's growth rate, and whether the growth rate would allow the species to recover.

As with the other DPSs we followed the same approach and assumptions discussed previously in Sections 3.2.10.1 and 7.10 to determine the likely effects of these takes on the individuals of this DPS. Boreman (1997) reports adult female Atlantic sturgeon in the Hudson River could likely sustain a total fishing mortality of 14 percent and still retain enough spawners for the population to remain stable (i.e., maintain an EPR of at least 20 percent of EPR_{max}). This total fishing mortality rate is specific to adult female spawners. Since estimates of total fishing mortality rates that would equal 20 percent of EPR_{max} are not available for the SA DPS, the information on the Hudson River is the best available. We do not know the sex ratio for adult sturgeon in the SA DPS. In the absence of this information, we chose to evaluate our anticipated takes of all adults against this female specific fishing mortality rate because we believe doing so is conservative toward the species.

Our analysis also assumes 50 percent of Atlantic sturgeon bycatch occurs in federal fisheries and the SA DPS population could sustain a total fishing mortality of 14 percent and still maintain at least 20 percent of EPR_{max}. Based on these assumptions, we would anticipate SA DPS Atlantic sturgeon could sustain a federal fishing mortality of approximately 7 percent and still maintain at least 20 percent of EPR_{max}. We anticipated two adults may be taken by the proposed action. The biological opinion for the Southeastern United States shrimp trawl fishery estimated eight lethal takes of adults from the SA DPS annually. Together, we anticipate that 10 adult Atlantic sturgeon may be taken annually in federal fisheries, or 2.5 percent of the adult population in the SA DPS.[70] This 2.5 percent is below the estimated 7 percent federal fishing mortality rate we believe the population could likely withstand and still maintain 20 percent of EPR_{max}. Based on this information, we believe the proposed action's removal of up to two adults annually will cause a reduction in numbers and reproduction. However, we do not believe these reductions are likely to reduce the population's ability to persist into the future.

Now our analysis considers whether the proposed action is likely to impede the recovery of Atlantic sturgeon from the SA DPS. Because the SA DPS of Atlantic sturgeon has only recently been listed, a recovery plan for this segment of the population has not yet been developed.

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[69] 1,170 estimated subadults in the SA DPS x 0.48 proportion of subadults likely to survive to be adults = 562 subadults that may survive to become adults (i.e., "adult equivalents").

[70] (8 shrimp trawl take + 2 takes associated with the proposed action) ÷ 390 estimated adults in the SA DPS = 2.5 percent of the SA DPS taken.

However, the first step in recovering a species is to reduce identified threats; only by alleviating threats can lasting recovery be achieved.

The final listing rule noted several potential threats to Atlantic sturgeon. Major threats affecting Atlantic sturgeon in the SA DPS were summarized in the final listing and include:

1) Dredging that can displace sturgeon while it is occurring and affect the quality of the habitat afterwards by changing the depth, sediment characteristics, and prey availability.
2) Degraded water quality in areas throughout the range of the five DPSs as a result of withdrawals for public use, runoff from agriculture, industrial discharges, and the alteration of river systems by dams and reservoirs.
3) Impeded access to historical habitat by dams and reservoirs.
4) Bycatch of Atlantic sturgeon in commercial fisheries.
5) Inadequacy of regulatory mechanisms to control bycatch and the modification and curtailment of Atlantic sturgeon habitat.

Nothing about the authorization of the smoothhound fishery or the continued authorization of the Atlantic shark fisheries will affect the habitat or water quality. Obviously, these actions have no relationship with the blockage of access to historical habitats by dams or reservoirs. The proposed action is actually likely to improve the inadequacy of regulatory mechanisms to control bycatch by bringing the smoothhound fishery under federal management for the first time.

The bycatch of Atlantic sturgeon in commercial fisheries will continue to be a threat under the proposed action. As noted previously, Boreman (1997) suggested maintaining an EPR of at least 50 percent of EPR_{max} would be appropriate to rebuild a species with life history characteristics like Atlantic sturgeon. Boreman (1997) estimated an EPR of at least 50 percent of EPR_{max} could be maintained if the total fishing mortality remained at or below 5 percent. Assuming the 50:50 split between Atlantic sturgeon bycatch in state and federal fisheries, the Atlantic sturgeon bycatch from the proposed action and other federal fisheries would have to remain below 2.5 percent to maintain an EPR of at least 50 percent of EPR_{max}. Previously, we estimated that proposed action, in conjunction with other federal fisheries, likely removes 2.5 percent of adults in the SA DPS. While we acknowledge this estimate matches the 50 percent of EPR_{max} limit, we have taken a number of steps throughout our analysis to act conservatively toward the species.[71] Because of these conservative actions we believe we likely overestimated the potential impacts of the proposed action.

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[71] For example, we converted the likely number of subadults lethally taken to adults and compared the number of adults and adult equivalents to our estimate of total adult population, without also converting the total number of subadults to total adult equivalents. This would have increased the total adult population. Additionally, as described in Appendix 7, our population estimates are based on very conservative assumptions that likely produced very conservative (i.e., low) population estimates. Finally, both the 20 percent and 50 percent fishing mortality thresholds are based on the removal of adult females (i.e., spawners). We acted conservatively and applied those thresholds to our estimates of *all* adults, not just females.

Recovery is a process. It is the process by which the ecosystems of the Atlantic sturgeon in SA DPS are restored and the threats to the species are removed. These recovery actions support self-populating and self-regulating populations so they can become persistent members of the native biological communities (USFWS and NMFS 1998). As discussed previously, the proposed action is not likely to impede the SA DPS from continuing to self-populate or self-regulate (i.e., survive). The proposed action will not impede the process of restoring the ecosystems that affect Atlantic sturgeon of the SA DPS and will not impede progress toward removing the other threats. The proposed action will actually bring the smoothhound fishery under federal management for the first time, establishing NMFS' authority to implement future regulations to minimize the bycatch of Atlantic sturgeon in the SA DPS. Ultimately, we believe recovery is a process and the likely fishing mortality of Atlantic sturgeon in the SA DPS is below both the estimate thresholds for survival and recovery.

Conclusion
Based on the information of this section, we believe the effects from proposed action are not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of Atlantic sturgeon originating from the SA DPS.

7.14 Atlantic Sturgeon – Carolina DPS

The proposed action may result in six Atlantic sturgeon takes from the Carolina DPS annually. We estimate those takes would be 2 adults (1 non-lethal, 1 lethal) and 4 subadults (3 non-lethal, 1 lethal).

The potential non-lethal takes of 4 Atlantic sturgeon annually (1 adults, 3 subadults) are not expected to have any measurable impact on the reproduction, numbers, or distribution of these animals from the Carolina DPS. The individuals are expected to fully recover such that no reductions in reproduction or numbers of Atlantic sturgeon are anticipated.

Atlantic sturgeon travel extensively throughout the marine environment and have large ranges over which they disperse. Because the anticipated takes (both lethal and non-lethal) could occur anywhere within the range of the species, no change in the distribution of the CB DPS Atlantic sturgeon is anticipated.

The potential lethal take of two Atlantic sturgeon annually (1 adult, 1 subadult) would reduce the population of Atlantic sturgeon in the Carolina DPS by that amount. Adult Atlantic sturgeon are generally considered more important to the species because of their ability to breed. For this reason, we believe the best way to evaluate the true impacts of the proposed action on Atlantic sturgeon reproduction is to consider not only how it is likely to affect adults, but also how it would affect subadults that may have lived to become adults ("adult equivalents"). In Section 5.9, we estimated the number of adult equivalents for the Carolina DPS would be zero based on conventional rounding. However, we will act conservatively and round up. Thus, we anticipate the proposed action is likely to result in two (1 adult, 1 adult equivalent) lethal adult Atlantic sturgeon annually from the Carolina DPS. In Appendix 7 we estimated 768 adults and 2,048 subadults may exist in the Carolina DPS in addition to the adults we believe occur there. If we convert those individuals to "adult equivalents" it would increase the number of adults in the

DPS by 983 individuals.[72] However, we have chosen to act conservatively and only evaluate our anticipated takes against our estimated adult population.

We believe the two lethal adult and adult equivalent takes could occur anywhere within the action area. Because these takes are likely to occur at random we do not anticipate any change in the distribution of Atlantic sturgeon in the DPS. Whether the reduction in number and reproduction we anticipate as a result of proposed action would appreciably reduce the species' likelihood of survival and recovery depends on how those changes would affect the population's growth rate, and whether the growth rate would allow the species to recover.

As with the other DPSs we followed the same approach and assumptions discussed previously in Sections 3.2.10.1 and 7.10 to determine the likely effects of these takes on the individuals of this DPS. Boreman (1997) reports adult female Atlantic sturgeon in the Hudson River could likely sustain a total fishing mortality of 14 percent and still retain enough spawners for the population to remain stable (i.e., maintain an EPR of at least 20 percent of EPR_{max}). This total fishing mortality rate is specific to adult female spawners. Since estimates of total fishing mortality rates that would equal 20 percent of EPR_{max} are not available for the Carolina DPS, the information on the Hudson River is the best available. We do not know the sex ratio for adult sturgeon in the Carolina DPS. In the absence of this information, we chose to evaluate our anticipated takes of all adults against this female specific fishing mortality rate because we believe doing so is conservative toward the species.

Our analysis also assumes 50 percent of Atlantic sturgeon bycatch occurs in federal fisheries and the SA DPS population could sustain a total fishing mortality of 14 percent and still maintain at least 20 percent of EPR_{max}. Based on these assumptions, we would anticipate Carolina DPS Atlantic sturgeon could sustain a federal fishing mortality of approximately 7 percent and still maintain at least 20 percent of EPR_{max}. We anticipated two adults may be taken by the proposed action. The biological opinion for the Southeastern United States shrimp trawl fishery estimated three lethal takes of adults from the Carolina DPS annually. Together, we anticipate that five adult Atlantic sturgeon may be taken annually in federal fisheries, or 0.6 percent of the adult population in the Carolina DPS.[73] This 0.6 percent is below the estimated 7 percent federal fishing mortality rate we believe the population could likely withstand and still maintain 20 percent of EPR_{max}. Based on this information, we believe the proposed action's removal of up to two adults annually will cause a reduction in numbers and reproduction. However, we do not believe these reductions are likely to reduce the population's ability to persist into the future.

Now our analysis considers whether the proposed action is likely to impede the recovery of Atlantic sturgeon from the Carolina DPS. Because the Carolina DPS of Atlantic sturgeon has only recently been listed, a recovery plan for this segment of the population has not yet been developed. However, the first step in recovering a species is to reduce identified threats; only by alleviating threats can lasting recovery be achieved.

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[72] 2,840 estimated subadults in the Carolina DPS x 0.48 proportion of subadults likely to survive to be adults = 983 subadults that may survive to become adults (i.e., "adult equivalents").

[73] (3 shrimp trawl take + 2 takes associated with the proposed action) ÷ 768 estimated adults in the Carolina DPS = 0.6 percent of the Carolina DPS taken.

The final listing rule noted several potential threats to Atlantic sturgeon. Major threats affecting Atlantic sturgeon in the Carolina DPS were summarized in the final listing and include:

1) Dredging that can displace sturgeon while it is occurring and affect the quality of the habitat afterwards by changing the depth, sediment characteristics, and prey availability.
2) Degraded water quality in areas as a result of withdrawals for public use, runoff from agriculture, industrial discharges, and the alteration of river systems by dams and reservoirs.
3) Impeded access to historical habitat by dams and reservoirs.
4) Bycatch of Atlantic sturgeon in commercial fisheries.
5) Inadequacy of regulatory mechanisms to control bycatch and the modification and curtailment of Atlantic sturgeon habitat.

Nothing about the authorization of the smoothhound fishery or the continued authorization of the Atlantic shark fisheries will affect the habitat or water quality. Obviously, these actions have no relationship with the blockage of access to historical habitats by dams or reservoirs. The proposed action is actually likely to improve the inadequacy of regulatory mechanisms to control bycatch by bringing the smoothhound fishery under federal management for the first time.

The bycatch of Atlantic sturgeon in commercial fisheries will continue to be a threat under the proposed action. As noted previously, Boreman (1997) suggested maintaining an EPR of at least 50 percent of EPR_{max} would be appropriate to rebuild a species with life history characteristics like Atlantic sturgeon. Boreman (1997) estimated an EPR of at least 50 percent of EPR_{max} could be maintained if the total fishing mortality remained at or below 5 percent. Assuming the 50:50 split between Atlantic sturgeon bycatch in state and federal fisheries, the Atlantic sturgeon bycatch from the proposed action and other federal fisheries would have to remain below 2.5 percent to maintain an EPR of at least 50 percent of EPR_{max}. Previously, we estimated that proposed action, in conjunction with other federal fisheries, likely removes only 0.6 percent of adults in the Carolina DPS. This estimate is below the 2.5 percent threshold we believe is necessary to maintain an EPR of at least 50 percent of EPR_{max}.

Recovery is a process. It is the process by which the ecosystems of the Atlantic sturgeon in Carolina DPS are restored and the threats to the species are removed. These recovery actions support self-populating and self-regulating populations so they can become persistent members of the native biological communities (USFWS and NMFS 1998). As discussed previously, the proposed action is not likely to impede the Carolina DPS from continuing to self-populate or self-regulate (i.e., survive). The proposed action will not impede the process of restoring the ecosystems that affect Atlantic sturgeon of the Carolina DPS and will not impede progress toward removing the other threats. The proposed action will actually bring the smoothhound fishery under federal management for the first time, establishing NMFS' authority to implement future regulations to minimize the bycatch of Atlantic sturgeon in the Carolina DPS. Ultimately, we believe the likely fishing mortality of Atlantic sturgeon in the Carolina DPS is below both the estimate thresholds for survival and recovery.

Conclusion
Based on the information of this section, we believe the effects from proposed action are not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of Atlantic sturgeon originating from the Carolina DPS.

8.0 Conclusion

We analyzed the best available data, the status of the species, environmental baseline, effects of the proposed action, and cumulative effects to determine whether the proposed action is likely to jeopardize the continued existence of Atlantic sturgeon, smalltooth sawfish or any species of ESA-listed large whale or sea turtle.

North Atlantic Right, Humpback, and Fin Whales
The proposed action is not expected to appreciably reduce the likelihood of survival and recovery of these species. Therefore, it is our opinion that the continued authorization of the Atlantic shark fisheries, including the new smoothhound fishery, is also not likely to jeopardize the continued existence of North Atlantic right, humpback, and fin whales.

Sea Turtles
The proposed action is not expected to appreciably reduce the likelihood of survival and recovery of these species. Therefore, it is our opinion that the continued authorization of the Atlantic shark fisheries, including the new smoothhound fishery, is also not likely to jeopardize the continued existence of hawksbill, green, Kemp’s ridley, leatherback, and loggerhead sea turtles.

Smalltooth Sawfish
The proposed action is not expected to appreciably reduce the likelihood of survival and recovery of this species. Therefore, it is our opinion the continued authorization of the Atlantic shark fisheries, including the new smoothhound fishery, is also not likely to jeopardize the continued existence of the United States DPS of smalltooth sawfish.

Atlantic Sturgeon
The proposed action is not expected to appreciably reduce the likelihood of survival and recovery of the 5 DPSs of this species. Therefore, it is our opinion that the continued authorization of the Atlantic shark fisheries, including the new smoothhound fishery, is also not likely to jeopardize the continued existence of the Gulf of Maine, New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs of Atlantic sturgeon.

9.0 Incidental Take Statement (ITS)

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 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 terms and conditions of the ITS.

Section 7(b)(4)(c) of the ESA specifies that to provide an ITS for an endangered or threatened species of marine mammal, the taking must be authorized under Section 101(a)(5) of the MMPA. Since no incidental take of listed marine mammals is expected or has been authorized under Section 101(a)(5) of the MMPA, no statement on incidental take of protected marine mammals is provided and no take is authorized. Nevertheless, F/SER2 must immediately notify (within 24 hours, if communication is possible) NMFS' Office of Protected Resources should a take of a listed marine mammal occur.

9.1 Anticipated Incidental Take

NMFS anticipates the following incidental takes of sea turtles, smalltooth sawfish, and Atlantic sturgeon may occur in the future because of the authorization of a federal smoothhound fishery and the continued authorization of the other Atlantic shark fisheries.

The incidental taking of North Atlantic right, humpback, or fin whales is not being authorized under this biological opinion at this time. According to Section 7 of the ESA, incidental taking of marine mammals must first be authorized under Section 101(a)(5)(E) of the MMPA, before such take is included in the ITS of a biological opinion. Therefore, NMFS SF/1 must acquire a take authorization under the MMPA for the expected takes of whales described in this opinion, after which the terms of that permit will be amended to this ITS.

The level of takes occurring annually is highly variable and influenced by sea temperatures, species abundances, and other factors that cannot be predicted. Because of this variability, it is unlikely that all species evaluated in this opinion will be consistently impacted year after year. For example, some years may have no observed interactions and thus no estimated captures. As a result, monitoring fisheries using 1-year estimated take levels is largely impractical. Since Amendment 3 brings the smoothhound fishery under federal management to collect data on the fishery, while continuing to authorize the other Atlantic shark fisheries as they currently operate, we do not believe drastic changes in the fishery are likely to occur in the near future. Any change in the management of the fishery would be a federal action potentially requiring ESA Section 7 review. For these reasons, and based on our experience monitoring fisheries, we believe a 3-year time period is appropriate for meaningful monitoring. The triennial takes are set as 3-year running sums (total for any 3-year period) and not for static 3-year periods (i.e., 2012-2014, 2013-2015, 2014-2016, and so on, as opposed to 2012-2014, 2015-2018, 2019-2022, etc.). 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 smoothhound and Atlantic shark fisheries are performing versus our expectations. Table 9.1 displays our 3-year take estimates.

Table 9.1 Anticipated Future Take Over 3 Years

Sea Turtles	Non-Lethal Take	Lethal Take	Total Estimated Take
Loggerhead	48	78	126
Green	24	33	57
Leatherback	9	9	18
Kemp’s ridley	15	21	36
Hawksbill	9	9	18
Marine Fish	**Non-Lethal Take**	**Lethal Take**	**Total Estimated Take**
Smalltooth sawfish	25	7	32
Atlantic sturgeon	GOM DPS = 27	GOM DPS = 9	GOM DPS = 36
	NYB DPS = 129	NYB DPS = 30	NYB DPS = 159
	CB DPS = 36	CB DPS = 9	CB DPS = 45
	SA DPS = 51	SA DPS = 12	SA DPS = 63
	Carolina DPS = 12	Carolina DPS = 6	Carolina DPS = 18
	All DPSs = 255	All DPSs = 66	All DPSs = 321
GOM = Gulf of Maine, NYB = New York Bight, CB = Chesapeake Bay, and SA = South Atlantic.			

9.2 Effect of the Take

NMFS has determined the level of anticipated take specified in Section 9.1 is not likely to jeopardize the continued existence of Atlantic sturgeon, smalltooth sawfish, or any species of ESA-listed sea turtle.

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 to minimize the impacts from the agency action, and terms and conditions to implement those measures, must be provided and followed. Only incidental taking that complies with the specified terms and conditions is authorized.

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 ITS. If it fails to adhere to the terms and conditions of the ITS through enforceable terms, and/or fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of Section 7(o)(2) may lapse. To monitor the impact of the incidental take, F/SF1 must report the progress of the action and its impact on the species to F/SER3 as specified in the ITS [50 CFR 402.14(i)(3)].

We have determined that the following RPMs are necessary and appropriate to minimize the impacts of future takes of sea turtles, smalltooth sawfish, and Atlantic sturgeon by the smoothhound and Atlantic shark fisheries and to monitor levels of incidental take.

1. Minimize Potential Effects to Sea Turtles, Smalltooth Sawfish, Atlantic Sturgeon and Marine Mammals:

   Sea Turtle. Smalltooth Sawfish, and Atlantic Sturgeon Handling Requirements
   Most, if not all, sea turtles, smalltooth sawfish, and Atlantic sturgeon released after entanglement and/or forced submergence events have experienced some degree of physiological injury. Experience with other gear types (i.e., hook-and-line) has shown that the ultimate severity of these events is dependent not only upon actual interaction (i.e., physical trauma from entanglement/forced submergence), but the amount of gear remaining on the animal at the time of release. The manner of handling an animal also greatly affects its chance of recovery. Therefore, the experience, ability, and willingness of fishermen to remove gear are crucial to the survival of sea turtles, smalltooth sawfish, and Atlantic sturgeon following release. F/SF1 shall ensure that smoothhound fishermen and fishermen in the other Atlantic shark fisheries receive outreach materials describing how captured sea turtles, smalltooth sawfish, and Atlantic sturgeon should be handled to minimize adverse effects from incidental take and reduce mortality.

   Adherence to Marine Mammal Take Reduction Plan (TRP) Requirements
   The smoothhound fishery will be subject to the applicable regulations for the Harbor Porpoise, Bottlenose Dolphin, and Atlantic Large Whale TRPs (50 CFR 229 Subpart C). Adhering to the measures prescribed in these TRPs is essential to ensure smoothhound fishery does not interact with marine mammals. For this reason, F/SF1 must ensure that all permitted commercial smoothhound fishermen are aware of their obligations under these TRPs.

   Soak Time Restrictions or Net Check Requirements
   Research indicates that the mortality of Atlantic sturgeon may be closely related to soak time. The mortality rates of Atlantic sturgeon incidentally caught in gillnets soaking longer than 24 hours are substantially higher that in nets soaking less than 24 hours. To improve the survival rate of incidentally taken Atlantic sturgeon, F/SF1 must ensure that animals are not being retained in smoothhound or Atlantic shark gillnets longer than 24 hours.

2. Monitoring the Frequency and Magnitude of Incidental Take:
   The jeopardy analyses for large whales, sea turtles, smalltooth sawfish, and Atlantic sturgeon are based on the assumptions that the frequency and magnitude of adverse effects that occurred in the past will continue into the future. If our estimates regarding the frequency and magnitude of incidental take prove to be an underestimate, we risk having misjudged the potential adverse effects to these species. Thus, it is imperative that we monitor and track the level of take occurring specific to the proposed action. Therefore, NMFS must ensure that monitoring and reporting of any sea turtle, smalltooth sawfish, and Atlantic sturgeon bycatch: (1) detect any adverse effects resulting from the

proposed action; (2) assess the actual level of incidental take in comparison with the anticipated incidental take documented in this opinion; and (3) detect when the level of anticipated take is exceeded.

9.4 Terms and Conditions

To be exempt from take prohibitions established by Section 9 of the ESA, F/SF1 must comply with the following terms and conditions, which implement the RPMs described above. These terms and conditions are mandatory.

The following terms and conditions implement RPM No. 1.

1. Upon initial permit issuance, F/SF1 must distribute outreach information to all commercial smoothhound and Atlantic shark fishermen regarding the sea turtle handling and resuscitation requirements that fishermen must undertake, as stated in 50 CFR 223.206(d)(1-3). This outreach information must remind fishermen that disentanglement of sea turtles from gillnet gear takes priority over transferring catch to vessels. Simply cutting lines and leaving entangled gear on sea turtles is strongly discouraged. If a sea turtle is cut loose with the netting attached, the flipper may eventually become occluded, necrotic, and infected, and this could lead to mortality.

