Endangered Species Act - Section 7 Consultation
Biological Opinion

Action Agency: National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS), Office of Sustainable Fisheries, Highly Migratory Species Management Division

Activity: The Continued Authorization of Shark Fisheries (Commercial Shark Bottom Longline, Commercial Shark Gillnet and Recreational Shark Handgear Fisheries) as Managed under the Consolidated Fishery Management Plan for Atlantic Tunas, Swordfish, and Sharks (Consolidated HMS FMP), including Amendment 2 to the Consolidated HMS FMP (F/SER/2007/05044)

Consulting Agency: NOAA, NMFS, SERO, Protected Resources Division

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Introduction

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended, (16 U.S.C. 1531 et seq.) requires each federal agency to ensure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species. When the action of a federal agency may affect a protected species, that agency is required to consult with either NMFS or the U.S. Fish and Wildlife Service, depending upon the protected species that may be affected. For actions described in this document, NMFS has dual responsibilities, under the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (MSA) (16 U.S.C. 1801 et seq.) and the ESA; therefore, the agency must conduct intra-service consultation. For the purposes of this opinion, the action agency is NMFS, Highly Migratory Species Management Division of the Office of Sustainable Fisheries (F/SF1) and the consulting agency is NMFS, Protected Resources Division of the Southeast Regional Office (F/SER3).

This document represents NMFS' biological opinion (opinion) based on our review of the effects on ESA-listed species that would result from the continued authorization of directed shark fisheries (i.e., commercial bottom longline, commercial gillnet, and recreational hand gear) as managed under the Consolidated HMS FMP, including proposed changes to management and regulations under Amendment 2 to the Consolidated HMS FMP.

This opinion is based on information provided in the Consolidated HMS FMP (NMFS 2006a), Draft Amendment 2 to the Consolidated HMS FMP (NMFS 2007a), ESA recovery plans, the most current stock assessment reports and 5-year status reviews, and observer and logbook (and associated analyses) fishery effort and protected species interactions data pertaining to Atlantic shark fisheries.

1.0 Consultation History

1.1 Previous consultations

For two decades, fisheries targeting highly migratory species (HMS) have undergone many formal and informal section 7 consultations. These consultations, which are summarized in the June 30, 2000, and June 14, 2001, HMS opinions have collectively addressed all components of Atlantic HMS fisheries: the fisheries for tuna, swordfish, sharks, and billfish (recreational only) in the western Atlantic, Caribbean, and Gulf of Mexico, including the pelagic driftnet, gillnet, pelagic longline, bottom longline, purse seine, and hand gear (rod-and-reel, handline, and harpoon) fisheries.

Consultations addressing Atlantic shark fisheries include:

- A September 7, 1989, informal consultation on the initial draft Secretarial Shark FMP.
- A September 23, 1991, formal consultation on fishing conducted under the Final Secretarial Shark FMP of 1991, which concluded with a no jeopardy opinion.
- A February 2, 1996, reinitiated formal consultation on the drift gillnet components of both the directed swordfish fishery and the shark fishery, which concluded with a no jeopardy opinion.

- A May 29, 1997, formal consultation on all components of the fishery (except billfish), which concluded with a jeopardy opinion; the jeopardy conclusion was primarily based on concerns regarding future lethal take of northern right whales in the Northeast swordfish driftnet fishery, as well as in the Southeast shark gillnet fishery. Reasonable and prudent alternatives (RPAs) were implemented to avoid jeopardy.
- A July 10, 1998, informal consultation, which amended the May 29, 1997, opinion by clarifying in the incidental take statement the percent observer coverage needed in the shark gillnet fishery outside of right whale season in the Southeast.
- An April 23, 1999, formal consultation on the proposed rule to implement the HMS FMP, which concluded with a no jeopardy opinion, assuming the reasonable and prudent alternative to avoid jeopardizing the continued existence of the right whale in the previous (May 29, 1997) jeopardy opinion was fully implemented. This opinion also concluded that HMS fisheries were likely to lethally and non-lethally take large numbers of threatened and endangered sea turtles and identified several reasonable and prudent measures with terms and conditions to minimize the effects of the anticipated take.
- A June 30, 2000, formal consultation on: (1) A proposed regulatory amendment to the HMS FMP, intended to reduce bycatch, and (2) data indicating that the pelagic longline component of the fishery exceeded its levels for leatherback and loggerhead sea turtle takes authorized in the April 23, 1999, opinion. The resulting opinion concluded jeopardy for the Atlantic pelagic longline component of the fishery because of its high level of leatherback and loggerhead takes, both lethal and non-lethal. The opinion specified a reasonable and prudent alternative (RPA) which would allow the continuation of the pelagic longline fishery without jeopardizing the continued existence of loggerhead and leatherback sea turtles. All other fishery components, including the Atlantic bottom longline and gillnet shark fisheries, were found not likely to jeopardize the continued existence of any ESA-listed species.
- A June 14, 2001, formal consultation on the effects of the continued authorization of fisheries under the HMS FMP and the Billfish FMP. In addition to new information on sea turtle interactions and sea turtle status, the consultation considered the effects of several regulatory changes: implementation of the bycatch reduction regulatory amendment with an August 1, 2000, final rule (65 FR 47213); the October 13, 2000, emergency rule on the pelagic longline fishery that temporarily closed an area off the Grand Banks (65 FR 60889); and the interim final rule requiring pelagic longline vessels to carry and use line clippers and dip nets (66 FR 17370, March 30, 2001). The resulting opinion concluded that the continued prosecution of the pelagic longline fishery was likely to jeopardize the continued existence of loggerhead and leatherback sea turtles. The opinion specified an RPA that would allow the continuation of the pelagic longline fishery without jeopardizing the continued existence of loggerhead and leatherback sea turtles. All other HMS fisheries, including the Atlantic shark

bottom longline and gillnet fisheries, were found not likely to jeopardize the continued existence of any ESA-listed species.

- A December 19, 2002, informal consultation on an emergency rule (67 FR 78990, December 27, 2002) to implement management measures in the Atlantic shark fisheries consistent with the 2002 stock assessments.
- An October 29, 2003, formal consultation on the effects of continued operation of Atlantic shark fisheries (commercial shark bottom logline and drift gillnet fisheries and recreational shark fisheries) under the HMS FMP and the proposed rule for Draft Amendment 1 to the HMS FMP (68 FR 45196, August 1, 2003), which concluded with a no jeopardy opinion.

The earlier consultations addressing Atlantic shark fisheries were primarily concerned with the impact of drift gillnet gear on endangered large whales (particularly Northern right whales), offshore cetaceans, and sea turtles. More recent consultations on Atlantic shark fisheries have focused on sea turtle takes in both shark bottom longline and gillnet gear. Terms and conditions implemented over the years include gear regulations, monitoring requirements, implementation of observer programs to document incidental take, regulations to reduce/eliminate mortalities in areas and season where the takes of threatened or endangered species are likely to occur, and outreach efforts including workshops with shark fishermen to provide information on sea turtle handling and resuscitation guidelines.

1.2 Present Consultation

In a March 12, 2007, memorandum, F/SF1 initiated informal consultation with F/SER3, when they requested a consultation assessment on a Pre-Draft document for Amendment 2 to the Consolidated HMS FMP. Based on the results of the 2005 Canadian porbeagle shark stock assessment, the 2006 dusky shark stock assessment, and the 2005/2006 large coastal sharks (LCS) stock assessment, F/SF1 determined a number of shark stocks and/or species are overfished and an amendment to the HMS FMP was needed to implement management measures to rebuild overfished stocks and prevent overfishing as mandated by the Magnuson-Stevens Act. The Pre-Draft of Amendment 2 to the Consolidated HMS FMP included a broad range of new management measures to rebuild sandbar, dusky, and porbeagle shark populations, to provide an opportunity for the sustainable harvest of blacktip sharks, particularly in the Gulf of Mexico where the stock has been declared rebuilt; and to end and/or prevent overfishing of Atlantic sharks, based on the recent stock assessments. Management tools considered included effort controls, quota and species complexes, retention limits, gear restrictions, changes in fishing regions and seasons, time and area closures, and monitoring and compliance.

F/SER3 corresponded with F/SF1 several times via conference calls to discuss the developing Amendment and its consultation assessment. Although significant changes to shark management measures were anticipated, the range of the alternatives under each action considered in the Pre-draft document was too broad (e.g., from status quo to complete gear closures) to make an effect determination. However, based on new information acquired since the last consultation, F/SER3 informed F/SF1 that reinitiating consultation on the continued authorization of shark fishing as managed under the Consolidated HMS FMP, including the proposed changes to management and regulations under Amendment 2, would likely be necessary. New information included regulatory changes in required sea turtle release gears and handling protocols to reduce accidental capture and harm to sea turtles, based on field-testing of equipment, user feedback, and product design updates resulting from experiments in the Northeast Distant statistical reporting area; updated post-release sea turtle mortality criteria; and 2004-2006 observer data, leading to better characterization of the shark bottom longline and gillnet fisheries and to an improved understanding of interactions between these fisheries and protected species.

On July 30, 2007, F/SF1 sent a memorandum to F/SER3 requesting consideration of the proposed rule (72 FR 41391, July 27, 2007) and Draft Amendment 2 to the Consolidated HMS FMP. F/SF1 concluded the measures in the proposed rule were not expected to have adverse impacts on protected species. They indicated none of the preferred alternatives are expected to alter fishing practices, techniques, or effort in any way that would increase interactions with protected species. They anticipated shark fishing effort would decline significantly due to reduced shark quota and retention limits, and this decline in effort would decrease protected species interactions. Based on previous discussions with F/SER3, F/SF1 acknowledged that a new opinion would be necessary.

In a September 6, 2007, memorandum, F/SF1 also informed F/SER3 that the smalltooth sawfish take authorized in the 2003 opinion had been exceeded. On July 23, 2007, NMFS observed a lethal smalltooth sawfish take in bottom longline gear in the South Atlantic region.

Reinitiation Analysis

As provided in 50 CFR 402.16, reinitiation of formal consultation is required when: (1) the amount or extent of the incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the agency action is subsequently modified in a manner causing an effect to the listed species or critical habitat not previously considered; or (4) if a new species is listed or critical habitat designated that may be affected by the identified action. F/SER3 reviewed Amendment 2 and the 2003 shark opinion to determine if the proposed action met any of these reinitiation criteria.

(1) *Has the amount or extent of incidental take been exceeded?*
Yes. The 2003 shark opinion authorized the take of sea turtles and smalltooth sawfish in bottom longline and in drift gillnet gear. The 5-year take estimates by gear type in the ITS for the 2003 shark opinion are provided in Table 1.1.

Incidental take authorized for gillnet gear was specified only for drift gillnets. This was because: (1) Sink gillnets were not known to be used in this fishery so were not analyzed or authorized take, and (2) strike gillnets were analyzed in the opinion, but were not expected to result in any adverse effects on listed species. However, through our shark gillnet observer program, we have discovered that: (1) sink gillnets are used to target sharks and do occasionally interact with sea turtles, and (2) sea turtles are also occasionally caught in strike-net sets. Additionally, although the total number of estimated sea turtle and smalltooth sawfish takes in bottom longline gear is below the authorized level, incidental take mortality for smalltooth sawfish has been exceeded.

Table 1.1 Authorized Take in the 2003 HMS Shark Opinion

Species	Bottom Longline		Drift Gillnet Gear	
	Total Takes (5-yr)	Mortalities (5-yr)	Total Takes (5-yr)	Mortalities (5-yr)
Loggerhead	1360	754	10	1
Leatherback	150	85	22	3
Green, Kemp's ridley, or Hawksbill	30 (I/C)	5 (E/S)	0	0
Smalltooth Sawfish	260	0	1	0

I/C these estimates are for all species in combination, not each species individually.
E/S these estimates are for each species individually.

(2) *Is there new information that reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not previously considered?*
Yes. New information indicates the effects of post-release mortality are different from those used in the 2003 opinion. In February 2001, NMFS used the best data available at the time to establish a policy and criteria for estimating sea turtle survival and mortality following interactions with longline fishing gear (NMFS SEFSC 2001a; see Table 4.3.1). These criteria were applied in the 2003 shark opinion. In April 2005, the Office of Protected Resources (OPR) finalized revisions to the post-release mortality criteria.

(3) *Has the agency action been subsequently modified in a manner that causes an effect to the listed species or critical habitat not previously considered?*
Possibly. Incidental takes are expected to continue to occur under the proposed action. However, anticipated effort reductions in the fishery may result in reducing the level of incidental takes. Therefore, the changes to the agency action proposed in Amendment 2 to the Consolidated HMS FMP may result in a decreased effect on listed species that was not previously considered.

(4) *Has a new species been listed or critical habitat designated that may be affected by the identified action?*
No. Since the last consultation on Atlantic shark fisheries was completed, two *Acropora* species were listed, but these species are extremely unlikely to be co-located with gear targeting sharks (see Section 3.1 details our rationale for this finding).

F/SER3 determined through its reinitiation analysis that at least two of the four factors requiring reinitiation of consultation had been met. However, additional data were needed before the consultation could be initiated. Conference calls between F/SER3 and F/SF1were held both before and after publication of the proposed rule to discuss the developing rulemaking alternatives, timeline, and the data needed for reinitiation. On September 13, 2007, F/SER3 informed F/SF1 that shark gillnet protected species incidental take estimates were the only remaining data needed before consultation could be initiated. However, discussions with F/SF1 at the beginning of the comment period on Draft Amendment 2 indicated there was little public support for the preferred alternative and that a substantial change in the proposed action for the final rule and Amendment was possible. Therefore, F/SER3 also requested notification of the proposed action to be analyzed in the new opinion. On October 30, 2007, F/SER3 requested additional data: A synopsis of circle hook and J-hook data relevant to the shark bottom longline fishery that had been collected over the past several years, but had not been compiled and assessed; and protected species take estimates in shark bottom longline for 2006. These data were necessary so that the opinion would reflect the best available information.

The additional information needed to reinitiate consultation was received during November and December 2007. On November 9, 2007, F/SER3 received a report on the estimated sea turtle takes for the shark gillnet fishery. On November 28, 2007, F/SER3 received the requested information on circle hook data. On December 19, 2007, F/SER3 received the 2006 estimated sea turtle takes for the shark bottom longline fishery. On December 20, 2007, F/SF1 provided F/SER3 with modifications to the proposed action to be considered in the opinion. With receipt of the subject proposed action, formal consultation was reinitiated.

Scope of the Present Consultation

This opinion considers the effects of F/SF1's continued authorization of directed Atlantic shark fisheries regulated under the Consolidated HMS FMP, as proposed to be amended. The management unit covered under the Consolidated HMS FMP consists of tunas, swordfish, billfish, and shark species. However, Amendment 2 pertains only to the management of sharks and regulations of shark fishing with commercial bottom longlines, commercial gillnets, and recreational handgear. There are no changes proposed that would affect other species or appreciably alter fishing effort or distribution of other gear types managed under the Consolidated HMS FMP and analyzed under other HMS biological opinions (i.e., the June 4, 2004 HMS pelagic longline opinion and the June 2001, HMS opinion for all other gear types) for their effects on listed species. For this reason, this reinitiated consultation will only address the continued authorization of the commercial bottom longline and gillnet shark fisheries and the recreational shark fishery under the Consolidated HMS FMP, including Amendment 2.

The Consolidated HMS FMP authorizes the retention of a limited number of incidentally-caught LCS and small coastal sharks (SCS) by fishing vessels in other fisheries (i.e., targeting non-shark species). Although the proposed amendment to the Consolidated HMS FMP does propose changes to the incidental catch allowances in other fisheries targeting other species, they are not expected to significantly affect fishing effort or fishing patterns in other non-shark fisheries. Therefore, those other directed fisheries are not considered part of the proposed action - they are not interrelated or interdependent on the HMS authorization - as they would still occur but for the Consolidated HMS FMP. The effects of other directed fisheries which incidentally catch sharks have been analyzed and will continue to be managed in other biological opinions for the respective directed fisheries.

2.0 Description of the Proposed Action

NMFS proposes to amend the commercial and recreational regulations governing shark fisheries in the Atlantic, Gulf of Mexico, and Caribbean Sea. Based on the results of the 2005 Canadian porbeagle shark stock assessment, the 2006 dusky shark stock assessment, and the 2005/2006 LCS stock assessment, NMFS has determined that a number of sharks are overfished and an amendment to the 2006 Consolidated HMS FMP is needed to meet the objectives of the MSA. Significant reductions in quotas are necessary to prevent overfishing and rebuild overfished stocks. F/SF1 has indicated necessary reductions effectively preclude operation of the shark fishery as it has been prosecuted in past years. The proposed action would provide for some fishing of sharks consistent with the stock assessments and would allow for continued collection of data needed for stock assessments and evaluation of conservation and management measures. Consistent with the Consolidated HMS FMP objectives, the MSA, and other relevant federal laws, the specific objectives of the proposed amendment are to: (1) implement rebuilding plans for sandbar, dusky, and porbeagle sharks; (2) provide an opportunity for the sustainable harvest of blacktip and other sharks, as appropriate; (3) prevent overfishing of Atlantic sharks; (4) analyze bottom longline time/area closures and take necessary action to maintain or modify the closures, as appropriate; and (5) improve, to the extent practicable, data collections or data collection programs.

The proposed action would establish a small research fishery that would harvest the entire available sandbar quota on an annual basis. Vessels inside the research fishery could also retain non-sandbar LCS, SCS, and pelagic sharks. Vessels with commercial shark permits outside of the research fishery could only retain non-sandbar LCS as well as SCS and pelagic sharks. Vessel participation in the research fishery would be conditioned on vessels meeting specific criteria designed to meet research objectives while allowing fishermen to earn revenue from selling sandbar and other sharks that are caught under the purview of this fishery. These criteria may include, but are not limited to: possession of a commercial shark permit, seasonal flexibility with regard to trips targeting sandbar sharks, willingness and ability to take an observer on 100 percent of fishing trips and collect biological samples from landed and released sharks, and ability to participate in the program for at least one year. Vessels not participating in the research program would still be authorized to land non-sandbar LCS, SCS, and pelagic sharks subject to the retention limits described below. Only vessels participating in the research fishery could land sandbar sharks.

The proposed management measures intended to meet the listed objectives are grouped into seven key topics: quotas/species complexes, commercial retention limits, time/area closures, reporting requirements, seasons, regions, and recreational measures.

Specific management measures proposed under each key topic include:

(1) Quotas/Species Complexes

Base quotas: Sandbar research quota = 116.6 mt dw; non-sandbar LCS research quota = 50 mt dw; Gulf of Mexico non-sandbar LCS = 439.5 mt dw; Atlantic non-sandbar LCS = 188.3 mt dw; SCS = 454 mt dw; Pelagic Sharks (Other than Blue and Porbeagle Sharks) = 488 mt dw; Blue Sharks = 273 mt dw; Porbeagle Sharks = 1.7 mt dw; and Display and Scientific Research = 60 mt ww (Sandbar = 2.8 mt ww (2 mt dw)); and all other shark species (except dusky sharks) = 57.2 mt ww (41.2 mt dw).

Adjusted quota process: Overharvests would be removed from the next season's quota or over multiple years (i.e., 5 years) depending on the level of overharvest. Underharvests for species whose status is not unknown, overfished, or experiencing overfishing would be transferred to the next season's quota, up to 50 percent of the base quota. For species/complexes whose status is overfished, unknown, or experiencing overfishing; underharvests would not be transferred to the next season's quota.

NMFS would implement adjusted annual quotas for 5 years (through the end of 2012) for sandbar sharks and non-sandbar LCS based on overharvests of the LCS complex during 2007. These adjusted quotas are as follows: Sandbar research quota = 87.9 mt dw; non-sandbar LCS research quota = 37.5 mt dw; Gulf of Mexico non-sandbar LCS = 390.5 mt dw; and Atlantic non-sandbar LCS = 187.8 mt dw. These quotas may be reduced further, if necessary, depending on future overharvests in the fishery.

(2) Time/Area Closures

Maintain status quo time area closures and close the eight time/area closures recommended by the SAFMC.

(3) Retention Limits

No sandbar sharks may be landed outside of the research program.

Trip limit for sandbar and non-sandbar LCS (combined) for vessels participating in research program would vary depending on research criteria and data needs.

Under the base non-sandbar LCS quota, 36 non-sandbar LCS/vessel/trip for directed permit holders and 3 non-sandbar LCS/vessel/trip for incidental permit holders outside the shark research program; Under the adjusted non-sandbar LCS quotas, 33 non-sandbar LCS/vessel/trip for directed permit holders and 3 non-sandbar

LCS/vessel/trip for incidental permit holders (from 2008-2012; see above) outside the shark research program.

No trip limit for SCS or pelagic sharks for directed permit holders; 16 SCS and pelagic sharks combined for incidental permit holders.

All sharks must be landed with all fins naturally attached.

(4) Reporting

Dealer reports must be received by NMFS no later than 10 days after each reporting period (i.e., 25th and 10th of each month).

There would be 100 percent observer coverage for vessels participating in sandbar shark research program.

Other logbook and vessel observer requirements would be maintained for vessels outside the research program.

Landings from dealer reports and/or observer reports from outside the research fishery would be used to proportion unclassified sharks according to the sandbar, non-sandbar LCS, SCS, and pelagic shark quotas.

(5) Seasons

There would be one commercial season opening on January 1 of each year.

Sandbar, non-sandbar LCS, SCS, and pelagic sharks would close with a five day notice when landings of each species/complex reach 80% of their respective quotas; NMFS would send out e-mail notices and other outreach materials to notify the public of the fishery closure when the notice files with the Federal Register. The fishery would close five days after the filing of the notice.

(6) Regions

Non-sandbar LCS: Two regions: an Atlantic (South Atlantic and North Atlantic combined) and Gulf of Mexico region; Sandbar: One region; SCS: One region; Pelagic sharks: One region.

(7) Recreational Management Measures

Recreational fishermen could land tiger sharks and non-ridgeback LCS (blacktip, spinner, bull, lemon, nurse, great hammerhead, smooth hammerhead, and scalloped hammerhead sharks). In addition, they can land SCS (bonnethead, Atlantic sharpnose, finetooth and blacknose sharks), and Pelagic sharks (shortfin mako, common thresher, oceanic whitetip, blue, and porbeagle sharks).

Recreational anglers would not be allowed to retain sandbar or silky sharks (and any other prohibited species).

Possession limit: 1 >54" fork length shark per vessel per trip, also 1 sharpnose and 1 bonnethead per person with no minimum size.

In addition to the proposed management measures listed above, NMFS proposes to take additional administrative actions to: (1) Allow fishermen to remove hooks from smalltooth sawfish [§635.21(d)(3)] based on a March 23, 2007, memorandum from SERO changing this requirement in the 2003 shark opinion; (2) require stock assessments at least once every 5 years; (3) allow for the release of the annual Stock Assessment and Fishery Evaluation report by fall of each year; and (5) clarify various existing regulations, for example, stating that only the first receiver needs a shark dealer permit and that shark dealer reports must be species-specific.

An overview of existing and proposed Atlantic shark management and regulations and the proposed management changes are provided in Section 2.1. A description of the fishery is provided below in Section 2.2. A summary of the overall characteristics of the fishery authorized under the Consolidated HMS FMP, which are relevant to the analysis of its potential effects on threatened and endangered species, are included. Further details can be found in the Draft Amendment (NMFS 2007a) and associated proposed rule (72 FR 41392), the Consolidated FMP (NMFS 2006a), and previous HMS FMP amendments available on F/SF1's website (http://www.nmfs.noaa.gov/sfa/hms/).

2.1 Atlantic Shark Management and Regulations

Atlantic shark fisheries are managed by NMFS under the authority of the MSA. The MSA is the principle federal statute governing the management of U.S. marine fisheries. Under the MSA, NMFS must, consistent with the National Standards, manage fisheries to maintain optimum yield by rebuilding overfished fisheries and preventing overfishing. 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.

Atlantic shark fisheries are managed directly by the Secretary of Commerce, who designated that responsibility to NMFS. Within NMFS, F/SF1 is the lead office 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 MSA or the Atlantic Tunas Convention Act.

In 1993, the Secretary of Commerce, through 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 theses 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 Draft Amendment 2 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 fisheries' impacts on MMPA and ESA-listed species. Major changes to shark management and regulations were included in the 1999 FMP and Amendment 1 to the FMP. The 1999 HMS FMP replaced both the 1993 Atlantic Shark FMP and the Atlantic Swordfish FMP and was the first FMP for Atlantic tunas. As part of the 1999 FMP, the regulations for all Atlantic HMS were consolidated into one part of the Code of Federal Regulations, 50 CFR Part 635, but Atlantic billfish were still 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 72 species of Atlantic sharks managed by NMFS, presently divided into four species groups for management: LCS, SCS, pelagic sharks, and prohibited sharks. 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. The remaining 33 species are included for data collection purposes only.

A summary of the primary management measures and regulations currently in place (i.e., status quo) and those proposed for future management under Amendment 2 to the Consolidated HMS FMP is provided in Table 2.1(a) and (b). The complete set of status quo 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) and species restrictions (i.e., possession of 19 species of sharks is prohibited). Both commercial and recreational fishermen are subject to monitoring and reporting requirements. Monitoring and reporting are important for evaluating the efficacy of fishery regulations in meeting the goals and objectives of the FMP and other applicable laws (for further discussion see Section 2.1.1). 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 2.1.2). A number of regulations are also in place to minimize or prevent adverse effects from these fisheries on ESA- and MMPA-listed species (Section 2.1.3).

Table 2.1(a) Commercial Regulations and Management under Status Quo and the Proposed Action

Management Tool	Status Quo	Proposed Action
Species Groups	LCS, SCS, pelagic, and prohibited sharks. There is a mechanism to add or remove prohibited shark species, as needed, via rulemaking	Manage sandbar sharks separately from other LCS; status quo for SCS, pelagic sharks, and prohibited sharks. There still is a mechanism to add or remove prohibited shark species, as needed, via rulemaking
Quotas/Species Complexes	- LCS (including sandbar sharks): 1,017 mt dw - SCS: 454 mt dw - Pelagic sharks, other than blue and porbeagle: 488 mt dw - Blue Sharks: 273 mt dw - Porbeagle: 92 mt dw - Display and Scientific Research: 60 mt ww - Overharvests and underharvests are deducted from/added to the next year's corresponding regional trimester - Count state landings after federal closure against federal quota	*Shark Research Fishery* (5-10 vessels) - Sandbar: Base quota: 116.6 mt dw - Adjusted quota (after deducting prior overharvests from 2008-2012 or 5 years): 87.9 mt dw - Non-sandbar LCS base quota: 50 mt dw - Adjusted quota (after accounting for overharvests from 2008-2012 or 5 years): 37.5 mt dw *Outside Research Fishery* - Sandbar: Prohibited - Non-sandbar LCS: Base quotas (mt dw): GOM: 439.5, ATL: 188.3; Adjusted quotas (after deducting prior overharvests over from 2008-2012 or 5 years): GOM: 390.5, ATL: 187.8) - SCS: Status quo - Pelagic sharks, other than blue and porbeagle: Status quo - Porbeagle: 1.7 mt dw - Display and Scientific Research: 60 mt ww (43.2 mt dw); Collection of sandbar sharks limited to 1 mt ww for research under EFPs and 1 mt ww for display; no dusky sharks authorized for public display - Overharvests will be taken from the subsequent years' quota, or spread over several years, depending on the level of overharvest, for all species/complexes. Underharvests will only be applied to subsequent years' quota if the species/complex's status is not overfished/overfishing, or unknown. - Count state landing after federal closure against federal quota

Management Tool	Status Quo	Proposed Action
Retention Limits	LCS: 4,000 lb dw for directed permit holders and 5 LCS for incidental permit holders SCS: No retention limit for directed permit holders and 16 SCS and pelagic sharks combined for incidental permit holders Fishermen may land sharks with fins removed except for the anal and 2nd dorsal fins. The total quantity of fins may not exceed 5% of the total dressed carcass weight of sharks on board.	- Sandbar: Sandbar retention only by vessels with shark research permit (retention limits depends upon research objectives) - Non-sandbar: under base quota: 36 for directed permit holders and 3 for incidental in both regions (starting in 2013) Under adjusted quota: 33 for directed permit holders and 3 for incidental in both regions (from 2008-2012) - All sharks landed fins on
Fishing Regions	- 3 Regions (Gulf of Mexico, South Atlantic and North Atlantic) for LCS and SCS. No regions for pelagic sharks.	- Non-Sandbar LCS: 2 Regions; Atlantic (ATL) Maine through East Florida and Caribbean; Gulf of Mexico (GOM) = West Florida (Key West) through Texas; 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 - Dealer Reporting: Dealer reports must be postmarked by the dealer within 10 days of the 1st and 15th of every month	- Research Fishery: Subject to 100 percent observer coverage - Observers/Logbooks: Status Quo - Dealer Reporting: Dealer reports received by NMFS within 10 days of end of reporting period; unclassified sharks counted against respective quotas based on scientific observers operating outside the shark research fishery and dealer reports; modify dealer reports to include "fins on" verification
Seasons	- Three trimesters (January-April, May-August, and September-December) for LCS and SCS, and pelagic sharks - Seasons are established based on quota availability, catch rates, and public comment. LCS opening and closing dates are announced before season opening. Pelagic and SCS closed, as needed, with 14-day notice.	- One season opening: Jan. 1 - Non-sandbar LCS, sandbar sharks pelagic sharks, and SCS each close at 80 percent (individually) with 5-day notice.

Management Tool	**Status Quo**	**Proposed Action**
Time/Area closures	- Mid-Atlantic Shark Closed Area (i.e., bottom longline gear closure, January through July from approximately Oregon Inlet to Cape Fear out to around the 60-fathom line) and Caribbean Sustainable Fisheries Act seasonal bottom longline closures - ALWTRT has implemented a suite of gear restrictions, observer requirements, etc., to reduce the likelihood of interaction between shark gillnet gear and endangered Northern right whales during the calving period - Several pelagic longline time/area closures apply if shark permit holders are using this gear	- All Status Quo time/area closures. - Bottom longline gear prohibited in Eight Marine Protected Areas (MPAs) implemented by the South Atlantic Fishery Management Council's Amendment 14 to the Snapper Grouper Fishery Management Plan
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	- Status quo

Table 2.1(b) Recreational Regulations and Management under Status Quo and the Proposed Action

Management Tool	**Status Quo**	**Proposed Action**
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	Status Quo
- Authorized Species	LCS: blacktip, spinner, silky, bull, nurse, tiger, lemon, sandbar, smooth hammerhead, great hammerhead, scalloped hammerhead SCS: Atlantic sharpnose, bonnethead, finetooth, blacknose, finetooth Pelagics: shortfin mako, common thresher, oceanic whitetip, blue, and porbeagle	- SCS, pelagics, and non-ridgeback LCS plus tiger sharks
Permits/Reporting	- HMS Angling permit - Charter/Headboat permit - Additional Reporting per Sec. 2.1.1.2 (e.g., MRFSS, tournament reporting)	Status quo

2.1.1 Monitoring and Reporting

2.1.1.1 Commercial

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, the Pelagic Observer Program, and the Shark Gillnet Observer Program. 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 1st trimester season of 2005 was coordinated by the Commercial Shark Fishery Observer Program (CSFOP), Florida Museum of Natural History, University of Florida, Gainesville, Florida (Burgess and Morgan 2003). Starting with second trimester season of 2005, responsibility for the fishery observer program was transferred to the National Marine Fisheries Service, Southeast Fisheries Science Center, Panama Laboratory (Hale et al. 2007).

Currently, observation of the directed shark bottom longline fishery is conducted by randomly selecting owners/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 Shark Gillnet Fishery Observer Program is coordinated by NMFS' Southeast Fisheries Science Center (SEFSC). From 1999 through 2004, there was 100 percent observer coverage of the Southeast shark drift gillnet fishery during the northern right

whale calving season (November 15–March 31) ("right whale season"). This coverage level was in response to a May 1997 opinion on HMS fisheries, which specified this requirement as part of reasonable and prudent alternative in to avoid jeopardy of 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) ("non-right whale season"), 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. 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-highly migratory species 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 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).

2.1.1.2 Recreational

NMFS conducts statistical sampling surveys of the recreational fisheries. Survey vehicles of the recreational sector conducted by NMFS are the MRFSS and the Large Pelagic Survey (LPS), and Southeast Headboat Survey (HBS). MRFSS does not cover Texas, so Texas Parks and Wildlife data are also used. Data for SCS and LCS comes from MRFSS, LPS, Texas Parks and Wildlife (Texas Headboat Survey). Data for pelagic sharks comes predominantly from LPS, vessel trip reports in the Northeast, and/or tournaments. Descriptions of these surveys, the geographic areas they include, and their limitations, are discussed in Section 2.6.2 of the 1999 FMP.

NMFS collects recreational catch-and-release data from dockside surveys (the LPS and MRFSS) for the rod-and-reel fishery and uses these data to estimate total landings and discards of bycatch or incidental catch. Statistical problems associated with small sample size remain an obstacle to estimating bycatch reliably in the rod-and-reel fishery. CVs can be high for many HMS (rare event species in the MRFSS) and the LPS does not cover all times/geographic areas for non-bluefin tuna species. New survey methodologies are being developed, however, especially for the charter/headboat sector of the rod-and reel-fishery, which should help to address some of the problems in estimating bycatch for this fishery. In addition, selecting recreational vessels for voluntary logbook reporting may be an option for collecting bycatch information for this sector of the HMS fishery.

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 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 U.S. 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.

2.1.2 Management of Exempted Fishing, Public Display, and Scientific Research

Exempted fishing permits (EFPs), display permits, and scientific research permits (SRPs) are requested and issued for sharks under the authority of the Magnuson-Stevens Act (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. SRPs are issued to agency scientists who are using NOAA vessels as their research platform for sharks. Display permits are issued to individuals who are collecting HMS for public display. Letters of Authorization are also given to outside researchers conducting shark research from research vessels, which is not subject to regulation under MSA, but is sometimes funded by NOAA to aid MSA management needs.

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. Amendment 1 to the 1999 HMS FMP implemented and created a separate display permitting system, which operates apart from the exempted fishing activities that are focusing on scientific research. However, the application process for display permits is similar to that required for EFPs and SRPs. The quota of 60 mt ww (43.2 mt dw) for all sharks collected under EFPs will be maintained in the proposed action; however, the quantity of sandbar sharks authorized for research and public display will be limited (2.8 mt ww for research/display annually) and dusky sharks would not be authorized for public display purposes.

Issuance of EFPs, display permits, and SRPs may be necessary because possession of certain shark (and other HMS) species are prohibited. These EFPs, SRPs, and display permits would authorize collections of sharks and other HMS species from federal waters in the Atlantic Ocean, Gulf of Mexico, and the Caribbean Sea for the purposes of scientific data collection and public display. In addition, NMFS regulations at 50 CFR 635.32 regarding implantation or attachment of archival tags in Atlantic HMS require prior authorization and a report on implantation activities.

The number of EFPs, display permits, and SRPs issued covering sharks from 2003 to 2007 by category are listed in Table 2.2.

Table 2.2 Number of EFPs, Display Permits, and SRPs Covering Sharks Issued Between 2003 and 2007

Permit type		2003	2004	2005	2006	2007
Exempted Fishing Permit	Sharks for display	8	8	6	7	6
	HMS for display	1	1	1	1	2
	Shark research on a non-scientific vessel	9	6	5	7	4
	HMS research on a non-scientific vessel	18	5	3	4	7
	Shark Fishing	1	0	0	--	--
Scientific Research Permit	Shark research	1	3	4	2	2
Letters of Acknowledgement	Shark research	3	2	4	5	7
TOTAL		41	25	23	26	28

2.1.3 Other Actions and Regulations Affecting the Proposed Action

Atlantic Large Whale Take Reduction Plan

The ALWTRP is a plan to reduce serious injury and mortality 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. Specific fisheries, as described in the MMPA 2007 List of Fisheries, currently regulated under the ALWTRP include the following: 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.

