FINAL AMENDMENT 1 to the FISHERY MANAGEMENT PLAN for ATLANTIC TUNAS, SWORDFISH, AND SHARKS

Includes:
Final Environmental Impact Statement,
Final Regulatory Impact Review,
Final Regulatory Flexibility Analysis, and
Final Social Impact Analysis

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Final Amendment 1 to the Fishery Management Plan for Atlantic Tunas, Swordfish, and Sharks

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Amendment 1 to the Fishery Management Plan for Atlantic Tunas, Swordfish and Sharks

Actions: Amend commercial and recreational regulations regarding the shark fisheries in the Atlantic, Gulf of Mexico, and Caribbean Sea to prevent overfishing and rebuild overfished species; Update Essential Fish Habitat identifications for some species of sharks; Revise the permit system for collecting highly migratory species for public display

Type of Statement: Final Environmental Impact Statement; Final Regulatory Impact Review; Final Regulatory Flexibility Analysis; and Final Social Impact Statement

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Abstract: In 2002, the National Marine Fisheries Service (NOAA Fisheries) conducted two new stock assessments for large and small coastal sharks. These stock assessments constitute the best available science and, in some cases, have resulted in a change of status of some shark species. Based on these new stock assessments, NOAA Fisheries decided that many of the shark management measures in the Fishery Management Plan for Atlantic Tunas, Swordfish, and Sharks should be re-examined and amended, as necessary. Additionally, because of the change of status in some species, some essential fish habitat identifications need to be updated. Management measures selected in this amendment include, among other things: aggregating the large coastal shark complex, using maximum sustainable yield as a basis for setting commercial quotas, eliminating the commercial minimum size, establishing regional commercial quotas and trimester commercial fishing seasons, adjusting the recreational bag and size limits, establishing gear restrictions to reduce bycatch or reduce bycatch mortality, establishing a time/area closure off the coast of North Carolina, removing the deepwater/other sharks from the management unit, establishing a mechanism for changing the species on the prohibited species list, updating essential fish habitat identifications for five species of sharks, and changing the administration for issuing permits for display purposes. Comments on the proposed rule and draft Amendment 1 were accepted from August 1, 2003, until October 3, 2003. The effective dates for the selected measures will likely vary from approximately January 1, 2004, to January 1, 2005.

EXECUTIVE SUMMARY

Since 1997, Atlantic shark regulations have been under litigation by different interest groups including commercial fishermen, recreational fishermen, and environmental groups. As a result of these lawsuits and to comply with a settlement agreement with some commercial litigants, the National Marine Fisheries Service (NOAA Fisheries) has: (1) implemented some but not all the regulations finalized in the 1999 Fishery Management Plan for Atlantic Tunas, Swordfish, and Sharks (HMS FMP); (2) had the 1998 large coastal shark (LCS) stock assessment peer reviewed; (3) based on the results of that peer review, decided not to base management decisions on the projections and modeling results of the 1998 LCS stock assessment; (4) managed the LCS fishery via several different emergency rules since 2001; (5) in 2002, conducted both a LCS and a small coastal shark (SCS) stock assessment; and (6) had the 2002 LCS stock assessment peer reviewed. As a result of this chain of events and because the 2002 LCS and SCS stock assessments are the best available science and, in some cases, have resulted in a change of status of some shark species, NOAA Fisheries decided that many of the shark management measures in the HMS FMP should be re-examined and amended, as necessary. Additionally, because of the change of status in some species, some essential fish habitat (EFH) identifications need to be updated.

The 2002 LCS and SCS stock assessments found that: (1) the LCS complex is overfished and overfishing is occurring; (2) sandbar sharks are not overfished but overfishing is still occurring; (3) blacktip sharks are rebuilt and healthy; (4) the SCS complex, Atlantic sharpnose, bonnethead, and blacknose sharks are healthy; and (5) finetooth sharks are not overfished but overfishing is occurring. Per a settlement agreement, the 2002 LCS stock assessment was peer reviewed. The peer reviews found that the 2002 LCS stock assessment was based on the best available science and that appropriate stock assessment models were used. The executive summaries of the peer reviews are presented in Appendix 1 of this document.