2. Prior to or in conjunction with issuing any smoothhound permits, F/SF1 must distribute outreach information to all commercial smoothhound and Atlantic shark fishermen explaining the permitees' obligations under the applicable take reduction plans.

3. By March 31 of each year, F/SF1 must provide SER with information described at 50 CFR 229.4(b) for all permitted smoothhound and Atlantic shark gillnet fishermen so they can be integrated into the Marine Mammal Authorization Program (MMAP). This information is required to ensure that each permitted smoothhound fisher receives an MMAP certificate and updates annually.

4. F/SF1 must require all Atlantic shark and smoothhound gillnet fishermen to either check their gear every 0.5 to 2.0 hours, or F/SF1 must require all Atlantic shark and smoothhound gillnet fishermen soak their gear no longer than 24 hours. F/SF1 may select some combination of these requirements (i.e., soak times and net check requirements) after collaborating with F/SER3. Soak time is considered to be the time between the gear first entering the water and the time when it is first removed. These requirements will ensure that any incidentally taken ESA-listed species are detected and released in a timely manner, reducing the likelihood of mortality. F/SF1 must have these requirements in place no later than December 31, 2014.

5. F/SF1, in cooperation with F/SER3, must remind Atlantic shark and smoothhound fishermen to take the following actions to safely handle and release an incidentally caught smalltooth sawfish:
    a) Leave the sawfish, especially the gills, in the water as much as possible.
    b) Do not remove the saw (rostrum) or injure the animal in any way.

c) Remove as much fishing gear as safely possible from the body of the animal.

d) If it can be done safely, untangle any line wrapped around the saw.

e) Use extreme caution when handling and releasing sawfish as the saw can thrash violently from side to side.

6. F/SF1 must remind Atlantic shark and smoothhound fishermen to take the following actions to safely handle and release an incidentally caught Atlantic sturgeon:

   a) Fish should be handled rapidly, but with care and kept underwater to the maximum extent possible during handling.

   b) If the fish has air in its bladder, efforts must be made to return the fish to neutral buoyancy prior to and during release. Air must be released by gently applying pressure to the stomach of the animal, moving from the tail toward the head.

   c) Before releasing the animal it should be held underwater, gently moving the tail fin back and forth to aid water passage over the gills.

   d) The fish should be released when it shows signs of increased activity and is able to swim away under its own power.

   e) The fish should be watched to make sure it stays underwater and does not float to the surface. If it does resurface, make one additional attempt to recapture the animal and repeat steps a-d above. If the animal is dead, collect tissue samples and recover and process the carcasses as described in Term and Condition 8(c).

The following terms and conditions implement RPM No. 2

7. F/SF1 must collaborate with the appropriate observer program (i.e., NEFOP, CSFOP, and/or SGOP) to ensure the appropriate observer data logs are used to collect data on the smoothhound and Atlantic shark fisheries and the appropriate observer data collection protocols are followed.

8. NMFS must ensure that observers are prepared and trained to correctly and safely tag and/or collect samples from incidentally taken sea turtles, smalltooth sawfish, and Atlantic sturgeon.

   a) *Sea Turtles*: For incidentally taken sea turtles, observers must collect tissue samples for genetic analysis. This opinion serves as the permitting authority for taking associated with handling, identifying, measuring, weighing, photographing, flipper tagging, passive integrated transponder (PIT) tagging, skin biopsying and releasing incidentally taken sea turtles (without the need for an ESA Section 10 permit). Samples collected must be analyzed to determine the genetic identity of individual sea turtles caught in the fishery.

   b) *Smalltooth Sawfish*: For incidentally taken smalltooth sawfish, observers must be trained to tag smalltooth sawfish. All dead carcasses of smalltooth sawfish must be placed on ice and transferred to the SEFSC, attention Dr. John Carlson (National Marine Fisheries Service, Panama City Laboratory, 3500 Delwood Beach Rd, Panama City, FL, 32408).

   c) *Atlantic Sturgeon*: For incidentally taken Atlantic sturgeon, observers must be trained to tag them, take a tissue sample, and scan them for PIT tags. Observers must also collect a tissue sample from any Atlantic sturgeon handled onboard an Atlantic shark or smoothhound vessel. Tissue samples should be a small (1.0 cm^2) fin clip collected from soft pelvic fin tissue using a pair of sharp scissors. Tissue samples should be preserved in individually labeled vials containing either alcohol (70 to 100 percent) or SDS-UREA. A total length measurement or estimate, time and location (i.e., lat./long. and approximate water depth) of capture, circumstances of capture, and status (i.e., dead, alive, injured) upon return to the water should accompany the tissue sample. Keep the tissue sample out of direct sun, but refrigeration is not necessary. For dead animals, once the tissue samples noted above have been collected, the remaining specimen(s) or body parts of dead Atlantic sturgeon must be preserved (iced or refrigerated) until sampling and disposal procedures are discussed with NMFS. Contact Kelly Shotts (Kelly.Shotts@noaa.gov or (727) 551-5603) for instructions on submitting the tissue samples and dead carcasses to NMFS. Send samples and supporting data within one month of the date the sample is taken.

9. F/SF1, in collaboration with the NEFSC/NER and SEFSC/SER, must develop a standardized protocol for determining which trips, and how much effort, were directed toward smoothhound. Since this is a fishery new to federal management, these protocols should be developed such that the true fishing effort can be ascribed to the fishery to avoid double reporting or underreporting of effort. This is necessary to better determine directed fishing effort levels in the smoothhound fishery and any effort shifts that may occur. This will improve NMFS' ability to monitor incidental takes of ESA-listed species and more accurately determine to what extent directed smoothhound fishing is taking listed species.

10. Prior to requiring the use of smoothhound permit, F/SF1 must work with the appropriate observer program (i.e., NEFOP, CSFOP, SGOP) to ensure observer coverage of the smoothhound fishery is sufficient for monitoring take of ESA-listed species. NMFS (2004d) recommends a level of observer coverage equal to that which provides estimates of a protected species interaction with an expected coefficient of variation of 30%. Since ESA-listed species are relatively rare, achieving bycatch estimates with CVs of 30 percent or less may not be feasible in certain cases. If F/SF1, in conjunction with the appropriate observer program, determines achieving CVs less than 30 percent are not possible, NMFS must determine and implement the number of trips and sets that should be observed to be confident that take is as extremely rare as estimated.

11. F/SF1, in collaboration with the appropriate Science Center (i.e., NEFSC, SEFSC) must collect and monitor observer reports from Atlantic shark and smoothhound trips having sea turtle, smalltooth sawfish, marine mammal, or Atlantic sturgeon interactions. F/SF1 must submit an annual report detailing these interactions to F/SER3; the information below must also be included. The required information may be included in a single report.
    a) Information Required for Species Interactions:
        i) *Sea Turtle Reports*: must include all information specified on the SEFSC sea turtle life history form for any sea turtle captured.
        ii) *Smalltooth Sawfish Reports*: must include a total length measurement or estimate, time and location (i.e., lat./long. and approximate water depth) of capture,

    circumstances of capture (e.g., position of sawfish in the trawl net), and status (i.e., dead, alive, injured) upon return to the water must be reported to the extent possible

    iii) *Atlantic Sturgeon Reports*: must include a total length measurement or estimate, weight measurement or estimate, sex (if discernible), time and location (i.e., lat./long. and approximate water depth) of capture, were the fish tagged and if so what type of tag was used, and status (i.e., dead, alive, injured) upon return to the water should be reported.

  b) Information Required on Fishery Operations

    i) *Gillnet Gear*: type of gear used (e.g., drift, sink, strike), set date, net length (ft), net depth (ft), minimum stretched mesh size (in), soak time (hrs), trip length, number of sets per trip, whether tie-downs were used, and length of tie-down if used.

    ii) *Bottom Longline Gear*: mainline length (ft), depth fished (ft), number of sets, number of lines per set, number of hooks fished per set, hook type (e.g., circle or j-hook), soak time (hrs), and bait used.

  c) Reports must also estimate the total take in the fishery based on effort and the observed takes. If the estimated take of sea turtles, smalltooth sawfish, or Atlantic sturgeon is unusually high, the report should include an analysis of the possible reasons for the higher than expected level of take and whether or not this level of take represents new information that requires a reinitiation of this consultation.

  d) These reports must be forwarded to the NMFS Assistant Regional Administrator for Protected Resources, Southeast Regional Office, Protected Resources Division, 263 1^{3th} Avenue South, St. Petersburg, Florida 33701-5505.

  e) In addition to the annual report, F/SF1 must also report the incidental take of any protected species by smoothhound and Atlantic shark fishermen within 24 hrs to takereport.nmfsser@noaa.gov. To improve the timeliness of reporting, the NEFSC/SEFSC or the observer program that documented an incidental take by smoothhound and Atlantic shark fishermen may submit a notification to the email address above on behalf of F/SF1. When reporting takes this way please ensure the message indicates incidental take was authorized via this biological opinion and include the opinion title, date of issuance, and consultation number (F/SER/2011/06520) to expedite processing of the report.

12. F/SF1, in collaboration with the NEFSC/NER and SEFSC/SER, must monitor the entanglements of large whales in gillnet gear. Based on the target species, and when and where the entanglement occurred, SF1 must determine if Atlantic shark or smoothhound gillnet gear may have been cause and whether consultation should be reinitiated. Since large whales can travel long distances after an entanglement occurs it is not always clear which gear/fishery cause the entanglements. This T/C will ensure any entanglements potentially associated with the proposed action are monitored and consultation potentially reinitiated if the adverse affects to large whales from the proposed action appear greater than anticipated.

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. For F/SER3 to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, F/SER3 requests notification of the implementation of any conservation recommendations.

Sea Turtles:

1. To better understand sea turtle populations and the impacts of incidental take in the smoothhound fishery, NMFS should support in-water abundance estimates of sea turtles to achieve more accurate status assessments for these species and improve our ability to monitor them.
2. Once reasonable in-water estimates are obtained, NMFS should support population modeling or other risk analyses of the sea turtle populations affected by the smoothhound fishery. This will help improve the accuracy of future assessments of the effects of different levels of take on sea turtle populations.

Smalltooth Sawfish:

3. NMFS should conduct or fund research or alternative methods (e.g., surveys) on the distribution, abundance, and migratory behavior of adult smalltooth sawfish off southwest Florida to better understand their occurrence in federal waters and potential for interaction with Atlantic shark and smoothhound gear.
4. NMFS should conduct or fund reproductive behavioral studies to ensure that the incidental capture of smalltooth sawfish in the Atlantic shark or smoothhound fisheries is not disrupting any such activities.
5. NMFS should conduct or fund surveys or other alternative methods for determining smalltooth sawfish abundance in federal fishing areas off southwest Florida, adjacent to areas where smalltooth sawfish are known to occur in the greatest concentration (e.g., off the Florida Keys).

11.0 Reinitiation of Consultation

This concludes formal consultation. As provided in 50 CFR 402.16, reinitiation of formal consultation is required if discretionary federal 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 ITS is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat (when designated) in a manner or to an extent not previously considered; (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 biological opinion; or

(4) a new species is listed or critical habitat designated that may be affected by the identified action. In instances where the amount or extent of incidental take is exceeded, F/SF1 must immediately request reinitiation of formal consultation.

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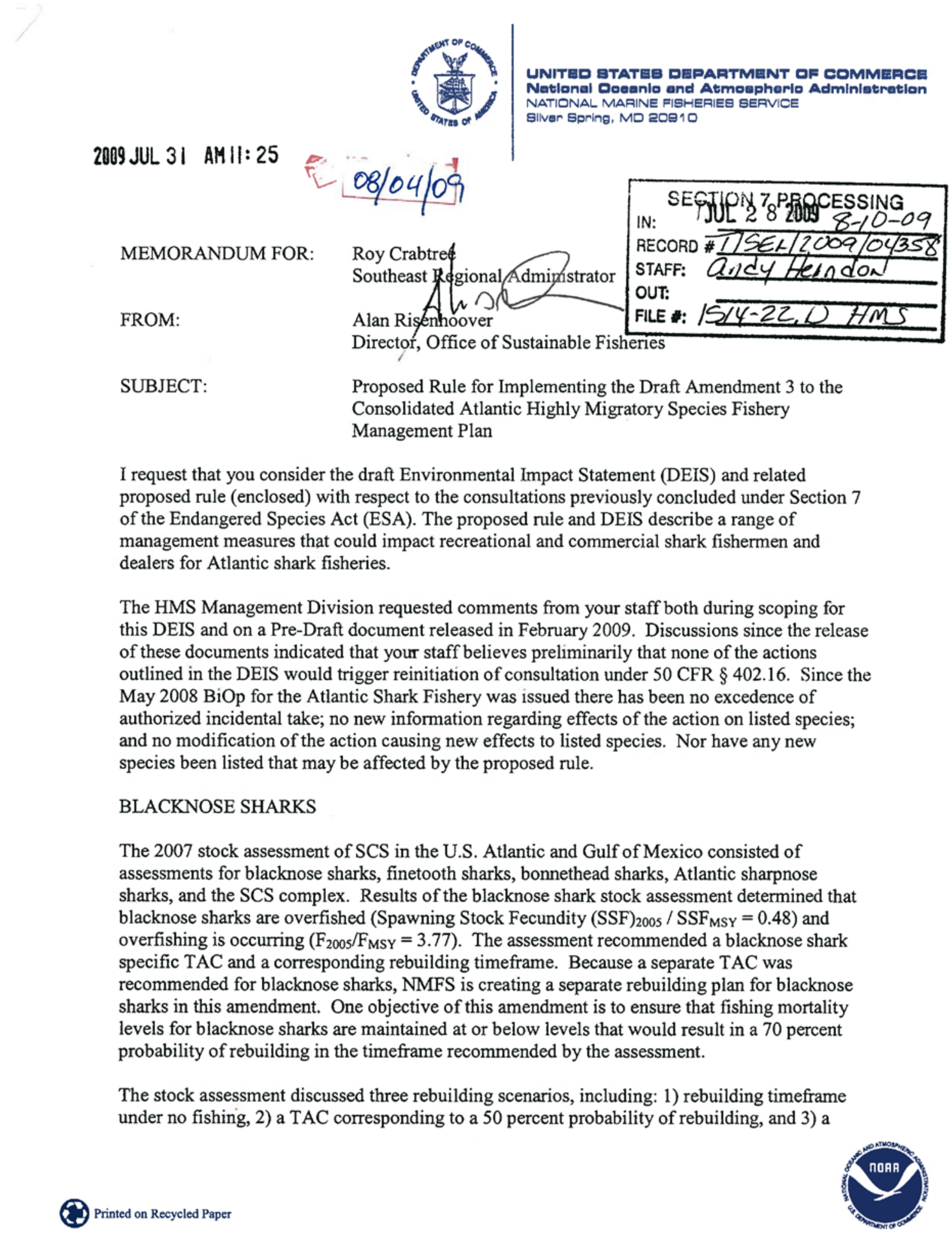
Appendix 1 Consultation Memoranda



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

2009 JUL 31 AM 11:25

08/04/09

SECTION 7 PROCESSING
IN: JUL 28 2009 8-10-09
RECORD # I/SER/2009/04358
STAFF: andy Herndon
OUT:
FILE #: 1514-22.D HMS

MEMORANDUM FOR: Roy Crabtree
Southeast Regional Administrator

FROM: Alan Risenhoover
Director, Office of Sustainable Fisheries

SUBJECT: Proposed Rule for Implementing the Draft Amendment 3 to the Consolidated Atlantic Highly Migratory Species Fishery Management Plan

I request that you consider the draft Environmental Impact Statement (DEIS) and related proposed rule (enclosed) with respect to the consultations previously concluded under Section 7 of the Endangered Species Act (ESA). The proposed rule and DEIS describe a range of management measures that could impact recreational and commercial shark fishermen and dealers for Atlantic shark fisheries.

The HMS Management Division requested comments from your staff both during scoping for this DEIS and on a Pre-Draft document released in February 2009. Discussions since the release of these documents indicated that your staff believes preliminarily that none of the actions outlined in the DEIS would trigger reinitiation of consultation under 50 CFR § 402.16. Since the May 2008 BiOp for the Atlantic Shark Fishery was issued there has been no excedence of authorized incidental take; no new information regarding effects of the action on listed species; and no modification of the action causing new effects to listed species. Nor have any new species been listed that may be affected by the proposed rule.

BLACKNOSE SHARKS

The 2007 stock assessment of SCS in the U.S. Atlantic and Gulf of Mexico consisted of assessments for blacknose sharks, finetooth sharks, bonnethead sharks, Atlantic sharpnose sharks, and the SCS complex. Results of the blacknose shark stock assessment determined that blacknose sharks are overfished (Spawning Stock Fecundity $(SSF)_{2005} / SSF_{MSY} = 0.48$) and overfishing is occurring ($F_{2005}/F_{MSY} = 3.77$). The assessment recommended a blacknose shark specific TAC and a corresponding rebuilding timeframe. Because a separate TAC was recommended for blacknose sharks, NMFS is creating a separate rebuilding plan for blacknose sharks in this amendment. One objective of this amendment is to ensure that fishing mortality levels for blacknose sharks are maintained at or below levels that would result in a 70 percent probability of rebuilding in the timeframe recommended by the assessment.

The stock assessment discussed three rebuilding scenarios, including: 1) rebuilding timeframe under no fishing, 2) a TAC corresponding to a 50 percent probability of rebuilding, and 3) a

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TAC corresponding to a 70 percent probability of rebuilding. Under no fishing, the stock assessment estimated that blacknose sharks would rebuild in 11 years. Adding a generation time (8 years), as described under NS1 for species that require more than 10 years to rebuild even if fishing mortality were eliminated entirely, the target year for rebuilding the stock was estimated to be 2027 (8 years mean generation time + 11 years to rebuild if fishing mortality eliminated = 19 years including 2009). Since the assessment did not have estimates of fishing mortality for 2006 and beyond at the time of the assessment, NMFS assumed that fishing mortality in 2006 was the same as in 2005 and declined by 50 percent from 2005 levels in 2007-2009 (to account for presumed reduction in effort due to Hurricane Katrina). NMFS determined that a constant TAC, or ACL (*i.e.*, ACL for all fisheries that interact with blacknose sharks), of 19,200 blacknose sharks per year would lead to rebuilding with a 70 percent probability by 2027. This is the shortest possible time necessary to rebuild the species as dictated by the species biology described above. Rebuilding with this same TAC would occur with a 50 percent probability by 2024. As described previously, NMFS is using the 70 percent probability of rebuilding to ensure that the intended results of a management action are actually realized given the life history traits of sharks.

In addition, the Southeast Fisheries Science Center (SEFSC) has been working with industry scientists to re-evaluate the shrimp bycatch models used in the 2007 SCS stock assessments. In particular, they have been evaluating the effect of turtle exclusion devices, or TEDs, on SCS bycatch in shrimp trawls. Once the SEFSC has finished their evaluation of those models, NMFS could revise blacknose shark bycatch estimates. Preliminary results suggest that the post-TED (*i.e.*, from1990 on) reduction in bycatch from the model currently in development is approximately 50 percent. The SEFSC has also run sensitivity analyses to determine the effect of reduced blacknose bycatch in shrimp trawls on the stock status of blacknose sharks. Although stock status improves, despite reductions in shrimp trawl bycatch of 25, 50, and 75 percent, the stock continues to be overfished (N_{2005}/N_{MSY} = 0.66 to 0.74 versus 0.48 in the baseline assessment run from the 2007 blacknose shark stock assessment) with overfishing occurring (F_{2005}/F_{MSY} = 2.67 to 2.21 versus 3.77 in the baseline assessment run from the 2007 blacknose shark stock assessment). Depending on the results of these evaluations, NMFS may need to work with the Councils to reduce bycatch of blacknose sharks in shrimp trawls, as appropriate.

Commercial and Recreational Alternatives

In order to rebuild blacknose sharks and stop overfishing, the preferred commercial SCS alternative would remove blacknose sharks from the SCS quota group and implement a blacknose shark-specific quota. The preferred alternative would also establish a separate non-blacknose SCS quota equal to 56.9 metric tons (mt) dressed weight (dw) (125,487 pounds (lb) dw), which would apply to finetooth, Atlantic sharpnose, and bonnethead sharks. The non-blacknose SCS quota would be based on a 76-percent reduction of the average annual landings of finetooth, Atlantic sharpnose, and bonnethead sharks from 2004 through 2007. NMFS determined that, by reducing the overall non-blacknose SCS quota, NMFS could reduce the level of blacknose shark discards such that the total blacknose shark mortality would stay below the commercial allowance. NMFS would establish a blacknose-specific quota of 14.9 mt dw (32,753 lb dw), which is the amount of blacknose sharks that would be landed while the non-blacknose SCS quota is harvested; however, incidental fishermen would not be allowed to retain any blacknose sharks under the preferred alternative. In addition, the preferred alternative assumes that gillnet gear would be prohibited under the commercial gear restriction alternatives. NMFS prefers this alternative at this time because by reducing the overall the non-blacknose SCS quota, NMFS could reduce the level of blacknose shark discards such that the total blacknose shark mortality would stay below the commercial allowance needed to rebuild the stock. Under the preferred alternative, blacknose shark landings would decrease by 76 percent and discards would decrease by 81 percent, which would have positive ecological impacts on this species. However, the reductions in landings of non-blacknose SCS and blacknose sharks would result in a 76-percent reduction in gross revenues from non-blacknose SCS and blacknose shark landings overall in order to lower the overall mortality on blacknose sharks.

The preferred recreational alternative for blacknose sharks would prohibit the retention of blacknose sharks in the recreational fishery making it a catch and release only fishery. This would have positive ecological impact for the stock as it could reduce recreational landings of blacknose sharks in federal waters. On average, from 1999-2005, the recreational fishery landed 10,408 blacknose sharks per year. However, since most, if not all, blacknose sharks rarely reach the 54 inch FL minimum size limit that is currently in place in federal waters, presumably blacknose sharks are being landed in state waters that have more liberal size limits. To the extent that individual states mirror federal regulations, blacknose shark recreational landings could also be reduced in state waters. Thus, cooperation by individual states and the Atlantic States Marine Fisheries Commission to prohibit the recreational retention of blacknose sharks in state waters would be essential in achieving the mortality reduction required to rebuild the blacknose shark stock.

NMFS considered seven other SCS commercial and recreational alternatives, however those alternatives were not chosen because they would not reduce mortality of blacknose sharks to a level that would allow this species to rebuild within their specified rebuilding timeframe.