The first ALWTRP went into effect in 1997 when it was published in the Federal Register as an Interim Final Rule (62 FR 39157, July 22, 1997). The ALWTRP was implemented via a rule published February 16, 1999 (64 FR 7529). Requirements in the final rule impacting 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 closure sand other restrictions on setting shark gillnets off the coasts of Georgia and Florida and in the mid-Atlantic. The area from 27°51' N lat. (near Sebastian Inlet, FL) to 32°00' N lat. (near Savannah, GA) extending from the shore outward to 80° W long. 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 (26°46.5' N lat.) to Sebastian Inlet (27°51' N lat.) 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 right whales are in an area, and increasing efforts to disentangle whales caught in fishing gear.

The protective regulations established under the ALWTRP have been updated several times since implementation. The most recent regulations amending the ALWTRP were published in the Federal Register on June 25, 2007 (72 FR 34632), and on October 5, 2007 (72 FR 57104).

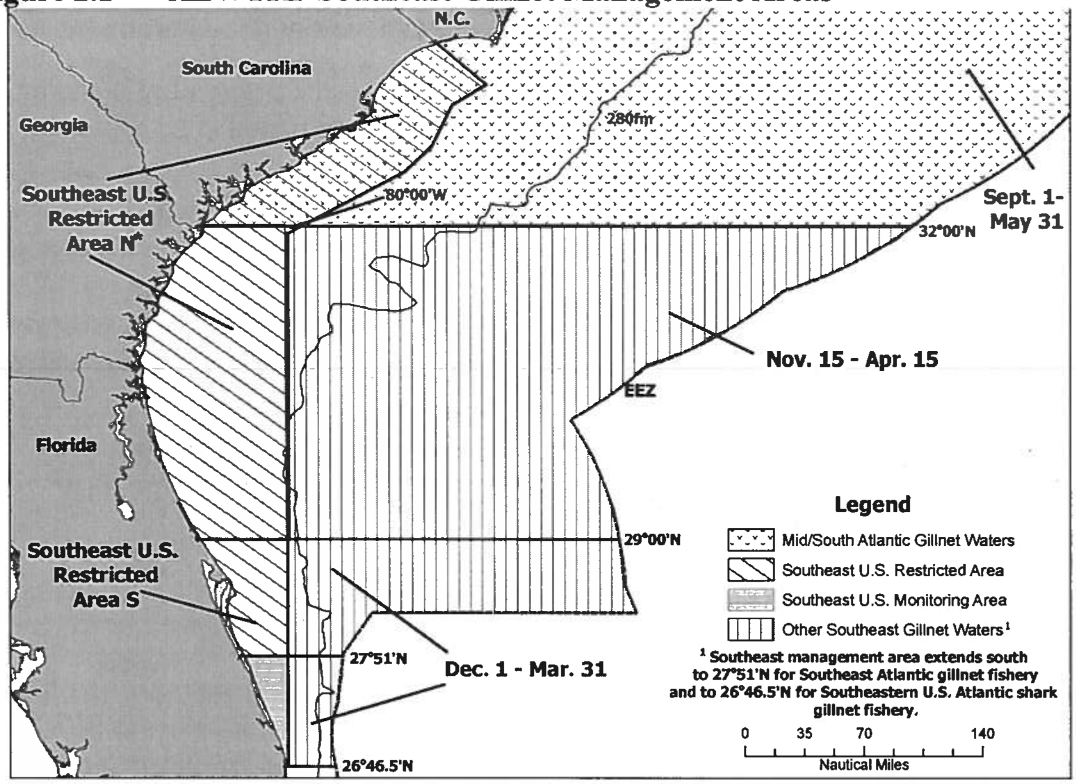
The ALWTRP, as amended, implements specific regulations for the shark gillnet component of the HMS fisheries. Figure 2.1 illustrates the ALWTRP Southeast Gillnet Management Areas. Protective regulations impacting the shark fisheries:

- Expanded the Southeast U.S. Restricted Area to include waters within 35 nautical miles of the South Carolina coast.
- Divided the Southeast U.S. Restricted Area at 29° N. latitude into two areas, the Southeast U.S. Restricted Areas North and South. 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 transition 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, if the following criteria are met:
    - o The gillnet is deployed so that it encloses an area of water;
    - o 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;
    - o no net is set or remains in the water at night or when visibility is less than 500 yards (460 m);
    - o 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 Southeast Fisheries Science Center, 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.

- Renamed and redefined the boundaries of the Southeast U.S. Observer Area. The new "Southeast U.S. Monitoring Area" includes regulated waters landward of 80°W. longitude from 27°51'N. latitude to 26°46.5'N. latitude The use of vessel monitoring systems (VMS) during December 1-March 31 is being used in this area in lieu of requiring 100 percent observer coverage of the HMS shark gillnet fishery during that time frame. NMFS continues to maintain observer coverage in this and other areas at a level that is sufficient to produce statistically reliable results for evaluating protected resource interactions. The ALWTRP amended the dates stated in Amendment 1 to the HMS FMP, that NMFS-approved VMS is required for gillnet vessels issued directed shark limited access permits that have gillnet gear on board to the reflect the new December 1-March 31 season.
- Created a new management area, "Other Southeast Gillnet Waters," and management measures, effective April 5, 2008, for the area east of 80° W. longitude from 32° N. latitude south to 26° 46.5′ N. latitude and out to the eastern edge of the EEZ.

Figure 2.1 ALWTRP Southeast Gillnet Management Areas



* 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)

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 §223.206(d)(1-3), resuscitation must be attempted on sea turtles that are comatose or inactive by:

- Placing the sea turtle on its bottom shell (plastron) so that the sea turtle is right side up and elevating its hindquarters at least six inches for a period of 4 to 24 hours. The amount of elevation depends on the size of the sea turtle; greater elevations are needed for larger sea turtles. Periodically, rock the sea turtle gently left to right and right to left by holding the outer edge of the shell (carapace) and lifting one side about three inches then alternate to the other side. Gently touch the eye and pinch the tail (reflex test) periodically to see if there is a response.
- Sea turtles being resuscitated must be shaded and kept damp or moist but under no circumstance be placed into a container holding water. A water-soaked towel placed over the head, carapace, and flippers is the most effective method in keeping a sea turtle moist.
- Sea turtles that revive and become active must be released over the stern of the boat only when fishing or scientific collection gear is not in use, when the engine gears are in neutral position, and in areas where they are unlikely to be recaptured or injured by vessels. Sea turtles that fail to respond to the reflex test or fail to

move within four hours (up to 24, if possible) must be returned to the water in the same manner as that for actively moving sea turtles.

- A sea turtle is determined to be dead if the muscles are stiff (rigor mortis) and/or the flesh has begun to rot; otherwise, the sea turtle is determined to be comatose or inactive and resuscitation attempts are necessary.
- Any sea turtle so taken must not be consumed, sold, landed, offloaded, transshipped, or kept below deck.

2.2. Description of Atlantic Shark Fisheries

Atlantic sharks are targeted and caught incidentally by both commercial and recreational fishermen. Recent commercial and recreational landings data are presented in Table 2.3 to depict the overall effort of each sector. NMFS (2006a) includes detailed information on the extent of commercial and recreational shark fishing by state and by individual communities in its state and community profiles.

Table 2.3 Recent Commercial and Recreational Landing Data

	2003		**2004**		**2005**		**2006**	
	GOM	ATL	GOM	ATL	GOM	ATL	GOM	ATL
LCS								
Commercial	835 mt dw (1,841,760 lbs dw)	626 mt dw (1,380,311 lbs dw)	638 mt dw (1,406,656 lbs dw)	526 mt dw (1,160,459 lbs dw)	713 mt dw (1,573,068 lbs dw)	483 mt dw (1,066,486 lbs dw)	931 mt dw (2,052,671 lbs dw)	565 mt dw (1,247,262 lbs dw)
Commercial Annual Total	**1,461 mt dw**		**1,164 mt dw**		**1,196 mt dw**		**1,496 mt dw**	
Recreational[1,2]	163 mt (360,675 lbs; 37,183 sharks)	117.9 mt (259,998 lbs; 26,804 sharks)	170 mt (376,398 lbs; 38,804 sharks)	64 mt (141,804 lbs; 14,619 sharks)	156 mt (345,048 lbs; 35,572 sharks)	142 mt (313,242 lbs; 32,293 sharks)	161 mt (354,738 lbs; 36,571 sharks)	44.6 mt (98,290 lbs; 10,133 sharks)
Recreational Annual Total	**280.9 mt**		**234 mt**		**298 mt**		**205.6 mt**	
SCS								
Commercial	**242 mt dw** (534,523 lbs dw)		**205 mt dw** (451,651 lbs dw)		**295 mt dw** (650,202 lbs dw)		N/A	
Recreational[3,4]	**127 mt** (282,187 lbs; 133,738 sharks)		**123 mt** (271,135 lbs; 128,500 sharks)		**114 mt** (251,301 lbs; 119,100 sharks)		N/A	
Pelagic Shark								
Commercial	**289 mt dw** (637,324 lbs dw)		**308 mt dw** (679,469 lbs dw)		**112 mt dw** (270,021 lbs dw)		N/A	
Recreational[5,6]	**409.59 mt ww** (903,000 lbs ww; 4,300 sharks)		**485 mt ww** (1,071,000 lbs ww; 5,100 sharks)		**514 mt ww** (1,134,000 lbs ww; 5,400 sharks)		N/A	

[1] Mean MRFSS weight for LCS, between 2002-2004, was 9.7 lbs
[2] Recreational effort by region for LCS (Cortés and Neer 2005): Gulf of Mexico = 53 percent; South Atlantic = 31 percent; and, Mid-Atlantic = 15 percent.
[3] Mean MRFSS weight for SCS, between 2003-2005, was 2.11 lbs
[4] Recreational effort by region for SCS (Cortés and Neer 2007): Gulf of Mexico = 58 percent; South Atlantic = 40 percent; and, Other = 2 percent.
[5] Mean weight of pelagic shark landed in NE shark tournaments was 210 lbs (Narragansett Lab)
[6] Number of tournaments targeting pelagic sharks by region (See table 3-38 in DEIS for Amendment 2): Gulf of Mexico = 22; North Atlantic = 33; Other = 2

2.2.1 Commercial Fisheries

Historic Overview, Catch and Landings Data

U.S. 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 this time, shark fishing gear included gillnets, anchored bottom longlines, floating 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 60s 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 large coastal 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 (9 percent of shark permits), Louisiana (8 percent of shark permits), and North Carolina (6 percent of shark permits) (NMFS 2007a). North of North Carolina, commercial shark fishing is largely incidental to the take of other species, particularly HMS tuna species (NMFS 2006a). There are no commercial vessel permit holders outside of the U.S. mainland (M. Clark, pers. comm.).

Commercial shark landings data from 2003-2006 are provided in Table 2.1. 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.

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 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, 2007, the number of permit holders had declined to 527 commercial permit holders; of these, 231 (44 percent) have directed shark permits and the remaining 296 (56 percent) hold incidental permits and target species other than sharks. Also, not all permit holders are active in the fishery in any given year. NMFS estimates that there are 143 active vessels with directed permits and 155 active vessels with incidental permits (NMFS 2007a). The addresses of these permit holders range from Texas through Maine with nearly half of the permit holders located in Florida.

Fishing Seasons

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. Since 2004, the fishery has been managed via trimester to provide for fishing opportunities throughout the year and to reduce fishing effort during months critical for shark pupping. While the LCS fishing season has generally been open for only a few months a year, the SCS quota has only been met once[1] and the pelagic shark fishery quota has never been reached.

Given the short, directed 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 2007a). Of the 527 directed and incidental shark permit holders, 81 percent also hold king or Spanish mackerel permits, 48 percent hold dolphin/wahoo permits, 34 percent hold directed swordfish permits, 22 percent hold snapper-grouper permits, and 29 percent hold charter/headboat permits (NMFS 2007a).

Vessel characteristics

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).

[1] The SCS fishery was closed from February 23 to April 30, 2007 (72 FR 6966, Feb.ruary 14, 2007)

2.2.1.1 Bottom longline

The shark bottom longline fishery is active in the U.S. Atlantic Ocean and Gulf of Mexico from North Carolina to Texas. There are currently 143 active vessels with directed shark permits in this fishery, out of 231 vessels that possess these fishing permits. 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).

HMS permitted vessels that fish with bottom longline gear normally target LCS, but SCS, pelagic sharks, and dogfish species are also caught. Recent observer data indicate bottom longlining for sharks has relatively low bycatch of other species, with shark species typically comprising over 92% of the catch (Hale and Carlson 2007, Hale et al. 2007). LCS comprise the greatest amount of the catch. For example, in the GOM, LCS comprised 69.5 percent of the shark catch in 2005-2006 and 75.4 percent of the shark catch in 2007, while small coastal shark species comprised 30.3 percent of the shark catch in 2005-2006 and 24.2 percent of the shark catch in 2007. Blacktip sharks (a LCS) were the most commonly caught shark in the GOM. In the U.S. Atlantic, LCS comprised 78.7 percent and 84.1 percent of the shark catch in 2005-2006 and 2007, respectively, while SCS comprised 19.2 percent and 13.5 percent of the shark catch in 2005-2006 and 2007, respectively. Sandbar and tiger sharks were the most commonly caught LCS in the U.S. Atlantic.

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 (NMFS 2007a)

Longline gear characteristics vary regionally. Hale et al. (2007) generalize the gear as normally consisting of about 8-24 km of longline and 500-1500 hooks. Haul characteristic also vary by region (Hale and Carlson 2007, Hale et al. 2007).

Table 2.4 Bottom Longline Gear and Haul Characteristics Based on Observer Data (Hale and Carlson 2007, Hale et al. 2007)

Observed Gear and Haul Characteristics	Region			
	Gulf of Mexico		Atlantic	
	2005-2006[1]	2007[2]	2005-2006[3]	2007[4]
Mainline length range	2.1 to 30.6 km	12.9-31.4 km	1.6-30.6 km	5.6-50 km
Average mainline length	13.5 km	18 km	14.9 km	21.1 km
Average bottom depth fished	39.4 m	25.4 m	56.4 m	40.2 m
Hooks fished per set	47-1354 hooks	228-1067 hooks	50-1270 hooks	96-1075 hooks
Average hooks fished per set	507 hooks	602.5 hooks	559 hooks	587 hooks
Hook type/Size used	14.0 C.=50% of hauls, 18.0 C.=30% of hauls, J.= 29.3% of hauls (12.0 J=87.5% of J-hauls), J&C mixed =21.9% of hauls (12.0 J=most common 2nd hook, i.e., 66.7% of hauls using 2 hooks)	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.=41.6% of hauls, J= 53.3% of hauls (12.0 J=34.5% of J-hauls), J&C mixed=20.8% of hauls (18.0 C.=most common 2nd hook, i.e., 75% 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).
Average soak duration	9.2 hours	10.9 hours	11.9 hours	11.9 hours

[1] Based on 82 hauls on 31 trips observed during 2005-2006 in the GOM.
[2] Based on 24 hauls on 7 trips observed during 2007 in the GOM.
[3] Based on 77 hauls on 50 trips during 2005-2006 in the U.S. Atlantic.
[4] Based on 39 hauls on 21 trips during 2007 in the U.S. Atlantic.

2.2.1.2 Gillnet Fishing

Atlantic shark gillnet fisheries operate along the southeastern U.S. Atlantic coast between central Florida and Cape Hatteras, North Carolina. "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.

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, where gillnets are less effective. As reviewed in Section 2.1.3, 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 (M. Clark, pers. comm.). 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 which fishing method is used. A summary of each method is provided below. Observed gear and haul characteristics data are provided in Table 2.5.

Drift Net Fishing
Drift gillnets are used exclusively in federal waters adjacent to Florida and Georgia to target coastal shark species, with catches dominated by Atlantic sharpnose sharks (*Rhizoprionodon terraenovae*) (Carlson and Bethea 2007, Trent et al. 1997). The drift gillnet fishery off the coast of Florida and Georgia developed during the early 1990s and has declined in recent years to a small fleet of 4-6 vessels. 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).

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. Strike sets typically target blacktip sharks (*Carcharhinus limbatus*), and 99 percent of the catch of these sets is comprised of 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.

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 water and poor weather conditions sometimes results in unsuccessful trips (i.e., no sets per trip) (Carlson et al. 2005).

Sink Net Fishing
Sink gillnets targeting sharks occur through 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 2.5 Gear and Haul Characteristics of Gillnet by Fishing Technique Based on Observer Data (Garrison 2007)

Gear and Haul Characteristics of Gillnet by Fishing Technique Based on Observer Data	Drift		Strike		Sink
	2004[1]	2005-2006[2]	2004[3]	2005-2006[4]	2006[5]
Net length (m)	1276.8-3237.6	182-2645	548.6-1641.6	14-1372	137-2051
Net depth (m)	6.1-12.2	~12	4.6-30.4	21-30	2-8
Stretched mesh size (cm)	12.7-22.9	12.7-25.4	17.8-24.1	22.9-30.4	7.3-20.3
Most frequently used stretched mesh size (cm)	12.7.	--	22.9	--	--
Average water depths sets made in (m)	18.8 (±4.7 S.D.).	20.9	18.3 (±6.6 S.D)	21.2	17.5 (21.3 S.D.)
Average set duration (hrs)	0.4 (±0.1 S.D.)	0.3	0.1 (±0.01 S.D.)	0.1	0.1 (1.0 S.D.)
Average haul time (hrs)	3.1 (±1.0 S.D.)	3.3	3.0 ((±4.1.S.D.)	0.9 (0.7 S.D.)	1.1 (1.0 S.D.)
Average soak time (time net was first set until time haulback began (hrs)	10.7 (±2.7 S.D)	--	--	--	--
Entire fishing process time (Average time net was first set until time haulback completed) (hrs)	--	10.2	3.5 (4.2 S.D.)	3.2	6.1 (6.5 S.D.)

[1] Based on 4 vessels making a combined 32 sets over 31 trips observed in 2004.
[2] Based on 4 vessels making a combined 35 sets over 4 trips observed in 2005 and 2006.
[3] Based on 4 vessels making a combined 25 sets over 4 trips observed in 2004.
[4] Based on 8 vessels making a combined 84 sets over 106 trips observed in 2005 and 2006.
[5] Based on 11 vessels making a combined 249 sets over 72 trips observed in 2006.

2.2.2 The Recreational Fishery: Rod-and-Reel and Handline

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., makos), 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.[2] Makos, 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 makos 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 operators advertise shark fishing as part of their offering, the recreational fishery is primarily a catch-and-release fishery using light tackle and tends to be incidental to tuna and billfish fishing offshore. Species typically retained for personal consumption include mako, thresher, and blacktip sharks. North of North Carolina, most sharks are usually landed incidental to tuna and billfish fishing (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, pelagic sharks are also frequently targeted in HMS tournaments (i.e., 67 tournaments, 25.9 percent in 2006; 59 tournaments, 20 percent of tournaments in 2007). Tournaments typically target shortfin mako, blue, and thresher sharks. Porbeagle sharks may also landed. Pelagic shark tournaments are predominantly held in the Northeast; however, there has been an increase in the number of Gulf of Mexico tournaments.

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

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 landings by species groups from 1998 through 2005 are presented in Table 2.6. The most commonly caught LCS species (in descending order) include blacktip, sandbar, bull, spinner, and lemon sharks. The most commonly caught SCS species include (in descending order) Atlantic sharpnose, bonnethead, blacknose, and finetooth (M. Clark, pers. com).

Table 2.6 Estimates of Total Recreational Harvest of Atlantic Sharks: 1998-2005 (numbers of fish in thousands; estimates include prohibited species)
(Cortés and Neer 2005, Cortés, pers. comm. *In* NMFS 2007a)

Species Group	1998	1999	2000	2001	2002	2003	2004	2005
LCS	169.6	92.3	131.5	127.9	76.3	86.1	66.3	86.2
Pelagic	11.8	11.1	13.3	3.8	4.7	4.3	5.1	5.4
SCS	175.1	125.7	197.8	211.6	154.6	134.7	128.5	119.1
Unclassified	8.0	6.9	11.0	22.2	5.3	18.1	27.3	47.4

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 (CHB) permit.

There has been a significant increase in angling category permits over the last several years, from 13,263 in 2002 to 25,238 in 2006 (NMFS 2006a). The total number of CHB permits increased from 3,963 in 2005 to 4,173 in 2006. 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).

Most fishermen targeting sharks use light tackle and practice catch-and-release (NMFS 2006a). Chum or other attractants may be used. Vessels generally focus on areas with sandy/silty bottom in addition to harder bottom types (or structure), depending on the species being targeted (M. Clark, pers. com).

Recreational fishing practices vary depending on the species targeted. 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 (M. Clark, pers. comm. 2008)

Beginning in 2008, if a tournament has a billfish prize category, participating anglers will be required to use circle hooks. As it pertains to sharks, this circle hook tournament requirement would only apply to those vessels holding HMS permits.

2.3 Action Area

Atlantic shark fisheries are managed under the HMS FMP throughout the U.S. EEZ in the Atlantic Ocean, the Gulf of Mexico, and the Caribbean Sea. Throughout this range of operation, directed Atlantic shark fisheries may target sharks and affect one or more listed species; therefore, the action area for this opinion is the U.S. Atlantic, Gulf of Mexico, and Caribbean EEZ. The range of most bottom longline sets runs from northwestern Florida in the Gulf of Mexico to southern Virginia in the Atlantic, with concentrations of activity around the Florida Keys, Cape Canaveral, and North Carolina (Figures 2.2 and 2.3). Gillnet fishery effort has concentrations northwest of the Florida Keys and along the central and east coast of Florida (Figure 2.4). The distribution of observed sets in the directed commercial bottom longline and gillnet fisheries observer programs are illustrated in Figures 2.2-2.4.

Figure 2.2 All Shark Bottom Longline Sets Observed Off Florida, 1994-2006
(NMFS Shark Bottom Longline Observer Program)

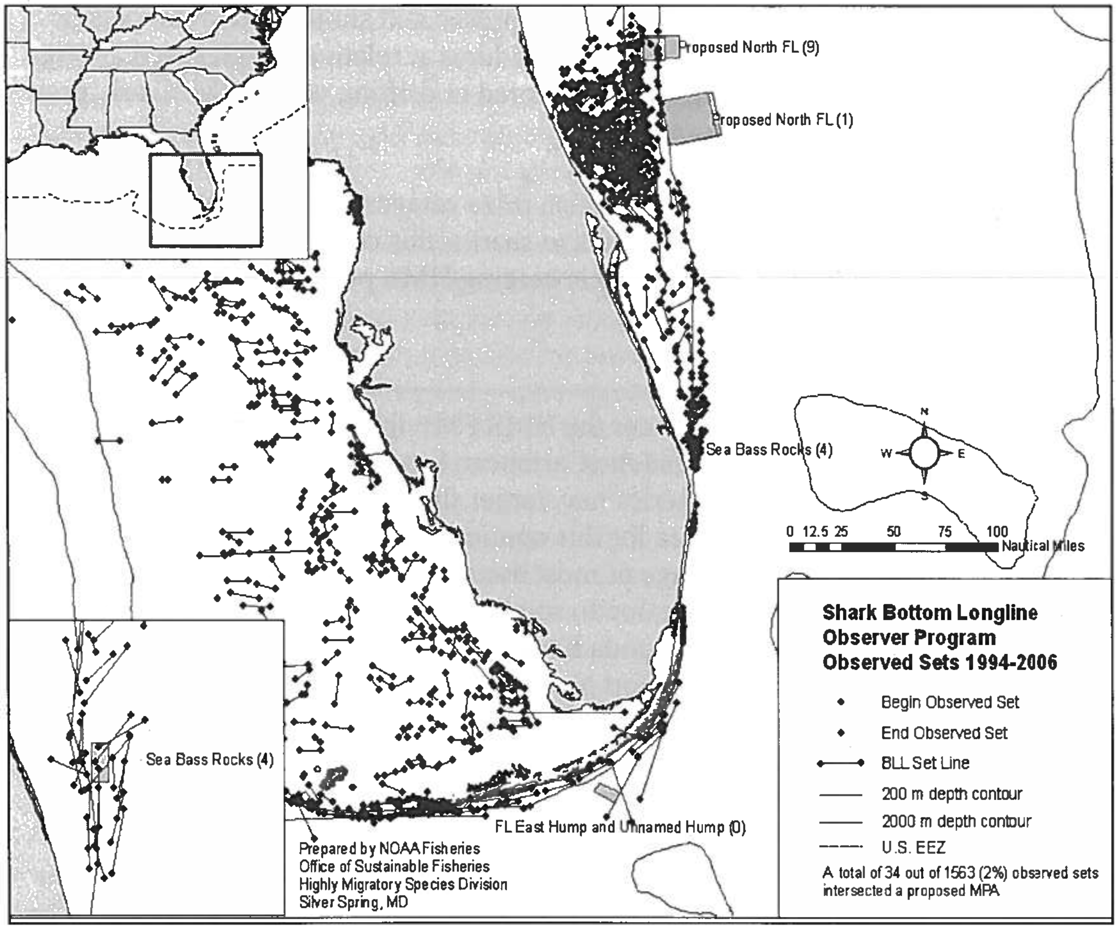


Figure 2.3 All Shark Bottom Longline Sets Observed from Northern Florida to North Carolina, 1994-2006 (NMFS Shark Bottom Longline Observer Program, NMFS).

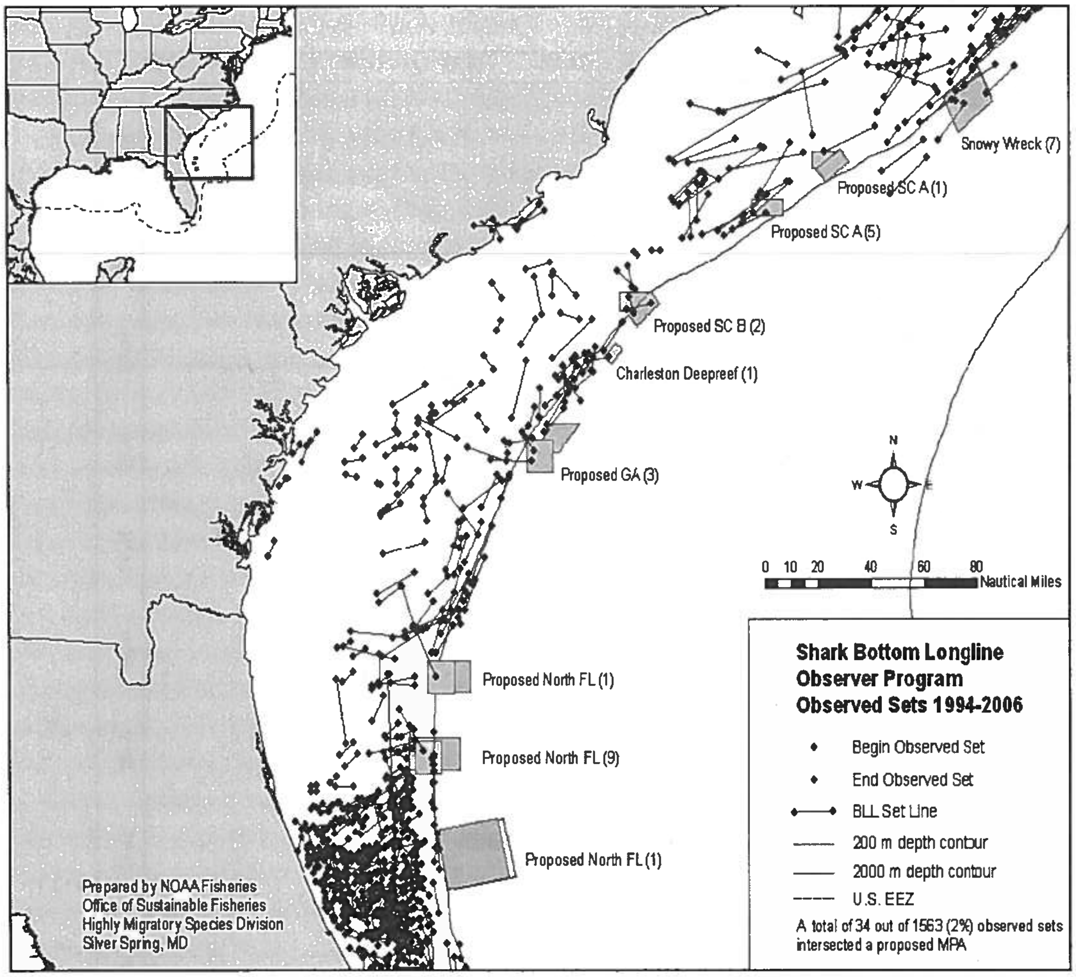
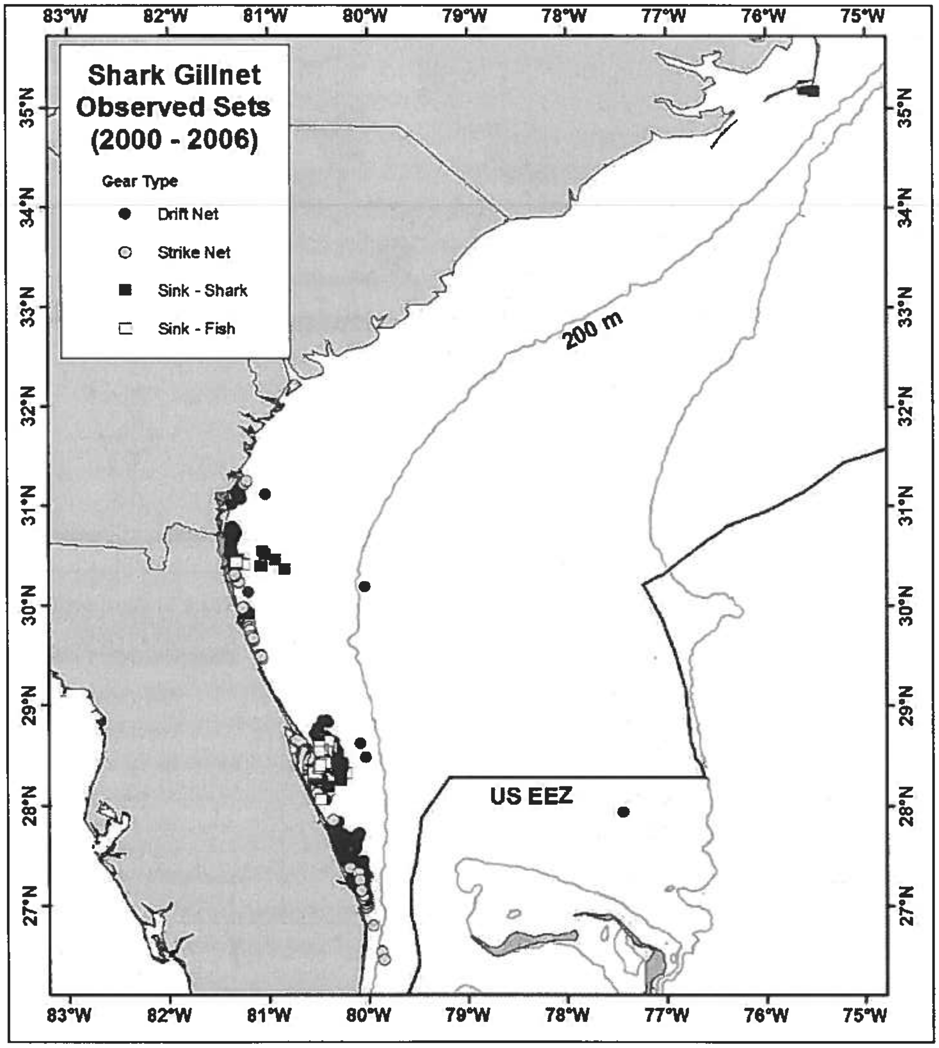


Figure 2.4 All Shark Gillnet Sets Observed from Florida to North Carolina, 2000-2006 Observed Effort of Sink Nets Targeting Sharks and Fish Only for 2005 and 2006. Nine Strike Sets Observed in the Central Gulf of Mexico during 2006 are not shown (Garrison 2007).



3.0 Species and Critical Habitat Occurring in the Action Area 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 turtle (*Chelonia mydas*)	Endangered/Threatened[3]
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
Invertebrates	
Elkhorn coral (*Acropora palmata*)	Threatened
Staghorn coral (*Acropora cervicornis*)	Threatened
Fish	
Smalltooth sawfish (*Pristis pectinata*)	Endangered[4]
Gulf sturgeon (*Acipencer oxyrinchus desotoi*)	Threatened
Gulf of Maine Atlantic salmon *(Salmo samar)*	Endangered[5]

Critical Habitat
There is no designated or proposed critical habitat in the action area that may be affected by the proposed action.

We have determined that the proposed action being considered in this opinion is not likely to adversely affect the following species listed under the ESA: blue whales, sei whales, sperm whales, fin whales, humpback whales, northern right whales, gulf sturgeon, and elkhorn and staghorn corals. These species are excluded from further analysis and consideration in this opinion. The following discussion summarizes our rationale for these determinations.

Blue, Sei, Fin, and Sperm Whales
We believe the chances of a blue, sei, fin, or sperm whales being affected by the proposed action are discountable. Blue, sei, and sperm whales are predominantly found seaward of the continental shelf, where shark fishing does not occur. Sightings of sperm

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[3] Green sea turtles in U.S. waters are listed as threatened except for the Florida breeding population, which is listed as endangered.
[4] The U.S. distinct population segment (DPS).
[5] Only the wild Gulf of Maine DPS is listed as endangered.

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 in the waters of the Gulf of Mexico or off the U.S. East Coast (CETAP 1982, Wenzel et al. 1988, Waring et al. 2002 and 2006). Fin whales are generally found along the 100-m isobath with sightings also spread over deeper water including canyons along the shelf break (Waring et al. 2006). Their numbers are not well known in the area seaward of the continental shelf adjacent to shark fishing grounds; however, their concentrations in these areas are thought to be low compared to more northern latitudes. The HMS bottom longline fishery typically operates in Southeast waters of 25.4 m to 40.2 m depths on average and the gillnet portion of this fishery primarily takes place in water 18.8-21.2 m in depth (Hale et al. 2007, Garrison 2007). Based on the depth at which Atlantic shark fishing occurs, these species of whales are expected to be rare in the action area. No interactions between these large whales and this fishery have been documented (see the observer effort and information in the Effects of the Action section of this opinion). The Southeastern U.S. Atlantic and Gulf of Mexico shark bottom longline/hook-and-line fisheries are listed as a Category III fisheries under the 2008 List of Fisheries (72 FR 66048; November 27, 2007), meaning the likelihood of interactions with marine mammals is remote [MMPA Section 118 (c)(1)(A)(iii)]. Based on the rarity of these species in the action area and the lack of interactions between these species and shark gear, we believe the chance of a blue, sei, or sperm whale being affected by the proposed action is discountable.