In the 1999 HMS FMP, NOAA Fisheries established a rebuilding plan for LCS. This rebuilding plan was not fully implemented. NOAA Fisheries did not establish a rebuilding plan for SCS or pelagic sharks because they were not overfished and overfishing was not occurring. This document presents a rebuilding plan that indicates that within 26 years of implementation, the LCS complex should be rebuilt to levels capable of sustaining maximum sustainable yield (MSY) on a long-term basis. This document also presents a plan of action to prevent overfishing of sandbar and finetooth sharks.

NOAA Fisheries announced its intent to conduct an Environmental Impact Statement and Amendment to the HMS FMP on November 15, 2002 (67 FR 69180) and held seven scoping meetings on an Issues and Options paper in February and March 2003 (68 FR 3853, January 27, 2003). A summary of the major comments received during scoping is presented in Appendix 2 of this document. Based in part on the comments received during scoping, the draft Amendment 1 to the HMS FMP examined numerous alternatives to revise commercial and recreational shark management measures, update, as appropriate, EFH, and update and present a plan to rebuild LCS and prevent overfishing of LCS, sandbar sharks, and finetooth sharks consistent with the

Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), the National Environmental Policy Act (NEPA), the Endangered Species Act (ESA), the Marine Mammal Protection Act (MMPA), the Coastal Zone Management Act (CZMA), the Regulatory Flexibility Act (Reg Flex Act), and other domestic laws.

This document analyzes the ecological, economic, and social impacts on numerous alternatives to rebuild the LCS complex, prevent overfishing, and minimize bycatch. The draft document was available for public comment from August 1, 2003, to October 3, 2003. During that time, NOAA Fisheries held six public hearings from Louisiana to New York, held one Highly Migratory Species (HMS) Advisory Panel meeting, and received over 30 written public comments. NOAA Fisheries also attended four Fishery Management Council meetings (New England, Mid-Atlantic, and two for the Gulf of Mexico) and one Atlantic States Marine Fisheries Commission meeting. NOAA Fisheries was scheduled to attend the South Atlantic Fishery Management Council meeting in mid-September that was canceled due to Hurricane Isabel and was not able to attend a Caribbean Fishery Management Council meeting due to scheduling differences. As a result of public comments, some of the selected alternatives have changed. Changes to the draft Amendment 1 and when selected alternatives are likely to be effective are summarized below.

PREFERRED ALTERNATIVES IN DRAFT AMENDMENT ONE TO HMS FMP	SELECTED ALTERNATIVES IN FINAL AMENDMENT ONE TO HMS FMP	APPROXIMATE DATE OF IMPLEMENTATION
COMMERCIAL MANAGEMENT MEASURES		
Shark Classification		
Alternative A3 - Aggregate LCS, one closure date	Same.	January 1, 2004
Quota Administration		
Alternative B3 - Regional quotas	Same.	January 1, 2004
Alternative B4 - Trimester season	Same but delay effective date to allow for adjustment period.	January 1, 2005
Quota Basis		
Alternative C2 - Quota based upon percentage of Maximum Sustainable Yield	Same but modify the LCS quota reduction from 40 to 45 percent.	January 1, 2004
Minimum Size		
Alternative D2 -No minimum size	Same.	January 1, 2004
RECREATIONAL MANAGEMENT MEASURES		
Retention limits		

PREFERRED ALTERNATIVES IN DRAFT AMENDMENT ONE TO HMS FMP	SELECTED ALTERNATIVES IN FINAL AMENDMENT ONE TO HMS FMP	APPROXIMATE DATE OF IMPLEMENTATION
Alternative E2 - Existing catch limits (E1) plus the addition of one bonnethead shark per person per trip	Same.	February 1, 2004
Minimum Size		
Alternative F2 - Existing size limits (F1) plus a no size limit for bonnethead sharks	Same.	February 1, 2004
Authorized Gear		
Alternative G2 - Only allow handline and rod and reel in the recreational shark fishery	Same.	February 1, 2004
DEEPWATER AND OTHER SHARKS		
Alternative H2 - Remove species group from management unit; data collection only	Same.	February 1, 2004
PROHIBITED SPECIES		
Alternative I6 - Retain established prohibited species group (I1) and establish criteria for the addition and removal of species to/from the prohibited species group	Same.	February 1, 2004
BYCATCH REDUCTION MEASURES		
Gear Restrictions		
Alternative J3 - Existing bycatch reduction measures (J1) and allow only strikenet method in shark gillnet fishery	Maintain current regulations regarding the gillnet fishery (Alternative J1); move toward gear restrictions and/or modifications in a future rulemaking.	Not Applicable
Alternative J4 - Existing bycatch reduction measures (J1) plus requiring Vessel Monitoring Systems (VMS) on shark gillnet vessels during right whale calving season and requiring VMS on directed bottom longline shark fishing vessels, if there are time/area closures	Same but clarify that VMS will be required on directed bottom longline fishermen operating near the time/area closure off of North Carolina (Alternative K2).	Likely November 15, 2004, for vessels with gillnet gear and January 1, 2005, for vessels with bottom longline gear. NOAA Fisheries must publish a type-approval notice in the Federal Register before VMS can be effective.