Commercial Gear Restriction Alternatives

Under the preferred alternative for commercial gear restrictions, NMFS would close the gillnet fishery to commercial shark fishing from South Carolina south, including the Gulf of Mexico and the Caribbean Sea. This would eliminate the predominant gear type used to harvest blacknose sharks in the South Atlantic region and would help rebuild blacknose sharks by reducing commercial blacknose shark landings. It would also help mitigate negative impacts to the smooth dogfish fishery participants, which uses gillnet gear from predominately North Carolina north to Massachusetts. Under this alternative, NMFS would allow directed and incidental permit holders to use other gear types to target sharks in the commercial shark fishery from South Carolina south. This would have positive ecological impacts on blacknose sharks as well as non-blacknose SCS by reducing landings from the predominate gear used to target SCS. Thus, the preferred alternative would help reduce commercial blacknose shark landings and help achieve the recommended commercial allowance for the Atlantic commercial shark fishery. Also, the removal of gillnets would eliminate the possible interaction with the endangered right whales and other protected resources. The preferred alternative would have negative social and economic impacts by affecting approximately 37 directed and 6 incidental SCS and LCS permit holders. However, given the need to reduce blacknose shark mortality, and the fact that gillnet gear is the predominate gear used to harvest blacknose sharks, at this time, NMFS is preferring the removal of gillnet gear in the areas that interact with blacknose sharks in order to rebuild this species. NMFS considered two other commercial gear restriction alternatives, however they were not chosen because the No Action alternative would not reduce commercial blacknose shark landings and the other alternative could have significant economic impacts on more shark fishery participants than the preferred alternative.

PELAGIC SHARKS

In 2008, the ICCAT's Standing Committee on Research and Statistics (SCRS) conducted an updated species-specific stock assessment for North Atlantic shortfin mako sharks and blue sharks. For North Atlantic shortfin mako sharks, multiple model outcomes indicated stock depletion to be about 50 percent of virgin biomass (1950s levels) and levels of F above those resulting in MSY, whereas other models estimated considerably lower levels of depletion and no overfishing. The SCRS determined that there is a "non-negligible probability" that the North Atlantic shortfin mako stock could be below the biomass that could support MSY ($B_{2007}/B_{msy} = 0.95\text{-}1.65$) and above the fishing mortality rate associated with MSY ($F_{2007}/F_{msy} = 0.48\text{-}3.77$). Similar outcomes were determined by the SCRS from the 2004 assessment; however, recent biological data show decreased productivity for this species. Therefore, given the results of this assessment, NMFS has determined that North Atlantic shortfin mako is not overfished, but is approaching an overfished status and is experiencing overfishing (June 19, 2009, 74 FR 21985). Based on this determination, NMFS is considering a range of alternatives in order to stop overfishing of shortfin mako sharks, through efforts at the international level.

Commercial and Recreational Alternatives

The United States commercial harvest of Atlantic shortfin mako sharks has historically been incidental in nature and less than 10 percent of the recorded total international landings, based on ICCAT data from 1997 through 2007. There are domestic regulations in place for shortfin mako sharks, such as a commercial quota, incidental shark trip limits, a fins-attached requirement, and recreational size and bag limits. Because of the small U.S. contribution to Atlantic shortfin mako shark mortality, domestic reductions on shortfin mako shark mortality would not end overfishing of the entire North Atlantic stock. NMFS has thus determined that the stock is subject to excessive international fishing pressure and there are presently no management measures in place to end overfishing through an international fishing agreement to which the United States is a party. Therefore, NMFS believes that ending overfishing and preventing an overfished status would be better accomplished through the procedures set forth in Section 304(i) of the Magnuson-Stevens Act. The United States would continue to manage its relative impact on shortfin mako domestically by maintaining existing quota and promoting live release in the commercial and recreational fisheries, while taking immediate action at the international level to end overfishing. It would develop international recommendations and present them to international fisheries organizations, such as ICCAT, where other countries that have large takes of shortfin mako sharks could participate in shortfin mako shark mortality reductions. These recommendations would also be provided to Congress to raise its awareness of the need for international action. In the short term, the preferred alternatives would not result in any negative economic or social impacts on commercial fishermen as it would not restrict the retention of shortfin mako sharks, nor alter the pelagic shark quota. While this alternative would have neutral ecological impacts for shortfin mako sharks in the short term, any management recommendations to reduce mortality of shortfin mako sharks could have positive ecological impacts on shortfin mako sharks in the long term. The long term socioeconomic impacts cannot be estimated without knowing the potential management recommendations. NMFS expects in the long term that any management measures adopted through international negotiations would render larger benefits to the species because other nations would help reduce overall mortality of the species. NMFS considered nine other commercial and recreational alternatives for shortfin mako sharks from the no action alternative to prohibiting the landing of this species. NMFS did not choose these alternatives because they would either have no impact on ending overfishing of shortfin mako sharks or they could have significant impacts to commercial and recreational fishery participants.

SMOOTH DOGFISH

Smooth dogfish sharks are not currently managed at the federal level; however, NMFS is considering adding smooth dogfish under NMFS management, establishing a commercial quota for this species, and implementing federal permitting requirements. Any management measures implemented for smooth dogfish would also apply to Florida smoothhounds (*Mustelus norrisi*). Emerging molecular and morphological research has determined that Florida smoothhounds have been misclassified as a separate species from smooth dogfish (Jones, pers. comm.). Because of this taxonomic correction, Florida smoothhounds would be considered smooth dogfish and would fall under all smooth dogfish management measures, such as permit requirements and quotas. Smooth dogfish were originally included in the 1999 FMP to prevent finning of smooth dogfish. However, smooth dogfish were removed from NMFS management in 2003 since they were protected under the Shark Finning Prohibition Act (67 FR 6124, February 11, 2002). A stock assessment has not been conducted for smooth dogfish; however, constituents have requested that NMFS implement management measures for smooth dogfish. Therefore, NMFS has determined that smooth dogfish may require conservation and management and is thus proposing to bring smooth dogfish back under NMFS management. However, since the stock has not been assessed, NMFS does not have the formal biological reference points to establish an OFL, ABC, or ACL for smooth dogfish. Therefore, under the preferred alternative, NMFS is using landings data to establish the landings component of the sector ACL for smooth dogfish as required under NSG1 by 2011 for stocks not determined to be undergoing overfishing per the Magnuson-Stevens Act.

Commercial and Recreational Alternatives

The preferred alternatives for smooth dogfish would implement federal management for this species, establish essential fish habitat, and establish a permit requirement for commercial and recreational retention of smooth dogfish in federal waters and a commercial quota. A federal permit requirement would allow NMFS to collect data regarding participants in the fishery and help ensure that all federal smooth dogfish landings are reported. Placing smooth dogfish under HMS management would require that the fishermen fishing for smooth dogfish comply with current federal regulations in the Atlantic, Gulf of Mexico, and Caribbean Sea, including the requirement that sharks be offloaded with their fins naturally attached. As mentioned under the Commercial Gear Restrictions section, gillnets are the primary gear type in the smooth dogfish fishery and if the fishery is brought under federal management, fishermen using gillnets to target smooth dogfish would be required to comply with federal marine mammal take regulations at 50 CFR Part 229 mandated by the Marine Mammal Protection Act. In the northeast United States, trawl gear is occasionally used in the smooth dogfish fishery. This gear type, however, is currently not an authorized gear under federal shark management regulations. NMFS is currently considering whether to incorporate trawl gear as an authorized gear within the smooth dogfish fishery.

If smooth dogfish are incorporated into a federal FMP, the FMP must comply with the Magnuson-Stevens Act Section 303(a)(15) requirement to establish ACLs and AMs and National Standard Guideline 1. The landings component of the sector-ACL, or commercial quota, would be based on historic landings data spanning 1998-2007 (the last 10 years with complete landings data). Due to the lack of a stock assessment, there is no evidence regarding the stock status of smooth dogfish, however, landings data for the past 10 years suggest stable landings of smooth dogfish. Therefore, NMFS considered a range of quota options based on the current level of harvest in order to establish a commercial quota. The preferred quota alternative would set the smooth dogfish quota equal to the maximum annual landings between 1998-2007 plus one standard deviation during the same time period (1,270,137 lb dw + 153,590 lb dw), for a total of 1,423,727 lb dw. NMFS prefers to set a commercial quota slightly higher than current landings since fishermen are currently not required to report smooth dogfish landings. The additional quota would allow for a buffer of potential unreported landings, which would allow the fishery to continue to operate according to the status quo. This is anticipated to have neutral ecological impacts as the commercial quota is meant to keep the fishery at the status quo. In addition, minimal social and economic impacts are anticipated as the commercial and recreational permits would be open access and available at a nominal cost.

NMFS is also considering a set-aside quota for activities that collect dogfish for research or for public display. The current set-aside for sharks for these types of activities is 60 mt whole weight (ww). At this time, NMFS prefers to establish a separate set-aside quota for smooth dogfish to be taken under research and for public display of 6 mt ww. The set-aside quota was based on current research activities. There are no anticipated ecological or socioeconomic impacts associated with this set-aside as smooth dogfish are currently being taken for research/public display and there is no charge associated with constituents obtaining a research or public display permit. NMFS considered two additional alternatives for smooth dogfish and within the preferred alternative, considered three other quota alternatives. However, NMFS did not choose these alternatives in order to minimize any potential impacts to the species or the fishery participants.

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NOV 13 2009

F/SER3:AH

MEMORANDUM FOR: Alan Risenhoover
Director, Office of Sustainable Fisheries

FROM: Roy E. Crabtree, Ph.D.
Regional Administrator

SUBJECT: Endangered Species Act (ESA) Consultation Assessment for the Draft Environmental Impact Statement (DEIS) on the Proposed Rule Implementing Draft Amendment 3 to the Consolidated Highly Migratory Species Fishery Management Plan (FMP)

This is in response to your memorandum dated July 31, 2009, requesting that we consider the DEIS and proposed rule implementing Amendment 3 to the Consolidated Highly Migratory Species FMP with respect to ESA section 7 consultation requirements. Since receipt of that memorandum, our staffs have corresponded several times to discuss modifications to the proposed action that was described in the DEIS. Presently, Amendment 3 would implement measures to rebuild the population of blacknose sharks, implement measures to end overfishing of blacknose and shortfin mako sharks, and implement measures to bring smooth dogfish under federal management.

Pursuant to section 7 of the ESA, consultation is required to ensure that any action authorized, funded, or carried out by a federal agency will not jeopardize the continued existence of ESA-listed species or adversely modify designated critical habitat. As provided in 50 CFR 402.16, reinitiation of an existing consultation is required if discretionary federal 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 action that may affect listed species or critical habitat (when designated) in a manner or to an extent not previously considered; (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 biological opinion; or (4) a new species is listed or critical habitat designated that may be affected by the identified action.

In your July 31, 2009, memorandum, you stated that, since the completion of the May 2008 biological opinion on the continued authorization of the Atlantic shark fisheries, the level of authorized incidental take has not been exceeded; there was no new information indicating the action is affecting ESA-listed species in a way not previously considered; Amendment 3 would not modify the action analyzed in that opinion in a way causing effects not previously considered; and no new species had been listed or critical habitat designated that may be affected by the action. You concluded that none of the reinitiation criteria have been met, and there would be no new effects to listed species.

After reviewing your proposed action, we now believe placing smooth dogfish under federal management for the first time represents a new federal action for which effects to listed species and designated critical habitat have not been considered. Furthermore, we believe smooth dogfish fishing is likely to adversely affect ESA-listed species. Therefore, I recommend you request initiation of an ESA section 7 consultation on the proposed authorization of the smooth dogfish fishery. Please include in your request a summary of the management measures the fishery would be subject to, as well as any new information pertaining to its operation or its monitoring so the potential effects of the smooth dogfish management measures to listed species and designated critical habitat can be analyzed. In particular, we need to know if trawl gear would be an authorized gear. My staff is prepared to expedite this consultation to the greatest extent practicable, but please be aware that subsequent changes to the proposed action may result in delays.

If you have any questions, please contact Andy Herndon at (727) 824-5312 or by e-mail at Andrew.Herndon@noaa.gov.

cc: F/SF1 – L. Southward Hogan, J. Wilson, K. Brewster-Geisz, S. Durkee, C. Rilling
F/SER3 – D. Bernhart, J. Lee

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

MEMORANDUM FOR: Roy E. Crabtree, Ph.D.
Regional Administrator

DEC 04 2009

FROM: Alan Risenhoover
Director, Office of Sustainable Fisheries

SUBJECT: Request for initiation of formal Endangered Species Act (ESA) Consultation on Amendment 3 to the 2006 Consolidated Highly Migratory Species (HMS) Fishery Management Plan (FMP) and proposed implementing regulations.

In response to your memorandum dated November 13, 2009, the Office of Sustainable Fisheries requests initiation of formal ESA section 7 consultation for the action to bring smooth dogfish under federal management. Discussions between our offices since the release of the Draft Environmental Impact Statement (DEIS) and Pre-Draft of Amendment 3 indicate that your staff preliminarily believes that only the smooth dogfish actions outlined in the DEIS would trigger initiation of consultation under 50 CFR § 402.16. The other management measures pertaining to blacknose and shortfin mako sharks were adequately addressed in the May 2008 Biological Opinion (BiOp) for the Atlantic Shark Fishery. Since the 2008 BiOp was issued, there has been no excedence of authorized incidental take; no new information regarding effects of the action on listed species; and no modification of the action causing new effects to listed species. Nor have any new species been listed that may be affected by the non-smooth dogfish actions considered in Amendment 3.

In your memo, you indicate smooth dogfish fishing is likely to adversely affect endangered or threatened species and potentially critical habitat, requiring the initiation of an ESA section 7 consultation. Listed species potentially occurring in the action area include: blue whale, sei whale, sperm whale, fin whale, humpback whale, North Atlantic right whale, green sea turtle, hawksbill turtle, kemps ridley sea turtle, leatherback sea turtle, loggerhead sea turtle, shortnose sturgeon, and Gulf of Maine Atlantic salmon. However,the only species likely to be affected by the proposed actions are the six species of sea turtles listed above. The remaining endangered or threatened species are not likely to be adversely affected by the proposed action due to geographical distribution, temporal distribution, and/or existing regulations. A more thorough explanation of which species are likely to be affected can be found in Section 3.0 of the 2008 BiOp for the Atlantic Shark Fishery.

Pursuant to 50 CFR § 402.14(c) and as requested in your memorandum, the following information will assist your office in the consultation process. This information includes, and is in addition to, that which was previously sent to your staff through informal consultation and review of the DEIS for the action. This information, taken together with previous consultations on fishing in accordance with the 2006 Consolidated HMS FMP with gillnets and other fisheries utilizing trawl gear, fulfills our responsibility to provide you the best scientific and commercial data available and complete information necessary to initiate formal consultation.

A description of the smooth dogfish fishery is included in the DEIS. The smooth dogfish fishery is not currently managed at the federal level and data on landings and participants are sparse. Although there are no reporting requirements for smooth dogfish, some fishermen have federal permits for other species and are required to report all landings, including smooth dogfish, due to the regulations in those fisheries. Other fishermen do not have federal permits and report smooth dogfish voluntarily. Using these sources of information, it is possible to generally characterize the fishery. Currently, the domestic commercial fishery is concentrated in the Mid-Atlantic region; however, the distribution of the species spans most of the Atlantic coast south of Massachusetts, the Gulf of Mexico, and the Caribbean Sea. Catch is roughly divided equally between state and federal waters. Gillnets are the dominant gear used to target smooth dogfish in the directed fishery, but a portion of the total landings are incidentally caught with trawl gear. The MRFSS database shows recreational landings in each of the five eastern U.S. Council regions (New England, Mid-Atlantic, South Atlantic, Gulf of Mexico, and Caribbean).

Since trawl gear is responsible for a portion of the landings, fishermen would continue to be allowed to harvest smooth dogfish with trawl gear at incidental levels. This will be accomplished with trip limit restrictions that are still being developed. Smooth dogfish are incidentally caught in this gear, and the implementing regulations will not authorize trawl gear in the directed smooth dogfish fishery. Therefore, trawl gear fishing effort should not increase beyond existing levels as a result of the proposed action. Based upon Vessel Trip Report Data from 2004 through 2007, trawl gear typically makes up 18 percent of the annual smooth dogfish landings. Of the four types of trawl gear that catch smooth dogfish, over 99 percent of the landings are from bottom fish otter trawl gear. For this reason, analysis of trawl gear impacts focused on bottom fish otter trawl gear. Of bottom fish otter trawl trips that retained smooth dogfish, 66 percent of the landings were made up of loligo squid, fluke, croaker, scup, and smooth dogfish. These species, with the exception of smooth dogfish, are likely the species targeted by bottom fish otter trawl. Each of these species is covered under a state and/or federal FMP, and therefore has already undergone ESA section 7 consultation. The breakdown of these species by percent of the total landings are as follows:

Species	Percent of total landings
Loligo squid	23.0 %
Fluke	17.7 %
Croaker	11.2 %
Scup	8.6 %
Smooth dogfish	5.7 %
Other	33.8 %

The smooth dogfish fishery would be subject to a number of management measures. NMFS has proposed establishing a permit requirement for commercial and recreational retention of smooth dogfish in federal waters and the species would be required to be landed with fins naturally attached. Within the gillnet fishery, the primary directed smooth dogfish fishery, fishermen would be required to abide by the appropriate take reduction plans (TRP) based on the geographical location of fishing. If selected, commercial vessels with a smooth dogfish permit will be required to carry an observer. Federal smooth dogfish permit holders will also be required to only sell to a federally permitted dealer. Dealers would be required to report landings through an appropriate data reporting program such as HMS dealer reports or the Standard Atlantic Fisheries Information System (SAFIS).

As noted in your November 13, 2009 memorandum, and as discussed during meetings between our staffs, we request an expedited consultation process. Included within the smooth dogfish rulemaking are a number of measures addressing overfishing of a different shark species. NMFS is under a Magnuson-Stevens Act timeline to implement management measures for this shark species, and this rulemaking must publish in early 2010. We appreciate your willingness to work with our timeline and find your suggested consultation completion date of January 4, 2010 sufficient.

If you have any questions, please contact Steve Durkee (steve.durkee@noaa.gov) or Karyl Brewster-Geisz (karyl.brewster-geisz@noaa.gov) via email or by phone at 301.713.2347.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

NOV 29 2011

MEMORANDUM FOR: Roy E. Crabtree, Ph.D.
Regional Administrator

FROM: for Alan Risenhoover
Director, Office of Sustainable Fisheries

SUBJECT: Formal Endangered Species Act (ESA) consultation on Amendment 3 to the 2006 Consolidated Highly Migratory Species (HMS) Fishery Management Plan (FMP) and implementing regulations -- Request for Completion by January 31, 2012

This memorandum confirms the understanding between NMFS Southeast Region's Office of Protected Resources (OPR) and the Highly Migratory Species (HMS) Management Division that the scope of the above-referenced consultation is all Atlantic shark fisheries under the 2006 Consolidated HMS FMP. For the reasons discussed below, I request that OPR complete the biological opinion (BiOp) for this action by January 31, 2012. If this date is not possible, please let the Division know the earliest date when the BiOp would be completed.

Scope of Consultation

In a memo dated December 4, 2009, our office requested initiation of formal Endangered Species Act (ESA) Consultation on Amendment 3 to the 2006 Consolidated HMS FMP and proposed implementing regulations (attached). Amendment 3 brought smoothhound sharks under federal management, established a rebuilding plan for blacknose sharks that significantly reduced landings for that species, and per the Magnuson-Stevens Fishery Conservation and Management Act section 304(i), indicated that the agency would seek measures at the international level to end overfishing for shortfin mako sharks. Initially, OPR believed that only the smoothhound shark actions triggered initiation of consultation, as the blacknose and shortfin mako measures were adequately addressed in a May 2008 BiOp for the Atlantic Shark Fishery. *See* R. Crabtree Memorandum to Risenhoover (November 13, 2009) (attached). Thus, OPR began development of a BiOp focusing on the smoothhound shark actions, and the HMS Management Division postponed the effective date for those actions pending completion of the consultation. *See* 75 FR 30484 (June 1, 2010) (indicating delay for smoothhound measures but implementing other Amendment 3 measures in final rule).

After further consultation between the HMS Management Division, OPR, and NOAA General Counsel Office, in September 2011, the agency decided to broaden the scope of the BiOp to include all Atlantic shark fisheries under the 2006 Consolidated HMS FMP.

The HMS Management Division sees this as an expedient way to move this consultation forward but believes that further dialog is needed to clarify the scope of future ESA consultations for the Atlantic shark fisheries. Although Atlantic shark measures are consolidated in the 2006 Consolidated HMS FMP and Part 635 regulations, the HMS Management Division does not conserve and manage sharks as one fishery. Rather, the Division manages a large coastal shark complex, small coastal shark complex, pelagic shark complex, prohibited species category, and now a smoothhound shark complex. To the extent that descriptions or characterizations of these fisheries in the 2006 Consolidated HMS FMP and Part 635 regulations has caused confusion during ESA consultation, the HMS Management Division would like to discuss how to achieve clarity for the future.

Timing of Consultation

The HMS Management Division needs to proceed with smoothhound shark rulemaking quickly, thus I request that the final BiOp be completed by January 31, 2012. In addition to implementing Amendment 3 smoothhound shark provisions, the Division also needs to do proposed and final rulemaking to implement smoothhound measures in the 2010 Shark Conservation Act. That rulemaking would include any measures needed to comply with any reasonable and prudent alternative in the BiOp.

I understand that the HMS Management Division is assisting OPR in identifying information necessary for the consultation. This would include information updating what was included in the 2008 HMS Biological Opinion for Continued Authorization of Shark Fisheries in Amendment 2 to the 2006 Consolidated HMS FMP. You should already have some of this information. The HMS Management Division can provide additional assistance, if needed.

If you have any questions, please contact Steve Durkee (steve.durkee@noaa.gov) or Karyl Brewster-Geisz (karyl.brewster-geisz@noaa.gov) via email or by phone at 301.427.8503.