Humpbacks and North Atlantic Right Whales
The continued authorization of shark fishing is not likely to adversely affect northern right whales or humpback whales. Northern right whales and humpback whales are coastal animals and have been sighted in the nearshore environment in the Atlantic along the southeastern U.S. from November-March on their migration south. December and January are peak times for humpbacks to occur off North Carolina as they migrate southward through coastal waters to their wintering grounds, with a second peak occurrence in March and April as they migrate north again to their summer feeding grounds. North Atlantic right whales and humpback whales are considered more coastal whale species. In the Gulf of Mexico portion of the action area, they are extremely rare. Individuals observed in the Gulf of Mexico have likely been inexperienced juveniles straying from the normal range of these stocks or occasional transients (although a single calf-mother pair was observed in Texas state waters in 2004) (Mullin et al. 1994, Würsig et al. 2000).

Bottom longline fishing, the primary shark fishing method, is not likely to adversely affect northern right and humpback whales. The Southeastern U.S. Atlantic and Gulf of Mexico shark bottom longline/hook-and-line fisheries are listed as a Category III fisheries under the 2008 List of Fisheries (72 FR 66048, November 27, 2007); meaning the likelihood of interactions with marine mammals is remote [MMPA Section 118 (c)(1)(A)(iii)]. No interactions between these large whales and this fishery have been documented (see the observer effort and information is detailed in Section 5, Effects of the Action, of this opinion).

Like the bottom longline component of the fishery, no interactions between shark gillnet gear and large whales have been documented. Reducing large whale entanglement risks is the primary responsibility of the Atlantic Large Whale Take Reduction Team (ALWTRT). The ALWTRT was created in 1996 to address entanglement issues of large whales in fishing gear, including gillnet gear. The ALWTRT was convened under the provisions of the Marine Mammal Protection Act, and through its efforts the ALWTRP was finalized in 1999. Atlantic shark gillnet fisheries are subject to rules and provisions resulting from the ALWTRP.

The ALWTRP has recently been updated (72 FR 34632, June 25, 2007; 72 FR 57104, October 5, 2007). Updates impacting the HMS shark fisheries include: (1) expanding the Southeast U.S. Restricted Area to include waters within 35 nautical miles of the South Carolina coast; (2) dividing the Southeast U.S. Restricted Area at 29°N. latitude into two areas, the Southeast U.S. Restricted Areas North and South. 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 transition 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 shark strike-net fishing if certain criteria are met; (3) renaming and redefining the boundaries of the Southeast U.S. Observer Area (see Figure 2.1). The new "Southeast U.S. Monitoring Area" includes regulated waters landward of 80°W. longitude from 27°51'N. latitude to 26°46.5'N. latitude The use of VMS is being used in this area in lieu of requiring 100 percent observer coverage of the HMS shark gillnet fishery. NMFS continues to maintain observer coverage in this and other areas at a level that is sufficient to produce statistically reliable results for evaluating protected resource interactions. The ALWTRP will also amend the dates stated in Amendment 1 to the Atlantic Tunas, Swordfish, and Sharks FMP, that NMFS approved VMS is required for gillnet vessels issued directed shark limited access permits that have gillnet gear on board, to the reflect the new December 1-March 31 season; and (4) creating a new management area, "Other Southeast Gillnet Waters," and management measures, effective April 5, 2008, for the area east of 80°W. longitude from 32°N. latitude south to 26°46.5'N. latitude and out to the eastern edge of the EEZ.

Shark gillnet fishing, by a fisher with a valid commercial directed shark limited access permit, is only exempt from the fishing prohibitions in Southeast U.S. Restricted Area South from December 1-March 31, if (1) The gillnet is 5-inches stretched mesh or greater; (2) the gillnet is deployed so that it encloses an area of water; (3) no net is set at night or when visibility is less than 500 yards (1,500 ft, 460 m); (4) The gillnet is removed from the water before night or immediately if visibility decreases below 500 yards (1,500 ft, 460 m); (5) each set is made under the observation of a spotter plane; (6) no gillnet is set within 3 nautical miles (5.6 km) of a right, humpback, or fin whale; and (7) the 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 [50 CFR 229.32 (f)(4)(iii)]. The gear marking requirements listed at 50 CFR 229.32 (f)(B)(2) remain in effect.

The ALWTRP also includes management measures for Mid-Atlantic gillnets. Regulations are as follows: From December 1-March 31 in Mid-Atlantic gillnet waters, anchored gillnets (includes those weighted to the bottom of the sea) must abide by the universal gear requirements (no line floating at the surface, no wet storage of gear--anchored gear must be hauled out of the water at least once every 30 days). Fishers are also encouraged to maintain their buoy lines to be as knot-free as possible. All buoys attached to the main buoy line must have a weak link having a maximum breaking strength of 1,100 lb. All net panels are required to have a weak link with a maximum breaking strength of 1,100 lb 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. No drift gillnet gear may be fished at night unless 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 [50 CFR 229.32 (d)(7) and (e)].

In summary, although gillnets can pose a serious entanglement threat to coastal whales, Atlantic shark gillnet fisheries are subject to the rules and provisions of the ALWTRP specifically intended to reduce the risks of entanglement. Based on the protections given to these species by the ALWTRP and existing gillnet practices, we believe adverse effects on humpback and Northern right whales are extremely unlikely and are therefore 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 season maximums for short periods of time. The environmental conditions of most of the Gulf of Mexico and Atlantic EEZ are not suitable for Acroporoid corals. The northern extent of Acroporid coral occurrence off the U.S. East Coast is Palm Beach County, Florida. Elkhorn coral commonly grows in turbulent shallow water on the seaward face of reefs in water ranging from 1-5m in depth, but have been found to 30m. Staghorn coral commonly grows in more protected, deeper water ranging from 5m to 20m in depth and have been found in rare instances to 60m.

Elkhorn and staghorn corals have a very limited distribution in the Gulf of Mexico and Atlantic U.S. 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*. These locations include in the Atlantic within the Florida Keys National Marine Sanctuary (FKNMS), in the Flower Garden Banks National Marine Sanctuary (FGBNMS)[6], and in the Gulf of Mexico northwest of the Florida Keys and in the Tortugas area.

Potential routes of effect on *Acropora* corals associated with fishing activity include abrasion and breakage resulting from: (1) vessel groundings, (2) anchoring, (3)

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[6] There are two known colonies of elkhorn at the FGNMS located 100 mi (161 km) off the coast of Texas. The FGBNMS is a group of three areas of salt domes that rise to approximately 15 m water depth and are surrounded by water depths of 60-120 m.

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 *Acropora spp.* and fishing gear are primary factors determining whether potential adverse impacts occur.

Of the fishing gear practices of HMS permit holders, only bottom fishing with vertical line gear for LCS or SCS by recreational permit holders has the potential to snag or become wrapped rapped around coral. Damaging fishing practices are not likely to result from commercial permit holders. Bottom longline fishing is primarily used in sandy and muddy bottom habitats where coral would not occur. Gillnets are also fished so as to not come in contact with corals to avoid damage to their gear. Recreational shark fishing targeting pelagic sharks troll at mid-water depths and also do not come in contact with corals.

Regulations are in place in the areas where *Acropora spp.* are most likely to occur 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 *Acropora* species), 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 *Acropora* species) 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 protect adverse effects on corals from occurring.

The unlikelihood of *Acropora* occurring where fishing is likely to occur, in combination with the measures in place to protect *Acropora* species where they may occur and shark fishing practices, make any adverse effect on these species from the proposed action extremely unlikely to occur. Based on this information, effects on the listed *Acropora* species from the continued authorization of shark fishing as managed under the Consolidated HMS FMP are 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 indicates Gulf sturgeon conduct alongshore migrations and primarily use shallow (2-6 m) nearshore areas as late wintering habitats (Edwards et al. 2007). Atlantic shark fisheries operate far offshore of these areas. No Gulf sturgeon have ever been observed caught during shark fishing. Based on this information, adverse affects from the proposed action are discountable.

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, it is highly unlikely the proposed action would have any effect on this species.

3.2 Status of the Species Likely to be Adversely Affected

The following subsections are synopses of the best available information on the life history, distribution, population trends, and current status of the five species of sea turtles, and the smalltooth sawfish that are likely to be adversely affected by one or more components of the proposed action. Additional background information on the status of sea turtle species can be found in a number of published documents, including: recovery plans for the Atlantic green sea turtle (NMFS and USFWS 1991a), hawksbill sea turtle (NMFS and USFWS 1993), Kemp's ridley sea turtle (USFWS and NMFS 1992), leatherback sea turtle (NMFS and USFWS 1992), loggerhead sea turtle (NMFS and USFWS 1991b) and; Pacific Sea Turtle Recovery Plans (NMFS and USFWS, 1998a-d); sea turtle status reviews and biological reports (NMFS and USFWS 1995, Marine Turtle Expert Working Group (TEWG) 1998, 2000, and 2007, NMFS SEFSC 2001a). Sources of background 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).

3.2.1 Green Sea Turtle

Green turtles are distributed circumglobally, and can be found in the Pacific, Indian and Atlantic Oceans as well as the Mediterranean Sea (NMFS and USFWS 1991a; Seminoff 2004; NMFS and USFWS 2007a). In 1978, the Atlantic population of the green sea turtle was listed as threatened under the ESA, except for the breeding populations in Florida and on the Pacific coast of Mexico, which were listed as endangered.

3.2.1.1 Pacific Ocean

Green turtles occur in the eastern, central, and western Pacific. Foraging areas are also found throughout the Pacific and along the southwestern U.S. coast (NMFS and USFWS 1998a). Nesting is known to occur in the Hawaiian archipelago, American Samoa, Guam, and various other sites in the Pacific. The only major (>2,000 nesting females) populations of green turtles in the western Pacific occurs in Australia and Malaysia, with smaller colonies throughout the area. Green turtles have generally been thought to be declining throughout the Pacific Ocean, with the exception of Hawaii, from a combination of overexploitation and habitat loss (Seminoff 2002). Indonesia has a widespread distribution of green turtles, but has experienced large declines over the past 50 years. Historically, green turtles were used in many areas of the Pacific for food. They were also commercially exploited and this, coupled with habitat degradation led to their decline in the Pacific (NMFS and USFWS 1998a). Green turtles in the Pacific continue to be affected by poaching, habitat loss or degradation, fishing gear interactions, and fibropappiloma (NMFS and USFWS 1998a, NMFS 2004a).

Hawaii green turtles are genetically distinct and geographically isolated, and the population appears to be increasing in size despite the prevalence of fibropapilloma and spirochidiasis (Aguirre et al. 1998 in Balazs and Chaloupka 2003). The East Island nesting beach in Hawaii is showing a 5.7 percent annual growth rate over 25 plus years (Chaloupka et al. 2007). In the eastern Pacific, mitochondrial DNA analysis has indicated that there are three key nesting populations: Michoacan, Mexico; Galapagos Islands, Ecuador; and Islas Revillagigedos, Mexico (Dutton 2003). The number of nesting females per year exceeds 1,000 females at each site (NMFS and USFWS 2007a). However, historically, greater than 20,000 females per year are believed to have nested in Michoacan, alone (Cliffton et al. 1982, NMFS and USFWS 2007a). Thus the current number of nesting females is still far below what has historically occurred. There is also sporadic green turtle nesting along the Pacific coast of Costa Rica. However, the status of at least a few of the non-Hawaiian nesting stocks in the Pacific have recently been found to also be undergoing long-term increases; data sets over 25 years in Chichi-jima, Japan, Heron Island, Australia, and Raine Island, Australia show increases (Chaloupka et al. 2007). These increases are thought to be the direct result of long-term conservation measures.

3.2.1.2 Indian Ocean

There are numerous nesting sites for green sea turtles in the Indian Ocean. One of the largest nesting sites for green sea turtles worldwide occurs on the beaches of Oman where an estimated 20,000 green sea turtles nest annually (Hirth 1997, Ferreira et al. 2003). Based on a review of the 32 Index Sites used to monitor green sea turtle nesting worldwide, Seminoff (2004) concluded that declines in green turtle nesting were evident for many of the Indian Ocean Index Sites. While several of these had not demonstrated further declines in the more recent past, only the Comoros Island Index Site in the Western Indian Ocean showed evidence of increased nesting (Seminoff 2004).

3.2.1.3 Atlantic Ocean

Life History and Distribution
The estimated age at sexual maturity for green sea turtles is between 20-50 years (Balazs 1982, Frazer and Ehrhart 1985). Green sea turtle mating occurs in the waters off the nesting beaches. Each female deposits 1-7 clutches (usually 2-3) during the breeding

season at 12-14 day intervals. Mean clutch size is highly variable among populations, but averages 110-115 eggs/nest. Females usually have 2-4 or more years between breeding seasons, whereas males may mate every year (Balazs 1983). After hatching, green sea turtles go through a post-hatchling pelagic stage where they are associated with drift lines of algae and other debris. At approximately 20 to 25 cm carapace length, juveniles leave pelagic habitats and enter benthic foraging areas (Bjorndal 1997).

Green sea turtles are primarily herbivorous, feeding on algae and sea grasses, but also occasionally consume jellyfish and sponges. The post-hatchling, pelagic-stage individuals are assumed to be omnivorous, but little data are available.

Green sea turtle foraging areas in the southeastern U.S. include any coastal shallow waters having macroalgae or seagrasses. This includes areas near mainland coastlines, islands, reefs, or shelves, and any open-ocean surface waters, especially where advection from wind and currents concentrates pelagic organisms (Hirth 1997, NMFS and USFWS 1991a). Principal benthic foraging areas in the southeastern U.S. include Aransas Bay, Matagorda Bay, Laguna Madre, and the Gulf inlets of Texas (Doughty 1984, Hildebrand 1982, Shaver 1994), 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, Florida (Ehrhart 1983), and the Atlantic Ocean off Florida from Brevard through Broward counties (Wershoven and Wershoven 1992, Guseman and Ehrhart 1992). Adults of both sexes are presumed to migrate between nesting and foraging habitats along corridors adjacent to coastlines and reefs.

Population Dynamics and Status

Some of the principal feeding pastures in the western Atlantic Ocean include the upper west coast of Florida and the northwestern coast of the Yucatán Peninsula. Additional important foraging areas in the western Atlantic include the Mosquito and Indian River Lagoon systems and nearshore wormrock reefs between Sebastian and Ft. Pierce Inlets in Florida, Florida Bay, the Culebra archipelago and other Puerto Rico coastal waters, the south coast of Cuba, the Mosquito Coast of Nicaragua, the Caribbean Coast of Panama, and scattered areas along Colombia and Brazil (Hirth 1997). 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).

The vast majority of green sea turtle nesting within the southeastern U.S. occurs in Florida (Meylan et al. 1995, Johnson and Ehrhart 1994). Green sea turtle nesting in Florida has been increasing since 1989 (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute Index Nesting Beach Survey Database). Nest counts can also be used to estimate the number of reproductively mature females nesting annually. 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 include: (1) Yucatán Peninsula, Mexico, (2) Tortuguero, Costa Rica, (3) Aves Island, Venezuela, (4) Galibi Reserve, Suriname, (5) Isla Trindade, Brazil, (6) Ascension Island, United Kingdom, (7) Bioko Island, Equatorial Guinea, and (8) Bijagos Achipelago

(Guinea-Bissau) (NMFS and USFWS 2007a). 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).

By far, the most important nesting concentration for green turtles in the western Atlantic is in Tortuguero, Costa Rica (NMFS and USFWS 2007a). Nesting in the area has increased considerably since the 1970's and nest count data from 1999-2003 suggest nesting by 17,402 to 37,290 females per year (NMFS and USFWS 2007a). The number of females nesting per year on beaches in the Yucatán, at Aves Island, Galibi Reserve, and Isla Trindade number in the hundreds to low thousands, depending on the site (NMFS and USFWS 2007a). In the U.S., certain Florida nesting beaches have been designated index beaches. Index beaches were established to standardize data collection methods and effort on key nesting beaches. The pattern of green turtle nesting shows biennial peaks in abundance, with a generally positive trend during the ten years of regular monitoring since establishment of the index beaches in 1989, perhaps due to increased protective legislation throughout the Caribbean (Meylan et al. 1995). 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). Occasional nesting has been documented along the Gulf coast of Florida, at southwest Florida beaches, as well as the beaches on the Florida Panhandle (Meylan et al. 1995). More recently, green 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. 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). Recent modeling by Chaloupka et al. (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, and the Tortuguero, Costa Rica population growing at 4.9 percent annually.

There are no reliable estimates of the number of immature green sea turtles that inhabit coastal areas (where they come to forage) of the southeastern U.S. However, information on incidental captures of immature green sea turtles at the St. Lucie Power Plant (they have averaged 215 green sea turtle captures per year since 1977) in St. Lucie County, Florida (on the Atlantic coast of Florida) show that the annual number of immature green sea turtles captured has increased significantly in the past 26 years (FPL 2005). It is likely that immature green sea turtles foraging in the southeastern U.S. come from multiple genetic stocks; therefore, the status of immature green sea turtles in the southeastern U.S. 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 over-exploitation 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 U.S., 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. However, there are still significant and ongoing threats to green sea turtles from human-related causes in the U.S. These threats include 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, other human activities, and interactions with fishing gear. Sea sampling coverage in the pelagic driftnet, pelagic longline, Southeast shrimp trawl, and summer flounder bottom trawl fisheries has recorded takes of green turtles. There is also the increasing threat from green sea turtle fibropapillomatosis disease. 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).

3.2.1.3 Summary of Status for Atlantic Green Sea Turtles

Green turtles range in the western Atlantic from Massachusetts to Argentina, including the Gulf of Mexico and Caribbean, but are considered rare in benthic areas north of Cape Hatteras (Wynne and Schwartz 1999). Green turtles face many of the anthropogenic threats described above. In addition, green turtles are also susceptible to fibropapillomatosis, which can result in death. In the continental United States, green turtle nesting occurs on the Atlantic coast of Florida (Ehrhart 1979). Recent population estimates for the western Atlantic area are not available. The pattern of green turtle nesting shows biennial peaks in abundance, with a generally positive trend during the almost 20 years of regular monitoring since establishment of index beaches in Florida in 1989. However, given the species' late sexual maturity, caution is warranted about over-interpreting nesting trend data collected for less than 20 years.

3.2.2 Hawksbill Sea Turtle

The hawksbill turtle was listed as endangered under the precursor of the ESA on June 2, 1970, and is considered Critically Endangered by the International Union for the Conservation of Nature (IUCN). The hawksbill is a medium-sized sea turtle, with adults in the Caribbean ranging in size from approximately 62.5 to 94.0 cm straight carapace length. The species occurs in all ocean basins, although it is relatively rare in the Eastern Atlantic and Eastern Pacific, and absent from the Mediterranean Sea. Hawksbills are the most tropical sea turtle species, ranging from approximately 30°N latitude to 30°S latitude They are closely associated with coral reefs and other hardbottom habitats, but they are also found in other habitats including inlets, bays and coastal lagoons (NMFS and USFWS 1993). There are only five remaining regional nesting populations with more than 1,000 females nesting annually. These populations are in the Seychelles, Mexico, Indonesia, and two in Australia (Meylan and Donnelly 1999). There has been a global population decline of over 80 percent during the last three generations (105 years) (Meylan and Donnelly 1999).

3.2.2.1 Pacific Ocean

Anecdotal reports throughout the Pacific indicate that the current Pacific hawksbill population is well below historical levels (NMFS 2004a). It is believed that this species is rapidly approaching extinction in the Pacific because of harvesting for its meat, shell, and eggs as well as destruction of nesting habitat (NMFS 2004a). Hawksbill sea turtles nest in the Hawaiian Islands as well as the islands and mainland of southeast Asia, from China to Japan, and throughout the Philippines, Malaysia, Indonesia, Papua New Guinea, the Solomon Islands, and Australia (NMFS 2004a). However, along the eastern Pacific Rim where nesting was common in the 1930s, hawksbills are now rare or absent (Cliffton et al. 1982, NMFS 2004a).

3.2.2.2 Atlantic Ocean

In the western Atlantic, the largest hawksbill nesting population occurs in the Yucatán Peninsula of Mexico (Garduño-Andrade et al. 1999). With respect to the U.S., nesting occurs in Puerto Rico, the U.S. Virgin Islands, and the southeast coast of Florida. Nesting also occurs outside of the U.S. and its territories in Antigua, Barbados, Costa Rica, Cuba, and Jamaica (Meylan 1999a). Outside of the nesting areas, hawksbills have been seen off of the U.S. Gulf of Mexico states and along the eastern seaboard as far north as Massachusetts, although sightings north of Florida are rare (NMFS and USFWS 1993).

Life History and Distribution
The best estimate of age at sexual maturity for hawksbill sea turtles is about 20-40 years (Chaloupka and Limpus 1997, Crouse 1999a). Reproductive females undertake periodic (usually non-annual) migrations to their natal beach to nest. Movements of reproductive males are less well known, but are presumed to involve migrations to their nesting beach or to courtship stations along the migratory corridor (Meylan 1999b). Females nest an average of 3-5 times per season (Meylan and Donnelly 1999, Richardson et al. 1999). Clutch size is larger on average (up to 250 eggs) than that of other sea turtles (Hirth 1980). Reproductive females may exhibit a high degree of fidelity to their nest sites.

The life history of hawksbills consists of a pelagic stage that lasts from the time they leave the nesting beach as hatchlings until they are approximately 22-25 cm in straight carapace length (Meylan 1988, Meylan and Donnelly 1999), followed by residency in developmental habitats (foraging areas where juveniles reside and grow) in coastal waters. Adult foraging habitat, which may or may not overlap with developmental habitat, is typically coral reefs, although other hard-bottom communities and occasionally mangrove-fringed bays may be occupied. Hawksbills show fidelity to their foraging areas over several years (van Dam and Díez 1998).

The hawksbill's diet is highly specialized and consists primarily of sponges (Meylan 1988). Other food items, notably corallimorphs and zooanthids, have been documented to be important in some areas of the Caribbean (van Dam and Díez 1997, Mayor et al. 1998, Leon and Díez 2000).

Population Dynamics and Status
Nesting within the southeastern U.S. and U.S. Caribbean is restricted to Puerto Rico (>650 nests/yr), the U.S. Virgin Islands (~400 nests/yr), and rarely Florida (0-4 nests/yr) (Eckert 1995, Meylan 1999a, Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute's Statewide Nesting Beach Survey data 2002). At the two principal nesting beaches in the U.S. Caribbean where long-term monitoring has been carried out, populations appear to be increasing (Mona Island, Puerto Rico) or stable (Buck Island Reef National Monument, St. Croix, USVI) (Meylan 1999a).

Threats
As with other sea turtle species, hawksbill sea turtles are affected by habitat loss, habitat degradation, marine pollution, marine debris, fishery interactions, and poaching in some parts of their range. A complete list of other indirect factors can be found in NMFS SEFSC (2001a). There continues to be a black market for hawksbill shell products ("tortoiseshell"), which likely contributes to the harvest of this species.

3.2.2.3 Summary of Status for Hawksbill Sea Turtles

Worldwide, hawksbill sea turtle populations are declining. They face many of the same threats affecting other sea turtle species. In addition, there continues to be a commercial market for hawksbill shell products, despite protections afforded to the species under U.S. law and international conventions.

3.2.3 Kemp's Ridley Sea Turtle

The Kemp's ridley was listed as endangered on December 2, 1970. Internationally, the Kemp's ridley is considered the most endangered sea turtle (Zwinenberg 1977, Groombridge 1982, TEWG 2000). Kemp's ridleys nest primarily at Rancho Nuevo, a stretch of beach in Mexico, Tamaulipas State. This species occurs mainly in coastal areas of the Gulf of Mexico and the northwestern Atlantic Ocean. Occasional individuals reach European waters (Brongersma 1972). Adults of this species are usually confined to the Gulf of Mexico, although adult-sized individuals sometimes are found on the east coast of the U.S.

Life History and Distribution
The TEWG (1998) estimates age at maturity from 7-15 years. Females return to their nesting beach about every 2 years (TEWG 1998). Nesting occurs from April into July and is essentially limited to the beaches of the western Gulf of Mexico, near Rancho Nuevo in southern Tamaulipas, Mexico. The mean clutch size for Kemp's ridleys is 100 eggs/nest, with an average of 2.5 nests/female/season.

Little is known of the movements of the post-hatchling stage (pelagic stage) within the Gulf of Mexico. Studies have shown the post-hatchling pelagic stage varies from 1-4 or more years, and the benthic immature stage lasts 7-9 years (Schmid and Witzell 1997). Benthic immature Kemp's ridleys have been found along the Eastern Seaboard of the U.S. and in the Gulf of Mexico. Atlantic benthic immature sea turtles travel northward as the water warms to feed in the productive, coastal waters off Georgia through New England, returning southward with the onset of winter (Lutcavage and Musick 1985, Henwood and Ogren 1987, Ogren 1989). Studies suggest that benthic immature Kemp's ridleys stay in shallow, warm, nearshore waters in the northern Gulf of Mexico until cooling waters force them offshore or south along the Florida coast (Renaud 1995).

Stomach contents of Kemp's ridleys along the lower Texas coast consisted of nearshore crabs and mollusks, as well as fish, shrimp, and other foods considered to be shrimp fishery discards (Shaver 1991). A 2005 dietary study of immature Kemp's ridleys off southwest Florida documented predation on benthic tunicates, a previously undocumented food source for this species (Witzell and Schmid 2005). These pelagic stage Kemp's ridleys presumably feed on the available *Sargassum* and associated infauna or other epipelagic species found in the Gulf of Mexico.

Population Dynamics and Status

Of the seven extant 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 (with 6,277 nests recorded in 2000) suggest 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 2007).

A period of steady increase in benthic immature ridleys has been occurring since 1990 and appears to be due to increased hatchling production and an apparent increase in survival rates of immature sea turtles beginning in 1990. The increased survivorship of immature sea turtles is attributable, in part, to the introduction of TEDs in the U.S. and Mexican shrimping fleets. As demonstrated by nesting increases at the main nesting sites in Mexico, adult ridley numbers have increased over the last decade. The population model used by TEWG (2000) projected that Kemp's ridleys could reach the Recovery Plan's intermediate recovery goal of 10,000 nesters by the year 2015.

Next to loggerheads, Kemp's ridleys are the second most abundant sea turtle in Virginia and Maryland waters, arriving in these areas during May and June (Keinath et al. 1987, Musick and Limpus 1997). The juvenile population of Kemp's ridley sea turtles in Chesapeake Bay is estimated to be 211 to 1,083 sea turtles (Musick and Limpus 1997). These juveniles frequently forage in submerged aquatic grass beds for crabs (Musick and Limpus 1997). Kemp's ridleys consume a variety of crab species, including *Callinectes* spp., *Ovalipes* spp., *Libinia* spp., and *Cancer* spp. Mollusks, shrimp, and fish are consumed less frequently (Bjorndal 1997). Upon leaving Chesapeake Bay in autumn, juvenile Kemp's 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. 1995a, Epperly et al. 1995b).

Threats

Kemp's ridleys face many of the same threats as other sea turtle species, including destruction of nesting habitat from storm events, natural predators at sea, and oceanic events such as cold-stunning. 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, 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. A complete list of other indirect factors can be found in NMFS SEFSC (2001a).

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 five 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.

3.2.3.1 Summary of Kemp's Ridley Status

The only major nesting site for Kemp's ridleys is a single stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Carr 1963). The number of nests observed at Rancho Nuevo and nearby beaches increased from 1985 to 1999. Nesting data has also exceeded 12,000 nests per year from 2004-2007 (Gladys Porter Zoo database). Kemp's ridleys mature at an earlier age (7-15 years) than other chelonids, thus 'lag effects' as a result of unknown impacts to the non-breeding life stages would likely have been seen in the increasing nest trend beginning in 1985 (USFWS and NMFS 1992).

The largest contributors to the decline of Kemp's ridleys in the past were commercial and local exploitation, especially poaching of nests at the Rancho Nuevo site, as well as the Gulf of Mexico trawl fisheries. The advent of TED regulations for trawlers and protections for the nesting beaches has allowed the species to begin to rebound. Many threats to the future of the species remain, including interactions with fishery gear, marine pollution, foraging habitat destruction, illegal poaching of nests and potential threats to the nesting beaches from such sources as global climate change, development, and tourism pressures.

3.2.3 Leatherback Sea Turtle

The leatherback sea turtle was listed as endangered throughout its global range on June 2, 1970. Leatherbacks are widely distributed throughout the oceans of the world, and are found in waters of the Atlantic, Pacific, and Indian Oceans (Ernst and Barbour 1972). Leatherback sea turtles are the largest living turtles and range farther than any other sea turtle species. The large size of adult leatherbacks and their tolerance to relatively low temperatures allows them to occur in northern waters such as off Labrador and in the Barents Sea (NMFS and USFWS 1995). Adult leatherbacks forage in temperate and subpolar regions from 71°N to 47°S latitude in all oceans and undergo extensive migrations to and from their tropical nesting beaches. In 1980, the leatherback population was estimated at approximately 115,000 adult females globally (Pritchard 1982). That number, however, is probably an overestimation as it was based on a particularly good nesting year in 1980 (Pritchard 1996). By 1995, the global population of adult females had declined to 34,500 (Spotila et al. 1996). Pritchard (1996) also called into question the population estimates from Spotila et al. (1996), and felt they may be somewhat low, because it ended the modeling on data from a particularly bad nesting year (1994) while excluding nesting data from 1995, which was a good nesting year. However, the most recent population estimate for leatherback sea turtles from just the North Atlantic breeding groups is a range of 34,000-90,000 adult individuals (20,000-56,000 adult females) (TEWG 2007).

3.2.3.1 Pacific Ocean

Based on published estimates of nesting female abundance, leatherback populations have collapsed or have been declining at all major Pacific basin nesting beaches for the last two decades (Spotila et al. 1996, NMFS and USFWS 1998c, Sarti et al. 2000, Spotila et al. 2000). For example, the nesting assemblage on Terengganu, Malaysia – which was one of the most significant nesting sites in the western Pacific Ocean – has declined severely from an estimated 3,103 females in 1968 to two nesting females in 1994 (Chan and Liew 1996). Nesting assemblages of leatherback turtles are in decline along the coasts of the Solomon Islands, a historically important nesting area (D. Broderick, pers. comm., in Dutton et al. 1999). In Fiji, Thailand, Australia, and Papua New Guinea (East

Papua), leatherback turtles have only been known to nest in low densities and scattered colonies.

Only an Indonesian nesting assemblage has remained relatively abundant in the Pacific basin. The largest extant leatherback nesting assemblage in the Indo-Pacific lies on the north Vogelkop coast of Irian Jaya (West Papua), Indonesia, with over 3,000 nests recorded annually (Putrawidjaja 2000, Suárez et al. 2000). During the early-to-mid 1980s, the number of female leatherback turtles nesting on the two primary beaches of Irian Jaya appeared to be stable. More recently, this population has come under increasing threats that could cause this population to experience a collapse that is similar to what occurred at Terengganu, Malaysia. In 1999, for example, local Indonesian villagers started reporting dramatic declines in sea turtle populations near their villages (Suárez 1999). Unless hatchling and adult turtles on nesting beaches receive more protection, this population will continue to decline. Declines in nesting assemblages of leatherback turtles have been reported throughout the western Pacific region, with nesting assemblages well below abundance levels observed several decades ago (e.g., Suárez 1999).

In the western Pacific Ocean and South China Seas, leatherback turtles are captured, injured, or killed in numerous fisheries, including Japanese longline fisheries. The poaching of eggs, killing of nesting females, human encroachment on nesting beaches, beach erosion, and egg predation by animals also threaten leatherback turtles in the western Pacific.

In the eastern Pacific Ocean, nesting populations of leatherback turtles are declining along the Pacific coast of Mexico and Costa Rica. According to reports from the late 1970s and early 1980s, three beaches on the Pacific coast of Mexico supported as many as half of all leatherback turtle nests for the eastern Pacific. Since the early 1980s, the eastern Pacific Mexican population of adult female leatherback turtles has declined to slightly more than 200 individuals during 1998-99 and 1999-2000 (Sarti et al. 2000). Spotila et al. (2000) reported the decline of the leatherback turtle population at Playa Grande, Costa Rica, which had been the fourth largest nesting colony in the world. Between 1988 and 1999, the nesting colony declined from 1,367 to 117 female leatherback turtles. Based on their models, Spotila et al. (2000) estimated that the colony could fall to less than 50 females by 2003-2004. Leatherback turtles in the eastern Pacific Ocean are captured, injured, or killed in commercial and artisanal swordfish fisheries off Chile, Columbia, Ecuador, and Peru, and purse seine fisheries for tuna in the eastern tropical Pacific Ocean, and California/Oregon drift gillnet fisheries. Because of the limited data, we cannot provide high-certainty estimates of the number of leatherback turtles captured, injured, or killed through interactions with these fisheries. However, between 8-17 leatherback turtles were estimated to have died annually between 1990 and 2000 in interactions with the California/Oregon drift gillnet fishery; 500 leatherback turtles are estimated to die annually in Chilean and Peruvian fisheries; 200 leatherback turtles are estimated to die in direct harvests in Indonesia; and before 1992, the North Pacific driftnet fisheries for squid, tuna, and billfish captured an estimated 1,000 leatherback turtles each year, killing about 111 of them each year.

Although all causes of the declines in leatherback turtle colonies in the eastern Pacific have not been documented, Sarti et al. (1998) suggest that the declines result from egg poaching, adult and sub-adult mortalities incidental to high seas fisheries, and natural fluctuations due to changing environmental conditions. Some published reports support this suggestion. Sarti et al. (2000) reported that female leatherback turtles have been killed for meat on nesting beaches like Píedra de Tiacoyunque, Guerrero, Mexico. Eckert (1997) reported that swordfish gillnet fisheries in Peru and Chile contributed to the decline of leatherback turtles in the eastern Pacific. The decline in the nesting population at Mexiquillo, Mexico, occurred at the same time that effort doubled in the Chilean driftnet fishery. In response to these effects, the eastern Pacific population has continued to decline, leading some researchers to conclude that the leatherback is on the verge of extinction in the Pacific Ocean (e.g., Spotila et al. 1996, Spotila et al. 2000). The NMFS assessment of three nesting aggregations in its February 23, 2004, opinion supports this conclusion: If no action is taken to reverse their decline, leatherback sea turtles nesting in the Pacific Ocean either have high risks of extinction in a single human generation (for example, nesting aggregations at Terrenganu and Costa Rica) or they have a high risk of declining to levels where more precipitous declines become almost certain (e.g., Irian Jaya) (NMFS 2004a).

3.2.3.2 Atlantic Ocean

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 2001a). Female leatherbacks nest from the southeastern U.S. 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 in French Guiana and Suriname (NMFS SEFSC 2001a). Previous genetic analyses of leatherbacks using only mitochondrial DNA (mtDNA) resulted in an earlier determination that within the Atlantic basin there are at least three genetically different nesting populations: the St. Croix nesting population (U.S. Virgin Islands), the mainland nesting Caribbean population (Florida, Costa Rica, Suriname/French Guiana), and the Trinidad nesting population (Dutton et al. 1999). Further genetic analyses using microsatellite markers in nuclear DNA 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). When the hatchlings leave the nesting beaches, they move offshore but eventually utilize both coastal and pelagic waters. Very little is known about the pelagic habits of the hatchlings and juveniles, and they have not been documented to be associated with the *Sargassum* areas as are other species. Leatherbacks are deep divers, with recorded dives to depths in excess of 1,000 m (Eckert et al. 1989, Hayes et al. 2004).

Life History and Distribution

Leatherbacks are a long-lived species, living for well over 30 years. It has been thought that they reach sexual maturity somewhat faster than other sea turtles (except Kemp's ridley), with an estimated range from 3-6 years (Rhodin 1985) to 13-14 years (Zug and Parham 1996). However, some 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). Continued research in this area is vitally important to understanding the life history of leatherbacks and has important implications in management of the species.