PREFERRED ALTERNATIVES IN DRAFT AMENDMENT ONE TO HMS FMP	SELECTED ALTERNATIVES IN FINAL AMENDMENT ONE TO HMS FMP	APPROXIMATE DATE OF IMPLEMENTATION
Alternative J5 - Existing bycatch reduction measures (J1) plus requiring the use of non-stainless steel corrodible hooks, the possession of release equipment on vessels with shark bottom longline gear (line cutters, dipnets, and, when approved, dehooking devices), and that bottom longline vessels move 1 nautical mile after an interaction with a marine mammal or a sea turtle	Same but clarify that vessels need to move 1 nmi after an interaction with any protected species including marine mammals, sea turtles, and sawfish.	February 1, 2004, for hooks, line cutters, dipnets, and moving 1 nautical mile; To be determined for dehooking devices but no earlier than Summer 2004.
Not Preferred - Alternative J8 -Existing bycatch reduction measures (J1) plus requiring commercial and recreational fishermen to attend workshops on present regulations, species identification, and release techniques	Not selected. However, NOAA Fisheries intends to conduct another rulemaking regarding implementation of Alternative J8.	Not Applicable.
Time/Area Closures		
Alternative K2 - Time/area closure for sandbar and dusky shark nursery and pupping areas off of Virginia, North Carolina, and South Carolina during the winter fishery	Modified Alternative K2 with a smaller area off only the coast of North Carolina.	January 1, 2005
ESSENTIAL FISH HABITAT		
Alternative L3 - Existing EFH and, as appropriate, identify EFH for the Fishery Management Unit (FMU) for each species and life stages as those habitats necessary for spawning, breeding, feeding, or growth to maturity	Clarified that Alternative L4 (selected) encompasses Alternative L3 (not preferred).	Not Applicable
Alternative L4 - Existing EFH and, as appropriate, increase or decrease the EFH areas identified for individual species in the FMU based on special needs	Same.	Not Applicable
EXEMPTED FISHING PERMITS		
Alternative M2 -Develop separate display permitting system for sharks, apart from research or exempted fishing permits	Same.	February 1, 2004.

NOAA Fisheries believes that the group of selected alternatives in the final document should, consistent with the Magnuson-Stevens Act and other domestic laws: rebuild the LCS complex;

prevent overfishing of the LCS complex, sandbar sharks, and finetooth sharks; and prevent other species of sharks from becoming overfished.

Most of the regulations that affect commercial and recreational shark fishermen, including the selected alternatives in this document, are summarized in the chart below.

What would the Final Amendment 1 to the HMS FMP mean to you? Changes as a result of Amendment 1 are in italics.

PROHIBITED SPECIES

The following sharks cannot be kept commercially or recreationally: Whale, basking, sand tiger, bigeye sand tiger, white, dusky, night, bignose, Galapagos, Caribbean reef, narrowtooth, longfin mako, bigeye thresher, sevengill, sixgill, bigeye sixgill, Caribbean sharpnose, smalltail, and Atlantic angel sharks. *There is a mechanism in place to add or remove species, as needed, via rulemaking.*