Attachments

Appendix 2a Northeast Gillnet Management Areas Seasonal Regulations and Maps

Table A2.1 Seasonal Regulations by Management Area and Gillnet Gear Type [50 CFR 229.32 (d)(1-7) and (e)(1-6)]

Gillnet Management Area				Type of Gillnet Gear	Gear Requirements
Cape Cod Bay	Great South Channel	Stellwagen Bank/Jeffrey's Ledge	Other Northeast Gillnet Waters		
Gillnet Restriction Effective Dates					
Jan. 1 – May 15	Apr. 1 – June 30, except Sliver Area	N/A		All	Gillnet Fishing Prohibited
May 16 – Dec. 31	July 1 – Mar. 31; Year Round in the Sliver Area	Year Round		All	All surface buoys must be marked with either the owner's motorboat registration number and/or U.S. vessel documentation number; the federal commercial fishing permit number; or whatever positive identification marking is required by the vessel's home-port state
					All letters and numbers marking the gear must be at least 1 inch (2.5cm) in height, block letters or Arabic numbers, in a color that contrasts with the color of the buoy, if other markings are not already required by state or federal regulation
					All buoy lines must be marked with one 4-inch (10.2 cm), GREEN, mark midway along the buoy line
				Anchored	Must have no buoy lines floating at the surface
					Wet storage prohibited (all gear must be hauled out of the water at least once every 30 days)
					All buoys, flotation devices and/or weights must be attached to the buoy line with a weak link* having a breaking strength no greater than 1,100 lbs
					All anchored gillnet panels must have weak links with the breaking strength of no greater than 1,100 lbs in the center of the floatline of each net panel up to and including 50 fathoms (100yds; 300ft), or at least every fathoms (50yds; 150ft) for longer panels
					Any gillnets not returning to port with the vessel, must be configured with five or more weak links per net panel, depending on panel length, with a breaking strength no greater than 1,100 lb, and be anchored with the holding power of at least a 22-lb Danforth-style anchor at each end of the net string (must be a burying anchor; no dead weights)**
					All groundlines must be made of sinking line
				Drift	Night fishing (i.e., anytime between one-half hour before sunset and one-half hour after sunrise) is prohibited unless nets are tended (i.e., attached to the vessel)
					All gear must be removed from the water and stowed on board before a vessel returns to port

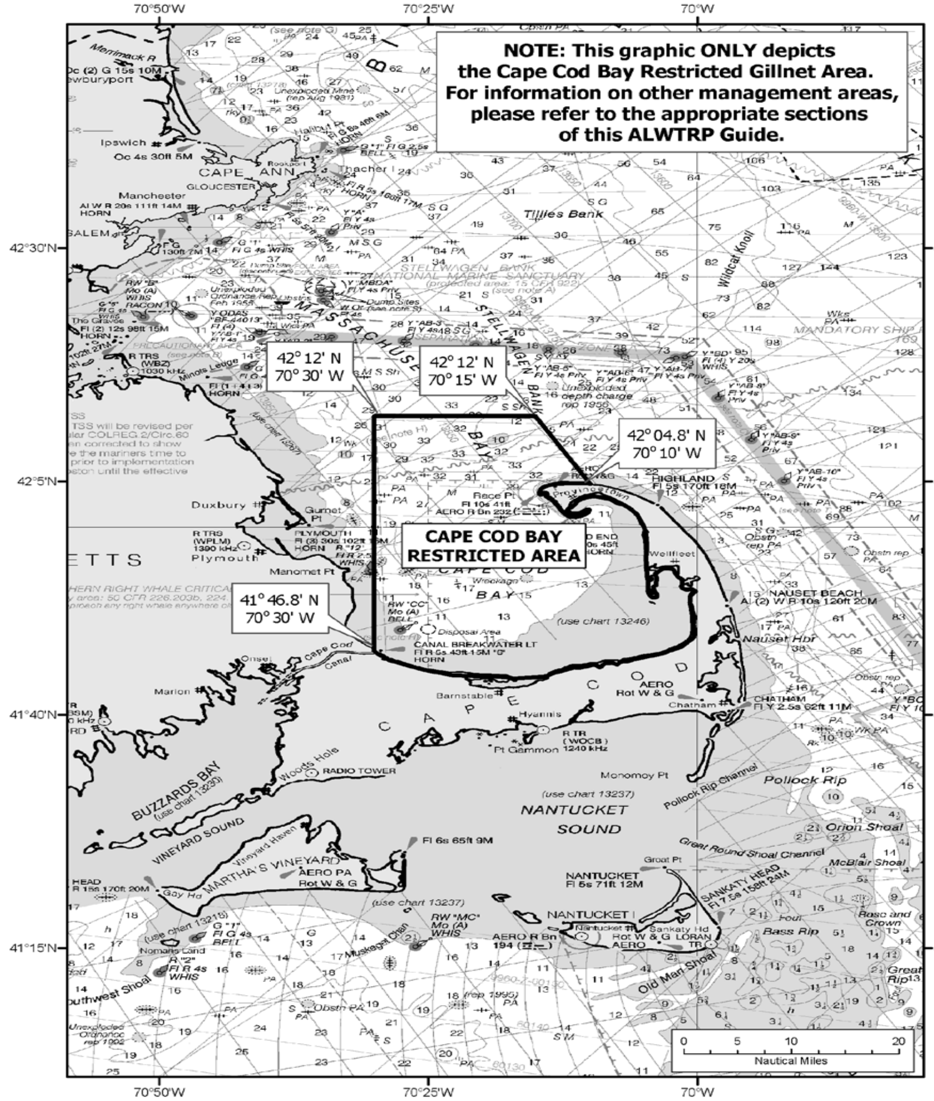
* Weak links must be chosen from the list of NMFS approved gear, which includes: off the shelf weak links, rope of appropriate breaking strength, hog rings, and other materials or devices approved in writing. Weak links must be designed in such a way that the bitter end of the buoy line is clean and free of any knots when the weak link breaks

** The weak link placement must meet one of two configuration options. The same configuration will be required for all gillnet net panels in a string

Cape Cod Bay Restricted Area (CCB)

The CCB restricted area includes the area bounded by: 42°04.8’N/70°10’W; 42°12’N/70°15’W; 42°12’N/70°30’W; 41°46.8’N/70°30’W; and on the south and east by the interior shoreline of Cape Cod, MA (Figure A1.1) [50 CFR 229.32 (d)(2) and (e)(1)].

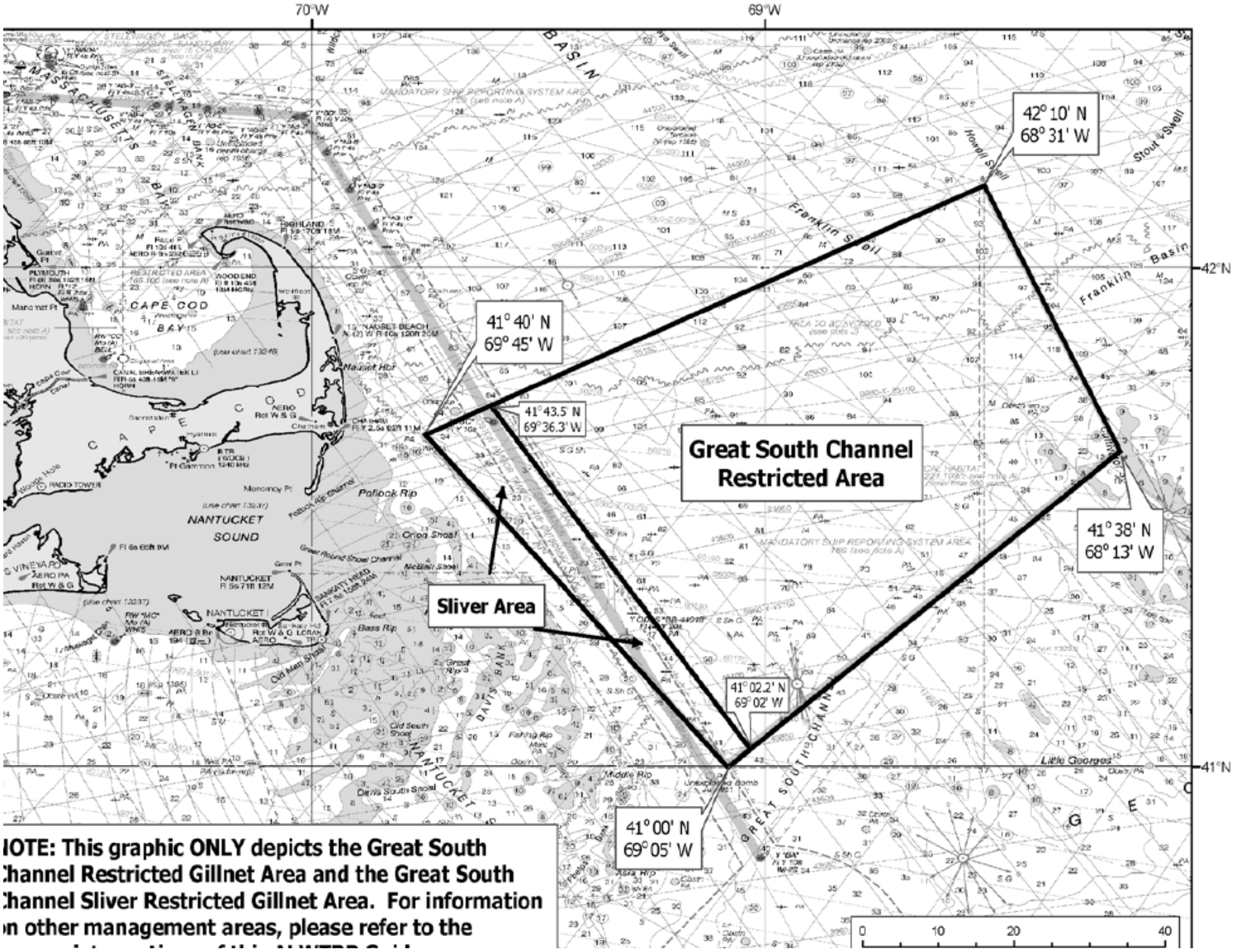
Figure A2.1 Map of the Cape Cod Bay Restricted Area (NMFS NERO 2010)



Great South Channel Restricted Area (GSC)

The GSC restricted area includes the waters bounded by 41°40’N/69°45’W; 41°00’N/69°05’W; 41°38’N/68°13’W; and 42°10’N/68°31’W. The Great South Channel Sliver Restricted Gillnet Area includes the area bounded by: 41°02.2’N/69°02’W; 41°43.5’N/69°36.3’W; 41°40’N/69°45’W; and 41°00’N/69°05’W (Figure A1.2) [50 CFR 229.32 (d)(3-4) and (e)(2-3)].

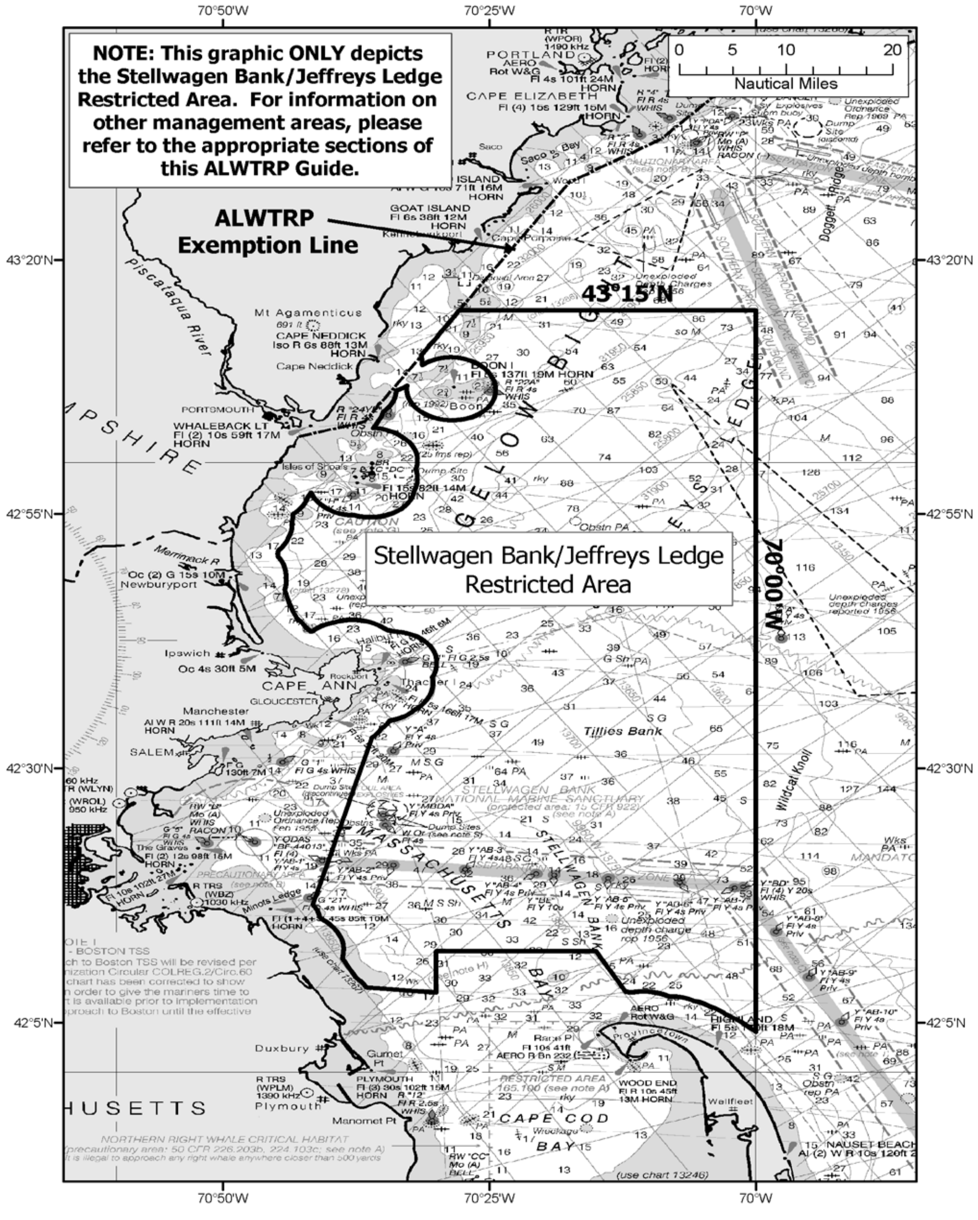
Figure A2.2 Map of the Great South Channel Restricted Area (NMFS NERO 2010)



Stellwagen Bank/Jeffrey’s Ledge Restricted Area (SB/JL)

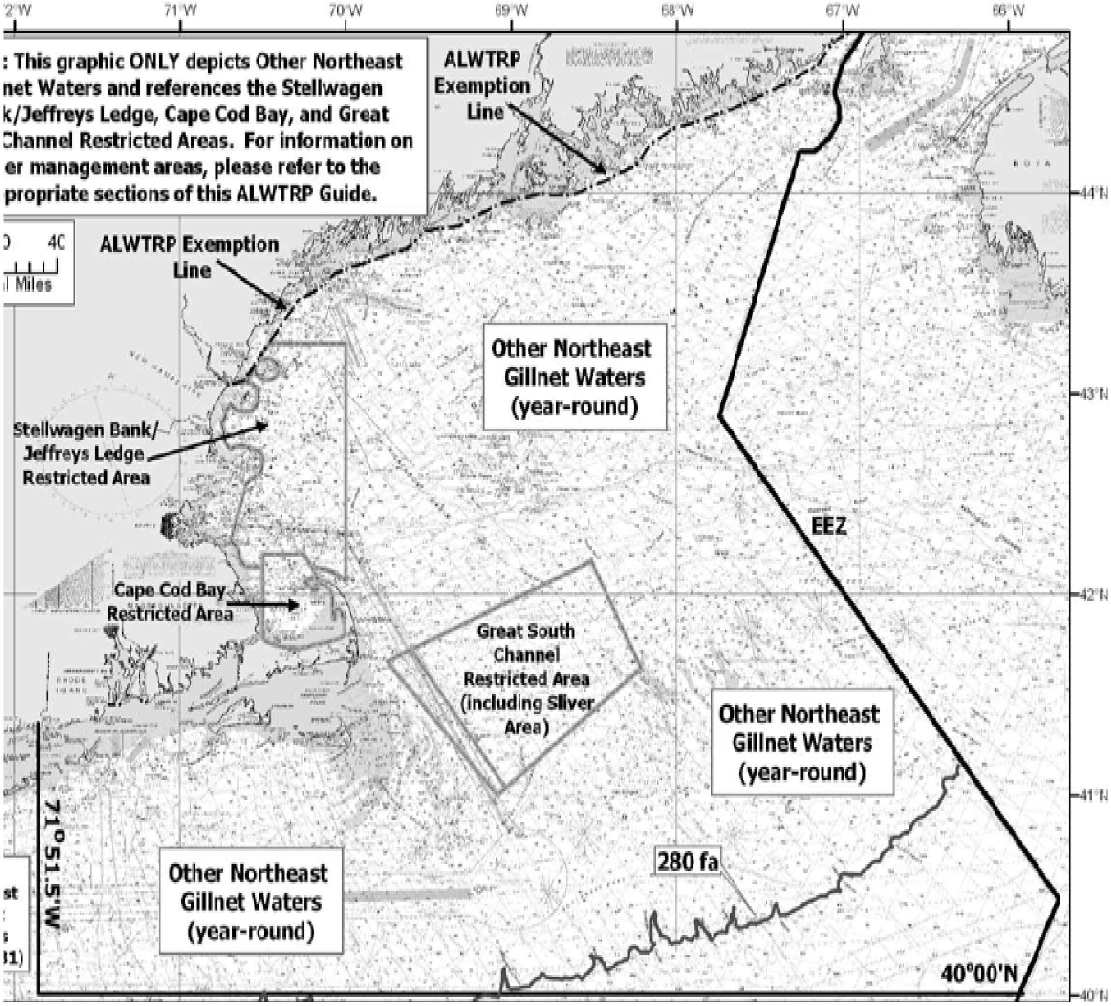
The SB/JL restricted area includes all federal waters of the Gulf of Maine (except those designated as the Cape Cod Bay Restricted Area) that lie south of 43°15’N and west of 70°00’W (Figure A1.3) [50 CFR 229.32 (d)(5) and (e)(4)].

Figure A2.3 Map of the Stellwagen Bank/Jeffrey’s Ledge Restricted Area (NMFS NERO 2010)



Other Northeast Gillnet Waters (ONGW)
ONGW are all U.S. waters from the U.S./Canada border to Long Island, NY, at 72°30' W. south to 36°33.03' N. and east to the eastern edge of the EEZ, with the exception of the CCB, SB/JL, and GSC restricted areas where the restriction noted above apply (Figure A1.4) [50 CFR 229.32 (d)(6) and (e)(5)].

Figure A2.4 Map of the Other Northeast Gillnet Waters (NMFS NERO 2010)



Appendix 2b Mid/South Atlantic Gillnet Management Areas Seasonal Regulations and Maps

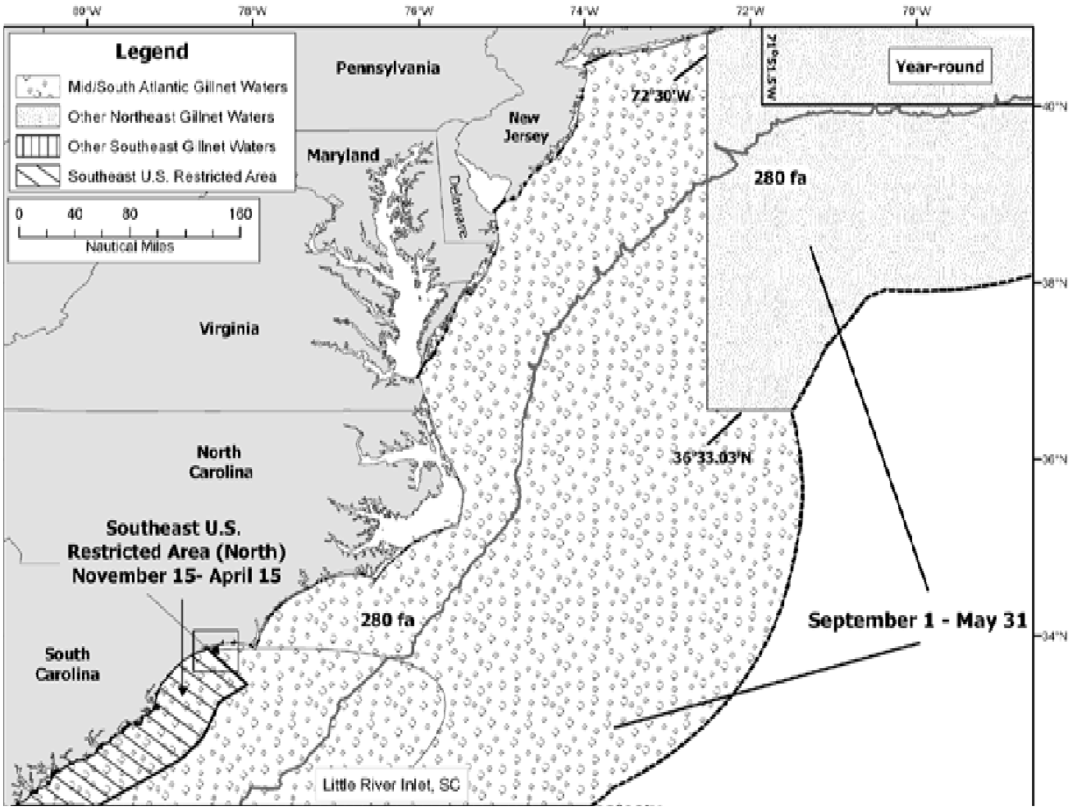
Table A2.2. Seasonal Regulations by Management Area and Gillnet Gear Type [50 CFR 229.32 (d)(1-7) and (e)(1-6)]

Effective Date	Type of Gillnet Gear	Gear Requirements
Jun. 1 – Aug. 31	All	No restrictions
Sept. 1 – May 31	All	All surface buoys must be marked with either the owner's motorboat registration number and/or U.S. vessel documentation number; the federal commercial fishing permit number; or whatever positive identification marking is required by the vessel's home-port state
		All letters and numbers marking the gear must be at least 1 inch (2.5cm) in height, block letters or Arabic numbers, in a color that contrasts with the color of the buoy, if other markings are not already required by state or federal regulation
		All buoy lines must be marked with one 4-inch (10.2 cm), BLUE, mark midway along the buoy line
	Anchored	Must have no buoy lines floating at the surface
		Wet storage prohibited (all gear must be hauled out of the water at least once every 30 days)
		All buoys, flotation devices and/or weights must be attached to the buoy line with a weak link* having a breaking strength no greater than 1,100 lbs
		All anchored gillnet panels must have weak links with the breaking strength of no greater than 1,100 lbs in the center of the floatline of each net panel up to and including 50 fathoms (100yds; 300ft), or at least every fathoms (50yds; 150ft) for longer panels
		Any gillnets not returning to port with the vessel, must be configured with five or more weak links per net panel, depending on panel length, with a breaking strength no greater than 1,100 lb, and be anchored with the holding power of at least a 22-lb Danforth-style anchor at each end of the net string (must be a burying anchor; no dead weights)**
		All groundlines must be made of sinking line
	Drift	Night fishing (i.e., anytime between one-half hour before sunset and one-half hour after sunrise) is prohibited unless nets are tended (i.e., attached to the vessel)
		All gear must be removed from the water and stowed on board before a vessel returns to port

* 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. Weak links must be 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

** The weak link placement must meet one of two configuration options. The same configuration will be required for all gillnet net panels in a string

Figure A2.5 Map of the Mid/South Atlantic Gillnet Waters (NMFS NERO 2010)



Appendix 2c Southeast Gillnet Management Areas Seasonal Regulations and Maps

Table A2.3a Seasonal Regulations by Management Area and Gillnet Gear Type [50 CFR 229.32 (b)(2)(i), (d)(1) and (f-h)]