They nest frequently (up to 10 nests per year) during a nesting season and nest about every 2-3 years. During each nesting, they produce 100 eggs or more in each clutch and, thus, can produce 700 eggs or more per nesting season (Schultz 1975). However, a significant portion (up to approximately 30 percent) of the eggs can be infertile. Thus, the actual proportion of eggs that can result in hatchlings is less than this seasonal estimate. The eggs incubate for 55-75 days before hatching. Based on a review of all sightings of leatherback sea turtles of <145 cm curved carapace length (ccl), Eckert (1999) found that leatherback juveniles remain in waters warmer than 26°C until they exceed 100 cm ccl.

Although leatherbacks are the most pelagic of the sea turtles, they enter coastal waters on a seasonal basis to feed in areas where jellyfish are concentrated. Leatherback sea turtles feed primarily on cnidarians (medusae, siphonophores) and tunicates.

Evidence from tag returns and strandings in the western Atlantic suggests that adult leatherback sea turtles engage in routine migrations between boreal, temperate, and tropical waters (NMFS and USFWS 1992). A 1979 aerial survey of the outer continental shelf from Cape Hatteras, North Carolina, to Cape Sable, Nova Scotia showed leatherbacks to be present throughout the area with the most numerous sightings made from the Gulf of Maine south to Long Island. Leatherbacks were sighted in waters where depths ranged from 1-4,151 m, but 84.4 percent of sightings were in areas where the water was less than 180 m deep (Shoop and Kenney 1992). Leatherbacks were sighted in waters of a similar sea surface temperature as loggerheads; from 7°-27.2°C (Shoop and Kenney 1992). However, this species appears to have a greater tolerance for colder waters because more leatherbacks were found at the lower temperatures (Shoop and Kenney 1992). This aerial survey estimated the in-water leatherback population from near Nova Scotia, Canada to Cape Hatteras, North Carolina at approximately 300-600 animals.

General differences in migration patterns and foraging grounds may occur between the seven nesting assemblages, but data is limited. Per TEWG (2007):

> Marked or satellite tracked turtles from the Florida and North Caribbean assemblages have been re-sighted off North America, in the Gulf of Mexico and along the Atlantic coast and a few have moved to western Africa, north of the equator. In contrast, Western Caribbean and Southern Caribbean/Guianas animals have been found more commonly in the eastern Atlantic, off Europe and northern Africa, as well as along the

North American coast. There are no reports of marked animals from the Western North Atlantic assemblages entering the Mediterranean Sea or the South Atlantic Ocean, though in the case of the Mediterranean this may be due more to a lack of data rather than failure of Western North Atlantic turtles moving into the Sea. The tagging data coupled with the satellite telemetry data indicate that animals from the western North Atlantic nesting subpopulations use virtually the entire North Atlantic Ocean. In the South Atlantic Ocean, tracking and tag return data follow three primary patterns. Although telemetry data from the West African nesting assemblage showed that all but one remained on the shallow continental shelf, there clearly is movement to foraging areas of the south coast of Brazil and Argentina. There is also a small nesting aggregation of leatherbacks in Brazil, and while data are limited to a few satellite tracks, these turtles seem to remain in the southwest Atlantic foraging along the continental shelf margin as far south as Argentina. South African nesting turtles apparently forage primarily south, around the tip of the continent.

Population Dynamics and Status

The status of the Atlantic leatherback population has been less clear than the Pacific population. 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, recent 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). Spotila et al. (1996) have estimated that over 40 percent of the world's leatherbacks nest in Suriname and French Guiana. 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 2001a). However, from 1979-1986, the number of nests was increasing at about 15 percent annually which could mean that the current decline could be part of a nesting cycle which 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 have shown large recent 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 (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 Columbia. The most intense nesting in that area occurs in Costa Rica, Panama, and the Gulf of Uraba in Colombia (Duque et al. 2000). The Caribbean coast of Costa Rica and extending through to Chiriqui 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 Pacuare, in Costa Rica) using various Bayesian and regression analyses indicated that the nesting population was likely not growing over the 1995-2005 time series of available data (TEWG 2007), though 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, the U.S. Virgin Islands (St. Croix), and the British Virgin Islands (Tortola). In Puerto Rico the primary nesting beaches are at Fajardo, and on the island of Culebra. Nesting between 1978-2005 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 1008 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 1994-2004 (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 2000's following nesting totals fewer than 100 nests per year in the 1980s (Florida Fish and Wildlife Conservation Commission, unpublished data). Using data from the Index Nesting Beach Surveys, the TEWG (2007) has estimated a significant annual nesting growth rate of 1.17 percent between 1989 and 2005.

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 is inconsistent. However, it is known that Gabon has a very large amount of leatherback nesting, with at least 30,000 nests laid along their coast in one season (Fretey et al. in press). Fretey et al. (in press) 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 include 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 the 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 population had decreased to about 15,000 nesting females. 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 nesting females, with an estimated range of 20,082-35,133. This is similar to the estimated figures of 34,000-95,000 total adults (20,000-56,000 adult females; 10,000-21,000 nesting females) determined by the TEWG (2007).

Threats

Zug and Parham (1996) pointed out that the main threat to leatherback populations in the Atlantic is the combination of fishery-related mortality (especially entanglement in gear and drowning in trawls) and the intense egg harvesting on the main nesting beaches. Other important ongoing threats to the population include pollution, loss of nesting habitat, and boat strikes.

Of sea turtle species, leatherbacks seem to be the most vulnerable to entanglement in fishing gear. 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, possibly their method of locomotion, and perhaps their attraction to the lightsticks used to attract target species in longline fisheries. They are also susceptible to entanglement in gillnets and pot/trap lines (used in various fisheries) and capture in trawl gear (e.g., shrimp trawls).

Leatherbacks are exposed to pelagic longline fisheries in many areas of their range. Unlike loggerhead turtle interactions with longline gear, leatherback turtles do not usually ingest longline bait. Instead, leatherbacks are typically foul hooked by longline gear (e.g., on the flipper or shoulder area) rather than getting mouth hooked or swallowing the hook (NMFS SEFSC 2001a). A total of 24 nations, including the U.S. (accounting for 5-8 percent of the hooks fished), have fleets participating in pelagic longline fisheries in the area. Basin-wide, Lewison et al. (2004) estimated that 30,000-60,000 leatherback sea turtle captures occurred in Atlantic pelagic longline fisheries in the year 2000 alone (note that multiple captures of the same individual are known to occur, so the actual number of individuals captured may not be as high). Genetic studies performed within the Northeast Distant Fishery Experiment indicate that the leatherbacks captured in the Atlantic highly migratory species pelagic longline fishery were primarily from the French Guiana and Trinidad nesting stocks (over 95 percent). Individuals from West African stocks were surprisingly absent (Roden et al. in press).

Leatherbacks are also susceptible to entanglement in the lines associated with trap/pot gear used in several fisheries. From 1990-2000, 92 entangled leatherbacks were reported from New York through Maine (Dwyer et al. 2002). Additional leatherbacks stranded wrapped in line of unknown origin or with evidence of a past entanglement (Dwyer et al. 2002). Fixed gear fisheries in the mid-Atlantic have also contributed to leatherback entanglements. In North Carolina, two leatherback sea turtles were reported entangled in a crab pot buoy inside Hatteras Inlet (D. Fletcher, pers. comm. to S. Epperly in NMFS SEFSC 2001a). A third leatherback was reported entangled in a crab pot buoy in Pamlico Sound near Ocracoke. This turtle was disentangled and released alive; however, lacerations on the front flippers from the lines were evident (D. Fletcher, pers. comm. to S. Epperly in NMFS SEFSC 2001a). In the Southeast, leatherbacks are vulnerable to entanglement in Florida's lobster pot and stone crab fisheries. In the U.S. Virgin Islands, where one of five leatherback strandings from 1982 to 1997 was due to entanglement (Boulon 2000), leatherbacks have been observed with their flippers wrapped in the line of West Indian fish traps (R. Boulon, pers. comm. to J. Braun-McNeill in NMFS SEFSC 2001a). Because many entanglements of this typically pelagic species likely go unnoticed, entanglements in fishing gear may be much higher.

Leatherback interactions with the southeast Atlantic shrimp fishery, which operates predominately from North Carolina through southeast Florida (NMFS 2002a), have also been a common occurrence. Leatherbacks, which migrate north annually, are likely to encounter shrimp trawls working in the coastal waters off the Atlantic coast from Cape Canaveral, Florida, to the Virginia/North Carolina border. Leatherbacks also interact with the Gulf of Mexico shrimp fishery. For many years, TEDs required for use in these fisheries were less effective at excluding leatherbacks than the smaller, hard-shelled turtle species. To address this problem, on February 21, 2003, the NMFS issued a final rule to amend the TED regulations. Modifications to the design of TEDs are now required in order to exclude leatherbacks and large and sexually mature loggerhead and green turtles.

Other trawl fisheries are also known to interact with leatherback sea turtles. In October 2001, a Northeast Fisheries Science Center observer documented the take of a leatherback in a bottom otter trawl fishing for *Loligo* squid off of Delaware; TEDs are not required in this fishery. The winter trawl flounder fishery, which did not come under the revised TED regulations, may also interact with leatherback sea turtles.

Gillnet fisheries operating in the nearshore waters of the mid-Atlantic states are also suspected of capturing, injuring, and/or killing leatherbacks when these fisheries and leatherbacks co-occur. Data collected by the Northeast Fisheries Science Center (NEFSC) Fisheries Observer Program from 1994 through 1998 (excluding 1997) indicate that a total of 37 leatherbacks were incidentally captured (16 lethally) in drift gillnets set in offshore waters from Maine to Florida during this period. Observer coverage for this period ranged from 54 to 92 percent.

Poaching is not known to be a problem for nesting populations in the continental U.S. However, in 2001 the NMFS Southeast Fishery Science Center (SEFSC) noted that poaching of juveniles and adults was still occurring in the U.S. Virgin Islands and the Guianas. In all, four of the five strandings in St. Croix were the result of poaching (Boulon 2000). A few cases of fishermen poaching leatherbacks have been reported from Puerto Rico, but most of the poaching is on eggs.

Leatherback sea turtles may be more susceptible to marine debris ingestion than other species due to their pelagic existence and the tendency of floating debris to concentrate in convergence zones that adults and juveniles use for feeding areas and migratory routes (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 plastic (Mrosovsky 1981). Along the coast of Peru, intestinal contents of 19 of 140 (13 percent) leatherback carcasses were found to contain plastic bags and film (Fritts 1982). The presence of plastic debris in the digestive tract suggests that leatherbacks might not be able to distinguish between prey items and plastic debris (Mrosovsky 1981). 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.

It is important to note that, like marine debris, fishing gear interactions and poaching are problems for leatherbacks throughout their range. Entanglements are common in Canadian waters where Goff and Lien (1988) reported that 14 of 20 leatherbacks encountered off the coast of Newfoundland/Labrador were entangled in fishing gear including salmon net, herring net, gillnet, trawl line and crab pot line. Leatherbacks are reported taken by many other nations that participate in Atlantic pelagic longline fisheries, including Taipei, Brazil, Trinidad, Morocco, Cyprus, Venezuela, Korea, Mexico, Cuba, U.K., Bermuda, People's Republic of China, Grenada, Canada, Belize, France, and Ireland (see NMFS SEFSC 2001a, for a description of take records). Leatherbacks are known to drown in fish nets set in coastal waters of Sao Tome, West Africa (Castroviejo et al. 1994, Graff 1995). Gillnets are one of the suspected causes for the decline in the leatherback sea turtle population in French Guiana (Chevalier et al. 1999), and gillnets targeting green and hawksbill turtles in the waters of coastal Nicaragua also incidentally catch leatherback turtles (Lageux et al. 1998). Observers on shrimp trawlers operating in the northeastern region of Venezuela documented the capture of six leatherbacks from 13,600 trawls (Marcano and Alio-M 2000). A study by the Trinidad and Tobago's Institute for Marine Affairs (IMA), in 2002 confirmed that bycatch of leatherbacks is high in Trinidad. IMA estimated that more than 3,000 leatherbacks were captured incidental to gillnet fishing in the coastal waters of Trinidad in 2000. As much as one half or more of the gravid turtles may be killed (Lee Lum 2003). However, many of the turtles do not die as a result of drowning, but rather because the fishermen butcher them in order to get them out of their nets (NMFS SEFSC 2001a).

3.2.3.3 Summary of Leatherback Status

In the Pacific Ocean, the abundance of leatherback turtle nesting individuals and colonies has declined dramatically over the past 10 to 20 years. Nesting colonies throughout the eastern and western Pacific Ocean have been reduced to a fraction of their former abundance by the combined effects of human activities that have reduced the number of nesting females. In addition, egg poaching has reduced the reproductive success of the remaining nesting females. At current rates of decline, leatherback turtles in the Pacific basin are a critically endangered species with a low probability of surviving and recovering in the wild.

In the Atlantic Ocean, our understanding of the status and trends of leatherback turtles is somewhat more confounded, although the overall trend appears to be stable to increasing, compared to the bleak situation in the Pacific. The data indicates increasing or stable nesting populations in all of the regions except West Africa (no long-term data are available) and the Western Caribbean (TEWG 2007). Some of the same factors that led to precipitous declines of leatherbacks in the Pacific also affect leatherbacks in the Atlantic (i.e., leatherbacks are captured and killed in many kinds of fishing gear and interact with fisheries in state, federal, and international waters). Poaching is also a problem that affects leatherbacks occurring in U.S. waters. Leatherbacks are also more susceptible to death or injury from ingesting marine debris than other turtle species.

3.2.5 Loggerhead Sea Turtle

The loggerhead sea turtle was listed as a threatened species throughout its global range on July 28, 1978. It was listed because of direct take, incidental capture in various fisheries, and the alteration and destruction of its habitat. Loggerhead sea turtles inhabit the continental shelves and estuarine environments along the margins of the Atlantic, Pacific, and Indian Oceans. Loggerhead sea turtles are the most abundant species of sea turtle in the U.S.

3.2.5.1 Pacific Ocean

In the Pacific Ocean, major loggerhead nesting grounds are generally located in temperate and subtropical regions with scattered nesting in the tropics. Within the Pacific Ocean, loggerhead sea turtles are represented by a northwestern Pacific nesting aggregation (located in Japan) and a smaller southwestern nesting aggregation that occurs in eastern Australia (Great Barrier Reef and Queensland) and New Caledonia (NMFS SEFSC 2001a). There are no reported loggerhead nesting sites in the eastern or central Pacific Ocean basin. Data from 1995 estimated the Japanese nesting aggregation at 1,000 female loggerhead sea turtles (Bolten et al. 1996). More recent information suggests that nest numbers have increased somewhat over the period 1998-2004 (NMFS and USFWS 2007e). However, this time period is too short to make a determination of the overall trend in nesting (NMFS and USFWS 2007e). Recent genetic analyses on female loggerheads nesting in Japan suggest that this "subpopulation" is comprised of genetically distinct nesting colonies (Hatase et al. 2002) with precise natal homing of individual females. As a result, Hatase et al. (2002) indicate that loss of one of these colonies would decrease the genetic diversity of Japanese loggerheads; recolonization of the site would not be expected on an ecological time scale. In Australia, long-term census data have been collected at some rookeries since the late 1960s and early 1970s, and nearly all the data show marked declines in nesting populations since the mid-1980s (Limpus and Limpus 2003). The nesting aggregation in Queensland, Australia, was as low as 300 females in 1997.

Pacific loggerhead turtles are captured, injured, or killed in numerous Pacific fisheries including Japanese longline fisheries in the western Pacific Ocean and South China Seas; direct harvest and commercial fisheries off Baja California, Mexico; commercial and artisanal swordfish fisheries off Chile, Columbia, Ecuador, and Peru; purse seine fisheries for tuna in the eastern tropical Pacific Ocean; and California/Oregon drift gillnet fisheries. In Australia, where turtles are taken in bottom trawl and longline fisheries, efforts have been made to reduce fishery bycatch (NMFS and USFWS 2007e).
In addition, the abundance of loggerhead sea turtles on nesting colonies throughout the Pacific basin has declined dramatically over the past 10 to 20 years. Loggerhead turtle colonies in the western Pacific Ocean have been reduced to a fraction of their former abundance by the combined effects of human activities that have reduced the number of nesting females and reduced the reproductive success of females that manage to nest (e.g., due to egg poaching).

In July 2007, NMFS received a petition requesting that loggerhead sea turtles in the North Pacific be classified as a DPS with endangered status and critical habitat designated. The petition also requested that, if the North Pacific loggerhead is not determined to meet the DPS criteria, that loggerheads throughout the Pacific Ocean be designated as a DPS and listed as endangered.

3.2.5.2 Indian Ocean

Loggerhead sea turtles are distributed throughout the Indian Ocean, along most mainland coasts and island groups (Baldwin et al. 2003). Throughout the Indian Ocean, loggerhead sea turtles face many of the same threats as in other parts of the world including loss of nesting beach habitat, fishery interactions, and turtle meat and/or egg harvesting.

In the southwestern Indian Ocean, loggerhead nesting has shown signs of recovery in South Africa where protection measures have been in place for decades. However, in other southwestern areas (e.g., Madagascar and Mozambique) loggerhead nesting groups are still affected by subsistence hunting of adults and eggs (Baldwin et al. 2003). The largest known nesting group of loggerheads in the world occurs in Oman in the northern Indian Ocean. An estimated 20,000-40,000 females nest at Masirah, the largest nesting site within Oman, each year (Baldwin et al. 2003). In the eastern Indian ocean, all known nesting sites are found in Western Australia (Dodd 1988). As has been found in other areas, nesting numbers are disproportionate within the area with the majority of nesting occurring at a single location. This may, however, be the result of fox predation on eggs at other Western Australia nesting sites (Baldwin et al. 2003).

3.2.5.3 Mediterranean Sea

Nesting in the Mediterranean is confined almost exclusively to the eastern basin. The greatest number of nests in the Mediterranean are found in Greece with an average of 3,050 nests per year. There is a long history of exploitation for loggerheads in the Mediterranean. Although much of this is now prohibited, some directed take still occurs. Loggerheads in the Mediterranean also face the threat of habitat degradation, incidental fishery interactions, vessel strikes, and marine pollution (Margaritoulis et al. 2003). Longline fisheries, in particular, are believed to catch thousands of juvenile loggerheads each year (NMFS and USFWS 2007e), although genetic analyses indicate that only a portion of the loggerheads captured originate from loggerhead nesting groups in the Mediterranean (Laurent et al. 1998).

3.2.5.4 Atlantic Ocean

In the western Atlantic, most loggerhead sea turtles nest from North Carolina to Florida and along the Gulf coast of Florida. There are at least five western Atlantic subpopulations, divided geographically as follows: (1) a northern nesting subpopulation, occurring from North Carolina to northeast Florida at about 29°N; (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 1990 and TEWG 2000); and (5) a Dry Tortugas nesting subpopulation, occurring in the islands of the Dry Tortugas, near Key West, Florida (NMFS SEFSC 2001a). The fidelity of nesting females to their nesting beach is the reason these subpopulations can be differentiated from one another. Fidelity for nesting beaches makes recolonization of nesting beaches with sea turtles from other subpopulations unlikely. Genetic analyses conducted at nesting sites for each of the five nesting groups indicate that there are genetic differences between turtles that nest at and originate from the beaches used by each nesting group of females (TEWG 2000). Genetics data suggests that it may be warranted to identify additional nesting groups (Shamblin 2007).

Life History and Distribution

Past literature gave an estimated age at maturity of 21-35 years (Frazer and Ehrhart 1985, Frazer et al. 1994) with the benthic immature stage lasting at least 10-25 years. However, based on new data from tag returns, strandings, and nesting surveys NMFS SEFSC (2001a) estimated ages of maturity ranging from 20-38 years and benthic immature stage lasting from 14-32 years.

Mating takes place in late March-early June, and eggs are laid throughout the summer, with a mean clutch size of 100-126 eggs in the southeastern U.S. Individual females nest multiple times during a nesting season, with a mean of 4.1 nests/individual (Murphy and

Hopkins 1984). Nesting migrations for an individual female loggerhead are usually on an interval of 2-3 years, but can vary from 1-7 years (Dodd 1988). Generally, loggerhead sea turtles originating from the western Atlantic nesting aggregations are believed to lead a pelagic existence in the North Atlantic Gyre for as long as 7-12 years or more. Stranding records indicate that when pelagic immature loggerheads reach 40-60 cm straight-line carapace length they begin to live in coastal inshore and nearshore waters of the continental shelf throughout the U.S. Atlantic and Gulf of Mexico, although some loggerheads may move back and forth between the pelagic and benthic environment (Witzell 2002). Benthic immature loggerheads (sea turtles that have come back to inshore and nearshore waters), the life stage following the pelagic immature stage, have been found from Cape Cod, Massachusetts, to southern Texas, and occasionally strand on beaches in northeastern Mexico.

Tagging studies have shown loggerheads that have entered the benthic environment undertake routine migrations along the coast that are limited by seasonal water temperatures. Loggerhead sea turtles occur year-round in offshore waters off of North Carolina where water temperature is influenced by the Gulf Stream. As coastal water temperatures warm in the spring, loggerheads begin to immigrate to North Carolina inshore waters (e.g., Pamlico and Core Sounds) and also move up the coast (Epperly et al. 1995a-c), occurring in Virginia foraging areas as early as April and on the most northern foraging grounds in the Gulf of Maine in June. The trend is reversed in the fall as water temperatures cool. The large majority leave the Gulf of Maine by mid-September but some may remain in Mid-Atlantic and Northeast areas until late fall. By December loggerheads have emigrated from inshore North Carolina waters and coastal waters to the north to waters offshore of North Carolina, particularly off of Cape Hatteras, and waters further south where the influence of the Gulf Stream provides temperatures favorable to sea turtles ($\geq$11°C) (Epperly et al. 1995a-c). Loggerhead sea turtles are year-round residents of central and south Florida.

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.

More recent studies are revealing that loggerheads' life history is more complex than previously believed. Rather than making discrete developmental shifts from oceanic to neritic environments, research is showing that both adults and (presumed) neritic stage juveniles continue to use the oceanic environment and will move back and forth between the two habitats (Witzell 2002, Blumenthal et al. 2006, Hawkes et al. 2006, McClellan and Read 2007). One of the studies tracked the movements of adult females post-nesting and found a difference in habitat use was related to body size with larger turtles staying in coastal waters and smaller turtles traveling to oceanic waters (Hawkes et al. 2006). A tracking study of large juveniles found that the habitat preferences of this life stage were also diverse with some remaining in neritic waters while others moved off into oceanic waters (McClellan and Read 2007). However, unlike the Hawkes et al. study (2006), there was no significant difference in the body size of turtles that remained in neritic waters versus oceanic waters (McClellan and Read 2007). In either case, the research not only supports the need to revise the life history model for loggerheads but also demonstrates that threats to loggerheads in both the neritic and oceanic environments are likely impacting multiple life stages of this species.

Population Dynamics and Status

A number of stock assessments (TEWG 1998, TEWG 2000, NMFS SEFSC 2001a, Heppell et al. 2003) have examined the stock status of loggerheads in the waters of the U.S., but have been unable to develop any reliable estimates of absolute population size. Based on nesting data of the five western Atlantic subpopulations, the South Florida nesting subpopulation and the Northern subpopulations are the most abundant (TEWG 2000, NMFS 2001a). Between 1989 and 1998, the total number of nests laid along the U.S. Atlantic and Gulf coasts ranged from 53,014 to 92,182, annually with a mean of 73,751 (TEWG 2000). On average, 90.7 percent of these nests were of the South Florida subpopulation and 8.5 percent were from the Northern subpopulation (TEWG 2000). The TEWG (2000) assessment of the status of these two better-studied populations concluded that the South Florida subpopulation was increasing at that time, while no trend was evident (may be stable but possibly declining) for the Northern subpopulation. A more recent, yet-to-be-published, analysis of nesting data from 1989-2005 by the Florida Wildlife Research Institute indicates there is a significant declining trend in nesting at beaches utilized by the south Florida nesting subpopulation (McRae letter to NMFS, October 25, 2006). Nesting data obtained for the 2006 and 2007 nesting seasons are also consistent with the decline in loggerhead nests (A. Meylan pers. comm. 2007). It is unclear at this time whether the nesting decline reflects a decline in population, or is indicative of a failure to nest by the reproductively mature females as a result of other factors (resource depletion, nesting beach problems, oceanographic conditions, etc.).

The meaning of the nesting decline data is further confused by various in-water research that suggest the abundance of neritic juvenile loggerheads is steady or increasing (Ehrhart et al. in press; M. Bresette pers. comm. regarding captures at the St. Lucie Power Plant; SCDNR unpublished SEAMAP-SA data; Epperly et al. 2007). Epperly et al. (2007) determined the trends of increasing loggerhead catch rates from all the aforementioned studies in combination, provide evidence that there has been an increase in neritic juvenile loggerhead abundance in the southeastern U.S. in the recent past. Whether this increase in abundance represents a true population increase among juveniles or merely a shift in spatial occurrence is not clear. NMFS has convened a new Turtle Expert Working Group for loggerhead sea turtles that will gather available data and examine the potential causes of the nesting decline and what the decline means in terms of population status. A final report by the loggerhead TEWG is expected soon.

Another consideration that may add to the importance and vulnerability of the Northern subpopulation is the sex ratios of this subpopulation. NMFS scientists have estimated that the Northern subpopulation produces 65 percent males (NMFS SEFSC 2001a). However, new research conducted over a limited time frame has found opposing sex ratios (Wyneken et al. 2004) so further information is needed to clarify the issue. 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. Producing fewer females will limit the number of subsequent offspring produced by the subpopulation.

The remaining three subpopulations (the Dry Tortugas, Florida Panhandle, and Yucatán) are much smaller subpopulations but no less relevant to the continued existence of the species. Nesting surveys for the Dry Tortugas subpopulation are conducted as part of Florida's statewide survey program. Survey effort has been relatively stable during the 9-year period from 1995-2003 (although the 2002 year was missed). Nest counts ranged from 168-270 but with no detectable trend during this period (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute, Statewide Nesting Beach Survey Data). Nest counts for the Florida Panhandle subpopulation are focused on index beaches rather than all beaches where nesting occurs. Currently, there is not enough information to detect a trend for the subpopulation (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute, Index Nesting Beach Survey Database). Similarly, nesting survey effort has been inconsistent among the Yucatán nesting beaches and no trend can be determined for this subpopulation. 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 2007e)

Actions have been taken to reduce anthropogenic impacts to loggerhead sea turtles from various sources, particularly since the early 1990's. 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 in various fisheries and other marine activities. Recent actions have taken significant steps towards reducing the environmental baseline and improving the status of all loggerhead subpopulations. For example, the TED regulation published on February 21, 2003 (68 FR 8456), represents a significant improvement in the baseline affecting loggerhead sea turtles. Shrimp trawling is considered to be the largest source of anthropogenic mortality on loggerheads.

Threats
The 5-year status review of loggerhead sea turtles recently completed by NMFS and the USFWS provides a summary of natural as well as anthropogenic threats to loggerhead sea turtles (NMFS and USFWS 2007e). The diversity of a sea turtle's life history leaves them susceptible to many natural and human impacts, including impacts while they are on land, in the benthic environment, and in the pelagic environment. Hurricanes are particularly destructive to sea turtle nests. Sand accretion and rainfall that result from these storms as well as wave action can appreciably reduce hatchling success. For example, in 1992, all of the eggs over a 90-mile length of coastal Florida were destroyed by storm surges on beaches that were closest to the eye of Hurricane Andrew (Milton et al. 1994). Also, many nests were destroyed during the 2004 and 2005 hurricane seasons. Other sources of natural mortality include cold stunning and biotoxin exposure.

Anthropogenic factors that impact hatchlings and adult female sea turtles on land, or the success of nesting and hatching include: beach erosion, beach armoring and nourishment, artificial lighting, beach cleaning, increased human presence, recreational beach equipment, beach driving, coastal construction and fishing piers, exotic dune and beach vegetation, and poaching. An increase in human presence at some nesting beaches or close to nesting beaches has led to secondary threats such as the introduction of exotic fire ants, feral hogs, dogs and an increased presence of native species (e.g., raccoons, armadillos, and opossums) which raid and feed on turtle eggs. Although sea turtle nesting beaches are protected along large expanses of the northwest Atlantic coast (in areas like Merritt Island, Archie Carr, and Hobe Sound National Wildlife Refuges), other areas along these coasts have limited or no protection. Sea turtle nesting and hatching success on unprotected high density east Florida nesting beaches from Indian River to Broward County are affected by all of the above threats.

Loggerhead sea turtles are affected by a completely different set of anthropogenic threats in the marine environment. These include oil and gas exploration, coastal development, and transportation, marine pollution, underwater explosions, hopper dredging, offshore artificial lighting, power plant entrainment and/or impingement, entanglement in debris, ingestion of marine debris, marina and dock construction and operation, boat collisions, poaching, and fishery interactions. Loggerheads in the pelagic environment are exposed to a series of longline fisheries, which include the HMS Atlantic pelagic longline fisheries, an Azorean longline fleet, a Spanish longline fleet, and various longline fleets in the Mediterranean Sea (Aguilar et al. 1995, Bolten et al. 1994, Crouse 1999b). Loggerheads in the benthic environment in waters off the coastal U.S. are exposed to a suite of fisheries in federal and state waters including trawl, purse seine, hook-and-line, gillnet, pound net, longline, and trap fisheries.

Loggerheads may also be facing a new threat that could be either natural or anthropogenic. A little understood disease may pose a new threat to loggerheads sea turtles. From October 5, 2000, to March 24, 2001, 49 debilitated loggerheads associated with the disease were found in southern Florida from Manatee County on the west coast through Brevard County on the east coast (Foley 2002). From the onset of the epizootic through its conclusion, affected sea turtles were found throughout south Florida. Most (N=34) were found in the Florida Keys (Monroe County). The number of dead or debilitated loggerheads found during the epizootic (N=189) was almost six times greater than the average number found in south Florida from October to March during the previous ten years. After determining that no other unusual mortality factors appeared to have been operating during the epizootic, 156 of the strandings were likely to be attributed to disease outbreak. These numbers may represent only 10 percent to 20 percent of the sea turtles that were affected by this disease because many dead or dying sea turtles likely never wash ashore. Overall mortality associated with the epizootic was estimated between 156 and 2,229 loggerheads (Foley 2002). Scientists were unable to attribute the illness and epidemic to any one specific pathogen or toxin. If the agent responsible for debilitating these sea turtles re-emerges in Florida, and if the agent is infectious, nesting females could spread the disease throughout the range of the adult loggerhead population.

3.2.5.3 Summary of Status for Loggerhead Sea Turtles

In the Pacific Ocean, loggerhead sea turtles are represented by a northwestern Pacific nesting aggregation (located in Japan) and a smaller southwestern nesting aggregation that occurs in Australia (Great Barrier Reef and Queensland) and New Caledonia. The abundance of loggerhead sea turtles on nesting colonies throughout the Pacific basin has declined dramatically over the past 10 to 20 years. Data from 1995 estimated the Japanese nesting aggregation at 1,000 female loggerhead sea turtles (Bolten et al. 1996), but it has probably declined since 1995 and continues to decline (Tillman 2000). The nesting aggregation in Queensland, Australia, was as low as 300 females in 1997.

In the Atlantic Ocean, absolute population size is not known, but based on extrapolation of nesting information, loggerheads are likely much more numerous than in the Pacific Ocean. The NMFS recognizes five subpopulations of loggerhead sea turtles in the western north Atlantic based on genetic studies. Cohorts from all of these are known to occur within the action area of this consultation. Because of its size, the South Florida subpopulation may be critical to the survival of the species in the Atlantic Ocean. In the past, this nesting aggregation was considered second in size only to the nesting aggregation on islands in the Arabian Sea off Oman (Ross 1979, Ehrhart 1989, NMFS and USFWS 1991b). However, the status of the Oman colony has not been evaluated recently and it is located in an area of the world where it is highly vulnerable to disruptive events such as political upheavals, wars, catastrophic oil spills, and lack of strong protections for sea turtles (Meylan et al. 1995). Given the lack of updated information on this population, the status of loggerheads in the Indian Ocean basin overall is essentially unknown. On March 5, 2008, NMFS and USFWS published a 90-day finding that a petitioned request to reclassify loggerhead turtles in the western North Atlantic Ocean as a distinct population segment may be warranted (73 FR 11849). A final determination on the petition must be made by November 16, 2008.

All loggerhead subpopulations are faced with a multitude of natural and anthropogenic effects that negatively influence the status of the species. Many anthropogenic effects occur as a result of activities outside of U.S. jurisdiction (i.e., fisheries in international waters).

3.2.6 Smalltooth Sawfish

The U.S. smalltooth sawfish distinct population segment (DPS) was listed as endangered under the ESA on April 1, 2003 (68 FR 15674). The smalltooth sawfish is the first marine fish to be listed in the U.S. Critical habitat for the species has not yet been designated, but a proposed designation is expected to be issued before the end of 2008. Historically, smalltooth sawfish occurred commonly in the inshore waters of the Gulf of Mexico and the U.S. Eastern Seaboard up to North Carolina, and more rarely as far north as New York. Based on smalltooth sawfish encounter data, the core range for the smalltooth sawfish currently extends from the Caloosahatchee River to Florida Bay (Simpfendorfer and Wiley 2004).

All extant sawfish belong to the Suborder Pristoidea, Family Pristidae, and Genus Pristis. Although they are rays, sawfish appear to more resemble sharks, with only the trunk and especially the head ventrally flattened. Smalltooth sawfish are characterized by their "saw," a long, narrow, flattened rostral blade with a series of transverse teeth along either edge.

Life History and Distribution

Life history information on smalltooth sawfish is limited. Small amounts of data exist in old taxonomic works and occurrence notes (e.g., Breder 1952, Bigelow and Schroeder 1953, Wallace 1967, Thorson et al. 1966). However, as Simpfendorfer and Wiley (2004) note, these relate primarily to occurrence and size. Recent research and sawfish public encounter information is now providing new data and hypotheses about smalltooth sawfish life history (e.g., Simpfendorfer 2001 and 2003, Seitz and Poulakis 2002, Poulakis and Seitz 2004, Simpfendorfer and Wiley 2004), but more data are still needed to confirm many of these new hypotheses.

As in all elasmobranchs, fertilization is internal. Bigelow and Schroeder (1953) report the litter size as 15 to 20. Simpfendorfer and Wiley (2004) however, caution that this may be an overestimate, with recent anecdotal information suggesting smaller litter sizes (~10). Smalltooth sawfish mating and pupping seasons, gestation, and reproductive periodicity are all unknown. Gestation and reproductive periodicity, however, may be inferred based on that of the largetooth sawfish, sharing the same genus and having similarities in size and habitat. Thorson (1976) reported the gestation period for largetooth sawfish was approximately five months and concluded that females probably produce litters every second year.

Bigelow and Schroeder (1953) describe smalltooth sawfish as generally about two feet long (61 cm) at birth and growing to a length of 18 feet (549 cm) or greater. Recent data from smalltooth sawfish caught off Florida, however, demonstrate young are born at 75-85 cm, with males reaching maturity at approximately 270 cm and females at approximately 360 cm (Simpfendorfer 2002, Simpfendorfer and Wiley 2004). The maximum reported size of a smalltooth sawfish is 760 cm (Last and Stevens 1994), but the maximum size normally observed is 600 cm (Adams and Wilson 1995). No formal studies on the age and growth of the smalltooth sawfish have been conducted to date, but growth studies of largetooth sawfish suggest slow growth, late maturity (10 years) and long lifespan (25-30 years) (Thorson 1982, Simpfendorfer 2000). These characteristics suggest very a low intrinsic rate of increase (Simpfendorfer 2000).