COMMERCIAL REGULATIONS

Management Unit	**Species that can be retained**	**Quota (mt dw)**	***Regional Quotas***	**Authorized Gears**
Large Coastal Sharks - directed commercial retention limit of 4,000 lb dw per trip - incidental retention limit	Sandbar, silky, tiger, blacktip, bull, spinner, lemon, nurse, smooth hammerhead, scalloped hammerhead, great hammerhead	*1,017*	*NA = 4%* *SA = 54%* *GM = 42%*	Pelagic or Bottom Longline; Gillnet; Rod and Reel; Handline; Bandit Gear
Pelagic Sharks - no directed retention limit - incidental retention limit	Shortfin mako, thresher, oceanic whitetip	488	*None*	
	Porbeagle	92		
	Blue	273		
Small Coastal Sharks - no directed retention limit - incidental retention limit	Atlantic sharpnose, blacknose, finetooth, bonnethead	*454*	*NA = 13%* *SA = 83%* *GM = 4%*	

Additional remarks:
- All sharks not retained must be released in a manner that ensures the maximum probability of survival
- Finning is prohibited for all sharks no matter what species
- Fishing seasons: From January 1, 2004, to December 31, 2004, the fishing seasons will be January 1 to June 30 and July 1 to December 31; *Starting January 1, 2005, the fishing seasons will be January 1 to April 30; May 1 to August 30; September 1 to December 31*
- *Fishing regions: NA = Maine through Virginia; SA = N. Carolina through East Florida and Caribbean; GM = Gulf of Mexico*
- Quota over- and underharvest adjustments will be made for the same season the following year; no reopening that season
- *Count state landings after Federal closure against Federal quota*
- *Time/area closure for vessels with bottom longline gear on board: January through July between 35° 41'N to 33° 51'N and west of 74° 46'W, roughly following the 60 fathom contour line, diagonally south to 76° 24'W and north to 74° 51'W .*
- *Vessel Monitoring Systems required for all gillnet vessels during right whale calving season and from January through July for all vessels with bottom longline gear on board between 33° 00' N and 36° 30'N*
- Limited access; Exempted Fishing Permit (EFP) requirements; *Display permits for collection for public display*
- Observer and reporting requirements
- For incidental limited access permit holders: 5 large coastal sharks per trip; a total of 16 pelagic or small coastal sharks (all species combined) per vessel per trip
- Vessel with bottom longline gear on board must: *(1) have non-stainless steel corrodible hooks; (2) have a dehooking device (when approved), linecutters, and a dipnet on board; (3) move 1 nmi after an interaction with a protected species;* and (4) post sea turtle handling and release guidelines in the wheelhouse

RECREATIONAL REGULATIONS

Management Unit	**Species that can be kept**	**Retention Limit**	*Authorized Gear*
Large Coastal, Pelagic, and Small Coastal Sharks	LCS: Sandbar, silky, tiger, blacktip, bull, spinner, lemon, nurse, smooth hammerhead, scalloped hammerhead, great hammerhead Pelagic: shortfin mako, thresher, oceanic whitetip, porbeagle, blue SCS: Atlantic sharpnose, blacknose, finetooth, bonnethead	1 shark per vessel per trip (all species) with a 4.5 feet fork length minimum size; allowance for 1 Atlantic sharpnose and *1 bonnethead* per person per trip (no minimum size)	*Rod and Reel; Handline*

Additional remarks:
Harvested sharks must have fins, head, and tail attached (can be bled and gutted if tail is still attached).

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1.0. INTRODUCTION

1.1 MANAGEMENT HISTORY

Sharks have been managed by the Secretary of Commerce since 1993. Below is a brief summary of management actions and issues. Table 1.1 provides a list of most of the abbreviations, acronyms, and initialisms that are used in this document or that are commonly used in fishery management. Table 1.2 provides a list of most Atlantic shark-related management actions published in the Federal Register. Table 1.3 provides a list of season opening and closing dates for large coastal sharks (LCS). The National Marine Fisheries Service (NOAA Fisheries) has never issued a closure date for the small coastal shark (SCS) and pelagic shark fisheries.

1.1.1 The 1993 Fishery Management Plan

In 1989, the five Atlantic Fishery Management Councils asked the Secretary of Commerce to develop a Shark Fishery Management Plan (FMP). The Councils were concerned about the late maturity and low fecundity of sharks, the increase in fishing mortality, and the possibility of the resource being overfished. The Councils requested that the FMP cap commercial fishing effort, establish a recreational bag limit, prohibit "finning," and begin a data collection system.