Gillnet Management Area	Effective Dates	Applicable Fishery	Gear Requirements
SEUS Restricted Area South	Dec. 1- Dec. 31 & Mar. 1- Mar. 31	SE Atlantic Gillnet Fishery (Spanish Mackerel)	Gillnet surface buoys must be marked with either the owner's motorboat registration number and/or U.S. vessel documentation number; the federal commercial fishing permit; number; or whatever positive identification marking is required by the vessel's home-port state. When marking is not already required by state or federal regulations, the letters and numbers to mark gear must be at least 1 inch in height, block letters or Arabic numbers, in a color that contrasts with the color of the buoy.
			Buoy lines must be marked with one 4-inch, YELLOW, mark midway along the buoy line.
			Gillnet mesh must be between 3.5" and 4 7/8" stretched mesh and vessels must has a valid commercial vessel permit for Spanish mackerel and it is on board;
			No person may fish with, set, place in the water, or have on board a gillnet with a float line longer than 800 yards; no more than one gillnet may be fished at any time; no more than two gillnets, may be possessed at any one time; and if there are two nets, they must have stretched mesh sizes that differ by at least 1/4";
			Soak times cannot be longer than 1 hour; and no nets may be set at night or when visibility is less than 500 yards;
			Gillnets must be removed from the water before night or immediately if visibility decreases below 500 yards; no gillnets may be set within 3 nautical miles (nm) of a right, humpback, or fin whale, and nets must be removed immediately from the water if a right, humpback, or fin whale moves within 3 nm of the set gear;
			All gillnets (regardless of how fished) must comply with the "anchored gillnet" and universal requirements

Table A2.3a Cont'd. Seasonal Regulations by Management Area and Gillnet Gear Type [50 CFR 229.32 (b)(2)(i), (d)(1) and (f-h)]

Gillnet Management Area	Effective Dates	Applicable Fishery	Gear Requirements
SEUS Restricted Area South	Dec. 1-Mar. 31	SE Atlantic Shark Gillnet Fishery	Gillnet surface buoys must be marked with either the owner's motorboat registration number and/or U.S. vessel documentation number; the federal commercial fishing permit; number; or whatever positive identification marking is required by the vessel's home-port state. When marking is not already required by state or federal regulations, the letters and numbers to mark gear must be at least 1 inch in height, block letters or Arabic numbers, in a color that contrasts with the color of the buoy.
			Gillnets must be marked with two, 4-inch color codes, one designating gear type (GREEN) and the other where the gear is set (BLUE). Each color of the two-color codes must be permanently marked on or along the line and must be clearly visible when the gear is hauled or removed from the water. The two color marks must be placed within 6" of each other.
			If the color of the rope is the same as or similar to a color code, a white mark may be substituted for that color code.
			All buoy lines greater than 4 f long must be marked within 2 ft of the top of the buoy line (closest to the surface) and midway along the length of the buoy line.
			Each gillnet net panel must be marked along both the floatline and the leadline at least once every 100 yards, unless otherwise required.
			Gillnet mesh must be 5" or greater stretched mesh;
			Gillnets must enclose an area of water and each set must be made under the observation of a spotter plane;
			Vessels must have a valid commercial vessel permit on board;
			No net may be set at night or when visibility is less than 500 yards, and gillnets must be removed from the water before night or immediately if visibility decreases below 500 yards;
			No gillnets may be set within 3 nm of a right, humpback, or fin whale, and nets must be removed immediately from the water if a right, humpback, or fin whale moves within 3 nm of the set gear;
			At least 48 hours prior to departing, shark gillnet gear fishermen must contact the Southeast Fisheries Science Center Panama City Laboratory. If the Panama City Laboratory requests that an observer be taken on board a vessel, no person may fish with such gillnet aboard the vessel unless an observer is on board that vessel during the trip.
	Dec. 1-Mar. 31	All Other Gillnet Fisheries	Gillnet fishing prohibited

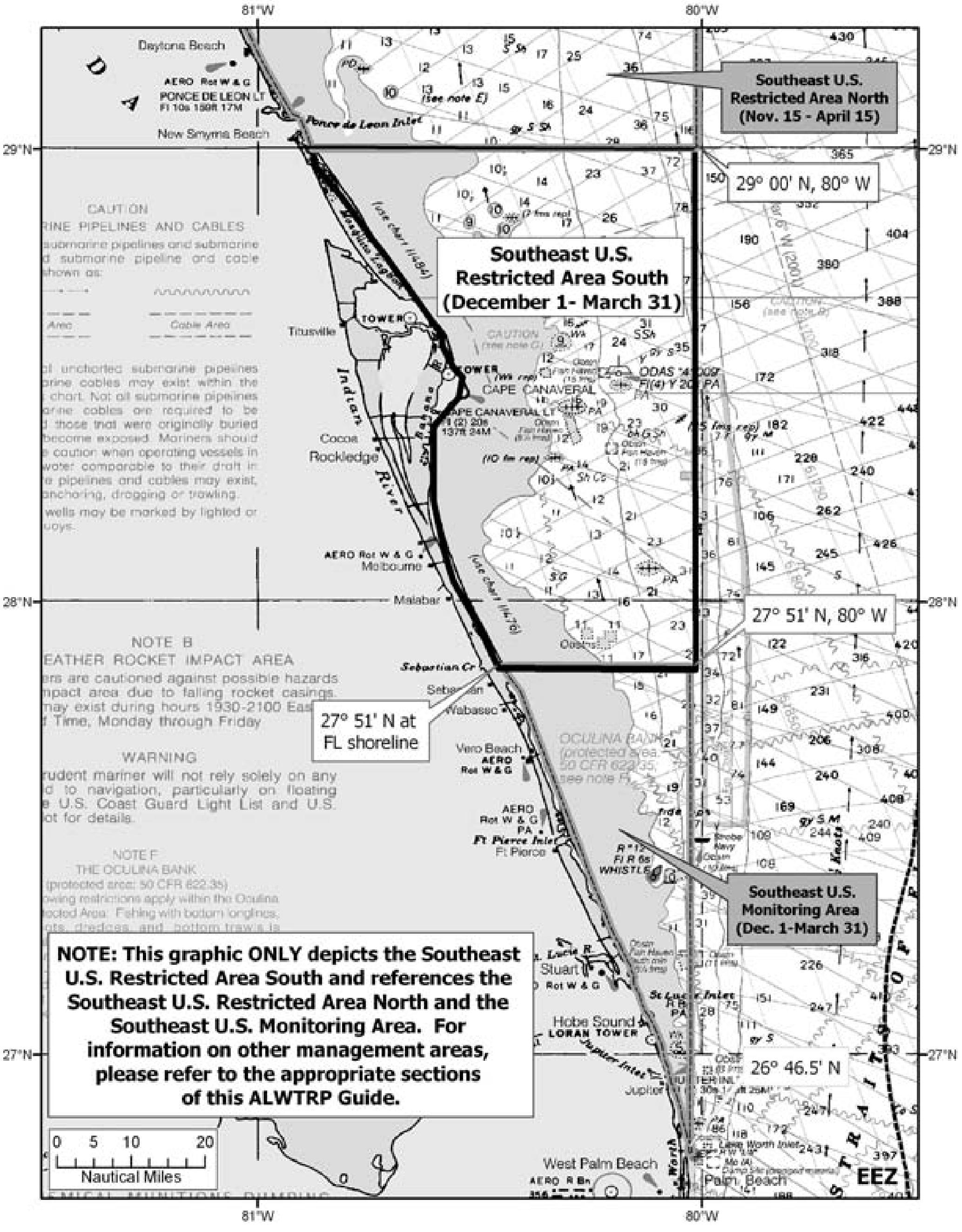
Table A2.3b Seasonal Regulations by Management Area and Gillnet Gear Type [50 CFR 229.32 (b)(2)(i), (d)(1) and (f-h)]

Gillnet Management Area	Effective Dates	Applicable Fishery	Gear Requirements
SEUS Restricted Area North	Nov. 15 – Apr 15	All Gillnet Fisheries	Gillnet fishing prohibited
SEUS Monitoring Area	Dec. 1- Mar. 31	SE Atlantic Shark Gillnet Fishery (only)	Same gear marking requirements as those listed for Other Southeast Gillnet Waters (North of 29°00')
			Vessels fishing with gillnet gear for shark with webbing of 5" or greater stretched mesh must be in compliance with the vessel monitoring system requirements found in 50 CFR 635.69.
			NMFS may select any shark gillnet vessel regulated under the ALWTRP to carry an observer. Selected vessels are required to take observers on a mandatory basis in compliance with the requirements for at-sea observer coverage found in 50 CFR 229.7.
Other Southeast Gillnet Waters (North of 29°00')	Nov. 15 – Apr 15	SE Atlantic Gillnet Fishery	Gillnet surface buoys must be marked with either the owner's motorboat registration number and/or U.S. vessel documentation number; the federal commercial fishing permit; number; or whatever positive identification marking is required by the vessel's home-port state. When marking is not already required by state or federal regulations, the letters and numbers to mark gear must be at least 1 inch (2.5cm) in height, block letters or Arabic numbers, in a color that contrasts with the color of the buoy.
			Buoy lines must be marked with one 4-inch, YELLOW, mark midway along the buoy line.
			Gillnets must comply with Universal Gear Requirements: no buoy line floating at the surface, no wet storage of gear (all gear must be hauled out at least once every 30 days); fishermen are encouraged to maintain knot-free buoy lines;
			All buoys, flotation devices and/or weights must be attached to the buoy line with a weak link having a breaking strength no greater than 1,100 lb; all gillnet panels to have weak links with the breaking strength of no greater than 1,100 lb in the center of the floatline of each net panel up to and including 50 fathoms, or at least every 25 fathoms for longer panels;
			Gillnets that do not return to port with the vessel must be configured with 5 or more weak links per net panel, depending on panel length, with a breaking strength no greater than 1,100 lb, and be anchored with the holding power of at least a 22-lb Danforth-style anchor at each end of the net string.
			All groundlines must be made of sinking line.
		SE Atlantic Shark Gillnet Fishery	Same gear marking requirements as required as those listed for SEUS Restricted Areas South
			No net can be set within 3 nm of a right, humpback or fin whale; and if a right, humpback, or fin whale moves within 3 nm of the set gear, the gear is removed immediately from the water.
Other Southeast Gillnet Waters (South of 29°00')	Dec. 1- Mar. 31	SE Atlantic Gillnet Fishery	Same requirements as those listed for Other Southeast Gillnet Waters (North of 29°00')
		SE Atlantic Shark Gillnet Fishery	Same requirements as those listed for SEUS Restricted Areas South

SEUS Restricted Area South

The SEUS Restricted Area South includes waters north of 27°51’ N (near Sebastian Inlet, Florida) to 29°00’ N (near Ponce de Leon Inlet, Florida) from the shoreline eastward to 80°00’ W.

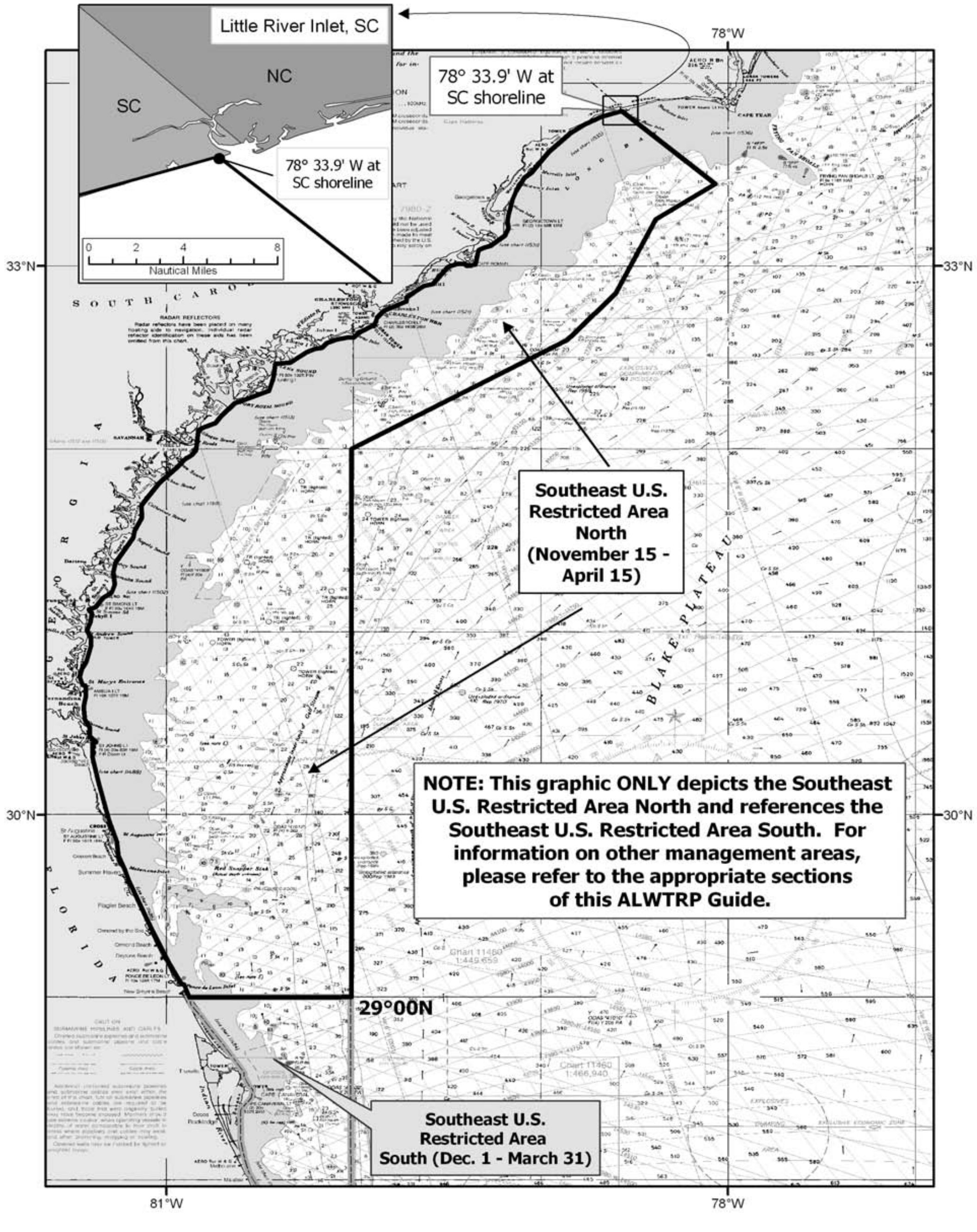
Figure A2.6 Map of the SEUS Restricted Area South (NMFS NERO 2010)



SEUS Restricted Area North

The SEUS Restricted Area North includes waters north of 29°00’ N (near Ponce de Leon Inlet, Florida) to 32°00’ N (near the Georgia/South Carolina border) from the shoreline eastward to 80°00’ W, and off South Carolina, within 35 nautical miles of the shoreline. Little River Inlet, South Carolina, is not located in the Southeast U.S. Restricted Area North.

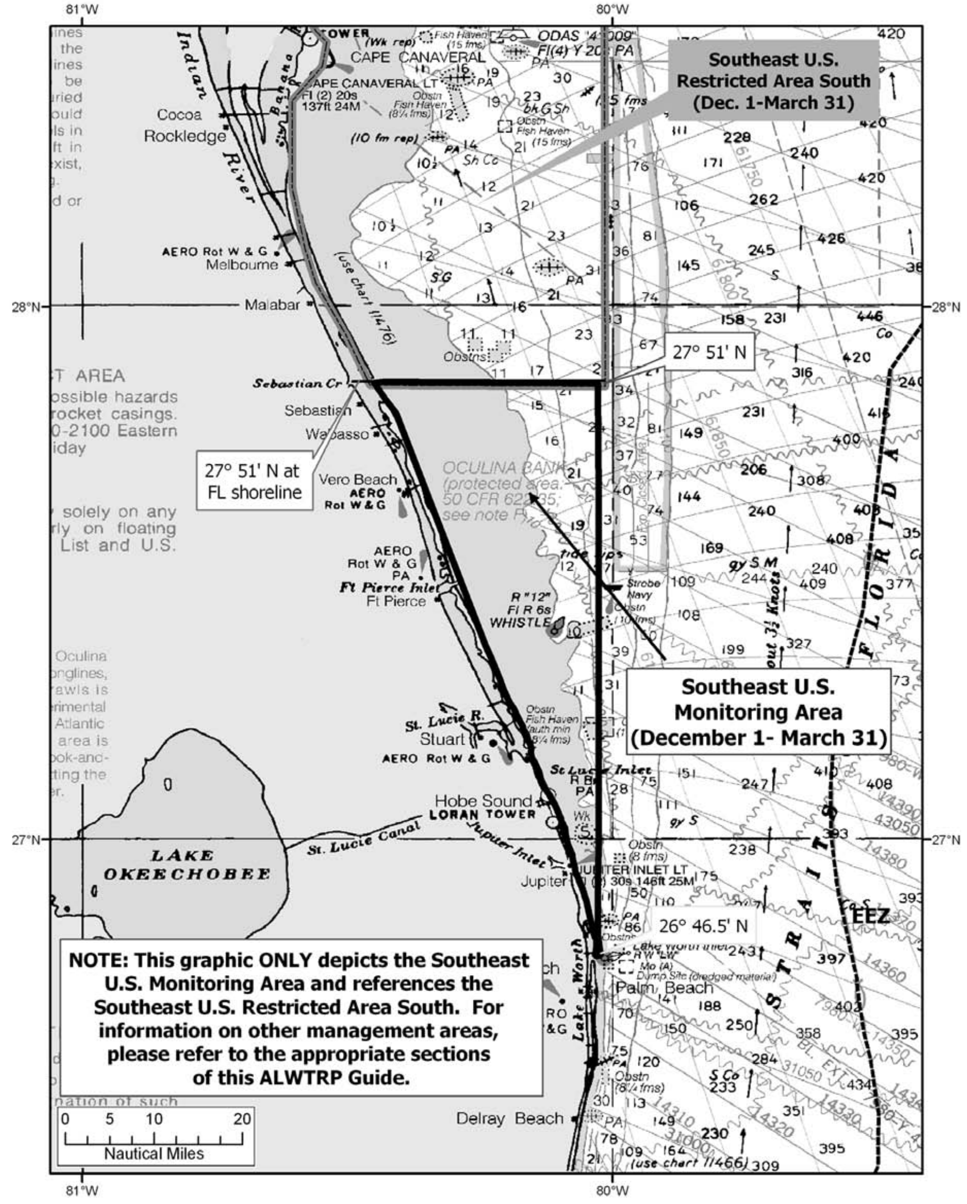
Figure A2.7 Map of the SEUS Restricted Area North (NMFS NERO 2010)



SEUS Monitoring Area

The SEUS Monitoring Area is a management area for the Southeastern U.S. Atlantic shark gillnet fishery **only,** and includes the area along the coast from 27°51’ N (near Sebastian Inlet, Florida) south to 26°46.5’ N (near West Palm Beach, Florida), and extending from the shoreline or exemption line eastward to 80°00’ W.

Figure A2.8 Map of the SEUS Monitoring Area (NMFS NERO 2010)



Southeast U.S. Restricted Area South (Dec. 1-March 31)

Southeast U.S. Monitoring Area (December 1- March 31)

27° 51' N

27° 51' N at FL shoreline

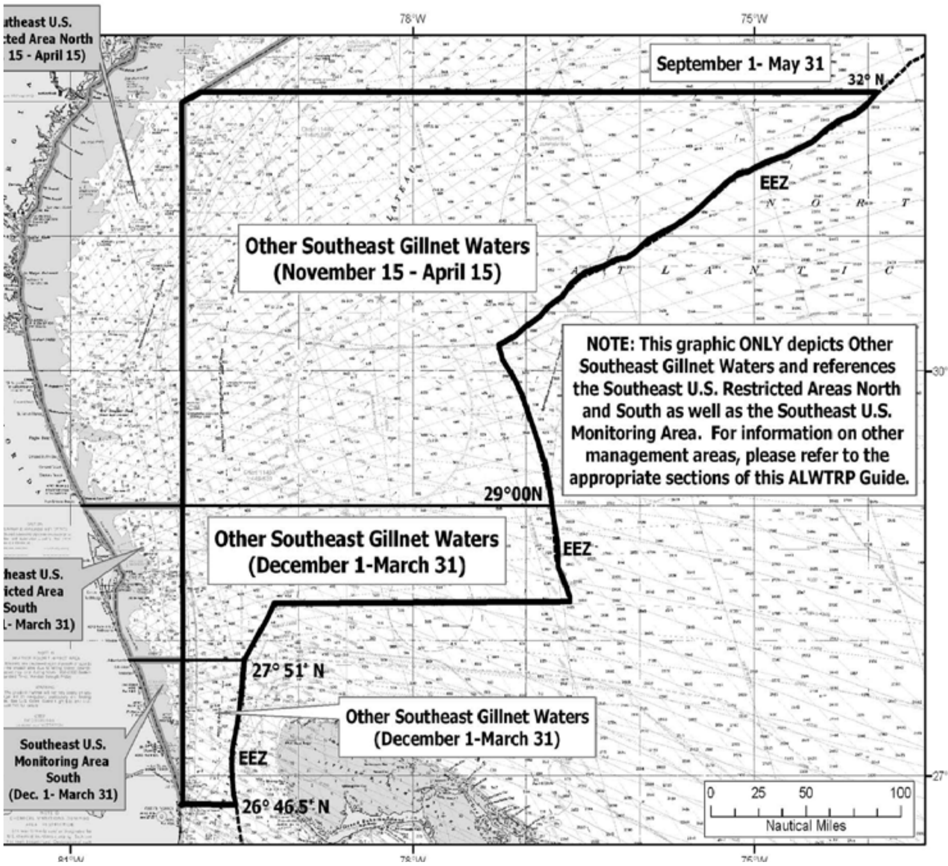
26° 46.5' N

NOTE: This graphic ONLY depicts the Southeast U.S. Monitoring Area and references the Southeast U.S. Restricted Area South. For information on other management areas, please refer to the appropriate sections of this ALWTRP Guide.

Other Southeast Gillnet Waters

Other Southeast Gillnet Waters consists of the area from 32°00’ N (near Savannah, Georgia) south to 27°51’ N lat for the Southeast Atlantic gillnet fishery, and from 32°00’ N (near Savannah, Georgia) south to 26°46.50’ N lat for the Southeastern U.S. Atlantic shark gillnet fishery, and extending from 80°00’ W long. east to the eastern edge of the EEZ, for both the Southeast Atlantic gillnet fishery and the Southeastern U.S. Atlantic shark gillnet fisheries.