Smalltooth sawfish feed primarily on 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 bottom substrate to remove the fish, which are then eaten. In addition to fish, smalltooth sawfish also prey on crustaceans (mostly shrimp and crabs), which are located by disturbing bottom sediment with their saw (Norman and Fraser 1937, Bigelow and Schroeder 1953).

Smalltooth sawfish are euryhaline, occurring in waters with a broad range of salinities from freshwater to full seawater (Simpfendorfer 2001). Their occurrence in freshwater is suspected to be only in estuarine areas temporarily freshwater from receiving high levels of freshwater input. Many encounters are reported at the mouths of rivers or other sources of freshwater inflows, suggesting estuarine areas may be an important factor in the species distribution (Simpfendorfer and Wiley 2004).

The literature indicates that smalltooth sawfish are most common in shallow coastal waters less than 25 m (Bigelow and Schroeder 1953, Adams and Wilson 1995). Indeed, the distribution of the smallest size classes of smalltooth sawfish indicate that nursery areas occur in areas of shallow water, close to shore and typically associated with mangroves (Simpfendorfer and Wiley 2004). However, encounter data indicate there is a tendency for smalltooth sawfish to move offshore and into deeper water as they grow. An examination of the relationship between the depth at which sawfish occur and their estimated size indicates that larger animals are more likely to be found in deeper waters. Since large animals are also observed in very shallow waters, it is believed that smaller (younger) animals are restricted to shallow waters, while large animals roam over a much larger depth range (Simpfendorfer 2001). Mature animals are known to occur in water depths of 100 m or more (C. Simpfendorfer pers. comm. 2006).

Data collected by Mote Marine Laboratory indicate smalltooth sawfish occur over a range of temperatures but appear to prefer water temperatures greater than 64.4°F (18°C) (Simpfendorfer 2001). The data also suggest that smalltooth sawfish may utilize warm water outflows of power stations as thermal refuges during colder months to enhance their survival or become trapped by surrounding cold water from which they would normally migrate. Almost all occurrences of smalltooth sawfish in warm water outflows were during the coldest part of the year, when water temperatures in these outfalls are typically well above ambient temperatures. Further study of the importance of thermal refuges to smalltooth sawfish is needed. Significant use of these areas by sawfish may disrupt their normal migratory patterns (Simpfendorfer and Wiley 2004).

Smalltooth sawfish historically occurred commonly in the shallow waters of the Gulf of Mexico and along the eastern seaboard as far north as North Carolina, with rare records of occurrence as far north as New York. The smalltooth sawfish range has subsequently contracted to predominantly peninsular Florida and, within that area, they can only be found with any regularity off the extreme southern portion of the state. Historic records of smalltooth sawfish indicate that some large mature individuals migrate north along the U.S. Atlantic coast as temperatures warmed in the summer and then south as temperatures cooled (Bigelow and Schroeder 1953). However, recent Florida encounter data do not suggest such migration. One smalltooth sawfish has been recorded north of Florida since 1963 - captured off of Georgia in July 2000 - but it is unknown whether this individual resided in Georgia waters annually or had migrated north from Florida. 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 undetectable or does not occur. NMFS observers have been collecting data in the Atlantic longline fishery since 1992 and have no documented interactions between the HMS pelagic longline fishery and smalltooth sawfish, which provides some additional support to these range estimates. Further research focusing on states north of Florida or using satellite telemetry is needed to test this hypothesis.

Population Dynamics, Status and Trends

Despite being widely recognized as common throughout their historic range up until the middle of the 20th century, the smalltooth sawfish population declined dramatically during the middle and later parts of the century. The decline in the population of smalltooth sawfish is attributed to fishing (both commercial and recreational), habitat modification, and sawfish life history. Large numbers of smalltooth sawfish were caught as bycatch in the early part of this century. Smalltooth sawfish were historically caught as bycatch in various fishing gears throughout their historic range, including gillnet, otter trawl, trammel net, seine, and to a lesser degree, handline. Frequent accounts in earlier literature document smalltooth sawfish being entangled in fishing nets from areas where smalltooth sawfish were once common but are now rare (Everman and Bean 1898). Loss and degradation of habitat contributed to the decline of many marine species and is expected to have impacted the distribution and abundance of smalltooth sawfish.

Estimates of the magnitude of the decline in the smalltooth sawfish are difficult to make. Because of the species' limited importance in commercial and recreational fisheries and its large size and toothed rostrum, making it difficult to handle, it was not well studied before incidental bycatch severely reduced its numbers. However, based on the contraction of the species' range, and other anecdotal data, Simpfendorfer (2001) estimated that the U.S. population size is currently less than 5 percent of its size at the time of European settlement.

Seitz and Poulakis (2002) and Poulakis and Seitz (2004) document occurrences of sawfish from 1990 to 2002 along the southwest coast of Florida, and in Florida Bay and the Florida Keys, respectively. The information was collected by soliciting information from anyone who would possibly encounter these fish via posters displaying an image of a sawfish and requesting anyone with information on these fish since 1990 to contact the authors. Posters were distributed beginning in January 1999 and continue to be maintained from Charlotte County to Monroe County in places where anglers and boaters would likely encounter them (e.g., bait and tackle shops, boat ramps, fishing tournaments). In addition to circulating posters, information was obtained by contacting other fishery biologists, fishing guides, guide associations, gun clubs, recreational and commercial fishers, scuba divers, mosquito control districts, and newspapers. The total number of sawfish in the combined study areas of both publications is 2,620. By November 2005, a total of 989 interviews had documented 3,289 smalltooth sawfish encounters in U.S. waters, the majority occurring in South Florida since 1998 (Seitz and Poulakis 2006). As of March 2008, a total of 1,440 interviews documented 3,395 smalltooth sawfish encounters in U.S. waters, the majority occurring in South Florida since 1998 (Seitz and Poulakis 2006, G. Poulakis pers. comm. 2008).

The Florida Fish and Wildlife Conservation Commission has also conducted research collections for smalltooth sawfish. From February 2005 through March 2008, they collected 65 juvenile smalltooth sawfish, primarily from the Caloosahatchee River. This research is currently on-going (G. Poulakis pers. comm. 2008).

Mote Marine Laboratory also maintains a smalltooth sawfish public encounter database, established in 2000 to compile information on the distribution and abundance of sawfish. Encounter records are collected using some of the same outreach tactics as above in Florida statewide. To ensure the requests for information are spread evenly throughout the state, awareness-raising activities were divided into six regions and focused in each region on a biannual basis between May 2002 and May 2004. Prior to 2002, awareness raising activities were organized on an ad-hoc basis because of limited resources. The records in the database extend back to the 1950s, but are mostly from 1998 to the present. The data are validated using a variety of methods (photographs, video, directed questions). As of February 29, 2006, a total of 958 verified sawfish encounters have been reported since 1998, most from recreational fishers (Mote Marine Laboratory 2008).

The majority of smalltooth sawfish encounters today are from the southwest coast of Florida between the Caloosahatchee River and Florida Bay. Outside of this core area, the smalltooth sawfish appears more common on the west coast of Florida and in the Florida Keys than on the east coast, and occurrences decrease the greater the distance from the core area (Simpfendorfer and Wiley 2004). The capture of a smalltooth sawfish off Georgia in 2003 is the first record north of Florida since 1963. New reports during 2004 extend the current range of the species from Panama City, offshore Louisiana (south of Timbalier Island in 100 ft of water), southern Texas, and the northern coast of Cuba. The Texas sighting was not confirmed to be a smalltooth sawfish so might have been a largetooth sawfish.

There are no data available to estimate the present population size. Although smalltooth sawfish encounter databases may provide a useful future means of measuring changes in the population and its distribution over time, conclusions about the abundance of smalltooth sawfish now cannot be made because outreach efforts and observation effort is not expanded evenly across each study period. Dr. Simpfendorfer reluctantly gives an estimate of 2,000 individuals based on his four years of field experience and data collected from the public, but cautions that actual numbers may be plus or minus at least 50 percent.

Recent encounters with neonates (young of the year), juveniles, and sexually mature sawfish indicate that the population is reproducing (Seitz and Poulakis 2002, Simpfendorfer 2003). The abundance of juveniles encountered, including very small individuals, suggests that the population remains reproductively active and viable (Simpfendorfer and Wiley 2004). Also, the declining numbers of individuals with increasing size is consistent with the historic size composition data (G. Burgess, pers.

comm. in Simpfendorfer and Wiley 2004). This information and recent encounters in new areas beyond the core abundance area suggest that the population may be increasing. However, smalltooth sawfish encounters are still rare along much of their historical range and absent from areas historically abundant such as the Indian River Lagoon and John's Pass (Simpfendorfer and Wiley 2004). With recovery of the species expected to be slow on the basis of the species' life history and other threats to the species remaining (see below), the population's future remains tenuous.

Threats
Smalltooth sawfish are threatened today by the loss of southeastern coastal habitat through such activities as agricultural and urban development, commercial activities, dredge-and-fill operations, boating, erosion, and diversions of freshwater runoff. Dredging, canal development, seawall construction, and mangrove clearing have degraded a significant proportion of the coastline. Smalltooth sawfish may be especially vulnerable to coastal habitat degradation due to their affinity to shallow, estuarine systems (NMFS 2000).

Fisheries also still pose a threat to smalltooth sawfish. Although changes over the past decade to U.S. fishing regulations such as Florida's net ban have started to reduce threats to the species over parts of its range, smalltooth sawfish are still occasionally incidentally caught in commercial shrimp trawls, bottom longlines, and recreational rod-and-reel. The current and future abundance of the smalltooth sawfish is limited by its life history characteristics (NMFS 2000). Slow-growing, late-maturing, and long-lived, these combined characteristics result in a very low intrinsic rate of population increase and are associated with the life history strategy known as "k-selection." K-selected animals are usually successful at maintaining relatively small, persistent population sizes in relatively constant environments. Consequently, they are not able to respond effectively (rapidly) to additional and new sources of mortality resulting from changes in their environment (Musick 1999). Simpfendorfer (2000) demonstrated that the life history of this species makes it impossible to sustain any significant level of fishing and makes it slow to recover from any population decline. Thus, the species is susceptible to population decline, even with relatively small increases in mortality.

4.0 Environmental Baseline

This section describes the effects of past and ongoing human and natural 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 action area at a specified point in time and includes state, tribal, local, and private actions already affecting the species, or that will occur contemporaneously with the consultation in progress. Unrelated federal actions affecting the same species or critical habitat that have completed formal consultation are also part of the environmental baseline, as are federal and other actions within the action area that may benefit listed species or critical habitat.

The environmental baseline for this biological opinion includes the effects of several activities that affect the survival and recovery of threatened and endangered species 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 vessel operations, additional military activities, dredging, oil and gas exploration, permits allowing take under the ESA, private vessel traffic, and marine pollution.

4.1 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 near shore 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.

4.2 Factors Affecting Sea Turtle 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 Army Corps of Engineers (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 and Gulf of Mexico EEZ, which have already concluded formal section 7 consultation.

4.2.1 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, coastal migratory pelagic, dolphin/wahoo, Gulf of Mexico reef fish, monkfish, Northeast multispecies, red crab, skate, South Atlantic snapper-grouper, Southeast shrimp trawl, southern flounder gillnet, spiny dogfish, summer flounder/scup/black sea bass, and tilefish fisheries. An Incidental Take Statement (ITS) has been issued for the take of sea turtles in each of these fisheries

(Appendix 1). A brief summary of each fishery is provided below, but more detailed information can be found in the respective biological opinions.

The *American lobster trap fishery* has been identified as a source of gear causing some injuries and mortality of loggerhead and leatherback sea turtles. American lobster occur within U.S. waters from Maine to Virginia, but most lobster trap effort occurs in the Gulf of Maine (NMFS 2007b). Previous biological opinions for this fishery concluded that operation of the lobster trap fishery may adversely affect loggerhead and leatherback sea turtles (NMFS 2002b). A Reasonable and Prudent Alternative (RPA) to avoid the likelihood that the lobster fishery would jeopardize the continued existence of right whales was implemented. However, these actions were not expected to reduce the number or severity of loggerhead and leatherback sea turtle interactions with the fishery. Reasonable and Prudent Measures to help minimize lobster gear interactions with sea turtles were also provided. Consultation on the lobster fishery has been reinitiated to address new information regarding the effectiveness of the RPA in avoiding jeopardizing the continued existence of northern right whales.

In a July 2, 1999, biological opinion on the *Atlantic bluefish fishery,* NMFS found the operation of the fishery was likely to adversely affect Kemp's ridley and loggerhead sea turtles, but not likely to jeopardize their continued existence (NMFS 1999b). Based on documented take in gillnets targeting bluefish and bottom otter trawls catching bluefish, NMFS provided an ITS for Kemp's ridley and loggerhead sea turtles. The Atlantic States Marine Fisheries Commission and the Mid-Atlantic Fishery Management Council jointly manage bluefish under Amendment 5 to the Bluefish FMP (NEFSC 2005a). The majority of commercial fishing activity in the North and Mid-Atlantic occurs in the late spring to early fall, when bluefish (and sea turtles) are most abundant in these areas (NEFSC 2005a). 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. Bottom otter trawls accounted for 44 percent of the total commercial trips targeting bluefish and landed 20.4 percent of the catch (MAFMC 2007). Consultation on the Bluefish FMP was reinitiated on December 18, 2007, to address leatherback takes in gillnet gear.

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.

Atlantic mackerel/squid/butterfish fisheries are managed under a single FMP, which was first implemented on April 1, 1983. The most recent biological opinion completed on these federal fisheries was completed on April 28, 1999. The opinion concluded that the continued authorization of the FMP was likely to adversely affect sea turtles, but not jeopardize their continued existence (NMFS 1999d). 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. Entanglements or entrapments of sea turtles have been recorded in one or more of these gear types. An ITS for sea turtles was provided with the opinion. In August 2007, NMFS received a new estimate of loggerhead sea turtle takes in bottom otter trawl gear used in the mackerel, squid, butterfish fisheries (Memo from K. Murray, NEFSC to L. Lankshear, NERO, PRD). Using vessel trip report (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 mackerel, squid, and butterfish fisheries was estimated to be 62 loggerhead sea turtles a year (Memo from K. Murray, NEFSC to L. Lankshear, NERO, PRD). Based on this new information on the capture of loggerhead sea turtles in the mackerel, squid, butterfish fisheries, section 7 consultation on the continued authorization of the Squid/Mackerel/Butterfish FMP was reinitiated on March 6, 2008.

NMFS recently completed a section 7 consultation on the *Atlantic sea scallop* fishery (NMFS 2008). The opinion concluded that the continued authorization of the fishery was likely to adversely affect green, Kemp's ridley, leatherback, and loggerhead sea turtles, but was not likely to jeopardize their continued existence; an ITS was issued. The sea scallop fishery has a long history of operation in Mid-Atlantic, as well as New England waters (NEFMC 1982, 2003). Effort in the Mid-Atlantic is about half of what it was prior to implementation of the Scallop FMP in the 1990s (NEFSC 2007a). Green, Kemp's ridley, and loggerhead sea turtles have been reported by NMFS-trained observers as being captured in scallop dredges and trawl gear. Methods used to detect any sea turtle interactions with scallop fishing gear (dredge or trawl gear) were insufficient prior to increased observation coverage in 2001, which now documents that this fishery results in many loggerhead mortalities on an annual basis. Although NMFS was not aware until 2001 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.

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 2004b) as a result of exceeded incidental take levels for loggerheads and leatherbacks sea turtles. 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.

NMFS recently completed a section 7 consultation on the continued authorization of the *coastal migratory pelagic* fishery in the Gulf of Mexico and South Atlantic (NMFS 2007c). 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.

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 2003b). The August 27, 2003, opinion concluded that green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles may be adversely affected by the longline component of the fishery, but it was not expected to jeopardize their continued existence. An ITS for sea turtles was provided with the opinion. Also, pelagic longline vessels can no longer target dolphin-wahoo with smaller hooks because of hook size requirements in the pelagic longline fishery.

NMFS completed a section 7 consultation on the continued authorization of the *Gulf of Mexico reef fish fishery* (NMFS 2005a). The biological opinion concluded that green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles may be adversely affected only by the hook-and-line component 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. 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 federal *monkfish fishery* occurs from Maine to the North Carolina/South Carolina border and is jointly managed by the New England Fishery Management Council (NEFMC) and Mid-Atlantic Fishery Management Council (MAFMC), under the Monkfish FMP (NEFSC 2005b). 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 2003c). 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. Following an event in which over 200 sea turtle carcasses washed ashore in an area where large-mesh gillnetting had been occurring, NMFS published new restrictions preventing the use of gillnets with larger than 8-inch stretched mesh in the EEZ off of North Carolina and Virginia (67 FR 71895, December 3, 2002). The rule was subsequently modified on April 26, 2006 to prohibit the use of gillnets with greater than or equal to 7-inch stretched mesh when fished in federal waters from the North Carolina/South Carolina border to Chincoteague, Virginia. Consultation on the continued authorization of the Monkfish fishery was reinitiated on April 2, 2008, based on the info presented in the follow-up memo to Murray 2006.

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 2001a). Data indicated that sink gillnet gear has taken loggerhead and leatherback sea turtles. 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 as a result of the Amendment 13 measures. 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, NERO, 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, NERO, PRD). Consultation on the Northeast Multispecies fishery was reinitiated on April 2, 2008, based on this new information on the capture of loggerhead sea turtles in the Northeast multispecies fishery.

Section 7 consultation was completed on the *red crab fishery* during the proposed implementation of the Red Crab FMP (NMFS 2002c). 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 along the continental shelf in the Northeast region, and is limited to waters north of 35°15.3'N (Cape Hatteras, North Carolina) and south of the Hague Line. Following concerns that red crab could be overfished, an FMP was developed and became effective on October 21, 2002.

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 2003d), 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. There have been no recorded takes of ESA-listed species in the skate fishery. However, given that sea turtle interactions with trawl and gillnet gear have been observed in other fisheries, sea turtle takes in gear used in the skate fishery may be possible. In August 2007, NMFS received an estimate of loggerhead sea turtle takes in bottom otter trawl gear used in the skate fishery (Memo from K. Murray, NEFSC to L. Lankshear, NERO, 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 skate fishery was estimated to be 24 loggerhead sea turtles a year (Memo from K. Murray, NEFSC to L. Lankshear, NERO, PRD). Based on this new information, consultation on the continued authorization of the Skate fishery was reinitiated on April 2, 2008.

A section 7 consultation on the *South Atlantic snapper-grouper fishery* (NMFS 2006b) has also recently been completed by NMFS. The fishery uses spear and powerhead, 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, 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.

On December 2, 2002, NMFS completed the biological opinion for *shrimp trawling in the southeastern U.S.* (NMFS 2002a) under proposed revisions to the TED regulations (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. This 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.

The primary gear types for the *spiny dogfish fishery* are sink gillnets, otter trawls, bottom longline, and driftnet gear (NEFSC 2003). NMFS reinitiated consultation on the Spiny Dogfish FMP on May 4, 2000, to reevaluate, in part, the effects of the spiny dogfish gillnet fishery on sea turtles (NMFS 2001b). 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 have been delays in implementing the plan, quota allocations are expected to be substantially reduced over the 4.5 year rebuilding schedule; this should result in a substantial decrease in effort directed at spiny dogfish. The reduction in effort should be of benefit to protected species by reducing the number of gear interactions that occur. A new ITS was provided for the take of sea turtles in the fishery.

The *summer flounder, scup, and black sea bass fisheries* are known to interact with sea turtles. The most recent opinion on the fishery (NMFS 2001c) found it was likely to adversely affect green and Kemp's ridley sea turtles, but would not jeopardize their continued existence. An ITS was provided for these species. In the Mid-Atlantic, summer flounder, scup, and black sea bass are managed under one FMP since these species occupy similar habitat and are often caught at the same time. 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). Significant measures have 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). 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. 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, NERO, 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, black sea bass fisheries was estimated to be 200 loggerhead sea turtles a year (Memo from K. Murray, NEFSC to L. Lankshear, NERO, PRD). Based on this new information, the on-going consultation on the continued authorization of the Summer Flounder/Scup/Black sea bass FMP was reinitiated on October 18, 2002, to address large whales will be expanded to also address sea turtles.

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 2001d). 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 (8°-18°C) 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.

4.2.2 Vessel Operations

Potential sources of adverse effects from federal vessel operations in the action area include operations of the U.S. Navy (USN) and Coast Guard (USCG), the Environmental Protection Agency (EPA), the National Oceanic and Atmospheric Administration

(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. At the present time, however, they present the potential for some level of interaction. Refer to the biological opinions for the USCG (NMFS 1995, 1996) and the USN (NMFS 1997) 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.

4.2.3 Additional Military Activities

Additional activities including ordnance detonation also affect 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 1997), 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 have been completed that evaluated the impacts of ordnance detonation during gunnery training or aerial bombing exercises (NMFS 1998a, NMFS 2004c, 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 the 1999 (NMFS 1999e). This consultation determined the training operations would adversely affect sea turtles but would not jeopardize their continued existence and an ITS was issued.

On May 27, 1997, NMFS completed an opinion on the continued hopper dredging of channels and borrow areas in the Southeast U.S. This consultation determined hopper dredging would adversely affect sea turtles but would not jeopardize their continued existence and an ITS was issued. Some of these borrow areas may occur in federal waters and result in incidental take of sea turtles.

4.2.4 Oil and Gas Exploration

COE and MMS authorize oil and gas exploration, well development, production, and abandonment/rig removal activities that may adversely affect sea turtles. Both of these agencies have consulted numerously with NMFS on these types of activities. These activities include the use of seismic arrays for oil and gas exploration in the Gulf of Mexico, the impacts vessel strikes, noise, and marine debris have been analyzed in biological opinions for individual and multi-lease sales.

Explosive removal of offshore structures may adversely affect sea turtles. Section 7 consultation for COE-New Orleans District rig removal activities found them likely to adversely affect, but not jeopardize, the continued existence of green, hawksbill, Kemp's ridley, leatherback, or loggerhead sea turtles (NMFS 1998b). An ITS for this activity was provided. In July 2004, MMS completed a programmatic environmental assessment (PEA) on geological and geophysical exploration on the Gulf of Mexico Outer Continental Shelf (MMS 2004). The MMS has also recently completed a PEA on removal and abandonment of offshore structures and effects on protected species in the Gulf of Mexico (MMS 2005).

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.

Sea turtles are the focus of research activities authorized by Section 10 permits under the ESA. As of January 2008, there were 35 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 a section 7 analysis to ensure the issuance of the permit does not result in jeopardy to the species.

4.2.6 Vessel Traffic

Commercial traffic and recreational pursuits can 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. NMFS and the USCG have completed several formal consultations on individual marine events that may impact sea turtles. NMFS and USCG St. Petersburg Sector are currently conducting a formal consultation regarding high-speed boating events and fishing tournaments occurring off the west coast of Florida that may impact sea turtles.

4.2.7 Marine Pollution

Anthropogenic sources of marine pollution, while difficult to attribute to a specific federal, state, local or private action, may indirectly affect sea turtles 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. The pathological effects of oil spills have been documented in laboratory studies of marine mammals and sea turtles (Vargo et al. 1986).

Nutrient loading from land-based sources, such as coastal communities and agricultural operations, are known to stimulate plankton blooms in closed or semi-closed estuarine systems. An example is the large area of the Louisiana continental shelf with seasonally depleted oxygen levels (< 2mg/l), caused by eutrophication from both point and non-point sources. Most aquatic species cannot survive at such low oxygen levels and these areas are known as "dead zones." 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 2001, when it was 21,700 km^2 (Rabalais et al. 2002). The hypoxic zone has impacts on the animals found there, including sea turtles, and the ecosystem-level impacts continue to be investigated.

4.3 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 Atlantic HMS and Gulf of Mexico reef fish; TED requirements for 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 Fishing Statistical Survey (MRFSS). The summaries below discuss all of these measures in more detail.

4.3.1 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. The rulemaking, based on the results of the 3-year Northeast Distant Closed Area research experiment and other available sea turtle bycatch reduction studies, is expected to have significant benefits to endangered and threatened sea turtles.

NMFS published the final rule to implement sea turtle release gear requirements and sea turtle careful release protocols in the Gulf of Mexico reef fish fishery on August 9, 2006 (71 FR 45428). These measures require owners and operators of vessels with federal commercial or charter vessel/headboat permits for Gulf reef fish to comply with sea turtle (and smalltooth sawfish) release protocols and have on board specific sea turtle release gear. NMFS is currently conducting rulemaking to implement similar release gear and handling requirements for the South Atlantic snapper-grouper fishery.

Revised Use of Turtle Excluder Devices in Trawl Fisheries
NMFS has also implemented a series of regulations aimed at reducing potential for incidental mortality of sea turtles in commercial shrimp trawl fisheries. In particular, NMFS has required the use of TEDs in southeast U.S. shrimp trawls since 1989 and in summer flounder trawls in the Mid-Atlantic area (south of Cape Charles, Virginia) since 1992. It has been estimated that TEDs exclude 97 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 proper placement and installation, configuration (e.g., width of bar spacing), floatation, and more widespread use.

Significant measures have 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) by requiring TEDs in trawl nets fished from the North Carolina/South Carolina border to Cape Charles, Virginia. However, the TED requirements for the summer flounder trawl fishery do not require the use of 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, 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. Limited observer data indicate that takes can be quite high in this fishery. A top-opening flynet TED was certified last summer (2007), but experiments are still ongoing to certify a bottom-opening TED.

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 of 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 72° 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 as a result 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.

4.3.2 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 Entanglements and Rehabilitation
There is an extensive network of Sea Turtle Stranding and Salvage Network 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 U.S. Coast Guard, 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
The Recovery Plans for Kemp's ridley and loggerhead sea turtles are in the process of being updated. 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 have recently been completed for green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles. 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, leatherback, and loggerhead sea turtles was recommended, to evaluate whether distinct population segments (DPS) should be established for these species (NMFS and USFWS 2007a-e).

4.4 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 U.S. DPS of smalltooth sawfish is confined to only a small portion of the action area, mainly waters off Florida and possibly occasionally off Georgia. 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, therefore, 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.

4.5 Factors Affecting Smalltooth Sawfish Within the Action Area

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 Atlantic, and Gulf of Mexico EEZ, which have already concluded formal section 7 consultation.

4.5.1 Fisheries

NMFS recently completed a section 7 consultation on the continued authorization of the *coastal migratory pelagic* fishery in the Gulf of Mexico and South Atlantic (NMFS 2007c). 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 the continued existence and an ITS was provided.

NMFS completed a section 7 consultation on the continued authorization of the *Gulf of Mexico reef fish fishery* on February 15, 2005 (NMFS 2005a). 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 the operation of the fishery. However, the proposed action was not expected to jeopardize the continued existence of this species and an ITS has been provided.

A section 7 consultation on the *South Atlantic snapper-grouper fishery* was completed by NMFS on June 7, 2006 (NMFS 2006b). 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.

NMFS has also conducted section 7 consultations on the impacts of the *Gulf of Mexico shrimp trawl fishery* (NMFS 2006c) *and the South Atlantic shrimp trawl fishery* (NMFS 2005c) on smalltooth sawfish. 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.

Smalltooth sawfish may infrequently be taken in other South Atlantic and Gulf of Mexico federal fisheries involving trawl, gillnet, bottom longline gear, and hook-and-line gear. NMFS is collecting data to analyze the impacts of these fisheries and will conduct section 7 consultations as appropriate.

4.5.2 ESA Permits

Regulations developed under the ESA allow for the issuance of permits allowing take of certain ESA-listed species for scientific research purposes under Section 10(a)(1)(a). Prior to issuance of these permits, the proposal must be reviewed for compliance with section 7 of the ESA. There are currently three active smalltooth sawfish research permits. Permit holders include Dr. Colin Simpfendorfer (Mote Marine Laboratory), Dr. John Carlson (SEFSC), and the Florida Fish and Wildlife Conservation Commission. Although the permitted 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.

4.5.3 Conservation and Recovery Actions

Under Section 4(f)(1) of the ESA, NMFS is required to develop and implement a recovery plan for the conservation and survival of endangered and threatened species. In September 2003, NMFS convened a smalltooth sawfish recovery team composed of nine members from federal, state, non-governmental, and non-profit organizations. The team has completed a draft recovery plan. The goal of the recovery plan is to rebuild and assure the long-term viability of the U.S. DPS of smalltooth sawfish in the wild, allowing initially for reclassification from endangered to threatened status (downlisting) and ultimately to recovery and subsequent removal from the List of Endangered and Threatened Wildlife (delisting). NMFS released the Draft Smalltooth Sawfish Recovery Plan for public review and comment on August 23, 2006 (71 FR 49418). Preparation of the Final Smalltooth Sawfish Recovery Plan is currently underway.

5.0 Effects of the Action

In this section of our opinion, we assess the direct and indirect 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 we would reasonably expect the proposed action to cause reductions in numbers, reproduction, or distribution that would appreciably reduce a listed species' likelihood of surviving and recovering in the wild. The ESA defines an endangered species as "...in danger of extinction throughout all or a significant portion of its range..." and a threatened species as "...likely to become an endangered species within the foreseeable future..." The status of each listed sea turtle species and the smalltooth sawfish likely to be adversely affected by the continued operation of the HMS Atlantic shark fisheries are reviewed in Section 3.0. Sea turtle species are listed because of their global status; therefore, a jeopardy determination must find the proposed action will appreciably reduce the likelihood of each species globally. Only the U.S. 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 U.S. DPS.

The quantitative and qualitative analyses in this section are based upon the best available commercial and scientific data on sea turtle and sawfish biology and the effects of the proposed action. Frequently, the best available information may include a range of values for a particular aspect under consideration, or different analytical approaches may be applied to the same data set. In cases where uncertainty exists regarding a parameter that bears evaluating impacts of an action on listed species, the uncertainty should be resolved in favor of the species. The U.S. Congress provided guidance to this end [House of Representatives Conference Report No. 697, 96th Congress, Second Session, 12 (1979)] and NMFS will generally select the value yielding the most conservative outcome to provide the "benefit of the doubt" to threatened and endangered species (i.e., would lead to conclusions of higher, rather than lower, risk to endangered or threatened species).

Effects of the HMS Atlantic shark fisheries on threatened and endangered species are from interactions with its fishing gear resulting in the capture, injury, or death of an individual. The operation of the HMS Atlantic shark fisheries (i.e., vessel operations, gear deployment, and retrieval) is not expected to impact the water column or benthic habitat in any appreciable way. Unlike mobile trawls and dredges that physically disturb habitat as they are dragged along the bottom, the gears used in Atlantic shark fisheries are either suspended in the water column or essentially stationary on the bottom so do not affect water column or benthic habitat characteristics. The fishery's target and bycatch species are not foraged on by sea turtles nor are they a primary prey species for smalltooth sawfish (Hopkins et al. 2003, Simpfendorfer 2001) so prey competition is also not a factor. Based on this information, it is our judgment that sea turtles and smalltooth sawfish 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.

Basic Approach to Assessment

There are three basic types of gear used in the HMS Atlantic shark fisheries: bottom longline, gillnets (drift, strike, and sink nets), and rod-and-reel and handline gear (recreational use only). Section 2 describes these gears and how recreational or commercial fishermen use them to target sharks. The type of fishing gear, the area, and the manner in which they are used, all affect the likelihood of sea turtle or smalltooth sawfish interactions. For this reason each gear type is evaluated separately.

In Section 5.1 we review the range of responses an individual sea turtle or smalltooth sawfish is likely to have if exposed to each shark fishing gear and the factors affecting the likelihood of exposure. The remainder of this section focuses on quantifying the impacts on sea turtles and smalltooth sawfish from the proposed action.

To quantify the total impact of continued authorization of HMS shark fisheries, we broke our analysis down into three main parts. First, we estimated what the impacts have been under the current management regime for the purpose of establishing baseline or status quo take levels (i.e., the level of take expected if the status quo were maintained and none of the proposed changed to shark fisheries were enacted). New observer data since the last biological opinion on the effects of HMS shark fisheries made it necessary to reanalyze the status quo effects instead of just relying on our take estimates in the previous opinion. In Sections 5.2-5.4, we estimated, by gear type, the number of individuals of each species likely to be exposed to shark fisheries, along with their estimated age or age class, and the likely fate of those animals. In determining the fate of incidentally caught sea turtles, we distinguished between immediate mortalities; animals that are captured and released, unharmed; and those animals that are captured and released, but later die as a result of the interaction. Revised criteria to estimate sea turtle post-release mortality in the pelagic longline fishery were applied to estimate mortality rates. In the second part of our analysis (Section 5.5), we analyze what effect, if any, implementation of Amendment 2 to the Consolidated HMS FMP would 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. In the final part (Section 5.6), we use the results from the first two parts of our analysis to calculate the anticipated level of effects under the proposed action.

5.1 ESA-listed Species Interactions with Commercial HMS Atlantic Shark Fishery Gears

5.1.1 Shark Bottom Longline Gear Interactions with Sea Turtles

Bottom longline gear is known to adversely affect sea turtles via entanglement, hooking, trailing line, and forced submergence. Captured sea turtles can be released alive or can be found 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 hook-and-line 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.

Fishing gear can drift according to oceanographic conditions, including wind and waves, surface and subsurface currents, etc.; therefore, depending on sea turtle behavior, environmental conditions, and location of the set, turtles can become entangled in the gear. On longline gear, sea turtles have been found entangled in branchlines (gangions), mainlines, and float lines. 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). If sea turtles become entangled in monofilament line the gear can inflict serious wounds, including cuts, constriction, or bleeding anywhere on a turtle's body. In addition, 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 (generally in the flippers, head, shoulders, armpits, or beak) or internally (inside the mouth or when the animal has swallowed the bait and the hook is ingested into the gastro-intestinal tract, often a major site of hooking) (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 turtles and longline gear, whereas internal hooking is much more prevalent in hard-shelled turtles, especially loggerheads (NMFS unpublished data). Internal hooking of leatherback 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.

Sea turtles that have swallowed hooks are of the greatest concern. The esophagus is lined with strong conical papillae directed caudally 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 to the sea turtle's colon or 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 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 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 their acid-base balance (i.e., 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 acid-base status. 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 acid-base balance, 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 acid-base balance after being forcibly submerged have a higher survival rate. The rate of acid-base 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).

5.1.2 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 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). Once hooked, the gangion or leader most commonly 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. Foul-hooking (i.e., hooking in fin, near eye, etc.) reports are not nearly as frequent, but do occasionally occur. However, there are no reports of smalltooth sawfish being deeply hooked.

Smalltooth sawfish captured on bottom longline gear have all been observed or reported as alive upon capture and as released in good condition, with one exception. Between 1994 and 2007, 16 smalltooth sawfish have been observed caught in the Atlantic and Gulf of Mexico HMS shark bottom longline fishery (Hale et al. 2007, Richards 2007, NMFS 2007d). In that time, only one of these takes has ever resulted in a mortality, all other individuals were very active when reaching the surface and in apparent good health. The amount of time hooked or entangled does not seem to influence mortality rates for smalltooth sawfish. Dr. Simpfendorfer speculates this is because the animal's natural habit consists of laying on the seafloor, using its spiracles to breathe (Simpfendorfer pers. comm. 2003). Thorson (1982) reports that largetooth sawfish (*Pristis pristis)* 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 stems from Simpfendorfer, who has been conducting smalltooth sawfish surveys since 2000 using bottom longline, nets, and rod-and-reel. As of February 2005, he had caught and handled over 50 individuals ranging in size from 87 cm to 450 cm, about half of which were caught on bottom longlines. 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, physiology, tagging recapture data, and only one confirmed report of a lethal take, we believe post-release mortality is extremely rare.