In 1993, the Secretary of Commerce, through NOAA Fisheries, implemented the FMP for Sharks of the Atlantic Ocean. The management measures in the 1993 FMP included:

- Establishing a fishery management unit (FMU) consisting of 39 frequently caught species of Atlantic sharks, separated into three groups for assessment and regulatory purposes (LCS, SCS, and pelagic sharks);
- Establishing calendar year commercial quotas for the LCS and pelagic sharks and dividing the annual quota into two equal half-year quotas that apply to the following two fishing periods--January 1 through June 30 and July 1 through December 31;
- Establishing a recreational trip limit of four sharks per vessel for LCS or pelagic shark species groups and a daily bag limit of five sharks per person for sharks in the SCS species group;
- Requiring that all sharks not taken as part of a commercial or recreational fishery be released uninjured;
- Establishing a framework procedure for adjusting commercial quotas, recreational bag limits, species size limits, management unit, fishing year, species groups, estimates of maximum sustainable yield, and permitting and reporting requirements;
- Prohibiting finning by requiring that the ratio between wet fins/dressed carcass weight not exceed 5 percent;
- Prohibiting the sale by recreational fishermen of sharks or shark products caught in the Economic Exclusive Zone (EEZ);
- Requiring annual commercial permits for fishermen who harvest and sell shark (meat products and fins);
- Establishing a permit eligibility requirement that the owner or operator (including charter vessel and headboat owners/operators who intend to sell their catch) must show proof that at

least 50 percent of earned income has been derived from the sale of the fish or fish products or charter vessel and headboat operations or at least $20,000 from the sale of fish during one of three years preceding the permit request;
- Requiring trip reports by permitted fishermen and persons conducting shark tournaments and requiring fishermen to provide information to NOAA Fisheries under the Trip Interview Program; and,
- Requiring NOAA Fisheries observers on selected shark fishing vessels to document mortality of marine mammals and endangered species.

At that time, NOAA Fisheries identified LCS as overfished and pelagic and SCS as fully fished. The quotas were 2,436 metric tons (mt) dressed weight (dw) for LCS and 580 mt dw for pelagic sharks. No quota was established for SCS. Under the rebuilding plan established in the 1993 FMP, the LCS quota was expected to increase every year up to the maximum sustainable yield (MSY) estimated in the 1992 stock assessment.

1.1.2 After the 1993 FMP

A number of difficulties arose in the initial year of implementation of the Shark FMP. First, the January to June semi-annual LCS quota was exceeded shortly after implementation of the FMP, and that portion of the commercial fishery was closed on May 10, 1993. The LCS fishery re-opened on July 1, 1993, with an adjusted quota of 875 mt dw. Derby-style fishing, coupled with what some participants observed to be an unusual abundance of sharks, led to an intense and short fishing season for LCS, with the fishery closing within one month. Although fin prices remained strong throughout the brief season, the oversupply of shark carcasses led to reports of record low prices. The closure was significantly earlier than expected, and a number of commercial fishermen and dealers indicated that they were adversely affected. The intense season also complicated the task of monitoring the LCS quota and closing the season with the required advance notice.

To address these problems, a commercial trip limit of 4,000 lb. for permitted vessels for LCS was implemented on December 28, 1993 (58 FR 68556), and a control date for the Atlantic shark fishery was established on February 22, 1994 (59 FR 8457). A final rule to implement additional measures authorized by the FMP was published on October 18, 1994 (59 FR 52453). This rule:

- Clarified operation of vessels with a Federal commercial permit;
- Established the fishing year;
- Consolidated the regulations for drift gillnets;
- Required dealers to obtain a permit to purchase sharks;
- Required dealer reports;
- Established recreational bag limits;
- Established quotas for commercial landings; and
- Provided for commercial fishery closures when quotas were reached.

In 1994, under the rebuilding plan implemented in the 1993 FMP, the LCS quota was increased to 2,570 mt dw. Additionally, a new stock assessment was completed in March 1994. This stock

assessment focused on LCS, suggested that recovery to the levels of the 1970s could take as long as 30 years, and concluded that "increases in the [Total Allowable Catch (TAC)] for sharks [are] considered risk-prone with respect to promoting stock recovery." Additionally, declining catch-per-unit-effort (CPUE) and life history characteristics indicated low productivity for pelagic and SCS and suggested a prudent approach for those species as well. A final rule that capped quotas for LCS and pelagic sharks at the 1994 levels was published on May 2, 1995 (60 FR 21468).