Figure A2.9 Map of the Other Southeast Gillnet Waters (NMFS NERO 2010)



Appendix 3 Maps of Observed Bottom Longline and Gillnet Sets, 2008-2010

Bottom Longline Gear

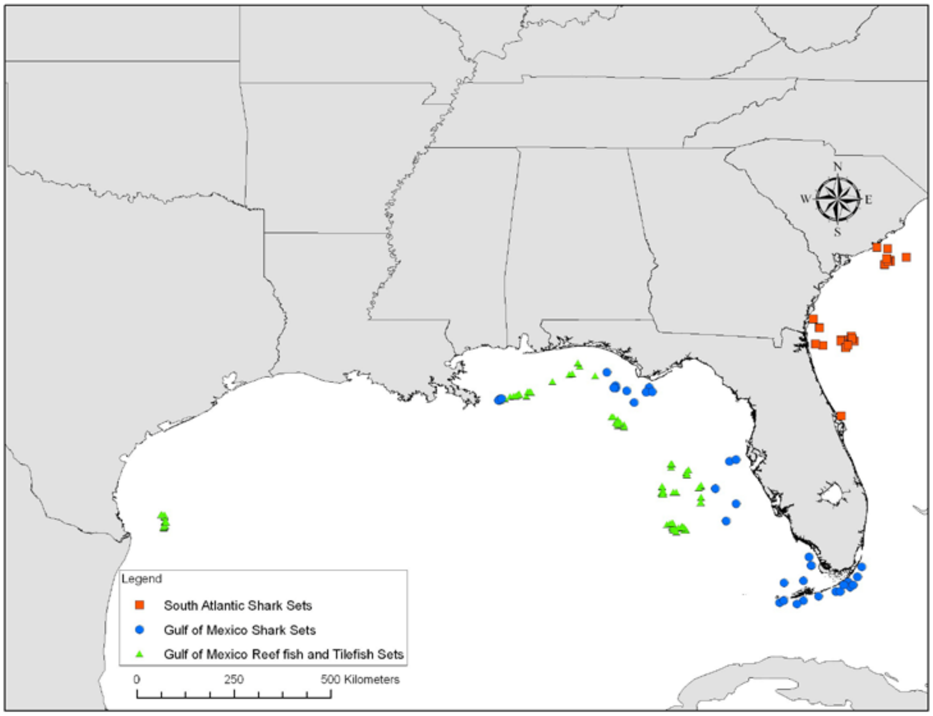


Figure A3.1. Distribution of all Bottom Longline Observed hauls by target in the Gulf of Mexico and U.S. Atlantic Ocean in 2008 (Hale et al. 2009)

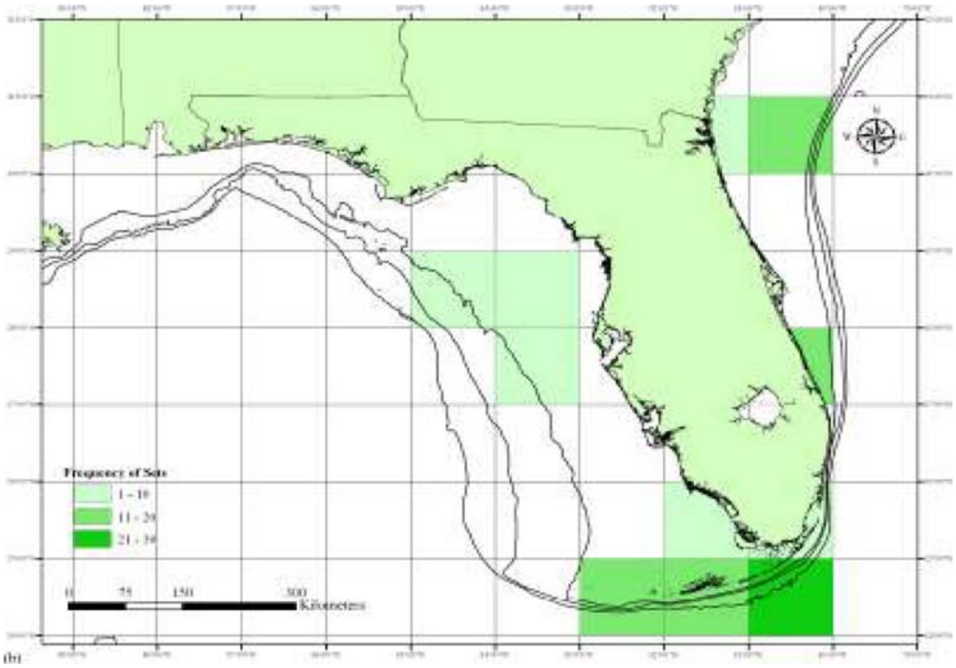


Figure A3.2. Distribution and frequency of all observed hauls targeting sandbar sharks in the Gulf of Mexico and U.S. Atlantic Ocean in 2009 (Hale et al. 2010)

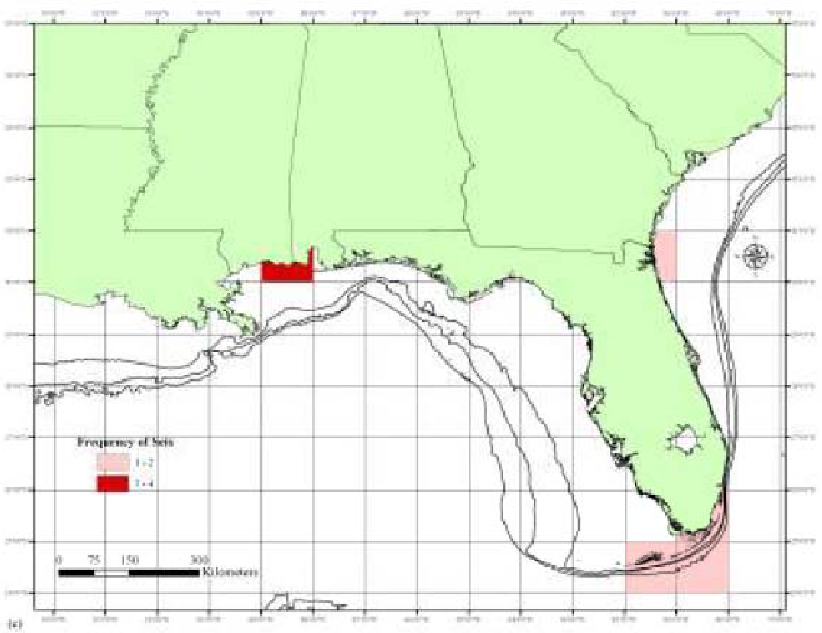


Figure A3.3 Distribution and frequency of all observed hauls targeting LCS in the Gulf of Mexico and U.S. Atlantic Ocean in 2009 (Hale et al. 2010)

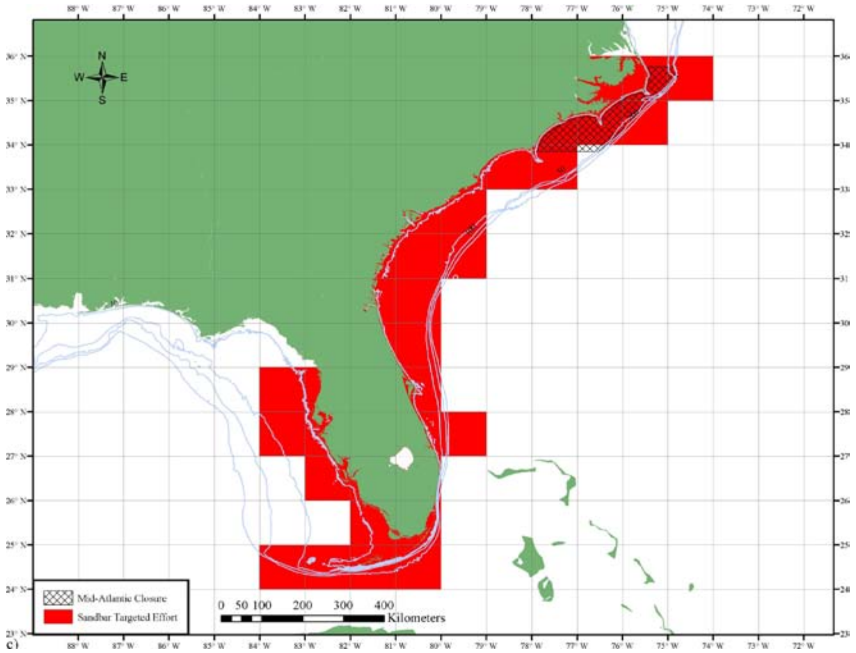


Figure A3.4. Distribution of all observed hauls targeting sandbar sharks in the Gulf of Mexico and U.S. Atlantic Ocean in 2010. Frequency of sets not reported due to confidentiality considerations (Hale et al. 2011)

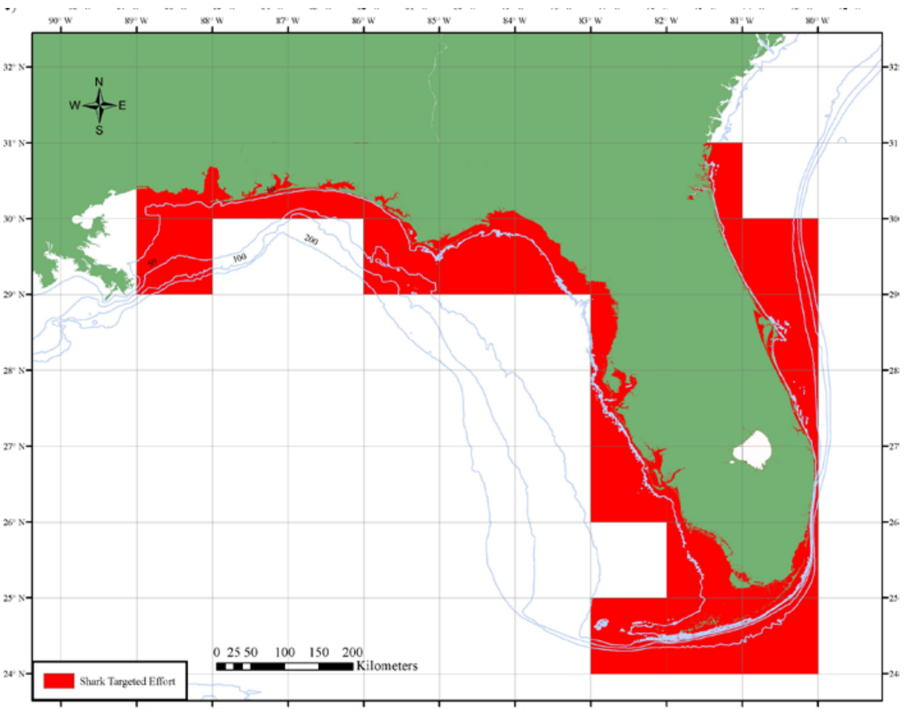


Figure A3.5. Distribution of all observed hauls targeting large coastal sharks in the Gulf of Mexico and U.S. Atlantic Ocean in 2010. Frequency of sets not reported due to confidentiality considerations (Hale et al. 2011)

Gillnet Gear

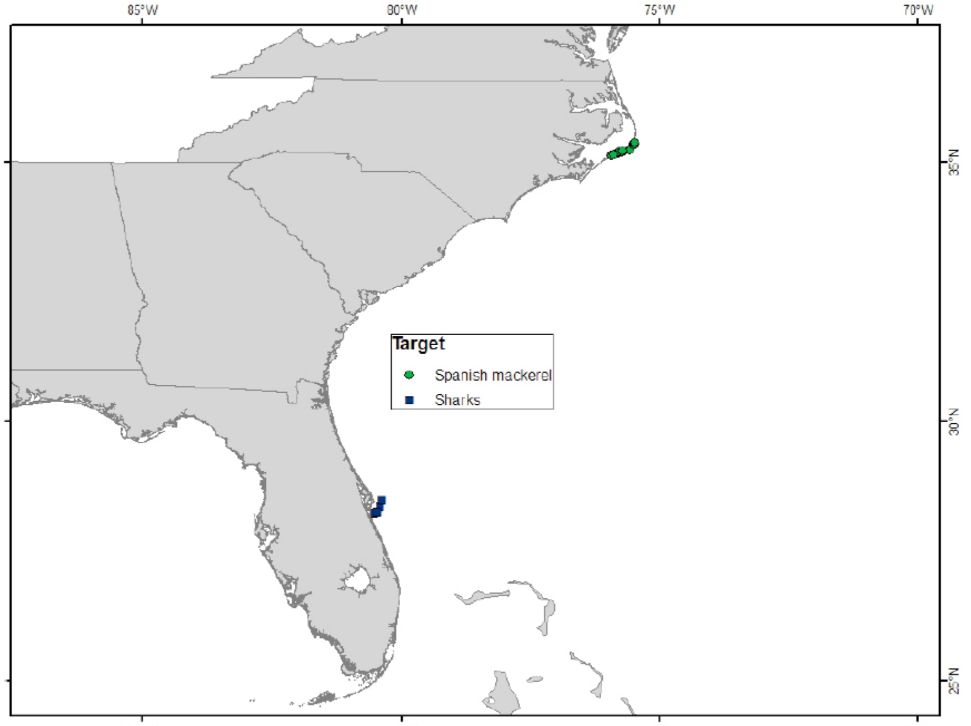


Figure A3.6 Distribution of observed drift gillnet sets, 2007 (Baremore et al. 2007)

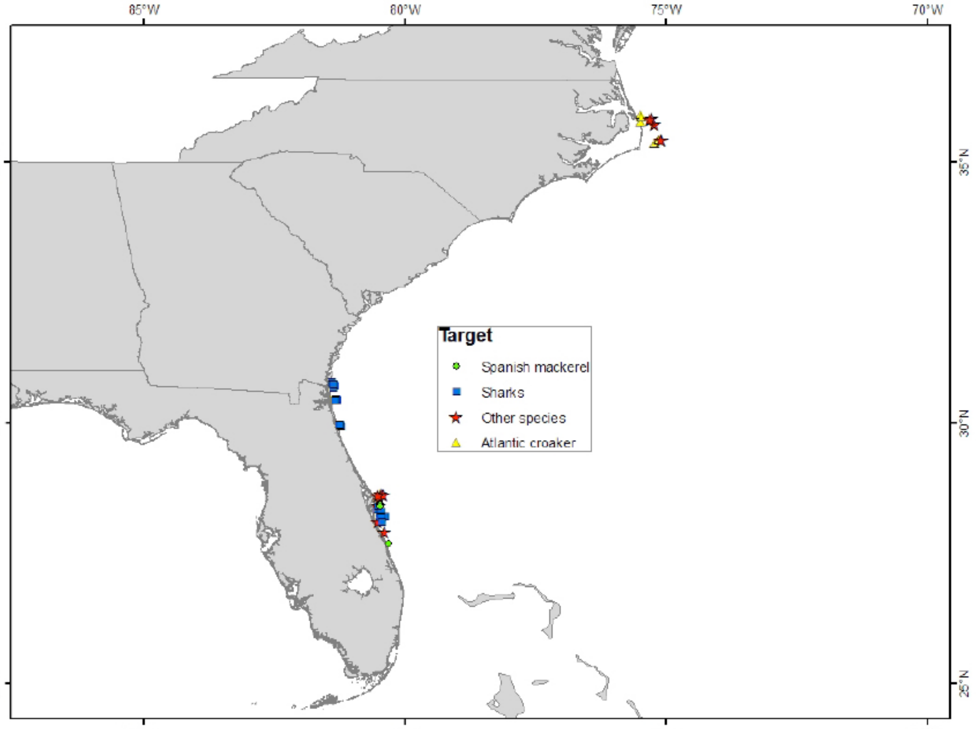


Figure A3.7 Distribution of observed sink gillnet sets, 2007(Baremore et al. 2007)

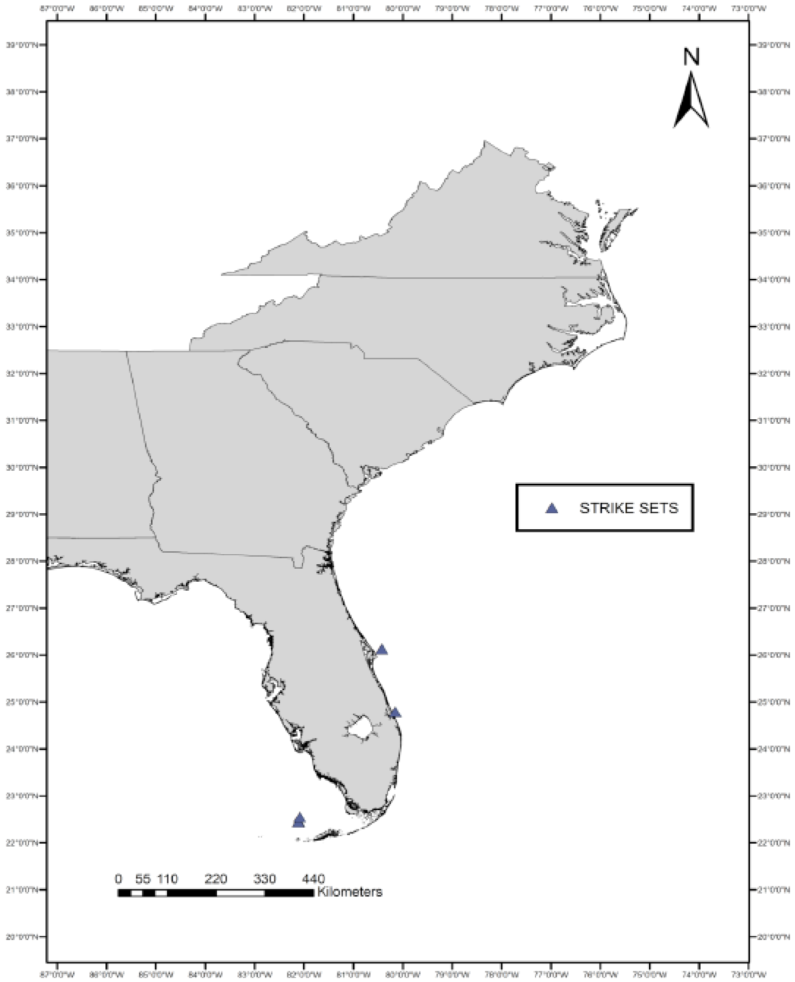


Figure A3.8 Distribution of observed drift gillnet sets, 2008 (Passerotti and Carlson 2009)

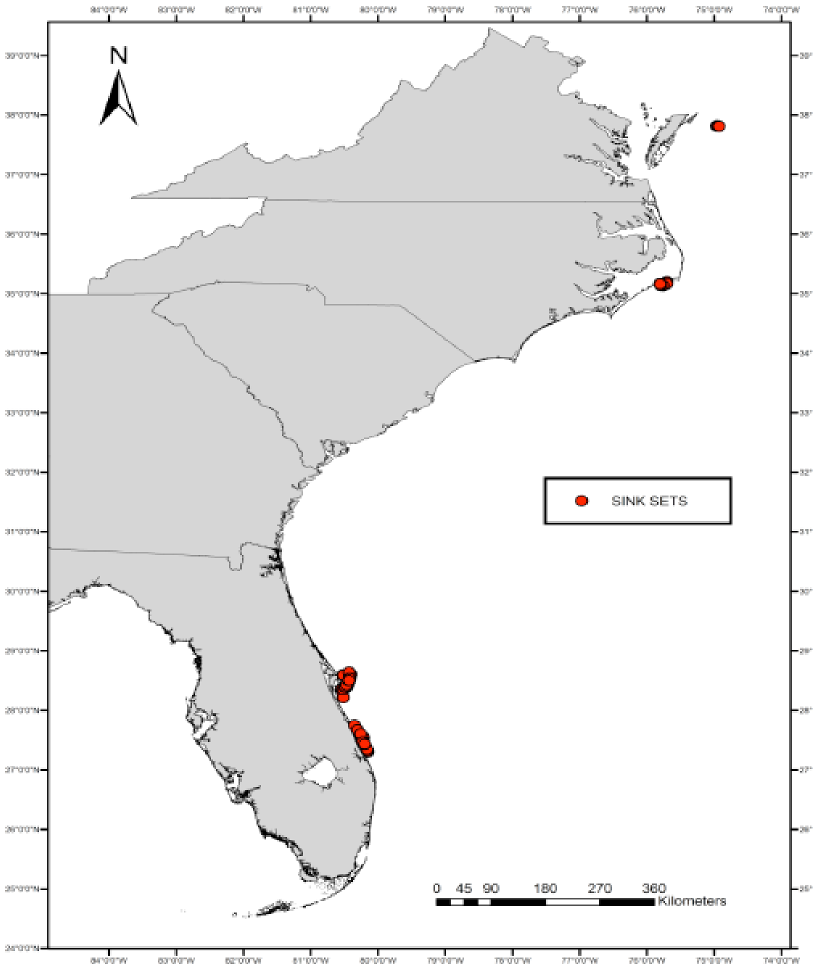
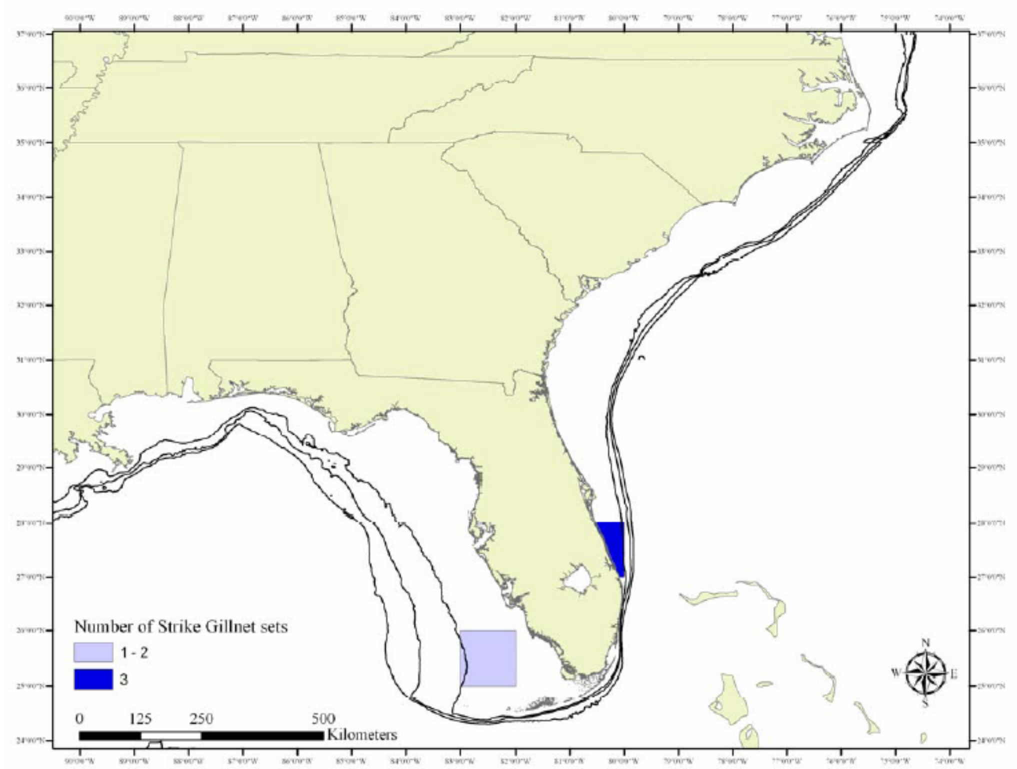
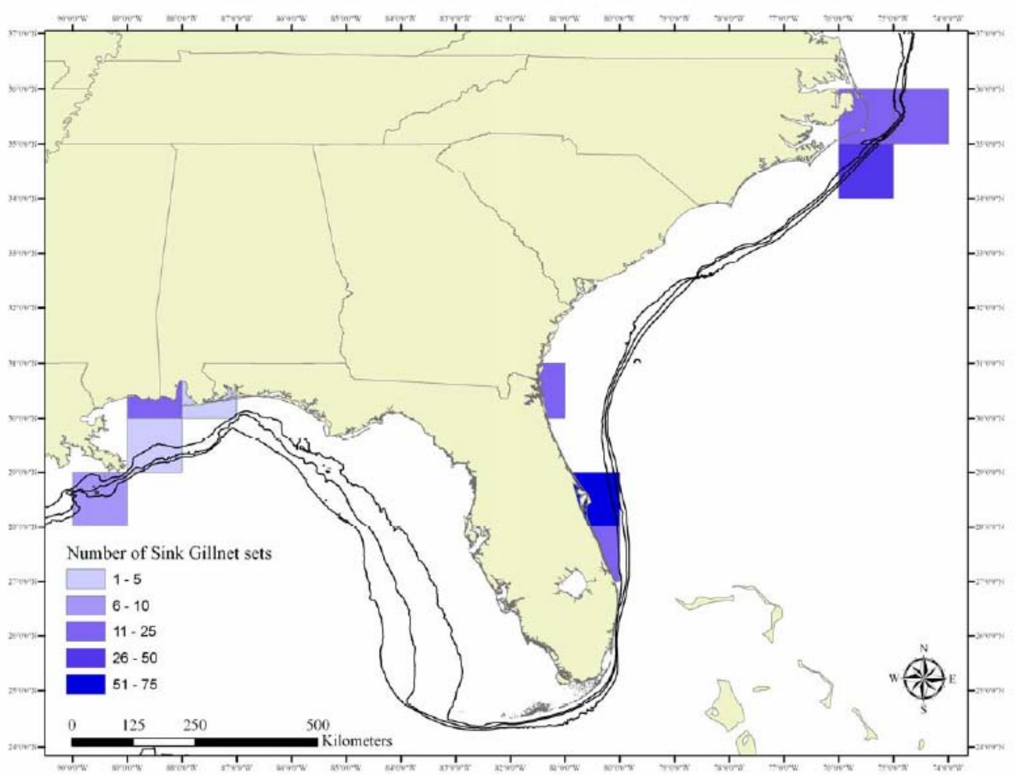