Temporary sub-lethal effects on smalltooth sawfish may occur. A few rare reports from recreational fishers indicate smalltooth sawfish can damage their rostrum by hitting it against the vessel or other nearby objects (e.g., piling, bridge) while the fishers 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. Given the rostrum's role in smalltooth sawfish feeding activities, however, damage to their rostrum, depending on the extent, is likely to hinder their ability to feed and may ultimately impact the affected animal's growth and reproductive abilities.

5.1.3 Factors Affecting the Likelihood of ESA-listed Species 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.

5.1.3.1 Gear Characteristics and Fishing Technique

Spatial/Temporal Overlap between Fishing Effort and Sea Turtle and Smalltooth Sawfish
Another 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 spatial distribution of sea turtles and smalltooth sawfish influences the rate of interaction with shark fishing gears. The more abundant sea turtles are in a given area where fishing occurs, the greater the probability a sea turtle or smalltooth sawfish will interact with gear. The temporal distribution of fishing effort and sea turtle and smalltooth sawfish abundance is also a factor. From 2004-2006, of the 20 loggerheads observed incidentally taken on shark bottom longline gear, eight (40 percent) were taken in January, and three (15 percent) were taken each month in February, July, and October; two takes (10 percent) occurred in March and one (5 percent) occurred in August (NMFS unpublished data).

Soak Time/Number of Hooks
Bottom longline gear interactions with sea turtles and smalltooth sawfish depend on 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 also impacts the probability and severity of interactions with sea turtles and smalltooth sawfish. 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). Thus, 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 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, 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.

Bait
Skates, sharks, or various finfishes are 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.

5.1.3.2 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 fishing frontal zones where ocean currents or water masses meet to create turbulence and sharp gradients of temperature and salinity, may set their gear across these temperature gradients ("breaks"), and when sea turtles are associated with these fronts, interactions are more likely.

5.1.3.3 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: Of the 17 loggerheads observed taken on bottom longline gear from 2004-2006, for which size data is available, 14 (82 percent) were adults and 3 (18 percent) were small benthic juveniles; no pelagic stage juveniles were observed taken (NMFS unpublished data). 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. Although genetic samples are collected from sea turtles, the number of samples currently available is too small to be able to determine the sub-population origin of individuals encountered in the shark fishery.

Juvenile smalltooth sawfish are most commonly associated with shallow water areas of Florida, close to shore and typically associated with mangroves (Simpfendorfer and Wiley 2004). Since large animals are also observed in very shallow waters, it is believed that smaller (younger) animals are restricted to shallow waters, while large animals roam over a much larger depth range (Simpfendorfer 2001). Mature animals are known to occur in water depths of 100 m or more (C. Simpfendorfer pers. comm. 2006). Thus, gear deployed in deeper water is more likely to encounter adult age classes.

5.1.4 Shark Gillnet Gear Interactions with Sea Turtles

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.

Entanglement
The effects of entanglement in gillnet gear are very similar to those noted above for bottom longline gear (see Section 5.1.1).

Forced Submergence
The effects of forced submergence resulting from entanglement in shark gillnet are the same as those noted above for bottom longline gear. See Section 5.1.1 for further discussion of the effects of forced submergence.

5.1.5 Shark Gillnet Gear Interactions with 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 3.2.6, 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

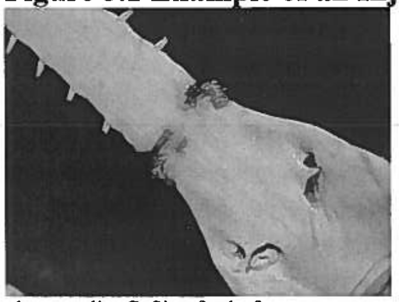

photo credit: C. Simpfendorfer.

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 fishers 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 fishers' handling practices. For example: (1) the amount of gear and time fishers 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. An observer record of the release of a smalltooth sawfish with no visible injuries, after it had been incidentally caught in the Atlantic shark drift gillnet fishery, suggests that smalltooth sawfish can be removed safely with careful handling (NMFS 2003d).

5.1.6 Factors Affecting the Likelihood of ESA-Listed Species Interacting with Shark Gillnet Gear

5.1.6.1 Gear Characteristics and Fishing Technique

A variety of factors may affect the likelihood of protected resource interactions with shark gillnet gear. The spatial overlap between fishing effort and sea turtle and smalltooth sawfish abundance is one such variable involved in anticipating entanglement events. Other factors for determining entanglement and forced submergence include gear configurations and soak times. It is also possible that mesh size compared to the sizes of the sea turtles and smalltooth sawfish exposed may influence entanglement and forced submergence frequency.

Spatial Overlap of Fishing Effort and Sea Turtle and Smalltooth Sawfish Abundance
As with shark bottom longline gear, the spatial overlap of shark gillnet effort with sea turtle and smalltooth sawfish abundance influences interactions. Section 5.1.3.1 discusses these relationships.

Net Profile
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 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 observed capture of a smalltooth sawfish in the Atlantic shark gillnet fishery (NMFS 2003e), 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.

Soak Times
The length of time gillnet gear is left in the water is another important consideration for both the likelihood of protected resource entanglement and the extent of impacts from forced submergence. The longer the soak time, the higher the likelihood of sea turtle and smalltooth sawfish encountering the gillnet gear and becoming entangled. Additionally, the mortality rate of captured sea turtles increases with soak time because of the higher potential for extended forced submergence times. Incidental captures of sea turtles, for example, 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 morality rates for incidentally caught animals.

Mesh Size
Generally, entanglement risks for sea turtles increase with increasing mesh size; although all mesh sizes are known to take sea turtles. In historical U.S. sea turtle fisheries, large mesh gillnets on the order of 12 inches were typically utilized (Witzell 1994). Various federal and state regulations have been promulgated to address the disparate impacts of gillnets with larger mesh sizes on incidental capture of sea turtles. Federal ESA regulations seasonally restrict gillnets larger than 7-inch stretched mesh in the Mid-Atlantic. North Carolina and Virginia also use regulations and proclamations to restrict and manage the use of larger mesh gillnets (greater than 7 inches) within their state waters during times of expected high seasonal abundance of sea turtles. It is possible that smaller sea turtles are more susceptible to entanglement in gillnets with smaller mesh sizes than are larger sea turtles. Therefore, the size classes within the area of

consideration may also come into play when examining the potential impact of gillnet fisheries.

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

5.2 Sea Turtle and Smalltooth Sawfish Takes by Shark Bottom Longline Gear From 2004-2006

Observer coverage in the shark bottom longline fishery was not mandatory until the 2002 fishing season. Since the 2003 shark opinion, new information has become available on the interactions between the fishery and ESA-listed species. Since several management measures for the Atlantic shark fisheries, implemented through Amendment 1 to the 1999 FMP, went into effect on December 24, 2003 (68 FR 74745), we use the years 2004 through 2006 as the baseline to project the number of individuals by species likely to be exposed to the various components of the fishery. We believe data from this time series best reflects the level of ESA-listed species interactions occurring under the current management regime.

The SEFSC estimates the level of protected resource take from 2004-2006, collectively in two reports NMFS (2007d) and Richards (2007) ("the 2007 reports"). In the following sections, we describe the take estimates calculated in the 2007 reports. We also describe ways we used the data provided in those reports, in conjunction with NMFS' revised post-release mortality estimates, to calculate post-release mortalities in sea turtles to estimate the level of lethal and non-lethal protected species takes likely to occur. NMFS (2007d) and Richards (2007) include more detailed discussion of the data sources used, calculation methods, constraints of those methods, and the assumptions under which those calculations were made.

5.2.1 Observer Data Summary

From January 2004 to December 2006, in the Gulf of Mexico (GOM), seven loggerhead sea turtles were observed caught on bottom longline gear; five were released alive and two were released dead. No smalltooth sawfish takes were observed. In the South Atlantic (SA), eight loggerhead sea turtles were observed caught on bottom longline gear; two were released alive, and six were released dead. One leatherback was observed caught in bottom longline gear and released dead. One unidentified turtle was also observed, but its condition upon release was unknown. Four smalltooth sawfish takes were observed, and all four were released alive (Hale and Carlson 2007, NMFS 2007d, Richards 2007). In total, 18 sea turtles (15 loggerheads, 2 leatherbacks, and 1 unidentified sea turtle) and four smalltooth sawfish takes were observed in these regions from 2004-2006 (Table 5.1).

No trips were observed in the North Atlantic region; therefore, the reported effort (19 shark trips, totaling 5,922 hooks) from this region was removed from the 2007 reports' analyses. Shark bottom longline effort in the North Atlantic region represented less than 12 percent of total effort in 2006. NMFS (2007d) structured its analysis around the Large Coastal Shark Complex season dates for 2006.[7]

Table 5.1 Observed Takes of Sea Turtles and Smalltooth Sawfish by Region and Season from 2004-2006

Year	Region	Season	Species	Number	Condition
2004	GOM	1	Loggerhead	1	Alive
2004	GOM	1	Loggerhead	1	Alive
2004	SA	1	Loggerhead	1	Dead
2004	SA	1	Loggerhead	1	Dead
2004	SA	1	Loggerhead	1	Alive
2004	SA	2	Unidentified Turtle	1	Unknown
2005	GOM	1	Leatherback	1	Alive
2005	GOM	1	Loggerhead	1	Alive
2005	GOM	2	Loggerhead	1	Dead
2005	GOM	2	Loggerhead	1	Dead
2005	GOM	2	Loggerhead	1	Alive
2005	SA	2	Leatherback	1	Dead
2005	SA	2	Loggerhead	1	Dead
2005	SA	2	Smalltooth Sawfish	2	Alive
2006*	SA	1	Loggerhead	1	Dead†
2006*	SA	1	Loggerhead	1	Dead†
2006*	SA	1	Loggerhead	1	Alive†
2006*	SA	2	Loggerhead	1	Dead†
2006*	GOM	3	Loggerhead	1	Alive†
2006*	SA	1	Smalltooth Sawfish	2	Alive

* Starting in 2006, fishing seasons were defined differently across regions. GOM region: Season 1 (January 1 through April 15), Season 2 (July 6 through either July 31), and Season 3 (September 1 through November 7). SA region: Season 1(January 1 through March 15), Season 2 (July 6 through August 16), and Season 3 (September 1 through October 3) (NMFS 2007d).

† Release condition of these animals not used in take extrapolation estimates.

Of the 15 loggerheads taken on bottom longline gear from 2004-2006, 12 (80 percent) were adults and 3 (20 percent) were small pelagic juveniles; no pelagic stage juveniles were observed taken (NMFS unpublished data).

5.2.2 Extrapolated Sea Turtle Takes from 2004-2006

The 2007 reports collectively estimated sea turtle takes from 2004-2006, using two measures of effort: sets and number of hooks fished. The 2003 shark opinion used hooks fished as the effort variable to estimate protected resource takes. For consistency with

[7] In the Gulf of Mexico region, Season 1 was defined as January 1 through April 15, Season 2 as July 6 through either July 31, and Season 3 as September 1 through November 7. In the South Atlantic region, Season 1-3 were defined as January 1 through March 15, July 6 through August 16, and September 1 through October 3, respectively (NMFS 2007d).

that earlier opinion, we used the 2007 reports' take estimates derived from the hooks fished effort variable. For consistency we also summed the extrapolated take estimates from the Gulf of Mexico and South Atlantic regions. The 2007 reports used the observed fishing effort and observed sea turtle take data for a given year to estimate a sea turtle bycatch rate for that year. That bycatch rate was then applied to the reported fishing effort for that year. This process was then repeated for each year to estimate the total number of interactions between the entire fishery and protected resources. Due to statistical and mathematical computation used to extrapolate take and estimate post-release mortality, some of our estimates do not use whole numbers. However, since it is not possible to take a fraction of a sea turtle or smalltooth sawfish, we round our final lethal and non-lethal take estimates up to the nearest whole number.

Extrapolated Loggerhead and Leatherback Sea Turtle Takes
The 2007 reports indicate that from 2004-2006, 588.2 loggerhead sea turtles have been taken in the Gulf of Mexico; 175.5 died as a direct result of interactions with fishing gear, while 412.5 were released alive. Over that period, the 2007 reports indicate 71.8 leatherback sea turtles were also taken in the Gulf of Mexico, all of which were released alive. In the South Atlantic, 198 loggerheads were taken from 2004-2006; 167.1 died as a direct result of interactions with fishing gear, while 29.9 were released alive. Over that time period, 11.4 leatherbacks are also estimated to have been incidentally captured, all were dead at the time of release. Additionally, 17.4 unidentified sea turtles are estimated to have been taken during this period.

Extrapolated Unidentified Sea Turtle Takes
Since the 2007 reports did not assign species for these unidentified sea turtle takes, we took additional steps to do so. Based on known interaction ratios between sea turtles and the shark bottom longline fishery these sea turtle takes were most likely loggerheads or leatherbacks. However, we do know that green, hawksbill, and Kemp's ridley sea turtles also occur in the action area, so the unidentified sea turtles takes could also have been one of these species. Using NMFS fisheries independent survey data available through the OBIS-SEAMAP database (Read et al. 2008)[8], we derived a sea turtle abundance estimate for the action area where shark fishing occurs most frequently. From 1993-2006, 1202 sea turtles were observed; loggerheads made up 89.2 percent (1073 individuals) of all observations, leatherbacks comprised 7.5 percent (90 individuals), followed by Kemp's ridleys (2.6 percent; 31 individuals), green (0.5 percent; 7 individuals) and hawksbill sea turtles (0.1 percent; 1 individual). This distribution parallels the distribution evident in the interaction rates between the HMS Atlantic shark fisheries and sea turtles. Therefore, we believe it is reasonable to use these species abundance ratios to estimate the species breakdown of the 17.4 unidentified sea turtles. Applying these ratios to the estimated unidentified sea turtle take yields an estimate of 15.5 loggerhead, 1.3 leatherback, 0.45 Kemp's ridley, 0.087 green, and 0.017 hawksbill sea turtles. Table 5.2 shows the estimates of sea turtles takes by species.

[8] Individual surveys aggregated included: NMFS NEFSC 2004 a-b; NMFS SEFSC 1994 a-b; NMFS SEFSC 1995 a-c; NMFS SEFSC 1996, 1997, 1998; NMFS SEFSC 1999 a-b; NMFS SEFSC 2000 a-b; NMFS SEFSC 2001b, Potter 1995.

Table 5.2 Estimated Sea Turtle Takes in the Commercial Directed Shark Bottom Longline Fishery from 2004-2006 (NMFS 2007d, Richards 2007)

Year	Season	Species	Non-Lethal Take	Lethal Take	Total Takes
		Gulf of Mexico			
2004	1	Loggerhead	126.7	0	126.7
2004	2	No Takes	0	0	0
2004	All	Loggerhead	126.7	0	126.7
2005	1	Loggerhead (Leatherback)	127.1 (71.8)	0(0)	127.1 (71.8)
2005	2	Loggerhead	103.1	175.7	278.8
2005	All	Loggerhead (Leatherback)	230.4 (71.8)	175.7 (0)	406.1 (71.8)
2006	1	No Takes	0	0	0
2006	2	No Takes	0	0	0
2006	3	Loggerhead	55.4	0	55.4
2006	All	Loggerhead	55.4	0	55.4
Regional Total		**Loggerhead (Leatherback)**	**412.5 (71.8)**	**175.7 (0)**	**588.2 (71.8)**
		South Atlantic			
2004	1	Loggerhead	15.1	60.2	75.3
2004	2	Loggerhead* (Leatherback)* [K/G/H]*	[*]	[*]	15.5* (1.3)* [0.45/0.087/0.017]*
2004	All	Loggerhead (Leatherback)* [K/G/H]*	15.1 [*]	60.2 [*]	75.3/15.5* (1.3)* [0.45/0.087/0.017]*
2005	1	Loggerhead	0	0	0
2005	2	Loggerhead (Leatherback)	0 (0)	14 (11.4)	14 (11.4)
2005	All	Loggerhead (Leatherback)	0 (0)	14 (11.4)	14 (11.4)
2006	1	Loggerhead	14.8	21.7	36.5
2006	2	Loggerhead	0	71.2	71.2
2006	3	No Takes	0	0	0
2006	All	Loggerhead	14.8	92.9	107.7
Regional Total		**Loggerhead (Leatherback) [K/G/H]***	**29.9 (0) [*]**	**167.1 (11.4) [*]**	**197/15.5* (11.4)/(1.3)* [0.45/0.087/0.017]***

*Since these estimates are derived from the estimate of unidentified sea turtle whose condition was unknown at the time of release, estimates of whether these takes were non-lethal or lethal do not appear here.

[K/G/H] = Kemp's ridley, green, and hawksbill sea turtles respectively

5.2.3 Estimating Mortality of Sea Turtles

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 for sea turtles released alive.

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). The final criteria are presented in Table 5.3 (see next page). Under the new criteria, overall mortality ratios are dependent upon the type of interaction (i.e., hooking, entanglement, etc.) and 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). 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. The new criteria also take into account differences in post-release mortality between hardshell sea turtles and leatherback sea turtles, with slightly higher rates of post-release mortality assigned to leatherbacks.

When sufficient data was available, the 2007 reports documented whether each sea turtle was released alive or dead. However, they did not estimate post-release mortality. Since some portion of the sea turtles released alive may ultimately succumb to the injuries they sustained at capture, we believe some of the non-lethal takes estimated in the 2007 reports may have actually resulted in mortality. Therefore, we applied an additional factor to the non-lethal takes estimated in the 2007 reports to calculate post-release mortality. We reviewed the individual observer reports of each sea turtle released alive to determine the type of injury it had received, using the criteria in Table 5.3. Applying the appropriate post-release mortality percentages from Table 5.3, we determined the number of animals with observer reports that likely died of their injuries following their release. Using that estimate and applying the delta lognormal approach (Pennington 1983) to the estimates of non-lethal sea turtle takes in the entire fishery, we calculated the total number of animals taken in the entire fishery that later succumbed to their injuries. Table 5.4 includes our estimates of the animals we believe survived their interaction with the fishery unharmed, 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).

The observer report on the unidentified sea turtle suggests the animal was released alive with trailing line longer than half its carapace length; however, no information exists on the where or if the animal was hooked. Therefore, we applied the mortality rate associated with Injury Category IV of the post-release hooking mortality to our take estimates for each species we believe made up the unidentified sea turtle takes. Those take were then combined with the leatherback and loggerhead incidental take estimates provided in the 2007 reports.

Table 5.3 Criteria for assessing marine turtle post-interaction mortality after release from pelagic longline gear. Percentage rates of mortality are shown for hardshell turtles, followed by percentages for leatherbacks (in parentheses).

	Injury Category	Release Condition			
		Released with hook and with trailing line greater than or equal to half the length of the carapace (line is trailing, turtle is not entangled)	**Released with hook and with trailing line less than half the length of the carapace (line is trailing, turtle is not entangled)**	**Released with hook and entangled (line is not trailing, turtle is entangled)[1]**	**Released with all gear removed**
		Hardshell (Leatherback)	Hardshell (Leatherback)	Hardshell (Leatherback)	Hardshell (Leatherback)
I	Hooked externally with or without entanglement.	20 (30)	10 (15)	55 (65)	5 (10)
II	Hooked in upper or lower jaw with or without entanglement. Includes ramphotheca, but not any other jaw/mouth tissue parts (see Category III).	30 (40)	20 (30)	65 (75)	10 (15)
III	Hooked in cervical esophagus, glottis, jaw joint, soft palate, tongue, and/or other jaw/mouth tissue parts not categorized elsewhere, with or without entanglement. Includes all events where the insertion point of the hook is visible when viewed through the mouth.	45 (55)	35 (45)	75 (85)	25 (35)
IV	Hooked in esophagus at or below level of the heart with or without entanglement. Includes all events where the insertion point of the hook is not visible when viewed through the mouth.	60 (70)	50 (60)	85 (95)	n/a[2]
V	Entangled only, no hook involved.	Released Entangled 50 (60)			Fully Disentangled 1 (2)
VI	Comatose/resuscitated	n/a[3]	70 (80)	n/a[3]	60 (70)

[1] Length of line is not relevant as turtle remains entangled at release.
[2] Per veterinary recommendation hooks would not be removed if the insertion point of the hook is not visible when viewed through the open mouth.
[3] Assumes that a resuscitated turtle will always have the line cut to a length less than half the length of the carapace, even if the hook remains.

Table 5.4 Estimate of Sea Turtle Takes in the Commercial Directed Shark Bottom Longline Fishery from 2004-2006, Incorporating Post-release Mortality

Year	Season	Species	Non-Lethal Takes[1]	Lethal Takes		Total Takes
				Immediate Mortalities[2]	Post-Release Moralities[3]	
Gulf of Mexico						
2004	1	Loggerhead	83.1	0	43.6	126.7
2004	2	No Takes	0	0	0	0
2004	All	Loggerhead	83.1	0	43.6	126.7
2005	1	Loggerhead (Leatherback)	125.8 (28.7)	0 (0)	1.3 (43.1)	127.1 (71.8)
2005	2	Loggerhead	92.8	175.7	10.3	278.8
2005	All	Loggerhead (Leatherback)	218.6 (28.7)	175.7 (0)	11.6 (43.1)	406.1 (71.8)
2006	1	No Takes	0	0	0	0
2006	2	No Takes	0	0	0	0
2006	3	Loggerhead	52.6	0	2.8	55.4
2006	All	Loggerhead	52.6	0	2.8	55.4
Regional Total		**Loggerhead (Leatherback)**	**354.3 (28.7)**	**175.7 (0)**	**58 (43.1)**	**588 (71.8)**
South Atlantic						
2004	1	Loggerhead	12.1	60.2	3	75.3
2004	2	Loggerhead (Leatherback) [K/G/H]	6.2 (0.39) [0.18/0.04/0.01]	0 (0) [0/0/0]	9.3 (0.91) [0.27/0.01/0.01]	15.5 (1.3) [0.45/0.087/0.017]
2004	All	Loggerhead (Leatherback) [K/G/H]	18.3 (0.39) [0.18/0.04/0.01]	60.2 (0) [0/0/0]	12.3 (0.91) [0.27/0.01/0.01]	90.8 (1.3) [0.45/0.087/0.017]
2005	1	No Takes	0	0	0	0
2005	2	Loggerhead (Leatherback)	0 (0)	14 (11.4)	0 (0)	14 (11.4)
2005	All	Loggerhead (Leatherback)	0 (0)	14 (11.4)	0 (0)	14 (11.4)
2006	1	Loggerhead	14.1	21.7	0.7	36.5
2006	2	Loggerhead	0	71.2	0	71.2
2006	3	No Takes	0	0	0	0
2006	All	Loggerhead	14.1	92.9	0.7	107.7
Regional Total		**Loggerhead (Leatherback) [K/G/H]**	**32.4 (0.39) [0.18/0.04/0.01]**	**167.1 (11.4) [0/0/0]**	**13 (0.91) [0.27/0.01/0.01]**	**212.5 (12.7) [0.45/0.087/0.017]**

[1]These numbers represent sea turtles that were alive when released and survived.
[2]These numbers represent sea turtles that were already dead when boated, or died before they were released.
[3]These numbers represent sea turtles that were alive when released but ultimately died as a result of trauma suffered from bottom longline gear.

Leatherback and Loggerhead Sea Turtle Post-Release Mortality Estimate
The past take estimates in Table 5.4 refine those summarized in Table 5.2. From 2004-2006, 588 loggerheads were taken in the Gulf of Mexico; 354.3 were released alive, 11.6 were released alive but ultimately died as a result of their injuries, and 175.7 died before they were boated or released. Over the same period in the Gulf of Mexico, 71.8 leatherbacks were taken: 28.7 were released alive and 43.1 were released alive but ultimately died as a result of their injuries.

In the South Atlantic region from 2004-2006, 212.5 loggerheads were taken: 32.4 were released alive, 13 were released alive but ultimately died as a result of their injuries, and 167.1 died before they were boated or released. During that period, 12.7 leatherbacks were also taken; 0.39 were released alive, 11.4 died before they were boated or released, and 0.91 were released alive but ultimately died as a result of their injuries.

Kemp's Ridley, Green, and Hawksbill and Post-Release Mortality Estimate
The past take estimates in Table 5.4 also include our estimate of the sea turtles that likely comprised the unidentified sea turtle takes. In the South Atlantic region from 2004-2006, 0.45 Kemp's ridley, 0.087 green, and 0.017 hawksbill sea turtles were taken.

It is clear from the estimates of past take that the number of sea turtle incidental captures varies widely from year to year. We aggregated our annual take estimates to account for this variation. Table 5.5 provides a summary of sea turtle takes by region and year. We rounded our final take estimates up to nearest whole number.

Table 5.5 Estimated Past Sea Turtle Takes, in the Commercial Directed Shark Bottom Longline Fishery from 2004-2006, by Region

Year	**Loggerhead**		**Leatherback**		**Kemp's ridley, Green, and Hawksbill**	
	Gulf of Mexico					
	Non-Lethal Take	Lethal Take	Non-Lethal Take	Lethal Take	Non-Lethal Take	Lethal Take
2004	83.1	43.6	0	0	0	0
2005	218.6	187.3	28.7	43.1	0	0
2006	52.6	2.8	0	0	0	0
Total	**355**	**234**	**29**	**44**	**0**	**0**
	South Atlantic					
	Non-Lethal Take	Lethal Take	Non-Lethal Take	Lethal Take	Non-Lethal Take	Lethal Take
2004	18.3	72.3	0.39	0.91	0.18/0.04/0.01	0.27/0.01/0.01
2005	0	14	0	11.4	0	0
2006	14.1	93.6	0	0	0	0
Total	**33**	**180**	**1**	**13**	**1/1/1***	**1/1/1***
	Gulf of Mexico and South Atlantic					
	Non-Lethal Take	Lethal Take	Non-Lethal Take	Lethal Take	Non-Lethal Take	Lethal Take
Total 2004-2006	**388**	**414**	**30**	**57**	**1/1/1***	**1/1/1***

*These represent individual takes for each species

5.2.4 Extrapolated Smalltooth Sawfish Takes from 2004-2006 and Estimated Mortality

The 2007 reports estimate based on extrapolation of observer data (see Section 5.2.1) that 60 smalltooth sawfish were taken and all were released alive from 2004-2006 (Table 5.6). Since all observed smalltooth sawfish takes were released alive, the 2007 reports did not estimate any lethal takes. 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,[9] we believe it is very possible all of these animals did survive.

Table 5.6 Estimated Takes and Mortality of Smalltooth Sawfish by the Commercial Directed Shark Bottom Longline Fishery from 2004-2006 (NMFS 2007d, Richards 2007)

Year	Season	Species	Non-Lethal Take	Lethal Takes	Total Takes
2004	1	No Takes	0	0	0
2004	2	No Takes	0	0	0
2004	All	No Takes	0	0	0
2005	1	No Takes	0	0	0
2005	2	Smalltooth Sawfish	20.8	0	20.8
2005	All	Smalltooth Sawfish	20.8	0	20.8
2006	1	Smalltooth Sawfish	39.2	0	39.2
2006	2	No Takes	0	0	0
2006	3	No Takes	0	0	0
2006	All	Smalltooth Sawfish	39.2	0	39.2
Regional Total		**Smalltooth Sawfish**	**60**	**0**	**60**

5.2.5 Discussion of Extrapolated Past Take Estimate Assumptions and Factors Influencing Accuracy

Extrapolating past sea turtle and smalltooth sawfish takes for the entire fishery from observed takes required an estimate of the total effort in the shark bottom longline fishery. Estimating total effort was difficult because the effort information was not consistently and reliably reported in common between the two sources of logbook data, and the two sequential sources of observation data (NMFS 2007d, Richards 2007).

The small sample size of observed incidental takes 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. This problem has been wrestled with by NMFS before (see Appendix A, NMFS 2004d), and although they recommended using bycatch estimates with a CV of 20 or 30 percent, they also noted that in many rare event cases this might require 80-90 percent observer coverage (NMFS 2007d, Richards

[9] Of 691 nurse sharks (*Ginglymostoma cirratum*) observed taken from 2005-2007 on bottom longline, 684 (98.9 percent) were released alive. Those not released alive were landed as catch (Hale and Carlson 2007, Hale et al. 2007).

2007). Additionally, sparse data 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 (NMFS 2007d, Richards 2007). Nonetheless, these estimates represent the best available information regarding ESA-listed species interactions with the fleet and provide the best picture of the likely interactions with the current levels of observer coverage.

In the 2007 reports, there were cases where observer data on the condition of incidentally caught sea turtles were not adequate for determining the ultimate fate of the animal. For these records the release condition (alive, dead, or some other category) was not extrapolated for the fishery. In those instances, only non-stratified (i.e., no designation of alive or dead) total past takes were extrapolated for the entire fishery (NMFS 2007d). When we estimated the post-release mortality for these animals we selected what we believed was the most reasonable and most conservative release condition (i.e., the columns in Table 5.4).

Additionally, estimating the past take of smalltooth sawfish for the entire SA region may have introduced a positive bias to these estimates. The bulk of the smalltooth sawfish population is thought to reside in the region near the Everglades National Park; therefore, extrapolating the single capture events of 2005 and 2006 to the entire SA region may have produced higher take estimates than if the analysis had been confined to the area near the Everglades (NMFS 2007d, Richards 2007). However, the existing smalltooth sawfish abundance and distribution data is not robust enough to define the species' range with a high degree of certainty. As a result, estimating smalltooth sawfish takes across the entire SA region represents the most reasonable approach for calculating fishery interactions.

The 2007 reports' estimates of past sea turtle and smalltooth sawfish takes were pooled across region and year to address the small sample size of observed sea turtle and smalltooth sawfish takes. Pooling data this way does not account for non-random distribution of the species incidentally captured, or the possible differential operation of the fishery between areas (NMFS 2007d, Richards 2007). However, given the information currently available, pooling data in this manner represents the most reasonable approach for calculating fishery interactions.

5.3 Sea Turtle and Smalltooth Sawfish Takes by Shark Gillnet Gear From 2004-2006

Since the last shark opinion, new information has become available on the interactions between the shark gillnet fishery and ESA-listed species. 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-highly migratory species or were not fishing gillnets in a drift or strike-net fashion. Garrison (2007) pooled the available 2000-2006 observed sea turtle take data to estimate an overall sea turtle bycatch rate by season ("right whale" versus "non-right whale[10]"). Because several management measures for the Atlantic shark fisheries implemented through Amendment 1 to the 1999 FMP, went into effect on December 24, 2003 (68 FR 74745), we use the years 2004 through 2006 as the baseline to project the number of individuals by species likely to be exposed to the gillnet components of the fishery. We believe data from this time series best reflects the level of ESA-listed species interactions occurring under the current management regime. Since our analysis in this section focuses on 2004-2006 as a measure of anticipated interaction levels under status quo management, only a summary of that data is included below.

In the following subsections, we describe the take estimates calculated in Garrison (2007). We also describe how we used the data provided in those reports to calculate post-release mortalities in sea turtles. Garrison (2007) provides a more detailed discussion of the data sources used, calculation methods, constraints of those methods, and the assumptions under which those calculations were made. As with bottom longline estimates above, the methods used to estimate take require us to use non-whole numbers in places; however, our final take estimates are rounded to nearest whole number.

5.3.1 Observer Data Summary

Drift, Strike, and Sink Gillnet Fisheries

Table 5.8(e) summarizes the sea turtle takes observed from 2004-2006 by all gillnet gears. In the drift gillnet fishery, four sea turtle takes were observed (three loggerheads and one leatherback), all during right whale calving season (November 15 - March 30); each was released alive. In the strike gillnet fishery there were four loggerhead sea turtle takes observed during northern right whale season; three were released alive. The sink gillnet fishery took one loggerhead sea turtle during northern right whale season and it was released alive. No interactions with sea turtles or smalltooth sawfish were observed during the entire 2004 calendar year. In fact, no interactions with smalltooth sawfish were observed during the entire three year period. (Garrison 2007).

Table 5.7 Observed Sea Turtle Takes in the Shark Gillnet Fishery from 2004-2006

Date	Gear Type	Season	Species	Number	Condition
2/8/2005	Drift	Right whale	Loggerhead	1	Alive
2/15/2005	Drift	Right whale	Loggerhead	1	Alive
2/20/2005	Drift	Right whale	Loggerhead	1	Alive
2/20/2005	Drift	Right whale	Loggerhead	1	Dead
2/15/2005	Drift	Right whale	Leatherback	1	Alive
1/27/2005	Strike	Right whale	Loggerhead	1	Alive
1/12/2006	Strike	Right whale	Loggerhead	1	Alive
2/17/2006	Strike	Right whale	Loggerhead	1	Dead
3/1/2006	Strike	Right whale	Loggerhead	1	Alive
9/23/2005	Sink-Shark	Non Right Whale	Loggerhead	1	Alive

[10] Takes were calculated separately for these two seasons to address differences in observer coverage. Observer coverage is 100% during right whale season,

Of the loggerheads observed taken by gillnet gear from 2004-2006, size data is available for seven. Of those seven, four (57 percent) were adults and three (43 percent) were small benthic juveniles, no pelagic stage juveniles were observed taken (NMFS unpublished data). Although genetic samples are collected from sea turtles, the number of samples currently available is too small to be able to determine the sub-population origin of individuals.

5.3.2 Extrapolated Sea Turtle Takes from 2004-2006

Garrison (2007) estimated sea turtle take from 2004-2006, separately for the North Atlantic right whale and non-North Atlantic right whale seasons for each species due to the differences in observer coverage and fishery activity between seasons. Each of the four gear types observed, including drift nets, strike nets, sink nets targeting sharks (Sink-Shark), and sink nets targeting fish (Sink-Fish), was analyzed separately. The effort from sink gillnet sets targeting finfish was omitted because the impacts to protected resources from these sets are authorized under biological opinions for other fisheries (e.g., coastal migratory pelagic). Data across all years were combined for each gear type, due to the low sample size and the small number of non-zero values (Garrison 2007).

Garrison (2007) indicates that since the implementation of Amendment 1 to the 1999 FMP, an estimated 19.5 loggerheads and 1.2 leatherback sea turtles are likely to have been taken by gillnet gear targeting sharks in the South Atlantic. Table 5.8(d) summarizes those findings.

The underreporting of fishing effort confounded take extrapolation for 2004-2006, because effort levels influence past take estimates. Therefore, underreporting could lead to an underestimate of total sea turtle takes. To be conservative, we selected the highest level of sea turtle takes for each year. In some cases that number was the actual number of takes observed, in others it was the number estimated by Garrison (2007) across the entire fishery. Tables 5.8(a-d) summarize those take estimates/observations for each gear type, with the highest level of take bolded.

Table 5.8(a) Observed/Estimated Sea Turtle Takes by Season for Drift Gillnet Gear from 2004-2006

Year	**Drift Gillnet Gear**			
	Loggerhead		Leatherback	
	Observed Takes	Estimated Takes	Observed Takes	Estimated Takes
Right Whale Season (Nov. 15-Mar. 31)				
2004	0	0	0	0
2005	**4**	0.5	1	**1.2**
2006	0	0	0	0
Seasonal Total	4	0.5	1	1.2
Non-Right Whale Season (Apr. 1-Nov. 14)				
2004	0	**0.3**	0	0
2005	0	**0.3**	0	0
2006	0	**0.1**	0	0
Seasonal Total	0	0.7	0	0

Table 5.8(b) Observed/Estimated Past Loggerhead Takes by Season for Strike Gillnet Gear* from 2004-2006

Year	Strike Gillnet Gear	
	Observed Takes	Estimated Takes
Right Whale Season (Nov. 15-Mar. 31)		
2004	0	**0.5**
2005	**1**	0.7
2006	**3**	1.1
Seasonal Total	4	2.3

*Only loggerhead takes were observed and only during northern right whale season (Garrison 2007).

Table 5.8(c) Observed/Estimated Past Loggerhead Takes by Season for Sink Gillnet Gear Targeting Sharks* from 2004-2006

Year	Sink Gillnet Gear	
	Observed Takes	Estimated Takes
Non-Right Whale Season (Apr. 1-Nov. 14)		
2004	0	**2.5**
2005	1	**4.1**
2006	0	**3.7**
Seasonal Total	1	10.3

*Only loggerhead takes were observed and only during non-right whale season (Garrison 2007).

Table 5.8(d) Estimated Past Sea Turtle Takes by All Gillnet Gears During All Season from 2004-2006

Year	Loggerhead	Leatherback
2004	3.3	0
2005	9.4	1.2
2006	6.8	0
Total	**19.5**	**1.2**

5.3.3 Estimated Mortality from Gillnet Interactions

Garrison (2007) did not denote whether a given sea turtle take was lethal or non-lethal. This level of specification is required for our jeopardy analysis. Therefore, we used the take estimates provided in Garrison (2007) and calculated the levels of lethal and non-lethal takes. By using the best available data (i.e., observer reports) on the condition of loggerhead sea turtles (alive or dead) observed taken by all gillnets gear, we determined the percentage of those interactions that were lethal (28.6 percent).[11] We applied that percentage to the estimate of sea turtle takes during both seasons from 2004-2006 to estimate the number of lethal and non-lethal takes (Table 5.8(e)). We rounded our final take estimate up to nearest whole number.

[11] No lethal takes of leatherbacks were observed.

Table 5.8(e) Estimated Past Sea Turtle Takes by All Gillnet Gears During All Season from 2004-2006

Year	Loggerhead		Leatherback	
	Non-Lethal Take	Lethal Take	Non-Lethal Take	Lethal Take
2004	2.4	0.9	0	0
2005	6.5	2.6	1.2	0
2006	4.9	1.9	0	0
Total	**14**	**6**	**2**	**0**

5.3.4 Extrapolated Smalltooth Sawfish Takes from 2004-2006 and Estimated Mortality

Since no smalltooth sawfish takes were observed, there are no extrapolated take estimates in Garrison (2007) and no further discussion of smalltooth sawfish in Section 5.3. However, in Section 5.6 (Anticipated Future Take as a Result of the Proposed Action, Including Amendment 2 to the Consolidated HMS FMP), additional consideration is given to the effect of shark gillnet gear on smalltooth sawfish.

5.3.5 Discussion of Extrapolated Past Take Estimate Assumptions and Factors Influencing Their Accuracy

Direct comparisons of the reported and observed data sets from several fishing vessels during various seasons and years show numerous examples of observed sets that were not reported. Garrison (2007) stated that estimating takes were confounded by the lack of a definitive way to identify the type of fishing gear used in the reported effort and the apparent underreporting of effort. The data suggest that as much as 50 percent of drift/strike gillnet effort is not reported to the logbooks. In the absence of more certain effort data, the estimates presented most likely represent minimum estimates of the past sea turtle takes (Garrison 2007). For both strike and drift nets the number of observed sets exceeded the number of reported sets in all but two years during the northern right whale season (Garrison 2007). In these cases, we erred on the side of the species and selected the number of takes that was greatest. We believe this approach is not only the most conservative toward the species, but is the most reasonable use of the best available data.

Of the 416 gillnet sets observed from 2004-2006, sea turtles takes were observed during 10 sets (nine loggerheads and one leatherback). The sparse data on sea turtle takes is unlikely to be adequately represented by standard probability distributions (Garrison 2007). Due to this small sample size, several approaches were explored to develop robust estimates of the bycatch rates and associated uncertainty. Binomial estimators, zero-inflated binomial, zero-inflated Poisson (Brown et al. 2001, Martin et al. 2005), and multinomial categorical models were all considered but ruled out because the very low incidental take rate violated many of the assumptions required to make these analyses reliable. Ultimately, a simple ratio estimator (number of animals/number of observed sets) was used to represent bycatch rates (Garrison 2007). The resulting estimates represent the best available information regarding sea turtle interactions with the fleet.

5.4 Effects of the Recreational Shark Fishery

Section 2.2.2 describes two main methods that are used to fish for sharks recreationally, depending on the species complex targeted. Each is reviewed in this subsection for their potential adverse effects on sea turtles and smalltooth sawfish.

5.4.1 Effects on Sea Turtles

Most sea turtle captures on rod-and-reel are reported to have occurred during pier fishing. Fishing piers are suspected to attract sea turtles that learn to forage there for discarded bait and fish carcasses. Sea turtles are known to bite baited hooks and hooked sea turtles have been reported by the public fishing from boats, piers, the beach, banks, and jetties. 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 fishers and sea turtles are possible. However, the proposed action pertains to recreational shark fishing in federal waters and we have no data showing that sea turtles are taken by recreational anglers fishing for sharks apart from pier fishing and nearshore shark fishing tournaments in state waters. Additionally, data collected in 2006 during MRFSS intercept survey in the Gulf of Mexico found recreational anglers had captured sea turtles while fishing in federal waters, but never during shark fishing.

Most directed shark fishing effort in the action area takes place while trolling at relatively high speeds for pelagic sharks (M. Clark, pers. comm.). Sea turtles are unlikely to be caught during recreational fishing involving trolled bait. Based on the speed at which the bait is pulled through the water (4 to 10 kts), it is unlikely that a sea turtle of any size would pursue and capture the bait.

The 2003 shark opinion discounted effects on sea turtles from recreational shark fishing. A review of available information (albeit limited) revealed no records of interactions from federal waters and only very few from state waters. We have collected more anecdotal data on recreational sea turtle captures since the last opinion, we still have no data, even anecdotal, indicating these species have been caught during recreational shark fishing authorized by the proposed action. Based on the absence of any anecdotal reports of interactions, we have no basis for changing our 2003 determination that effects on sea turtles from recreational sharking in federal waters are discountable.

5.4.2 Effects 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, Everglades National Park, monitors fishing activity and harvest in this area, in part by conducting interviews with anglers and fishing guides at local boat ramps. Most anglers did not report targeting a particular fish species. The target species of the few anglers indicating they did target a particular fish species includes 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.

The 2003 shark opinion did not list sharks as one of the target species during which smalltooth sawfish takes commonly occur. However, Simpfendorfer and Wiley (2004) note that fishermen who captured smalltooth sawfish commonly reported that they were targeting snook, redfish, and sharks. Based on this information, we are revisiting our determination that effects on smalltooth sawfish are discountable.

Over the ten year period from 1999-2008, MML's Smalltooth Sawfish National Encounter Database includes 378 sawfish captures in state waters on recreational rod-and-reel gear. Of the 93 reports that included target species information, 40 of them were targeting sharks. However, only five smalltooth sawfish captures in federal waters on rod-and-reel have been reported. Three of these were from recreational fishing, but did not indicate a target; one indicated they were recreational fishing for "jewfish" (*Epinephelus itajara*); and the fifth smalltooth sawfish capture on rod-and-reel was caught by an aquaria collector, in federal waters, while targeting sharks (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 this diminution of effort and abundance in federal waters, that make incidental take of smalltooth sawfish by recreational shark anglers fishing in federal waters so rare. The record of a smalltooth sawfish incidental capture by an aquaria collector (noted above) is the first known take targeting sharks in federal waters. Based on this new information, we believe these events are extremely rare, but not discountable. We predict one smalltooth sawfish may be incidentally caught by recreational anglers targeting sharks in federal waters over the next ten years.

5.5 Analysis of New Management Measures in Amendment 2

In the preceding subsections, we reanalyzed the effects of HMS shark fisheries on sea turtle and smalltooth sawfish under all aspects of status quo management using updated information. We now consider what effect, if any, implementation of Amendment 2 to the Consolidated HMS FMP would 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. Here we analyze what effects those proposed changes in management and regulations would have on overall operation of shark fisheries, and how those effects might impact the fisheries' effects on sea turtles and smalltooth sawfish.

Because permits and quotas in commercial shark fisheries are not gear specific, our analysis is not broken down into sections on each gear type as in Section 5.2-5.4. Instead, our analysis is organized by the seven key topics for which there are proposed changes: quotas/species complexes, retention limits, seasons, regions, recreational measures, time and area closures, and reporting. We review how each proposed change will impact shark fisheries and then discuss associated effects on sea turtles and smalltooth sawfish. Our analysis focuses on how effort reductions and effort shifts resulting from the proposed measures might increase or decrease potential interactions between sea turtles and smalltooth sawfish and gear targeting sharks. The additional administrative management measures proposed (e.g., conduct stock assessments for sharks every five years, publish a SAFE Report, etc.) discussed in Section 2.1 do not impact the manner and extent of fishing practices and therefore are not anticipated to have any effect on sea turtle and smalltooth sawfish interactions with shark fishing.

5.5.1 Effects of Proposed Quotas/Species Complexes and Retention Limits

Effects of Species Complex/Quotas and Retention Limits on Shark Fisheries
The total weight of LCS that could be harvested under the new base quotas would be 837.6 mt dw. The overall LCS base quota would change from 1,017 mt dw under status quo, to 837.6 mt dw, which is a reduction of approximately 18 percent.[12] Due to overharvests of LCS that occurred in 2007, the total weight of LCS that could be harvested under 2008-2012 adjusted quotas would be 746.9 mt dw, which is an approximately 27 percent reduction from the LCS base quota under status quo management.[13] The base quota proposed under Amendment 2 (836.7 mt dw) would become effective in 2013, if another FMP or amendment has not already been implemented.

The majority of directed LCS fishing effort under the proposed action would be conducted by the research fishery. Vessels in the shark research program would fish under the trip limits dictated by the research objectives in a given year. NMFS would determine when these trips would take place throughout the year to ensure regional and seasonal scientific sampling by observers. Only a few (5-10 estimated) vessels would likely be participating in the research fishery.

Although the LCS non-research fishery adjusted quota (578.3 mt dw) is still substantially larger than the adjusted quota for the research fishery (125.4 mt dw), the proposed retention limits for this sector (i.e., 33 sharks for directed permit holders and 3 sharks for incidental permit holders) would make targeting LCS outside of the research fishery economically impractical. If the retention limits prevent fishing targeting LCS outside the research fishery as predicted, then fishing targeting LCS during 2008-2012 under the adjusted quotas would actually be reduced by approximately 88 percent relative to the

[12] The revised overall quota would include quotas for a shark research fishery (116.6 mt dw for sandbar sharks and 50 mt dw for non-sandbar sharks; 166.6 mt dw, combined), a non-sandbar shark fishery outside the research fishery (439.5 mt dw for the GOM and 188.3 mt dw for the Atlantic region; 627.8 mt dw, combined), and shark research/display (43.2 mt dw).

[13] NMFS would implement from 2008-2012 an adjusted sandbar quota for the research fishery of 87.9 mt dw (i.e., 28.7 mt dw less than base) and non-sandbar LCS of 37.5mt dw (i.e., 12.5 mt dw less than base). Similarly, the adjusted quotas in 2008-2012 for the non-research fishery would be 578.3 mt dw (390.5 mt dw in the Gulf of Mexico region and 187.8 mt dw in the Atlantic region) (i.e., 49.5 mt dw less than base). In 2013, if there is not another FMP or amendment in place, the base quotas would be implemented.

overall LCS quota under the status quo.[14] Even if the adjusted quotas revert back to the proposed base quota levels (166.6 mt dw LCS in the research fishery) starting in 2013, these retention limits would still likely reduce effort by 84 percent.[15]

How vessels fishing outside the research fishery that have targeted LCS with bottom longline and gillnet gear in the past will respond to the proposed quotas/species complexes and retention limits is currently unknown. Bottom longline effort will be most affected by theses measures because catch on this gear type is dominated by LCS (see Proposed Action description under Section 2.3). Regardless of the shark permit type (i.e., incidental or directed) held by fishermen, the LCS non-research fishery quota is expected to be harvested incidentally by these fishermen, as they fish under other non-shark permits they hold. It is also possible some lost directed shark bottom longline effort would be redirected toward gillnetting for SCS and therefore still contribute to overall directed shark fishing effort.

Baremore et al. (2007) expects effort will probably remain unchanged for those vessels that target sharks with drift or sink gillnet gear, as the dominant sharks caught in these fisheries are SCS. The proposed action would not change the quota for SCS. However, vessels that target sharks utilizing strike-net gear may stop employing this technique because it is primarily used to target LCS and likely would not be cost effective under the proposed retention limits. There is some indication that vessels may attempt to continue to direct on sharks by strike-netting for some SCS, such as finetooth sharks (Baremore et al. 2007).

Some directed LCS effort might be lost to other fisheries. It is assumed that some of the LCS fishing effort (i.e., either from bottom longline or strike-net) may be displaced to other gillnet and bottom longline fisheries in which participants are permitted. However, other fisheries such as the South Atlantic snapper-grouper and Gulf of Mexico reef fish fisheries are limited-access fisheries. If fishermen do not currently hold permits in these fisheries, it would be difficult and expensive for them to enter these fisheries in the future. For shark fishermen that are currently permitted in these fisheries, strict retention limits and quotas are either in place or about to be implemented, which would protect these stocks from further overfishing, and being further overfished by any redirected shark fishing effort. Therefore, significant redistributed effort to these limited-access fisheries is not anticipated. Fisheries that are still open-access that shark fishermen could pursue include the mackerel fishery and the dolphin-wahoo fisheries. Although it is reasonable to assume some effort transferring to these fisheries, there are retention limits, quotas, and other effort controls in place for these fisheries to protect the stocks from overfishing and from being overfished. Also, due to the seasonality of the dolphin-wahoo fishery, commercially targeting these species would be difficult. It would also be difficult for shark fishermen using pelagic longline gear to catch smaller dolphin and wahoo due to hook requirements in the pelagic longline fishery.

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[14] 125.4 mt dw for the research fishery under 2008-2012 adjusted quota versus the 1,017 mt dw under current quotas.

[15] 166.6 mt dw for the research fishery under the 2013 quota versus the 1,017 mt dw under the current quotas.

The proposed action also reduces the quota for porbeagle sharks, but because porbeagles are mainly caught on pelagic longline gear like other pelagic sharks, this reduction in quota should not affect bottom longline or gillnet effort. The quotas for other pelagic sharks will remain unchanged.

Impacts of the Resulting Effort Reduction (Associated with the Species Complex/Quotas and Retention Limits) on Sea Turtles and Smalltooth Sawfish
There is a significant portion of sea turtle interactions and mortality in bottom longline; therefore, effort reductions in this gear type could substantially lower impacts on sea turtles. Smalltooth sawfish interactions with bottom longline gear may also decline; however, since nearly all individuals are expected to survive the event, this would have little effect on smalltooth sawfish mortality. A reduction in shark strike-net effort is not likely to have much impact on sea turtle or smalltooth sawfish takes because very few takes occur in this gillnet practice currently. Drift or sink gillnet sea turtle and smalltooth sawfish takes are more frequent, but still minimal compared to bottom longline fishing.

5.5.2 Effects of Proposed Reporting Requirements

With 100 percent observer coverage in the research fishery, observer reports could be used to monitor interactions of this directed shark fishing component in near real-time, without the need for extrapolation, which often delays monitoring as well as introducing error. It would also increase the sample size available for evaluating important sea turtle and smalltooth sawfish interaction characteristics (e.g., average life stage, genetic origin data).

Outside the research fishery, the current observer requirements and coverage levels for bottom longline and gillnet will remain in place. The Shark Bottom Longline Observer Program and Gillnet Observer Program observes shark permit holders trips regardless of their target species. This would allow NMFS to continue to observe the non-research bottom longline and gillnet fishing by vessels with directed and incidental shark permits at a level that allows for statistically reliable monitoring and would provide a better understanding of the changing dynamics of this fishery and its impacts on all marine resources.

5.5.3 Time Area Closures

Implementing the South Atlantic Fishery Management Council's proposed MPAs will have little impact on shark fishing behavior and not affect overall effort levels. The proposed closures are located on the edge of the shelf in deeper waters where currents are strong and where very little bottom longline shark fishing effort has occurred in the past. Thus, while these closures could provide additional protection for sea turtles and smalltooth sawfish within the MPA, they are not likely to reduce the overall interactions between the fishery and protected species.

5.5.4 Seasons and Regions

Previously, spikes in effort and sea turtle bycatch occurred immediately following the opening of a fishing season, followed by periods of no effort when the fishery was closed How the proposed changes to seasons and regions would affect sea turtle and smalltooth sawfish interactions is unknown. The research fishery would likely to create a more uniform distribution of effort. Effort could also occur earlier in the year. The quota and retention limit reductions would likely reduce the likelihood of interactions with protected species, regardless of changes in effort patterns.

5.5.5 Recreational Measures

The proposed recreational measures are not expected to have any effect on this fishery's effects on sea turtles and smalltooth sawfish. As discussed in 5.4, we have no documented takes to indicate adverse effects on sea turtles, and only one documented take of a smalltooth sawfish using rod-and-reel to target sharks in federal waters.

5.6 Anticipated Future Take As a Result of the Proposed Action, including Amendment 2 to the Consolidated HMS FMP

Sea Turtles

We believe Amendment 2 would alter future take levels. Based on our analysis of Amendment 2, the proposed measures (i.e., the species complexes, associated quotas, retention limits, etc.) will likely reduce effort and therefore also reduce the number of interactions between the fisheries and sea turtles. Given the proposed changes to the commercial shark fisheries, and that reductions in the number of interactions between protected species and the fishery may occur, assuming that the level of interactions that occurred in the past will continue at those levels into the future may overestimate the adverse effects of the fishery on sea turtles.

To quantify this reduction, we used quota as a surrogate to estimate both changes in effort and changes in total interactions. We believe quota is a reasonable surrogate for effort because bottom longline gear is primarily used to target only a few species (i.e., sandbar and blacktip) so capping the harvest of those species will effectively cap all bottom longline effort. Fishing effort as a proxy for reductions in interactions with ESA-listed species is reasonable because interaction levels are based on CPUEs extrapolated by fishing effort.

The reduction in quota for directed shark fishing and retention limits will measurably (i.e., anywhere from approximately 18 to 88 percent) reduce effort targeting LCS. The actual level of effort reduction will depend on how fishermen react to the change. Based on discussion with F/SF1 staff, the draft FEIS for Amendment 2 to the Consolidated HMS FMP indicates the reduction in effort targeting LCS associated with the reduction in the LCS quota would most likely result in effort moving out of the shark fishery and into non-shark directed fisheries (i.e., 84 to 88 percent reduction in directed LCS quota and effort). The retention limits outside the research fishery were developed so that directed permit holders would not target non-sandbar LCS outside the research fishery to minimize discards of sandbar sharks. The draft FEIS for Amendment 2 to the Consolidated HMS FMP also specifies that if observer data indicates that directed permit holders outside of the research fishery continue to target non-sandbar LCS and results in excessive sandbar discards, NMFS would take additional action to ensure that sandbar discards remain below the recommended TAC.

It is still possible that some bottom longline vessels will continue to target sharks outside the research fishery, finding some way to make it profitable despite retention limits. Based on that possibility, in considering the risk to ESA-listed species from the proposed action, we assumed an 18 percent reduction in fishing quota would result in an equal 18 percent reduction in bottom longline fishing effort, and ultimately 18 percent fewer sea turtle interactions in this gear type. We selected this lower level of effort reduction for our analysis to be more conservative in our estimates of listed species impacts.[16]

The SCS quota does not change under the proposed action. Only a small portion of gillnet effort is associated with targeting LCS. Gillnet fishermen unable to target these species anymore could possibly shift to targeting SCS with gillnet. However, since SCS are primarily targeted as bait, and given current market conditions, and ALWTRP regulations limiting where and when drift and sink gillnet can be used, we believe this is unlikely to occur. Still, to be conservative, we will project listed species takes on the assumption that total gillnet effort targeting sharks will not decrease despite the additional restrictions on LCS.

Because of the high degree of variability in takes associated with variability in water temperatures, species abundances, and other factors that cannot be predicted, a 5-year estimated take was used for the incidental take statement (ITS) and jeopardy analysis in the last shark opinion. Annual take estimates do have high variability because of natural and anthropogenic variation. It is unlikely that all species evaluated in this opinion will be consistently impacted year after year by every gear type. Some years may have no observed interactions and thus no estimated captures. This makes it easy to exceed average take levels in years when interactions are observed. As a result, monitoring fisheries using 1-year estimated take levels is largely impractical. However, too long of a time frame is also problematic. Based on our experience monitoring this fishery since the last opinion, we believe the 5-year time period is too long for meaningful monitoring given the frequency of changes in management and the uncertainty of how effort by gear type will shift in response to the proposed action. Instead, we are electing to authorize take for 3-year time periods for this opinion. Such an approach will allow us reduce the likelihood of requiring reinitiation unnecessarily because of inherent variability in take levels, but still allow for an accurate assessment of how the fishery is performing versus expectations.

[16] We applied this 18 percent reduction to our take estimates for Kemp's ridley, green, and hawksbill sea turtles. However, since our initial take estimate for each species was one, when we applied that reduction and rounded up to the nearest whole number, we still estimated one lethal and non-lethal take for each species every three years.

Our 3-year anticipated future take estimates for sea turtles are presented in Table 5.9.

Smalltooth Sawfish

For the same reasons described in our sea turtle analysis above, we also used quota as a surrogate to estimate both changes in effort and changes in total interactions between smalltooth sawfish and shark bottom longline gear. The assumptions regarding effort shift within the sectors of the fisheries remain the same. Based on an 18 percent reduction in fishing quota and a correlated 18 percent reduction in bottom longline fishing effort, we predict 18 percent fewer smalltooth sawfish interactions with bottom longline gear.

There has been only one documented lethal take of a smalltooth sawfish in the bottom longline fishery in the thirteen years (1994-2007) the fishery has been observed. Other bottom-dwelling shark species (i.e., nurse sharks) also show a very low mortality rate when caught on bottom longline gear.[17] Based on this information, we believe the vast majority of smalltooth sawfish will continue to survive interactions with this gear type. However, in light of this lethal take, we believe we might have another lethal take sometime in the future despite the predicted effort changes. Therefore, we conservatively assume another lethal smalltooth sawfish take might occur over the next three years.

Only one smalltooth sawfish non-lethal take in a shark gillnet has been documented over the last 10 years, and none were observed between 2004 and 2006. The animal was released in good condition and likely survived the interaction. While we believe smalltooth sawfish takes 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 gillnet component of the fishery may occur over the next three years. 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.

None of the proposed changes to the recreational fishery are anticipated to lead to an increase in fishing effort. Therefore, we believe the one incidental take of a smalltooth sawfish that occurred in the past may occur again in the future. Given the high survival rate of smalltooth sawfish caught on hook-and-line gear we believe this take will be non-lethal.

5.7 Summary

Based on our analysis of the effects, commercial shark bottom longlines and gillnets have adversely affected sea turtles and smalltooth sawfish via hooking and entanglement. The recreational handgear component of the Atlantic shark fisheries has only adversely affected smalltooth sawfish. After evaluating the effects of implementation of Amendment 2, we believe proposed changes to management will decrease these fisheries' impacts on both sea turtles and smalltooth sawfish. Take will continue but at a

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[17]Of 691 nurse sharks (*Ginglymostoma cirratum*) observed taken from 2005-2007 on bottom longline, 684 (98.9 percent) were released alive. Those not released alive were landed as catch (Hale and Carlson 2007, Hale et al. 2007).

reduced level in the future because of reductions in fishing effort. Table 5.9 summarizes the anticipated take we expect on a 3-year basis.

Table 5.9 3-year Anticipated Future Take

	Species							
Gear Type	**Loggerhead**		**Leatherback**		**Kemp's Ridley, Green, and Hawksbill**		**Smalltooth Sawfish**	
	Non-Lethal Take	Lethal Take	Non-Lethal Take	Lethal Take	Non-Lethal Take	Lethal Take	Non-Lethal Take	Lethal Take
Bottom Longline	319	340	25	47	1/1/1	1/1/1	49	1
Gillnet[1]	14	6	2	0	0	0	1	0
Recreational	0	0	0	0	0	0	1	0
Total	**333**	**346**	**27**	**47**	**1/1/1**	**1/1/1**	**51**	**1**

[1]This includes sink, strike, and drift gillnet gears.

6.0 Cumulative Effects

Cumulative effects are the effects of future state, local, or private activities that are reasonably certain to occur within the action area considered in this biological opinion. Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. Within the action area, major future changes are not anticipated in ongoing human activities described in the environmental baseline. The present, major human uses of the action area such as commercial fishing, recreational boating and fishing, and shipping of goods through the area, are expected to continue at the present levels of intensity in the near future as are their associated risks of injury or mortality to sea turtles and smalltooth sawfish posed by incidental capture by fishermen, accidental oil spills, vessel collisions, marine debris, chemical discharges, and man-made noises.

Beachfront development, lighting, and beach erosion control are all ongoing activities along the Atlantic and Gulf coasts of the U.S. 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, an increasing number of coastal counties have or are adopting more stringent protective measures to protect hatchling sea turtles from the disorienting effects of beach lighting. Some of these measures were drafted in response to law suits brought against the counties by concerned citizens who charged the counties with failing to uphold the ESA by allowing unregulated beach lighting which results in takes of hatchlings.

Urbanization in many southeastern coastal states has resulted in substantial loss of coastal habitat through activities such as agricultural and urban development (wetland conversion, flood control and diversion projects, dredge-and-fill operations). Smalltooth sawfish are particularly vulnerable to coastal habitat degradation because of their affinity for shallow, estuarine systems. Marine pollutants and debris may also negatively impact smalltooth sawfish if they get caught on their saw and interfere with feeding.

State-regulated commercial and recreational boating and fishing activities in local waters currently result in the incidental take of threatened and endangered species. It is expected that states will continue to license and permit large vessel and thrill-craft operations that do not fall under the purview of a federal agency and will issue regulations that will affect fishery activities. Recreational hook-and-line fisheries have been known to take sea turtles and smalltooth sawfish. Future cooperation between NMFS and the states on these issues should help decrease take of sea turtles caused by recreational activities. NMFS will continue to work with states to develop ESA Section 6 agreements and Section 10 permits to enhance programs to quantify and mitigate these takes.

In addition to fisheries, NMFS is not aware of any proposed or anticipated changes in other human-related actions (e.g., habitat degradation, poaching) or natural conditions (e.g., changes in oceanic conditions, etc.) that would substantially change the impacts that each threat has on the sea turtles or smalltooth sawfish covered by this opinion. Therefore, the NMFS expects that the levels of take of these species described for each of the fisheries and non-fisheries will continue at similar levels into the foreseeable future.

7.0 Jeopardy Analysis

The analyses conducted in the previous sections of this opinion serve to provide a basis to determine whether the proposed action would be likely to jeopardize the continued existence of any ESA-listed sea turtles or smalltooth sawfish. In Section 5, we have outlined how the proposed action can affect sea turtles and smalltooth sawfish, and the extent of those effects in terms of estimates of the numbers of each species caught, injured or killed. Now we turn to an assessment of each species' response to this impact, in terms of overall population effects from the estimated take, and whether those effects of the proposed action, when considered 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 the affected species.

"To jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and the recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02). Thus, in making this determination for each species, we must first determine 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 evaluate whether it will cause an appreciable reduction in the likelihood of both the survival and the recovery of the species.

7.1 Effects of the Action on the Likelihood of Green, Hawksbill, and Kemp's Ridley Sea Turtle Survival in the Wild

This section analyzes the effects of the action on the likelihood of green, hawksbill, and Kemp's ridley sea turtles survival in the wild. We first evaluate whether the anticipated take of each species will result in any reduction in distribution, reproduction, or numbers of these species.

The non-lethal take of a green, hawksbill, and Kemp's ridley sea turtle, every three years, is not expected to have any measurable impact on the reproduction or numbers of these species. Application of the post-release mortality criteria ensures that sea turtles that are likely to be seriously injured by capture in the fisheries are counted as lethal takes. Thus, while the range of impacts from non-lethal takes is variable, all are expected to be fully recoverable such that no reductions in reproduction or numbers are anticipated. Individual takes may occur anywhere in the action area and sea turtles would be released within the general area where they are caught.

The lethal take of one green, hawksbill, and Kemp's ridley sea turtle by the Atlantic shark fisheries every three years would reduce the number of sea turtles as compared to the number that would have been present in the absence of the continued authorization of Atlantic shark fisheries, 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 some of these individuals are females. 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. The annual loss of one adult female sea turtle, on average, could preclude the production of thousands of eggs and hatchlings, of which a fractional percentage are expected to survive to sexual maturity. Thus, the death of a female eliminates an individual's contribution to future generations, resulting in a reduction in sea turtle reproduction. Changes in distribution are not expected to result from the continued authorization of the Atlantic shark fisheries. Since the anticipated takes could occur anywhere in the action area and sea turtles generally have large ranges in which they disperse, no reduction in the distribution of green, hawksbill, and Kemp's ridley sea turtles is expected from the take of these individuals.

Whether the reductions in numbers and reproduction of these species attributed to Atlantic shark fisheries would appreciably reduce their 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 determined to be 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. Additionally, the pattern of green sea turtle nesting shows biennial peaks in abundance, with a generally positive trend during the ten years of regular monitoring since establishment of index beaches in Florida in 1989. 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).

The 5-year status review for hawksbill sea turtles states their populations appear to be increasing or stable at the two principal nesting beaches in the U.S. Caribbean where long-term monitoring has been carried out, Mona Island, Puerto Rico and Buck Island Reef National Monument (BIRNM), St. Croix, USVI (NMFS 2007b). Mona Island sees between 199-332 nesting females per season, while 99 females nest at BIRNM per season (NMFS 2007b). Although today's nesting population is only a fraction of what it was, nesting activity in recent years by hawksbills has increased on well-protected beaches in Mexico, Barbados, and Puerto Rico (Caribbean Conservation Corporation 2005). Increasing protections for live coral habitat in the Atlantic, Gulf of Mexico, and Caribbean over the last decade may also increase survival rates of hawksbills in the marine environment.

The total population of Kemp's ridleys is not known, but nesting has been increasing significantly in the past several years (9 to 13 percent per year) with over 15,000 nests recorded in 2007 (Gladys Porter Zoo 2007). Kemp's ridleys mature and nest at an age of 7-15 years, which is earlier than other chelonids. A younger age at maturity may be a factor in the response of this species to recovery actions. A period of steady increase in benthic immature ridleys has been occurring since 1990 and appears to be due to increased hatchling production and an apparent increase in survival rates of immature sea turtles. The increased survivorship of immature sea turtles is largely attributable to the introduction of turtle excluder devices (TEDs) in the U.S. and Mexican shrimping fleets and Mexican beach protection efforts. The TEWG (2000) projected that Kemp's ridleys could reach the Recovery Plan's intermediate recovery goal of 10,000 nesters by the year 2015.

Although the anticipated mortalities of green, hawksbill, and Kemp's ridley sea turtles expected from the proposed action would result in an instantaneous reduction in absolute population numbers, it is not likely these small reductions would appreciably reduce the likelihood of survival of any of these sea turtle species. If the hatchling survival rate to maturity is greater than the mortality rate of the population, the loss of breeding individuals would be replaced through recruitment of new breeding individuals from successful reproduction of non-taken sea turtles. Considering that all three species' nesting trends are either stable or increasing, we believe the loss of a single green, hawksbill, and Kemp's ridley sea turtle over three years will not have any measurable effect on those trends.

Based on the above analysis, we believe that the lethal and non-lethal takes of green, hawksbill, and Kemp's ridley sea turtles associated with the proposed action are not reasonably expected to cause, directly or indirectly, an appreciable reduction in the likelihood of survival of these species of sea turtles in the wild.

7.2 Effects of the Action on the Likelihood of Green, Hawksbill, and Kemp's Ridley Sea Turtle Recovery in the Wild

The analysis in Section 7.1 on the effects of the action on the likelihood of each species' survival in the wild considered the effects of the numbers of lethal and non-lethal takes anticipated for each species. Although no change in distribution was concluded for any species, we concluded lethal takes would result in an instantaneous reduction in absolute population numbers that may also reduce reproduction, but these reductions are not expected to appreciably reduce the likelihood of survival of any species in the wild. The following analysis considers the effects of the anticipated take on the likelihood of recovery in the wild. We consider the recovery objectives in the recovery plans prepared for each species that relate to population numbers or reproduction that may be affected by the predicted reductions in the numbers or reproduction of sea turtles resulting from the proposed action.

The Atlantic Recovery Plan for the population of Atlantic green sea turtles (NMFS and USFWS 1991b) lists the following relevant recovery objectives over a period of 25 continuous years:

- The level of nesting in Florida has increased to an average of 5,000 nests per year for at least 6 years; and
    - Green turtle nesting in Florida over the past six years has been documented as follows: 2001 – 581 nests, 2002 – 9,201 nests, 2003 – 2,622, 2004 – 3,577 nests, 2005 – 9,644 nests, and 2006 – 4,970 nests. This averages 5,039 nests annually over the past 6 years (NMFS and USFWS 2007a).
- A reduction in stage class mortality is reflected in higher counts of individuals on foraging grounds.
    - Several actions are being taken to address this objective, however there are currently no estimates available specifically addressing changes in abundance of individuals on foraging grounds.

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:

- 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; and
    - 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).

- 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).

The recovery plan for Kemp's ridley sea turtles (USFWS and NMFS 1992) lists the following relevant recovery objective:

- Attain a population of at least 10,000 females nesting in a season.
  - An estimated 4,047 females nested in 2006, which is a substantial increase from the 247 nesting females estimated during the 1985 nesting season (P. Burchfield, Gladys Porter Zoo, personal communication, 2007, in NMFS and USFWS 2007c).
  - In 2007, an estimated 5,500 females nested in the State of Tamaulipas from May 20-22 (P. Burchfield, Gladys Porter Zoo, personal communication, 2007, in NMFS and USFWS 2007c).
  - 10,000 nesting females in a season = about 30,000 nests (NMFS and USFWS 2007c).

The potential lethal take of one green, hawksbill, and Kemp's ridley sea turtle every three years will result in a reduction in numbers and potentially a reduction in reproduction if the sea turtles taken were adult females, but is unlikely to have any detectable influence on the population trends noted above. Non-lethal takes of sea turtles would not affect these trends either. Thus, the proposed action will not interfere with achieving the recovery objectives above and will not result in an appreciable reduction in the likelihood of green, hawksbill, and Kemp's ridley sea turtles' recovery in the wild.

7.3 Effects of the Action on the Likelihood of Leatherback Sea Turtle Survival in the Wild

In the following analysis, we demonstrate that although some short-term reduction in numbers and reproduction is expected, the anticipated take of leatherback sea turtles will not appreciably reduce the likelihood of survival of this species in the wild.

The non-lethal take of 27 leatherback sea turtles every three years is not expected to have any measurable impact on reproduction, numbers, or distribution. Application of the post-release mortality criteria ensures that sea turtles that are likely to be seriously injured by capture in the fisheries are counted as lethal takes. Any negative sub-lethal effects experienced by a captured and released individual are expected to be minimal and temporary in nature. Although the range of impacts of non-lethal takes are variable, all are expected to be fully recoverable such that no reductions in reproduction or numbers are anticipated. No effect on leatherback distribution is expected to result from the proposed action. Individual takes may occur anywhere in the action area and turtles would be released within the general area where they are caught.