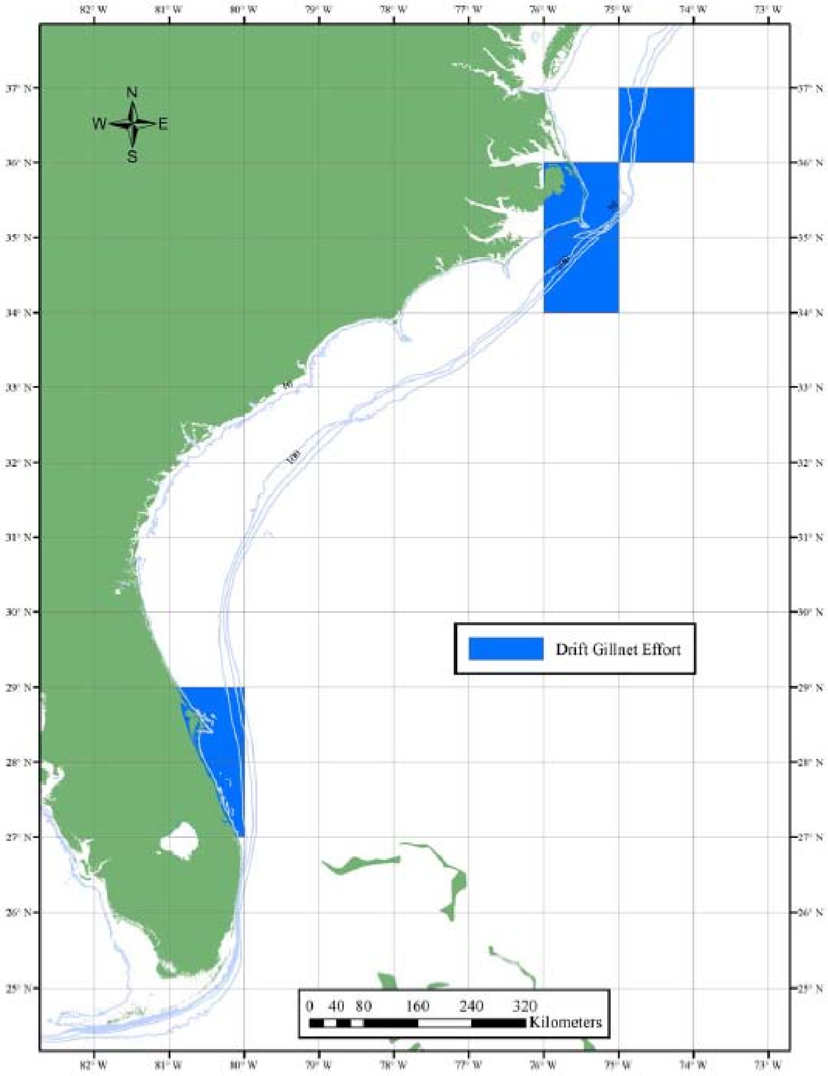
Figure A3.9 Distribution of observed sink gillnet sets, 2008 (Passerotti and Carlson 2009)



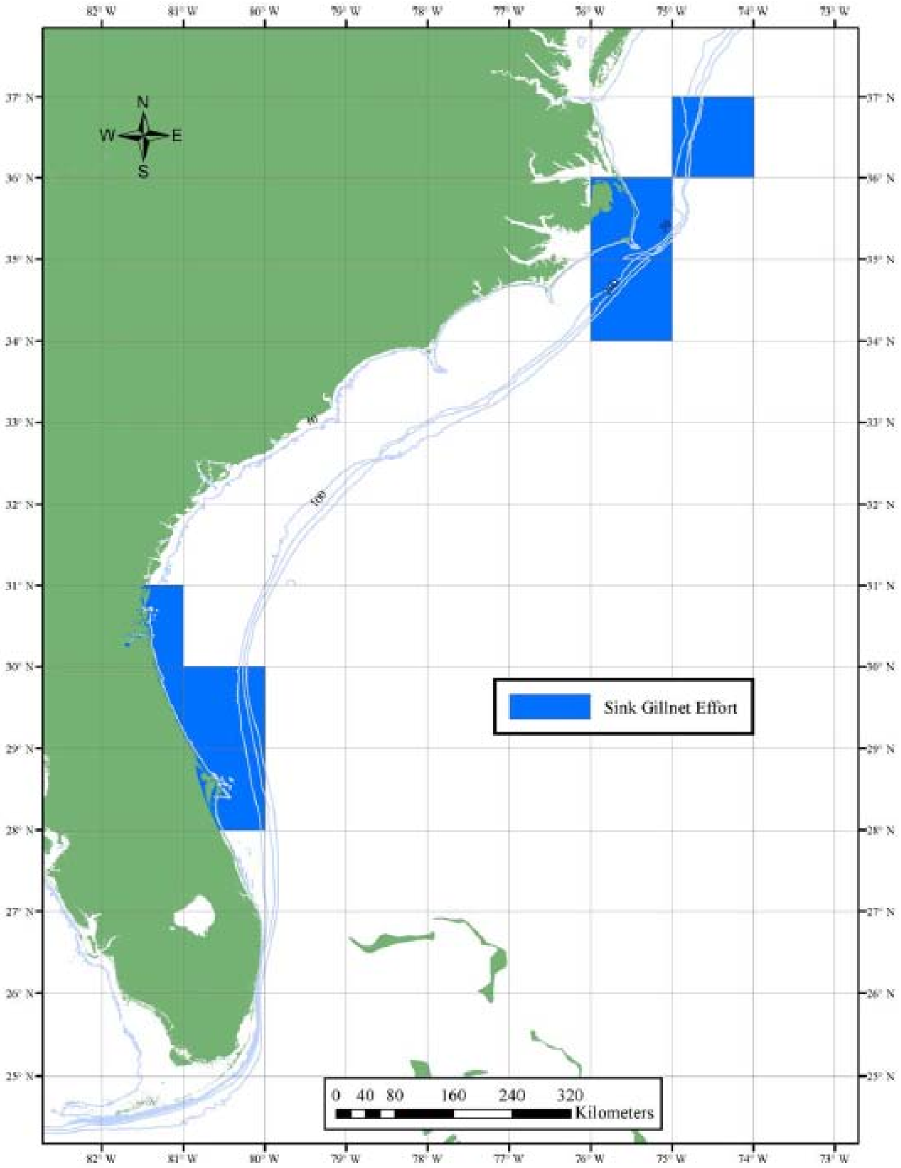
A3.10 Distribution of observed strike gillnet sets, 2009 (Passerotti et al. 2010)



A3.11 Distribution of observed sink gillnet sets, 2009 (Passerotti et al. 2010)



A3.12 Distribution of observed drift gillnet sets, 2010 (Passerotti et al. 2011)



A3.13 Distribution of observed sink gillnet sets, 2010 (Passerotti et al. 2011)

Appendix 4 The Anticipated Incidental Take of ESA-Listed Species as Outlined In the Most Recent Opinions on NMFS-Authorized Federal Fisheries

Table A4.1 Anticipated Incidental Takes of Sea Turtles

Fishery	ITS Authorization Period	Sea Turtle Species				
		Loggerhead	Leatherback	Kemp's Ridley	Green	Hawksbill
Atlantic Bluefish (trawl) [NER]	1-Year (Based on 5-Yr Average)	3-No more than 2 lethal	4-Lethal or non-lethal (both trawl and gillnet)	4-Lethal or non-lethal (both trawl and gillnet)	5-Lethal or non-lethal (both trawl and gillnet)	None
Atlantic Bluefish (gillnet) [NER]	1-Year (Based on 5-Yr Average)	79-No more than 32 lethal				None
Atlantic Herring [NER]	1-Year	6-No more than 3 lethal	1-Lethal or non-lethal	1-Lethal or non-lethal	1-Lethal or non-lethal	None
American Lobster [NER]	1-Year	1-Lethal or non-lethal	5-Lethal or non-lethal	None	None	None
Caribbean Reef Fish [SER]	3-Year	None	18-All lethal	None	75-All lethal	51-No more than 3 lethal
Coastal Migratory Pelagics [SER]	3-Year	33-All lethal	2 lethal takes for Leatherbacks, Hawksbill, and Kemp's Ridley-both lethal take		14-All Lethal	See leaterback entry
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		
Gulf of Mexico Reef Fish [SER]	3-Year	1,044-No more than 572 lethal	11-All lethal	108-No more than 41 lethal	116-No more than 75 lethal	9-No more than 8 lethal
HMS-Pelagic Longline [SER]	3-Year	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-Year	679-No more than 346 lethal	74-No more than 47 lethal	2 – No more than 1 lethal	2 – No more than 1 lethal	2 – No more than 1 lethal

Table A4.1 con’t

Fishery	ITS Authorization Period	Sea Turtle Species				
		Loggerhead	Leatherback	Kemp’s Ridley	Green	Hawksbill
Mackerel/Squid/ Butterfish [NER]	1-Year (Based on 5-Yr Average)	62-No more than 27 lethal	2-Lethal or non-lethal	2-Lethal or non-lethal	2-Lethal or non-lethal	None
Monkfish (gillnet) [NER]	1-Year (Based on 5-Yr Average)	171-No more than 69 lethal	4-Lethal or non-lethal (both trawl and gillnet)	4-Lethal or non-lethal (both trawl and gillnet)	5-Lethal or non-lethal (both trawl and gillnet)	None
Monkfish (trawl) [NER]	1-Year (Based on 5-Yr Average)	2-No more than 1 lethal				None
Multispecies (gillnet) [NER]	1-Year (Based on 5-Yr Average)	3-No more than 2 lethal	4-Lethal or non-lethal (both trawl and gillnet)	4-Lethal or non-lethal (both trawl and gillnet)	5-Lethal or non-lethal (both trawl and gillnet)	None
Multispecies (trawl) [NER]	1-Year (Based on 5-Yr Average)	43-No more than 19 lethal				None
Red Crab [NER]	1-Year	1-Lethal or non-lethal	1-Lethal or non-lethal	None	None	None
Skate (gillnet) [NER]	1-Year (Based on 5-Yr Average)	15-No more than 6 lethal	4-Lethal or non-lethal (both trawl and gillnet)	4-Lethal or non-lethal (both trawl and gillnet)	5-Lethal or non-lethal (both trawl and gillnet)	None
Skate (trawl) [NER]	1-Year (Based on 5-Yr Average)	24-No more than 11 lethal				None
Spiny Dogfish (gillnet) [NER]	1-Year (Based on 5-Yr Average)	1-Lethal or non-lethal	4-Lethal or non-lethal (both trawl and gillnet)	4-Lethal or non-lethal (both trawl and gillnet)	5-Lethal or non-lethal (both trawl and gillnet)	None
Spiny Dogfish (trawl) [NER]	1-Year (Based on 5-Yr Average)	1-Lethal or non-lethal				None
Gulf of Mexico/South Atlantic Spiny Lobster Fishery [SER]	3-Year	3-Lethal or Non-Lethal Take	1 –Lethal or Non-Lethal take for Leatherbacks, Hawksbill, and Kemp’s Ridley		3-Lethal or Non-Lethal Take	1 –Lethal or Non-Lethal take for Leatherbacks, Hawksbill, and Kemp’s Ridley

Table A4.1 con't

Fishery	ITS Authorization Period	Sea Turtle Species				
		Loggerhead	**Leatherback**	**Kemp's Ridley**	**Green**	**Hawksbill**
Summer Flounder/Scup/ Black Sea Bass (gillnet) [NER]	1-Year (Based on 5-Yr Average)	12-No more than 5 lethal	2-Lethal or non-lethal	2-Lethal or non-lethal	3-Lethal or non-lethal	None
Summer Flounder/Scup/ Black Sea Bass (trawl) [NER]	1-Year (Based on 5-Yr Average)	192-No more than 79 lethal	2-Lethal or non-lethal	2-Lethal or non-lethal	3-Lethal or non-lethal	None
Summer Flounder/Scup/ Black Sea Bass (trap/pot) [NER]	1-Year (Based on 5-Yr Average)	1-Lethal or non-lethal	2-Lethal or non-lethal	None	None	None
Tilefish [NER]	1-Year	6-No more than 3 lethal	1-Lethal or non-lethal take	None	None	None
South Atlantic Snapper-Grouper [SER]	3-Year	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	163,160-No more than 3,948 lethal	3,090-No more than 80 lethal	155,503-No more than 4,208 lethal	18,757-No more than 514 Lethal	640-All lethal
Atlantic Sea Scallop – Dredge [NER]	2-Year	929 – No more than 595 lethal	1 – Non-Lethal Take	2 - Lethal or non-lethal take	2 - Lethal or non-lethal take	None
Atlantic Sea Scallop – Trawl [NER]	1-Year	154 – No more than 20 lethal	1 – Non-Lethal Take	1 – Non-Lethal Take	1 – Non-Lethal Take	None

Table A4.2 Anticipated Incidental Take of Smalltooth Sawfish

FISHERY	3-YEAR INCIDENTAL TAKE OF SMALLTOOTH SAWFISH
ATLANTIC HMS-SHARK FISHERIES	51–No more than 1 lethal take
COASTAL MIGRATORY PELAGICS	2 Non-lethal Takes
GULF OF MEXICO/SOUTH ATLANTIC SPINY LOBSTER FISHERY	2 Non-lethal Takes
GULF OF MEXICO REEF FISH	8 Non-lethal Takes
SOUTH ATLANTIC SNAPPER-GROUPER	8 Non-lethal Takes
SOUTHEASTERN U.S. SHRIMP	240 – No More than 90 lethal takes

Table A4.3 Anticipated Incidental Take of Atlantic Sturgeon by DPS

Fishery	ITS Authorization Period	Atlantic Sturgeon DPS				
		Gulf of Maine	New York Bight	Chesapeake Bay	Carolina	South Atlantic
Southeastern U.S. Shrimp [SER]	3-Year	24-No more than 3 lethal	66-No more than 9 lethal	48-No more than 6 lethal	75-No more than 9 lethal	198-No more than 24 lethal

Appendix 5 Atlantic Sturgeon Estimated Bycatch Rates and Participants/Observer Coverage of Fisheries Known to Interact with Atlantic Sturgeon

Table A5.1 Estimated Atlantic Sturgeon (ATS) Bycatch Rates By FMP and Target Species (Source: Stein et al. 2004b)

Target Species	ATS Bycatch (lbs)	Lbs of Target Species Landed	Bycatch Rate (lbs of ATS/lbs of Target Spp.)	FMP
Red/silver hake	50	2,912	0.017170	Northeast Multispecies
Witch flounder	341	20,628	0.016531	Northeast Multispecies
Winter skate	105	7,008	0.014983	Skate
Scup	570	48,525	0.011747	Summer Flounder, Scup, and Black Sea Bass
Weakfish/bluefish	116	11,163	0.010391	Atlantic Bluefish
Goosefish (monkfish)	7,985	1,599,948	0.004984	Monkfish
Atlantic cod	1,542	323,795	0.004762	Northeast Multispecies
Winter flounder	277	108,613	0.002550	Northeast Multispecies
Summer flounder	1196	720,499	0.001660	Summer Flounder, Scup, and Black Sea Bass
Unidentified dogfish	2,107	1,320,843	0.001595	Spiny Dogfish
Spiny dogfish	3,910	4,126,878	0.000947	Spiny Dogfish
Butterfish	265	331,064	0.000800	Atlantic Mackerel/Squid/Butterfish
Bluefish	169	257,215	0.000657	Atlantic Bluefish
Yellowtail flounder	230	434,270	0.000530	Northeast Multispecies
Haddock	45	97,974	0.000459	Northeast Multispecies
Long fin squid	355	1,826,769	0.000194	Atlantic Mackerel/Squid/Butterfish
Pollock	75	717,607	0.000105	Northeast Multispecies
Unidentified squid	50	519,933	0.000096	Atlantic Mackerel/Squid/Butterfish

Note: Similar data (bycatch, number of monitored trips, and bycatch rate) were not available for all FMPs. For example, ASMFC (2007) notes that 73 percent of all Atlantic sturgeon bycatch in New England and the mid-Atlantic is attributable to the monkfish fishery, but the bycatch rate was not available, though presumed to be high, and the monkfish fishery is not included in this table.

Table A5.2 Number of Participants, Level of Observer Coverage, and Target Species of Gillnet and Trawl Fisheries That May Interact with Atlantic Sturgeon (Source: LOF 76 FR 73912; November 29, 2011).

Gear Type	Participants/ Number of Vessels	Observer Coverage	Targeted Species
Mid-Atlantic gillnet fishery	6,402	1-5% (1995-2008)	monkfish, spiny dogfish, smooth dogfish, bluefish, weakfish, menhaden, spot, croaker, striped bass, large and small coastal sharks, Spanish mackerel, king mackerel, American shad, black drum, skate spp., yellow perch, white perch, herring, scup, kingfish, spotted seatrout, and butterfish
Northeast sink gillnet fishery	3,828	1-7% (1990-2008)	Atlantic cod, haddock, pollock, yellowtail flounder, winter flounder, witch flounder, American plaice, windowpane flounder, spiny dogfish, monkfish, silver hake, red hake, white hake, ocean pout, skate spp, mackerel, redfish, and shad
North Carolina inshore gillnet fishery	2,250	Up to 10%	southern flounder, weakfish, bluefish, Atlantic croaker, striped mullet, spotted seatrout, Spanish mackerel, striped bass, spot, red drum, black drum, and shad
Northeast anchored float gillnet fishery	414	1-7% (1990-2008)	Mackerel, herring (particularly for bait), shad, and menhaden
Northeast drift gillnet fishery	414	1-7% (1990-2008)	shad, herring, mackerel, and menhaden and any residual large pelagic driftnet effort in New England
Southeast Atlantic gillnet fishery	779	n/a	king mackerel, Spanish mackerel, whiting, bluefish, pompano, spot, croaker, little tunny, bonita, jack crevalle, cobia, and striped mullet
Mid-Atlantic mid-water trawl fishery	669	0-13% (1997-2008)	Atlantic mackerel, chub mackerel, and miscellaneous other pelagic species
Mid-Atlantic bottom trawl fishery	1,388	0-18%	bluefish, croaker, monkfish, summer flounder (fluke), winter flounder, silver hake (whiting), spiny dogfish, smooth dogfish, scup, and black sea bass. The nearshore fishery targets Atlantic croaker, weakfish, butterfish, harvestfish, bluefish, menhaden, striped bass, kingfish species, and other finfish species; the deeper water fisheries target bluefish, Atlantic mackerel, Loligo squid, black sea bass, and scup
Northeast mid-water trawl fishery	887	0-20% (1997-2008)	mackerel, spiny dogfish, and silver hake
Northeast bottom trawl fishery	2,584	0.1-12% (1994-2008)	Atlantic cod, haddock, pollock, yellowtail flounder, winter flounder, witch flounder, American plaice, Atlantic halibut, redfish, windowpane flounder, summer flounder, spiny dogfish, monkfish, silver hake, red hake, white hake, ocean pout, and skate species
Southeastern Shrimp trawl fishery	4,950	<1% (1992-2007)	Brown, pink and white shrimp within estuaries, and near coastal and offshore regions. Royal Red shrimp along the deep continental slope
Note: The number of participants listed could overestimate of the number of participants interacting with Atlantic sturgeon. For example, the number of participants in gillnet fisheries includes fishermen using non-sink gillnets, which have fewer interactions with Atlantic sturgeon. Additionally, all fishery participants may not be operating at times or in areas where Atlantic sturgeon are present. Further, available bycatch data suggests sturgeon are primarily caught in waters less than 50 meters deep. Fisheries using trawl and gillnet gear in waters greater than 50 meters deep may not have Atlantic sturgeon bycatch. Estimates for Atlantic sturgeon bycatch in these fisheries is largely unavailable, as bycatch is underreported in state waters and there is limited observer coverage in fisheries potentially capturing Atlantic sturgeon in the South Atlantic (North Carolina to Florida) Federal waters.			

Appendix 6 Estimating Sea Turtle Takes in the Shark Gillnet, Bottom Longline, and Smoothhound Gillnet Fisheries

Estimating Non-Loggerhead Sea Turtle Takes in the Shark Gillnet and Bottom Longline Fisheries

Since to takes of green, leatherback, and hawksbill sea turtles were observed in the Atlantic shark gillnet fishery and from 2007-2010, Carlson and Richards (2011) did not estimate the potential number of takes for these species. Similarly, no green, leatherback, Kemp's ridley or hawksbill sea turtles captures were observed in the Atlantic shark bottom longline fishery during the same period, so Carlson and Richards (2011) did not estimate take number for these species either. To estimate the number of these species potentially taken we queried the Sea Turtle Salvage and Stranding Network's (STSSN) on-line database for the number of sea turtle strandings of each species at occurred in the Gulf of Mexico and South Atlantic from 2006-2011. The ratios from STSSN dataset were used to calculate the number of non-loggerhead species taken. Derived STSSN species abundance were 49.6 percent loggerheads, 32.8 percent green, 1.1 percent leatherbacks, 1.9 percent hawksbills and 14.7 percent Kemp's ridleys.