The lethal take every three years of up to 47 leatherback sea turtles by the Atlantic shark fisheries would reduce the number of leatherback sea turtles as compared to the number that would have been present in the absence of the continued authorization of Atlantic shark fisheries 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, assuming some of these individuals are females, eliminating their contribution to future generations. Leatherbacks nest frequently (up to 7-10 nests per year) during a nesting season and nest about every 2-3 years. During each nesting, they can produce 100 eggs or more in each clutch and, thus, can produce 700 eggs or more per nesting season (Schultz 1975). A significant portion (up to approximately 30 percent) of the eggs can be infertile. Thus, the actual proportion of eggs that can result in hatchlings is less than this seasonal estimate. Even still, the annual loss of adult females could preclude the production of thousands of eggs and hatchlings, of which a small percentage are expected to survive to sexual maturity.

Whether the reductions in numbers and reproduction of leatherback sea turtles attributed to Atlantic shark fisheries would appreciably reduce their likelihood of survival depends on the effect the changes in numbers and reproduction would have on population sizes and trends.

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 (TEWG 2007). 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, there is not enough information available on the West African population to conduct a trend analysis. For the Western Caribbean, a slight decline in annual population growth rate was detected (TEWG 2007).[18]

Although the anticipated mortalities would result in an instantaneous reduction in absolute population numbers, which could also constitute an instantaneous reduction in reproduction, we do not believe these mortalities will have any measurable effect on the size or stability of the overall leatherback population. Especially since the population growth rate is increasing at the largest leatherback nesting site in the Atlantic Basin. Therefore, we believe the anticipated lethal takes of leatherback sea turtles associated with the proposed action are not reasonably expected to cause, directly or indirectly, an

[18] An annual growth rate of 1.0 is considered a stable population, the growth rates of two nesting populations in Western Caribbean were 0.98 and 0.96 (TEWG 2007).

appreciable reduction in the likelihood of survival of this species of sea turtles in the wild.

7.4 Effects of the Action on the Likelihood of Leatherback Sea Turtle Recovery in the Wild

The above analysis on the effects of the action on the likelihood of the leatherback sea turtles' survival in the wild considered the effects of the numbers of lethal and/or non-lethal takes anticipated. Although no change in distribution was expected, we concluded lethal takes would result in an instantaneous reduction in absolute population numbers, which may also reduce reproduction, but these reductions are not expected to appreciably reduce the likelihood of survival of leatherback sea turtles in the wild. The following analysis considers the effects of the anticipated take on the likelihood of leatherback recovery in the wild. We consider the recovery objectives in the leatherback sea turtle recovery plan that relate to population numbers or reproduction that may be affected by the predicted reductions in the numbers or reproduction resulting from the proposed action.

The Atlantic recovery plan for the U.S. population of the leatherback sea turtles (NMFS and USFWS 1992) lists the following relevant recovery objective:

- The adult female population increases over the next 25 years, as evidenced by a statistically significant trend in the number of nests at Culebra, Puerto Rico, St. Croix, USVI, and along the east coast of Florida.
    - In Puerto Rico, the main nesting areas are at Fajardo on the main island of Puerto Rico and on the island of Culebra. Between 1978 and 2005, nesting increased in Puerto Rico from a minimum of 9 nests recorded in 1978 and to a minimum of 469-882 nests recorded each year between 2000 and 2005. Annual growth rate was estimated to be 1.1 with a growth rate interval between 1.04 and 1.12 using nest numbers between 1978 and 2005 (NMFS and USFWS 2007d).
    - In the U.S. Virgin Islands, researchers estimated a population growth of approximately 13 percent per year on Sandy Point National Wildlife Refuge from 1994 through 2001. Between 1990 and 2005, the number of nests recorded has ranged from 143 (1990) to 1,008 (2001). The average annual growth rate was calculated as approximately 1.10 (with an estimated interval of 1.07 to 1.13) (NMFS and USFWS 2007d).
    - In Florida, a Statewide Nesting Beach Survey program has documented an increase in leatherback nesting numbers from 98 (1989) to 800-900 (early 2000s). Based on standardized nest counts made at Index Nesting Beach Survey sites surveyed with constant effort over time, there has been a substantial increase in leatherback nesting in Florida since 1989. The estimated annual growth rate was approximately 1.18 (with an estimated 95 percent posterior interval of 1.1 to 1.21) (NMFS and USFWS 2007d).

The potential lethal take of 47 leatherback sea turtles every three years will result in reduction in numbers when takes occur and potential reductions in reproduction if sea turtles taken are adult females, but these takes are unlikely to have any detectable affect on the population trends noted above. Non-lethal takes will not affect the adult female nesting population. 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 leatherback sea turtles' recovery in the wild.

7.5 Effects of the Action on the Likelihood of Loggerhead Sea Turtle Survival in the Wild

In the following analysis, we demonstrate that although some short-term reduction in numbers and reproduction is expected, the anticipated take of loggerhead sea turtles will not appreciably reduce the likelihood of survival of this species in the wild.

The non-lethal take of 333 loggerhead sea turtles every three years is not expected to have any measurable impact on the reproduction, numbers, or distribution of loggerhead sea turtles. Application of the post-release mortality criteria ensures that sea turtles that are likely to be seriously injured by capture in the fisheries are counted as lethal takes. Any negative effects experienced by captured and released individuals are expected to be minimal and temporary in nature. Although the range of impacts of non-lethal takes are variable, all are expected to be fully recoverable such that no reductions in reproduction or numbers of loggerhead sea turtles are anticipated. No effect on loggerhead distribution is expected to result from the non-lethal takes expected from the proposed action. Individual takes may occur anywhere in the action area and turtles would be released within the general area where they are caught.

The lethal take of 346 loggerhead sea turtles every three years from the Atlantic would reduce the number of loggerhead sea turtles as compared to the number of loggerhead sea turtles 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 reproductive value as compared to the reproductive value in the absence of the proposed action, assuming some of these individuals are females; eliminating each 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 are expected to survive to sexual maturity. Changes in distribution are not expected from lethal takes by fishing gear during HMS Atlantic shark fishing. Because all the potential takes are expected to occur at random throughout the action area and sea turtles generally have large ranges in which they disperse, no reduction in the distribution of loggerhead sea turtles is expected from the take of these individuals.

Whether the reductions in numbers and reproduction of this species attributed to Atlantic shark fisheries would appreciably reduce its likelihood of survival depends on the effect the changes in numbers and reproduction would have on population sizes and trends.

Regarding the Florida nesting group of loggerhead sea turtles, a trend analysis of the nesting data collected for Florida's Index Nesting Beach Survey (INBS) program showed a decrease in nesting of 22.3 percent in the annual nest density of surveyed shoreline over a 17-year period (1989-2005) and a 39.5 percent decline since 1998 (letter to NMFS from the Director, Fish and Wildlife Research Institute, Florida Fish and Wildlife Conservation Commission, October 25, 2006; Meylan et al. 2006). Data collected in Florida for the 2007 loggerhead nesting season reveals that the decline in nest numbers has continued, with even fewer nests counted in 2007 in comparison to any previous year of the period, 1989-2007 (Fish and Wildlife Research Institute, Florida Fish and Wildlife Conservation Commission web posting November 2007). With respect to the northern nesting group of loggerheads, standardized ground surveys of 11 North Carolina, South Carolina, and Georgia nesting beaches showed a significant declining trend of 1.9 percent annually in loggerhead nesting from 1983-2005 (NMFS and USFWS 2007e). Aerial surveys conducted by the South Carolina Department of Natural Resources showed a 3.1 percent annual decline in nesting since 1980 (Dodd 2003, NMFS and USFWS 2007e). The South Carolina data represents approximately 59 percent of nesting by the northern nesting group (Dodd 2003). A significant declining trend in loggerhead nesting of 6.8 percent annually from 1995-2005 has also been detected for the Florida Panhandle nesting group (NMFS and USFWS 2007e). Nesting for the Yucatán nesting group is characterized as having declined since 2001 while no trend is detectable for the Dry Tortugas nesting group (NMFS and USFWS 2007e).

However, these declines need to be viewed in the context of the number of nests observed and are not necessarily applicable to the population as a whole. While the number of nests is a proxy for the size of the adult nesting female population, nesting declines do not necessarily mean the numbers of adult females are declining. Likewise, nesting declines do not necessarily mean the population or stock is declining as a whole. The method of converting the number of nests to the number of females is also confounded by several factors, for example the variability in number of nests per female per year or the variability in the remigration interval. Additionally, nest counts alone do not provide any insight into the status of other age classes or the male population (letter to J. Lecky, NMFS Office of Protected Resources, from N. Thompson, NMFS Northeast Fisheries Science Center, December 4, 2007).

These declining nesting beach trends also seem in contradiction to some in-water survey results. Epperly et al. (2007) reported a 13.2 percent per year increase in loggerhead catch per unit effort (CPUE) off North Carolina during sea turtle sampling in 1995-1997 and 2001-2003. Ehrhart et al. (2007) also reported a significant increase in loggerhead CPUE over the last four years in the Indian River Lagoon, Florida. Entrainment of loggerheads at St. Lucie Power Plant on Hutchison Island, Florida, has also increased at an average rate of 11 percent per year from 1998 to 2005 (M. Bersette pers. comm. in Epperly et al. 2007).

It is unclear whether nesting beach trends, in-water abundance trends, or some combination of both, best represents the actual status of loggerhead sea turtle populations in the Atlantic. Regardless, we believe the proposed action will not have a measurable negative affect on either of these trends. Estimates of the total loggerhead population in the Atlantic are not currently available. However, TEWG (1998) estimated the total loggerhead population of benthic individuals in U.S. waters – a subset of the whole Western Atlantic population – at over 200,000. While this population estimate is dated, it provides some context for evaluating the size of the likely population of loggerheads in the Atlantic. Scaled against the likely size of the population, and the magnitude of the trends noted above, even if they accurately represent the status of the loggerhead population, we do not believe the level of take projected every three years will have a measurable impact on the likelihood of the loggerhead's survival in the wild.

Additionally, NMFS concluded a section 7 consultation on the Atlantic sea scallop fishery (NMFS 2008) on March 14, 2008. This consultation used an estimate of 619 lethal loggerhead takes annually by the fishery, to evaluate the impact of its continued authorization on the likelihood of loggerhead survival in the wild (Merrick and Haas 2008, NMFS 2008). To measure the potential impact, a population viability analysis (PVA) model was developed for adult females in the western Atlantic Ocean. The estimate of 619 annual lethal takes was used as a baseline to estimate the level of adult female loggerhead bycatch mortality annually. Adult female loggerheads were chosen as a surrogate for the entire Atlantic loggerhead population because no estimates of the number of mature males, immature males, and immature females are available. Likewise, the age structure of the population is currently unknown (NMFS 2008). NMFS considered running the PVA at the nesting subpopulation group level, but chose not to because the data available were insufficient to develop a PVA model for each nesting group (NMFS 2008). While data was available to conduct a PVA model on the South Florida and Northern nesting subpopulations, NMFS chose not to conduct such analysis. They noted it was unlikely that such a model would differ from the results of a PVA conducted on the western Atlantic Ocean stock, because the south Florida index nesting sites make up such a large proportion of the total nest counts (i.e., 95 percent in 2005) (NMFS 2008). Additionally, given the inter-annual variability in nest counts for the Northern nesting population, they believed this variability would ultimately produce estimates with a high degree of variance which could reduce their ability to detect effects of the fishery (NMFS 2008). Ultimately, a PVA for the entire western North Atlantic was deemed to be the best approach to detect effects of the sea scallop fishery on loggerheads in the North Atlantic. In selecting the western Atlantic Ocean stock for analysis, the model implicitly accounts for previous and continuing actions that have adverse effects on loggerheads throughout the western Atlantic Ocean. Therefore, the impacts of the past operation of HMS Atlantic shark fisheries on loggerheads, prior to the proposed action considered here, are conceptually addressed in the PVA model.

The PVA concluded that the level of adult female bycatch mortality associated with 619 lethal loggerhead takes annually would not have an appreciable effect on the number of adult female loggerheads in the western Atlantic Ocean over the next 100 years (see Merrick and Haas 2008 and NMFS 2008 for further discussion of the PVA). Using the results of this PVA model, NMFS determined the biennial lethal take associated with the continued authorization of the Atlantic sea scallop fishery would not appreciably reduce the survival of loggerheads in the Atlantic Ocean (NMFS 2008).

We believe this analysis further supports our assertion that the continued authorization of the Atlantic shark fisheries will not appreciably reduce the likelihood of survival of loggerhead sea turtles, given that the proposed action is expected to result in 346 lethal takes of loggerheads over every future three year period. The PVA model was conducted on the loggerhead population most likely to occur within the action area for our consultation (i.e., western North Atlantic stock). Additionally, because the section 7 consultation on the Atlantic sea scallop fishery was completed so recently, the factors influencing the environmental baseline and status of the species considered in that consultation are representative of those affecting loggerheads in the action area for shark fisheries. Thus, we believe the conclusions derived from the PVA models regarding the impact of lethal takes by the Atlantic sea scallop fishery to the overall stability of the loggerhead population in the western Atlantic Ocean are applicable to the loggerheads that will be impacted by shark fisheries.

Although the declining annual nest density at major loggerhead sea turtle nesting beaches require further study and analysis to determine the causes and long-term effects on population dynamics, the likelihood of survival in the wild of loggerheads will not be appreciably reduced as a result of this action. Therefore, we believe that 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 survival of this species of sea turtles in the wild.

7.6 Effects of the Action on the Likelihood of Loggerhead Sea Turtle Recovery in the Wild

The above analysis on the effects of the action on the likelihood of loggerhead sea turtles' survival in the wild considered the current status of loggerheads and effects of the numbers of anticipated lethal and/or non-lethal takes. Although no appreciable change in distribution was concluded, we concluded lethal takes would result in an instantaneous reduction in absolute population numbers that may also reduce reproduction, but the reductions are not expected to appreciably reduce the likelihood of survival of loggerhead sea turtles in the wild. The following analysis considers the effects of the take on the likelihood of recovery in the wild. We consider the recovery objectives in the loggerhead recovery plan that relate to population numbers or reproduction that may be affected by the predicted reductions in the numbers or reproduction resulting from the proposed action.

The Atlantic recovery plan for the U.S. population of loggerhead sea turtles (NMFS and USFWS 1991a), herein incorporated by reference, lists the following relevant recovery objective over a period of 25 continuous years:

- The adult female population in Florida is increasing and in North Carolina, South Carolina, and Georgia, it has returned to pre-listing nesting levels (North Carolina = 800 nests/season; South Carolina = 10,000 nests/season; Georgia = 2,000 nests/season).

- In North Carolina, South Carolina, and Georgia, an average of 5,151 nests per year were documented from 1989-2005, well below the total target of 12,800 nests per season for these three states. Standardized ground surveys of 11 North Carolina, South Carolina, and Georgia nesting beaches showed a significant declining trend of 1.9 percent annually in loggerhead nesting from 1983-2005. In addition, standardized aerial nesting surveys in South Carolina have shown a significant annual decrease of 3.1 percent from 1980-2002.
- In Florida, the South Florida Nesting Subpopulation showed a decrease in nests of 22.3 percent over the 17-year period from 1989-2005. The Florida Panhandle Nesting Subpopulation showed a significant declining trend of 6.8 percent annually from 1995-2005. No trend in the annual number of nests was detected in the Dry Tortugas Nesting Subpopulation from 1995-2004; because of the annual variability in nest totals, a longer time series is needed to detect a trend.

The potential lethal take of 346 loggerheads every three years will result in reduction in numbers when takes occur but, given the magnitude of these trends, is unlikely to have any detectable influence on the population trends noted above. Non-lethal takes of sea turtles will not affect the adult female nesting population or number of nests per nesting season. Thus, the effects of the proposed action will not result in an appreciable reduction in the likelihood of loggerhead sea turtle recovery in the wild.

7.7 Effects of the Action on the Likelihood of Smalltooth Sawfish Survival in the Wild

In the following analysis, we demonstrate that although some short-term reduction in numbers and reproduction is expected, the anticipated take of smalltooth sawfish will not appreciably reduce the likelihood of survival of this species in the wild.

The non-lethal take of 51 smalltooth sawfish every three years is not expected to have any measurable impact on the reproduction or numbers of these species. The vast majority of smalltooth sawfish released after incidental capture show no apparent signs of any negative sub-lethal effects. Any adverse affects experienced are expected to be minimal and temporary in nature. Although the range of impacts of non-lethal takes are variable, all are expected to be fully recoverable such that no reductions in reproduction or numbers of smalltooth sawfish are anticipated. No effect on smalltooth sawfish distribution is expected to result from the proposed action. Individual takes may occur anywhere in the action area and smalltooth sawfish would be released within the general area where they are caught.

The loss of one smalltooth sawfish from the Atlantic every three years 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. This lethal take 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 annual loss of one adult female smalltooth sawfish, on average, could preclude the production of 10 pups every three years. As 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 one animal from the population every three years will have no impact of the distribution of the species.

A trend analysis of smalltooth sawfish abundance in the Everglades National Park, considered within the species core range, shows a slightly increase population abundance trend since 1972 (Carlson et al. 2007). From 1989-2004, smalltooth sawfish relative abundance has increased 5 percent annually (NMFS 2006c). Although the anticipated mortality of one smalltooth sawfish over the next three years would result in an instantaneous reduction in absolute population number, we do not believe this mortality 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.

7.8 Effects of the Action on the Likelihood of Smalltooth Sawfish Recovery in the Wild

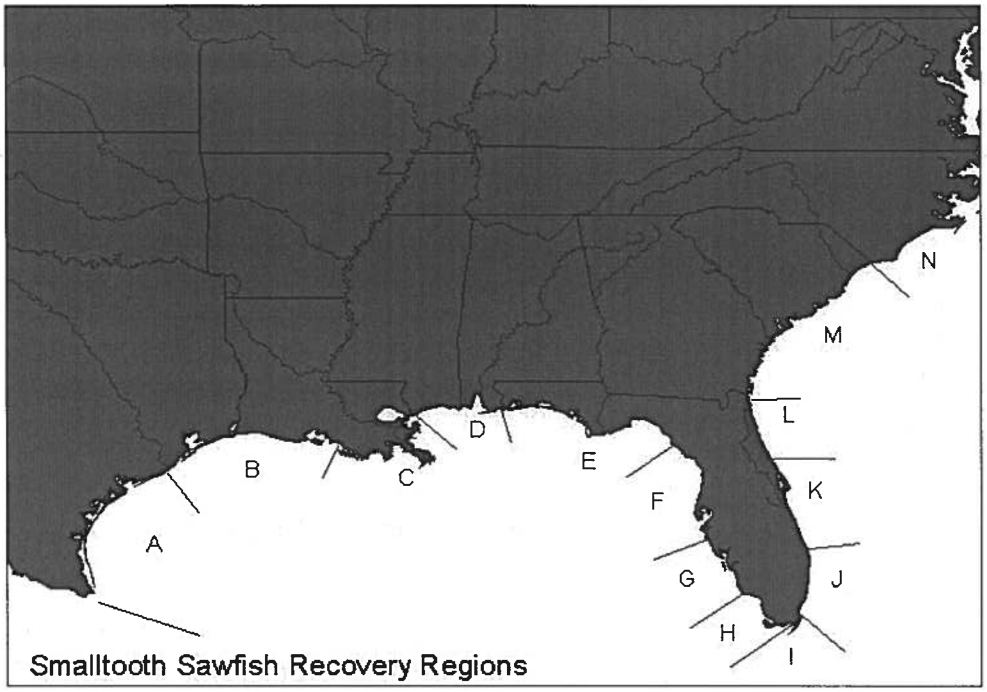
The above analysis on the effects of the action on the likelihood of smalltooth sawfish survival in the wild considered the effects of the numbers of lethal and/or non-lethal takes anticipated for the species. Although we believe no change in distribution will occur, we concluded the lethal take would 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 draft 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 draft recovery plan for the smalltooth sawfish (NMFS 2006c) lists the following relevant recovery objectives:

- Relative abundance of adult smalltooth sawfish in combined recovery regions J through L (east coast of Florida) has increased to a level at least 15-times higher than the level at the time of listing, and greater than 95 percent certainty that abundance at this level has been sustained for a period of at least 14 years.
- Relative abundance of adult smalltooth sawfish in combined recovery regions F through H (west coast of Florida) has increased to a level at least 15-times higher than the level at the time of listing and greater than 95 percent certainty that abundance at this level has been sustained for a period of at least 14 years.

- Verified records of adult smalltooth sawfish are observed in 12 out of 14 years, with consecutive records occurring in the last 3 years in recovery regions M or N, and in at least one of recovery regions A, B, C, or D.

Figure 7.1 Recovery Regions for Smalltooth Sawfish Along the Gulf of Mexico and U.S. Atlantic Coast.



The potential lethal take of one smalltooth sawfish every three years will result in a reduction in overall population numbers in any given year. We have already determined this take is not likely to reduce population numbers over time due to current population sizes and expected recruitment. Non-lethal takes of smalltooth sawfish will not affect the population of reproductive adult females. Thus, the effects of the proposed action will not result in an appreciable reduction in the likelihood of smalltooth sawfish recovery in the wild.

8.0 Conclusion

We have analyzed the best available data, the current 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 any sea turtle species or smalltooth sawfish.

Green, Hawksbill, Kemp's ridley, Leatherback, and Loggerhead Sea Turtles
Our sea turtle analyses focused on the impacts to and population response of sea turtles in the Atlantic basin. However, the impact of the effects of the proposed action on the Atlantic populations must be directly linked to the global populations of the species, and the final jeopardy analysis is for the global populations as listed in the ESA. Because the proposed action will not reduce the likelihood of survival and recovery of any Atlantic

populations of sea turtles, it is our opinion that the continued operation of the HMS Atlantic shark fishery is also not likely to jeopardize the continued existence of loggerhead, green, hawksbill, Kemp's ridley, or leatherback sea turtles.

Smalltooth Sawfish

The smalltooth sawfish analyses focused on the impacts and population response of the U.S DPS of smalltooth sawfish. Based on these analyses, it is our opinion that the continued operation of the HMS Atlantic shark fishery is not likely to jeopardize the continued existence of smalltooth sawfish.

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/SF1 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 Amount or Extent of Incidental Take

NMFS anticipates the following incidental takes may occur every three years starting July 2008 as a result of the continued operation of Atlantic HMS shark fisheries under the HMS Consolidated FMP, including Amendment 2.

Table 9.1 3-Year Anticipated Future Take in the HMS Atlantic Shark Fishery

Species	Amount of Take	Total
Green	Total Take	2
	Lethal Take	1
Hawksbill	Total Take	2
	Lethal Take	1
Kemp's ridley	Total Take	2
	Lethal Take	1
Leatherback	Total Take	74
	Lethal Take	47
Loggerhead	Total Take	679
	Lethal Take	346
Smalltooth sawfish	Total Take	51
	Lethal Take	1

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 green, hawksbill, Kemp's ridley, leatherback, or loggerhead sea turtles, or smalltooth sawfish.

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 incidental take statement. If it fails to adhere to the terms and conditions of the incidental take statement 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 incidental take statement [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 and smalltooth sawfish from HMS Atlantic shark fishing and monitor levels of incidental take.

1. NMFS must require that captured sea turtles and smalltooth sawfish be handled in a way that minimizes adverse effects from incidental take and reduces mortality.

2. NMFS must explore ways HMS Atlantic shark fishing gears and techniques could be modified to reduce long-term sea turtle and smalltooth sawfish incidental take and mortality.
3. NMFS must ensure that monitoring and reporting of any sea turtles or smalltooth sawfish encountered: (1) detects any adverse effects resulting from the HMS Atlantic shark fishing; (2) assesses the actual level of incidental take in comparison with the anticipated incidental take documented in that opinion; and (3) detects 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, NMFS must comply with the following terms and conditions, which implement the RPMs described above. These terms and conditions are non-discretionary.

The following terms and conditions implement RPM No. 1.

1. As new information becomes available, NMFS must update sea turtle careful release protocols and smalltooth sawfish handling guidelines and must modify release gears as appropriate.
2. NMFS must distribute the sea turtle resuscitation and handling techniques found below.
    a. As stated in 50 CFR 223.206(d)(1-3), resuscitation must be attempted on sea turtles that are comatose or inactive by:
        i. Placing 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.
        ii. 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.
        iii. 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.

iv. 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.

v. Any sea turtle so taken must not be consumed, sold, landed, offloaded, transshipped, or kept below deck.

The following terms and conditions implement RPM No. 2

3. F/SF1 must include a representative or seek comment from F/SER3 when developing the research objectives for the shark research fishery. This must be done to ensure research conducted to address the Stock Enhancement Data Assessment Review's LCS research recommendations also considers measures to minimize take of sea turtles and smalltooth sawfish.
4. To address Term and Condition No. 3, NMFS must research how the use of circle hooks in the HMS Atlantic shark bottom longline fishery influences mortality of sharks, sea turtles, and smalltooth sawfish.
5. NMFS must also research the influence hook type (J-hook or circle hook) and soak time variations have on catch per unit effort and mortality of sharks, sea turtles, and smalltooth sawfish.
6. F/SF1 must propose additional action to minimize the impacts of take on sea turtles if: (1) Research conducted in accordance with Terms and Conditions Nos. 4 and 5 finds that circle hooks and/or soak times reduce adverse impacts to sea turtles and smalltooth sawfish from interactions with shark bottom longline gear, and shark CPUEs are not significantly increased so as to negate FMP goals and objectives, and (2) monitoring shows that fishermen are continuing to target sharks outside of the research fishery.

The following terms and conditions implement RPM No. 3.

7. SERO, in collaboration with the SEFSC, must develop a standardized protocol for determining the target species and effort of HMS Atlantic shark fishing gears for use in future take analyses. These protocols should be developed such that the fishing effort can be allocated to specific federally managed fisheries (e.g., Gulf of Mexico reef fish, coastal migratory pelagics, and South Atlantic snapper-grouper) and avoid double reporting or underreporting of effort conducted under the Consolidated HMS FMP. This is necessary to better determine actual effort levels in the HMS shark fishing components (e.g., bottom longline and gillnet) of the fishery and any effort shifts that have occurred. This will improve NMFS' ability to monitor incidental takes of ESA-listed species and more accurately allocate these takes to specific fisheries with existing incidental take authorizations.NMFS must monitor protected resource interactions with HMS Atlantic shark fisheries. NMFS F/SF1 must monitor the proposed shark bottom longline research fishery and the directed shark gillnet fishery at levels determined by the SEFSC to provide statistically reliable monitoring.

8. NMFS must require its observers to record information on the condition of incidentally taken sea turtles and smalltooth sawfish when released, and the interaction in detail (e.g., for longline interactions: whether hooked or entangled, where and to what extent; whether hooks and lines are removed; and how much gear remained on the animal). For sea turtle interactions, the SEFSC, Sea Turtle Life History Form must be filled out to the greatest extent possible. Photographs must be taken to confirm species identity and release condition. For smalltooth sawfish interactions the following information must be recorded: date, time, the latitude and longitude of capture, habitat type (sand, mud etc.) water depth, weather conditions (wind, cloud cover, temperature) sea conditions (e.g., wave height, water clarity, temperature), estimated total length and saw length, whether or not tags were present, the tag number if available, the location and type of tag if the number is not available. NMFS must ensure that when protected species are taken, dealing with each animal (e.g., tagging/scanning for tags, collecting a full suite of samples and releasing, etc.) must be the observer's top priority.

9. NMFS must collect tissue samples from sea turtles caught in the shark fisheries and ensure that these tissue samples are analyzed to determine the genetic identity of individual sea turtles caught in the fishery. To fulfill this requirement, NMFS must ensure that observers are equipped with the tools, supplies, training, and instructions to collect and store tissue samples.

10. F/SF1, in collaboration with the SEFSC, must submit observer reports, including the information below, from the monitored shark fisheries to F/SER3 for each fishing season prior to the following season.

    a. The shark bottom longline report must include information on: species, date and location of interaction, target catch, tag identification (if appropriate), where the animal was hooked or otherwise entangled, depths of imbedded hooks, the release condition of the animal (alive or dead), whether photographs or genetic samples were taken, and actual written comments by the observers when available. An analysis of hook type use (J-hook or circle hook) must also be conducted to provide information on the use patterns of different hook types in the shark research fishery and non-research fishery.

    b. The shark gillnet reports must include information on the species, type of gear used (drift, set, strike, or sink), set date, net length (ft), net depth (ft), minimum stretched mesh size (in), latitude and longitude of capture, release condition of the animal (alive or dead), whether photographs or genetic samples were taken, and actual written comments by the observers when available.

    c. The reports must also estimate the total take in the fishery based on effort and the observed takes. If the estimated take of sea turtles and smalltooth sawfish is unusually high, the report must 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 [Because take is issued for a 3-year period unusually high take for any one season would be anything greater than about 33 percent of the estimated take listed above].

d. These reports must be forwarded to the Assistant Regional Administrator for Protected Resources, Southeast Regional Office, Protected Resources Division, 263 13th Avenue South, St. Petersburg, Florida 33701.

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.

Smalltooth Sawfish:

1. NMFS should investigate fishing modifications, devices, modifications, and techniques that may work to avoid interaction with smalltooth sawfish and enhance the likelihood of successful release of healthy sawfish.
2. NMFS should conduct or fund research on the distribution, abundance, and migratory behavior of smalltooth sawfish to better understand their occurrence in federal waters.
3. NMFS should conduct or fund reproductive behavioral studies to ensure that the incidental capture of smalltooth sawfish in Atlantic shark fisheries is not disrupting any such activities.
4. NMFS should reconsider time/area closures to reduce fishery interactions in areas where significant numbers of smalltooth sawfish interactions occur.

Sea Turtles:

5. To better understand sea turtle populations and the impacts of incidental take in HMS Atlantic shark fisheries, 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.
6. Once reasonable in-water estimates are obtained, NMFS should support population modeling or other risk analyses of the sea turtle populations affected by HMS and other fisheries. This will help improve the accuracy of future assessments of the effects of different levels of take on sea turtle populations.

7. The SEFSC should attempt to devise a probability-based approach or other statistical method to evaluate take in fisheries. Use of such a method, instead of using a single number to indicate ITS overages, may provide a better approach to evaluating the actual risk of greater than expected take levels occurring. Such an approach would allow NMFS to establish a trigger that reduces the likelihood of requiring reinitiation unnecessarily because of inherent variability in take levels (which is expected to be large), but still allows for an accurate assessment of how the fishery is performing versus expectations. Once such a method is devised, SEFSC and F/SER3 could then consult to determine whether the new approach is biologically valid and equivalent to the current method, and if it provides a better tool for evaluating and managing takes in the HMS Atlantic shark fishery.

11.0 Reinitiation of Consultation

This concludes formal consultation on the HMS Atlantic shark fisheries. 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 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 instances where the amount or extent of incidental take is exceeded, F/SF1 must immediately request reinitiation of formal consultation.

12.0 Literature Cited

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Appendix 1a The anticipated annual incidental take of loggerhead, leatherback, Kemp's ridley, green, and hawksbill sea turtles as outlined in the most recent opinions on NMFS-authorized federal fisheries.

Fishery	Sea Turtle Species				
	Loggerhead	Leatherback	Kemp's Ridley	Green	Hawksbill
Bluefish	6-No more than 3 lethal	None	6-Lethal or non-lethal	None	None
Herring	6-No more than 3 lethal	1-Lethal or non-lethal	1-Lethal or non-lethal	1-Lethal or non-lethal	None
HMS-Pelagic Longline	635-No more than 113 lethal	588-No more than 28 lethal	35-No more than 6 lethal for these species in combination		
HMS-Shark Fisheries[1]	274-No more than 151 lethal	35-No more than 18 lethal	6-Total takes for these species in combination; 1 lethal for each species		
Lobster	2-Lethal or non-lethal	4-Lethal or non-lethal	None	None	None
Mackerel/Squid/ Butterfish	6-No more than 3 lethal	1-Lethal or non-lethal	2-Lethal or non-lethal	2-Lethal or non-lethal	None
Monkfish (gillnet)	3-Loggerhead (No more than 5 Lethal loggerhead takes by all monkfish gear over 5 yrs)	1-Leatherback, Kemp's ridley or green			None
Monkfish (trawl)	1-Loggerhead, leatherback, Kemp's ridley or green				None
Multispecies	1-Lethal or non-lethal	1-Lethal or non-lethal	1-Lethal or non-lethal	1-Lethal or non-lethal	None
Red Crab	1-Lethal or non-lethal	1-Lethal or non-lethal	None	None	None
Skate	1 (either a loggerhead, leatherback, Kemp's ridley or green) - lethal or non-lethal				None
Spiny Dogfish	3-No more than 2 lethal	1-Lethal or non-lethal	1-Lethal or non-lethal	1-Lethal or non-lethal	None

[1] The take numbers represented here will be superseded by this biological opinion.

Appendix 1a cont'd

Fishery	Sea Turtle Species				
	Loggerhead	Leatherback	Kemp's Ridley	Green	Hawksbill
Summer Flounder/Scup/ Black Sea Bass	19-No more than 5 lethal (total - either loggerheads or Kemp's ridley)	None	See loggerhead entry	2 lethal or non-lethal	None
Tilefish	6-No more than 3 lethal or having ingested the hook	1-Lethal or non-lethal take (includes having ingested the hook)	None	None	None
South Atlantic Snapper-Grouper	68-No more than 23 lethal	9-No more than 5 lethal	7-No more than 3 lethal	13-No more than 5 lethal	2-No more than 1 lethal
Gulf of Mexico Reef Fish	68-No more than 26 lethal	7-No more than 3 lethal	1-Lethal or non-lethal	17-No more than 7 lethal	15-No more than 5 lethal
Caribbean Spiny lobster, Queen Conch, Reef Fish, and Coral	None	7-No more than 6 lethal	None	8-No more than 4 lethal	8-No more than 4 lethal
Southeastern U.S. Shrimp	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
Dolphin-wahoo	12-No more than 2 lethal	12-No more than 1 lethal	3 for all species in combination-no more than 1 lethal take		
Coastal Migratory Pelagics	11 Lethal takes	2 lethal takes for Leatherbacks, Hawksbill, and Kemp's Ridley-both lethal take	14 lethal takes	2 lethal takes for Leatherbacks, Hawksbill, and Kemp's Ridley-both lethal take	

Appendix 1b The anticipated incidental take of smalltooth sawfish as outlined in the most recent opinions for NMFS-authorized federal fisheries.

FISHERY	SMALLTOOTH SAWFISH
SOUTH ATLANTIC SNAPPER-GROUPER	8 - NON-LETHAL TAKES OVER ANY 3-YR PERIOD
GULF OF MEXICO REEF FISH	8 - NON-LETHAL TAKES OVER ANY 3-YR PERIOD
SOUTHEASTERN U.S. SHRIMP	1 - LETHAL OR NON-LETHAL TAKE ANNUALLY IN THE SOUTH ATLANTIC 1 - LETHAL TAKE ANNUALLY IN THE GULF OF MEXICO
COASTAL MIGRATORY PELAGICS	2 - LETHAL OR NON-LETHAL TAKES OVER ANY 3-YR PERIOD
HMS-SHARK FISHERIES[1]	260 - NON-LETHAL TAKES OVER ANY 5-YR PERIOD BY BOTTOM LONGLINE GEAR 1 - NON-LETHAL TAKE OVER ANY 5-YR PERIOD BY DRIFT GILLNET GEAR

[1]The take numbers represented here will be superseded by this biological opinion.