Estimating Non-Loggerhead Sea Turtle Takes in the Shark Bottom Longline Fishery

The total number of all sea turtles (N_{Total}) taken annually was calculated by dividing Carlson and Richards' (2011) annual estimate of loggerheads taken by Atlantic shark bottom longline gear ($N_{BLL\ Lo}$) by the loggerhead species abundance ($STSSN_{Lo}$). The number of each green ($N_{BLL\ Gr}$), leatherback ($N_{BLL\ Le}$) and hawksbill ($N_{BLL\ Hwk}$) taken was estimated by multiplying the respective species abundance (i.e., $STSSN_{Gr}$, $STSSN_{Le}$, or $STSSN_{Hwk}$) by the total number of sea turtles taken annually. Table A6.1 reports the results of those calculations.

(1) $N_{BLL\ Lo} = STSSN_{Lo} \text{ x } N_{Total}$

(2) $N_{BLL\ Lo} \text{ x } STSSN_{Lo}^{-1} = N_{Total}$

(3a) $N_{BLL\ Gr} = STSSN_{Gr} \text{ x } N_{Total}$

(3b) $N_{BLL\ Le} = STSSN_{Le} \text{ x } N_{Total}$

(3c) $N_{BLL\ Hwk} = STSSN_{Hwk} \text{ x } N_{Total}$

Estimating Non-Loggerhead Sea Turtle Takes in the Shark Gillnet Fishery

The same approach described above was used to estimate the number of non-loggerhead sea turtle takes in the Atlantic shark gillnet fishery. The number of each green ($N_{GN\ Gr}$), leatherback ($N_{GN\ Le}$) and hawksbill ($N_{GN\ Hwk}$) taken was estimated by multiplying the respective species abundance (i.e., $STSSN_{Gr}$, $STSSN_{Le}$, or $STSSN_{HWK}$) by the total number of sea turtles taken annually. Table A6.1 reports the results of those calculations. Since Carlson and Richards (2011) provided an estimate of Kemp's ridley takes we did not estimate them here.

(4) $N_{GN\ Lo} = STSSN_{Lo} \text{ x } N_{Total}$

(5) $N_{GN\ Lo} \text{ x } STSSN_{Lo}^{-1} = N_{Total}$

(6a) $N_{GN\ Gr} = STSSN_{Gr} \text{ x } N_{Total}$

(6b) $N_{GN\ Le} = STSSN_{Le} \text{ x } N_{Total}$

(6c) $N_{GN\ Hwk} = STSSN_{Hwk} \text{ x } N_{Total}$

Estimating Non-Loggerhead Sea Turtle Takes in the Smoothhound Fishery

Murray (2009b) did not estimate takes of the non-loggerhead species found in the action area. To estimate the number of Kemp's ridley, green, hawksbill, and leatherback sea turtle takes, we used the same approach described above. The ratios from STSSN dataset were used to calculate the number of non-loggerhead species taken because the ratios were similar to those reported in Murray (2009a), and the STSSN data represented a larger sample size.[74] Derived STSSN species abundance were 61.4 percent loggerheads, 15.9 percent green, 5.3 percent leatherbacks, 0.2 percent hawksbills and 17.2 percent Kemp's ridleys.

The total number of all sea turtles (N_{Total}) taken annually was calculated by dividing the high estimate of 53 loggerheads taken by the smoothhound fishery (N_{Lo}) by the loggerhead species abundance ($STSSN_{Lo}$). The number of each green (N_{Gr}), leatherback (N_{Le}) and Kemp's ridley (N_{Kr}) taken was estimated by multiplying the respective species abundance (i.e., $STSSN_{Gr}$, $STSSN_{Le}$, or $STSSN_{Kr}$) by the total number of sea turtles taken annually. Each estimate is rounded up to nearest whole number. Table A6.1 reports the results of those calculations.

$$N_{Lo} = STSSN_{Lo} \text{ x } N_{Total} \tag{7}$$
$$N_{Lo} \text{ x } STSSN_{Lo}^{-1} = N_{Total} \tag{8}$$
$$N_{Gr} = STSSN_{Gr} \text{ x } N_{Total} \tag{9a}$$
$$N_{Le} = STSSN_{Le} \text{ x } N_{Total} \tag{9b}$$
$$N_{Kr} = STSSN_{Kr} \text{ x } N_{Total} \tag{9c}$$
$$N_{Hwk} = STSSN_{Hwk} \text{ x } N_{Total} \tag{9d}$$

Table A6.1 Estimated Annual Sea Turtle Takes in the Shark Gillnet, Bottom Longline, and Smoothhound Gillnet Fisheries

Fishery	Species	Estimated Take
Atlantic Shark Bottom Longline	Loggerhead	9.9
	Green	6.6
	Leatherback	0.2
	Hawksbill	0.4
	Kemp's ridley	2.9
Atlantic Shark Gillnet	**Species**	**Estimated Take**
	Loggerhead	7.1[a]
	Green	5
	Leatherback	0.2
	Hawksbill	0.3
	Kemp's ridley	2.4[a]
	Species	**Estimated Take[b]**
Smoothhound Shark Gillnet	Loggerhead	53[c]
	Green	14
	Leatherback	5
	Hawksbill	1
	Kemp's ridley	15

[a]Estimated by Carlson and Richards (2011).
[b]These estimates includes takes in both state and federal waters.
[c]Estimated by Murray (2009b).

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[74] Murray (2009a) noted species abundances of 41 loggerheads (69.7%), 5 greens (8.4%), 5 leatherbacks (8.4%), and 8 Kemp's ridleys (13.5%). STSSN data provided species abundance estimates of 2,178 loggerheads (61.4%), 566 green (15.9%), 187 leatherbacks (5.3%), hawksbill 7 (0.2%), and 609 Kemp's ridleys (17.2%).

Appendix 7 Estimating Atlantic Sturgeon Population by DPS

The status review and listing rules correctly state that no total population estimates are currently available for any of the DPSs. However, for the purposes of conducting an effects analysis under Section 7, we believe deriving some population estimate of either the entire population or one or more life stages would be very beneficial because it provides some context against which we can compare our take estimates. Unfortunately, the information available to conduct such estimates is often lacking or incongruous. For example, the information across the DPSs ranges from actual CPUE estimates to population abundance, to spawner abundance, and even population trends from some areas, while others have no available information. Presently, the Hudson River is the most data rich system.

While the data on the Hudson River population is the most complete, significant data gaps remain regarding life stages and survival at various life stages. Thus, it is currently impossible to calculate/estimate the total number of animals from all life stages. However, we can calculate the number of adults in the river, based on the available information. We believe this approach is appropriate since our jeopardy analysis is based on the number of adult or adult equivalents likely taken by the proposed action.

Estimate of Mature Adults in the Hudson River

Kahnle et al. (2007) estimated the mean annual number of mature adults in the Hudson River population using data from surveys from 1985 to 1995, and the mean harvest by sex divided by a sex specific exploitation rate. While this data is over 20 years old, it is currently the best available published data. Kahnle et al. (2007) provided an estimated annual mean of 863 mature adults in the Hudson River, 596 males and 267 females. This number represents the total number of mature adults originating from the Hudson River that are likely to exist in a given year. Although based on older data, this maybe a conservative estimate when considering the current effects to the species because a moratorium on commercial fishing for Atlantic sturgeon was enacted in 1998, eliminating a primary threat to the species. Given that the juvenile abundance index has not significantly increased or decreased over the last approximately 30 years, we assume that the adult estimate of 863 fish is still reasonable.

Calculating a Hudson River Adult Population Intercept Rate in Commercial Fisheries

Regardless of the DPS, all Atlantic sturgeon originating in the spawning rivers are vulnerable to capture by commercial fisheries in the marine environment. The Northeast Fisheries Science Center estimated that 3,118 Atlantic sturgeon are captured in the marine environment by certain commercial gillnet and trawl fisheries in the Northeast each year (see NEFSC 2011). The estimates were based on trips monitored by Northeast Fisheries Observer Program's (NEFOP). Because NEFOP monitors trips from Cape Hatteras, North Carolina, to Maine, the bycatch estimates in NEFSC 2011 only considered animals occurring in this area. In other words, NEFSC (2011) bycatch estimate only considered the ocean population of animals large enough to be captured by fisheries, occurring from Maine to Capet Hatteras, North Carolina. This is significant because it excludes any animals that were in rivers or estuaries, and it excludes any animals south of Cape Hatteras, meaning the population estimate derived from these bycatch estimates are likely very conservative.

Using what is known about the genetic makeup of Atlantic sturgeon caught as bycatch in these fisheries (see NER-PRD 2012), we can determine how many Hudson River Atlantic sturgeon were intercepted by commercial fisheries considered in this bycatch estimate on an annual basis. For the calculation below, we state that 91 percent of the New York Bight fish are likely to have originated from the Hudson River. Of the New York Bight fish genetically sampled from NEFOP database, all were identified as Hudson River fish. However, based on other sampling in Atlantic coast waters where commercial fisheries operate, we anticipate that New York Bight fish consist of 91 percent Hudson River origin and 9 percent Delaware River origin in the marine environment (based on information presented in Wirgin, in prep, and by Wirgin and King 2011). We believe the underrepresentation in the NEFOP database of fish originating in the Delaware River is a reflection of a small sample size[75] and think it is reasonable to use the nine percent cited elsewhere.

NEFOP data indicate approximately 75 percent of the captured fish observed were subadults and 25 percent were adults based on length (n=726; subadults less than 150cm, adults 150cm or longer). We used the information available regarding number of bycaught animals each year, the likely genetic make-up of Atlantic sturgeon by DPS, and the ratio of adults to subadults, to estimate the likely number of adult Atlantic sturgeon from the Hudson River captured in commercial fisheries each year, on average. This calculation is illustrated below in Figure A7.1.

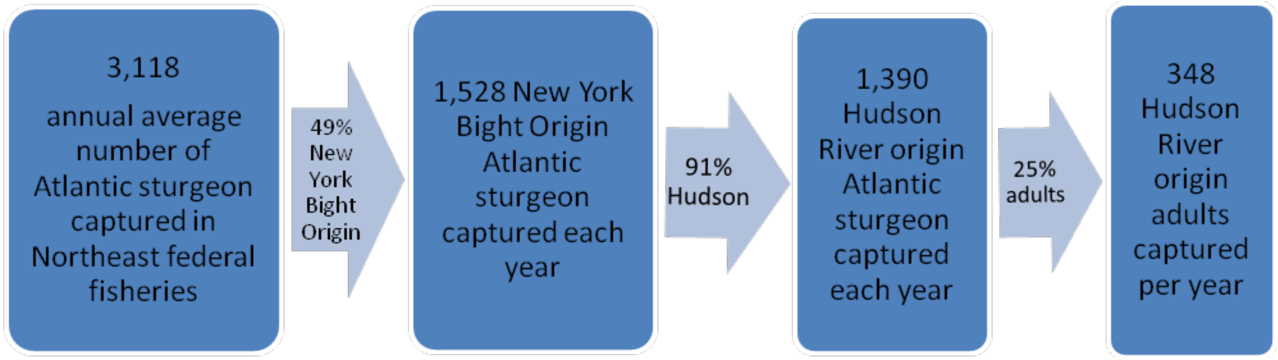

Figure A7.1 Estimate of Adult Atlantic Sturgeon Take from the Hudson River Per Year

Based on the estimated number of Hudson River origin Atlantic sturgeon adults taken as bycatch on average annually, we can calculate what percentage of the total estimated number of Hudson River origin Atlantic sturgeon adults these represent (348/863 = 40%). This provides an average annual intercept rate for Hudson River adult Atlantic sturgeon in commercial fisheries.

NEFSC (2011) estimates Atlantic sturgeon bycatch across both trawl and gillnet fisheries targeting a variety of species. Since Atlantic sturgeon mix extensively throughout their marine range, and because trawls and gillnet gears are fished in essentially the same ways throughout their range, we believe it is reasonable to assume the catchability of fish originating in any river

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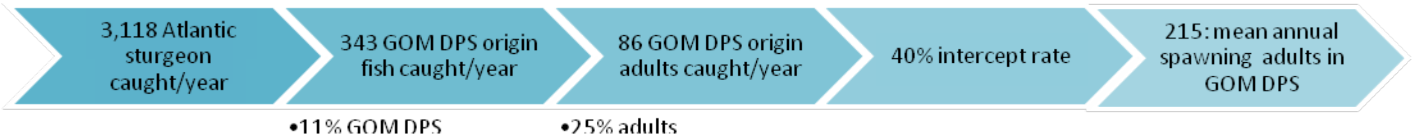
[75] Genetic sampling was only conducted on 84 of the 726 animals observed captured by NEFOP from 2006-2010.

in any DPS will be similar to those intercepted by the observed commercial fisheries considered in the NEFSC bycatch report. Under that assumption, we used this intercept rate to estimate the number of Atlantic sturgeon in the other rivers of origin. This type of back calculation allows us to use the information we have for the Hudson River to fill in significant data gaps present for the other rivers.

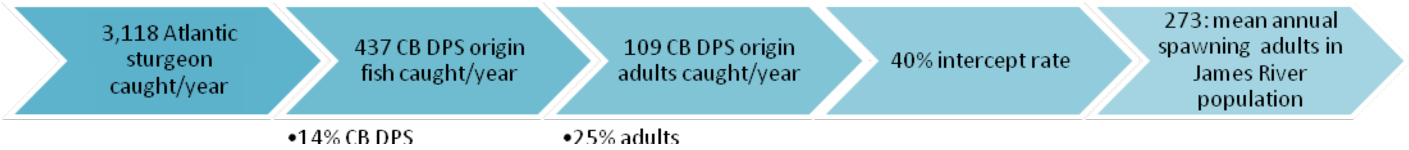
Using the Hudson River Intercept Rate to Estimate the Number of Adults in Other DPSs

Using the Hudson River intercept rate and the number of bycaught sturgeon estimated in NEFSC bycatch report (NEFSC 2011), we estimated the number of adults in spawning rivers other than the Hudson River that are of a size vulnerable to capture in commercial fisheries. We used this approach to calculate an annual average of the number of spawning adult populations for the Gulf of Maine, New York Bight, Chesapeake Bay and South Atlantic DPSs. Figures A7.2 and A7.3 illustrates these calculations.

Gulf of Maine DPS:



Chesapeake Bay DPS:



South Atlantic DPS:

New York Bight DPS (Delaware River Only):

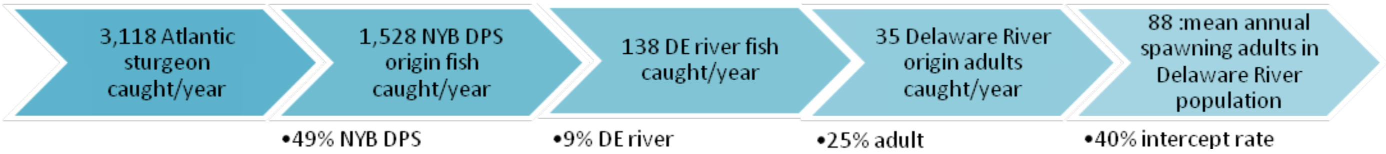


Figure A7.2 Estimated Number of Mean Annual Spawning Adults for Each DPS.

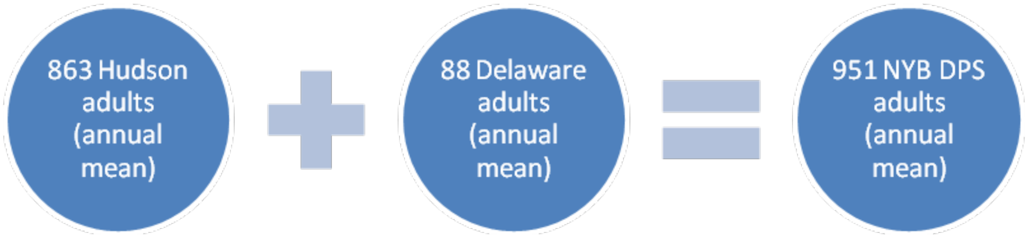


Figure A7.3 Estimated Number of Mean Annual Spawning Adults in the NYB DPS

Estimating the Number of Adults in the Carolina DPS

Carolina DPS origin fish were only very rarely detected in the NEFOP observer program or in the other genetics data sets. For this reason, we were unable to use our previous methodology to calculate an estimate of the number of mature adults in the Carolina DPS. However, using the available information on the decline in abundance of animals in the Carolina DPS relative to their historical numbers we can reasonably estimate the potential current population. Armstrong and Hightower (2002) and Secor (2002) estimated that between 7,200 and 10,500 adult females likely existed in North Carolina prior to 1890. The populations in the Carolina DPS have declined by 97 percent from their historical abundance (77 FR 5914: February 6, 2012). Based on this level of decline, approximately 216-315 adult females would now exist in the five known spawning rivers of North Carolina.[76]

Schueller (2008) in Moyer et al. (2012) reported a male to female sex ratio of approximately 3:1 in the Altamaha, based on animals captured during the 2006 and 2007 spawning runs. No sex ratios specific to rivers in North Carolina exist. Using this sex ratio and our estimates of adult females potentially in North Carolina now, we anticipate 864-1,260 spawning adults may exist in North Carolina.[77]

The information from Kahnle et al. (2007) suggests a male to female sex ratio of 2:1. Using this sex ratio, we would anticipate 648-945 spawning adults in North Carolina.[78] We chose to use the population estimates derived from using this sex ratio because there are no sex ratio estimates for North Carolina rivers and this approach is more conservative toward the species. We will also act conservatively and use the lower population number (i.e., 648 adult spawners) from the estimate derived using that equal sex ratio. Therefore, we anticipate there are potentially 648 adult spawners in the rivers off North Carolina.

Secor (2002) also estimated that 8,000 adult females were likely present in South Carolina prior to 1890. A portion of the Atlantic sturgeon originating from South Carolina belong to the Carolina DPS and a portion belong to the South Atlantic DPS. The ASSRT (2007) determined

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[76] A 97% decline in abundance means only 3% of historical population remains; 7,200-10,500 historic female spawners in North Carolina x 3% remaining = 216-315 female spawners remaining off North Carolina.

[77] A male to female sex ratio of 3:1 = 3 males for every 1 female; 216 females x 3 males/female = 648 males; 648 males + 216 females = 864 total adults; 315 females x 3 males/female = 945 males; 945 males + 315 females = 1,260 total adults

[78] A male to female sex ratio of 2:1 = 2 male for every 1 female; 216 females x 2 males/female = 432 males; 432 males + 216 females = 648 total adults; 315 females x 2 males/female = 630 males; 630 males + 315 females = 945 total adults

the Altamaha (located in Georgia) had the largest Atlantic spawning population in the Southeast with 343 adult spawners annually. The remaining rivers in the South Atlantic DPS are estimated to be less than one percent of their historical abundance. If we conservatively assume that only one percent of Secor's (2002) estimated 8,000 adult females remain, we anticipate 80 adult females exist in South Carolina Rivers.[79]

If we use the sex ratio estimated for the Altamaha River [i.e., 3:1 male to female; Schueller (2008) in Moyer et al. (2012)] we would anticipate up to 320 annual spawning adults in South Carolina Rivers.[80] If we use the 2:1 sex ratio described in Kahnle et al. (2007), we estimate 240 annual spawning adults in South Carolina Rivers.[81] Based on the borders of the Carolina and South Atlantic DPS, approximately half of the Atlantic sturgeon from spawning rivers in South Carolina belong to the Carolina DPS. This would indicate that of the 240 spawning adults potentially in South Carolina, 120 could be classified as Carolina DPS fish. For the reasons mentioned in our discussion of North Carolina spawners, we have decided to act conservatively and use the low end of the estimate derived using a 2:1 sex ratio.

Based on these assumptions and estimates, we anticipate 768 spawning adults exist in the Carolina DPS.[82] We summarize our estimates of the number of spawning adults in each DPS.

Table A7.1: Summary of Adult Population Estimates by DPS

DPS	Estimated Mean Annual Number of Spawning Adults
Gulf of Maine	215
New York Bight	951
Chesapeake Bay	273
Carolina	768*
South Atlantic	390
*The number of spawners in the Carolina DPS were estimated using a different approach than the other DPSs	

As explained previously, the NEFOP observer information indicates that 25 percent of bycaught Atlantic sturgeon are adults and the rest are subadults. We assume the encounter rate of adults and subadults is proportional to the number of individuals present. Based on this ratio (1 adult:3 subadults), we anticipate that there are at least three times as many subadults in the marine environment as adults. Applying this ratio, we estimated the number of subadults in each DPS likely to be of a size vulnerable to capture in commercial fisheries (Table A7.2).

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[79] A 99% decline in abundance means only 1% of historical population remains; 8,000 historic female spawners in South Carolina x 1% remaining = 80 female spawners remaining off South Carolina.

[80] A male to female sex ratio of 3:1 = 3 males for every 1 female; 80 females x 3 males/female = 240 males; 240 males + 80 females = 320 total adults

[81] A male to female sex ratio of 2:1 = 2 male for every 1 female; 80 females x 2 males/female = 160 males; 160 males + 80 females = 240 total adults

[82] 120 spawning adults from South Carolina + 648 spawning adults from North Carolina = 768 spawning adults in the entire Carolina DPS.

Table A7.2: Estimates of Subadults at a Size Vulnerable to Commercial Fisheries

DPS	Subadults at Size Vulnerable to Capture in Commercial Fisheries
Gulf of Maine	645
New York Bight	2,853
Chesapeake Bay	825
Carolina	2,304
South Atlantic	1,170

Conclusion

This approach to Atlantic sturgeon population estimation has been internally reviewed and is believed to be conservative. In particular, the NEFSC commented that an intercept rate of 40 percent seemed quite high, citing mark and recapture rates reported by Atlantic sturgeon researchers and USFWS staff. While we have no reason to dispute the recapture rates reported by researchers and USFWS staff, we believe it is prudent to use the population estimates based on a 40 percent intercept rate. We believe this rate is reasonable because the sheer amount of fishing effort and the larger geographic scope over which commercial fisheries operate, makes them more likely to capture Atlantic sturgeon than an individual researcher.

The NEFSC is currently evaluating a number of additional models and data sources to estimate Atlantic sturgeon populations. Those models and final estimates are not yet available. Based on preliminary information from the NEFSC, our estimate of approximately 10,000 individuals at a size vulnerable to capture in commercial fisheries is near the lower end of NEFSC’s most conservative estimate (i.e., lowest population) preliminary estimates.

Using the population estimates we derived from the 40 percent intercept rate is conservative toward the species. When we lack information or the information we have is not definitive, the ESA requires us to use a non-arbitrary conservative approach erring on the side of the species to estimate effects and conduct a jeopardy analysis. Therefore, since we believe our population estimates using the 40 percent intercept rate are conservative, we prefer to base our jeopardy analysis on those numbers, rather than to assume a higher population. If we determine the proposed action is not likely to jeopardize any DPS of Atlantic sturgeon assuming lower populations, then we feel confident we would not arrive at a jeopardy conclusion if future population modeling estimates indicate populations are higher than we estimated.