1.1.3 The 1996 LCS Stock Assessment and its Results

In June 1996, NOAA Fisheries convened another stock assessment to examine the status of LCS stocks. The 1996 stock assessment found no clear evidence that LCS stocks were rebuilding and concluded that "[a]nalyses indicate that recovery is more likely to occur with reductions in effective fishing mortality rate of 50 [percent] or more." In response to these results, in 1997, NOAA Fisheries reduced the LCS commercial quota by 50 percent to 1,285 mt dw and the recreational retention limit to two LCS, SCS, and pelagic sharks combined per trip with an additional allowance of two Atlantic sharpnose sharks per person per trip (62 FR 16648, April 2, 1997). In this same rule, NOAA Fisheries established an annual commercial quota for SCS of 1,760 mt dw and prohibited possession of five species. On May 2, 1997, the Southern Offshore Fishing Association (SOFA) and other commercial fishermen and dealers sued the Secretary of Commerce (Secretary) on the April 1997 regulations.

On February 26, 1998, Judge Steven D. Merryday of the U.S. District Court for the Middle District of Florida issued an order in the SOFA case finding that the Secretary "failed to conduct a proper analysis to determine the [April 1997 LCS] quota's economic effect on small businesses." As a result of this finding, Judge Merryday directed NOAA Fisheries "to undertake a rational consideration of the economic effects and potential alternatives to the 1997 [LCS] quotas" on small businesses engaged in the Atlantic shark commercial fishery. Judge Merryday allowed NOAA Fisheries to maintain the 1997 quotas pending further order of the court.

In May 1998, NOAA Fisheries completed its consideration of the economic effects of the 1997 LCS quotas on fishermen and submitted the analysis to the court. NOAA Fisheries concluded that 1997 LCS quotas may have had a significant economic impact on a substantial number of small entities and that there were no other available alternatives that would both mitigate those economic impacts and ensure the viability of the LCS stocks.

1.1.4 The 1999 Fishery Management Plan for Atlantic Tunas, Swordfish, and Sharks

In 1996, amendments to the Magnuson-Stevens Act modified the definition of overfishing and established new provisions to halt overfishing and rebuild overfished stocks, minimize bycatch and bycatch mortality to the extent practicable, and identify and protect essential fish habitat. Accordingly, in 1997, NOAA Fisheries began the process of creating a rebuilding plan for overfished highly migratory species (HMS), including LCS, consistent with the new provisions.

In June 1998, NOAA Fisheries held another LCS stock assessment. The 1998 stock assessment found that LCS were overfished and would not rebuild under 1997 harvest levels. Based in part

on the results of the 1998 stock assessment, in April 1999, NOAA Fisheries published the final Fishery Management Plan for Atlantic Tunas, Swordfish and Sharks ("Highly Migratory Species" or HMS FMP), which included numerous measures to rebuild or prevent overfishing of Atlantic sharks in commercial and recreational fisheries. The HMS FMP replaced the 1993 FMP. Management measures related to sharks that changed in the HMS FMP included:

- Reducing commercial LCS and SCS quotas;
- Establishing ridgeback and non-ridgeback categories of LCS;
- Implementing a commercial minimum size for ridgeback LCS;
- Establishing blue shark, porbeagle shark, and other pelagic shark subgroups of the pelagic sharks and establishing a commercial quota for each subgroup;
- Reducing recreational retention limits for all sharks;
- Establishing a recreational minimum size for all sharks except Atlantic sharpnose;
- Expanding the list of prohibited shark species;
- Implementing limited access in commercial fisheries;
- Establishing a shark public display quota;
- Establishing new procedures for counting dead discards and state landings of sharks after Federal fishing season closures against Federal quotas; and
- Establishing season-specific over- and underharvest adjustment procedures.

The implementing regulations were published on May 28, 1999 (64 FR 29090). On June 25, 1999, SOFA *et al*. sued NOAA Fisheries again, this time challenging the Atlantic shark commercial measures implemented in the HMS FMP. Around this time, NOAA Fisheries was also sued by Bluewater Fisherman's Association regarding the pelagic shark management measures adopted in the HMS FMP and by the Recreational Fishing Alliance regarding the recreational shark regulations adopted in the HMS FMP.

On June 30, 1999, NOAA Fisheries received a court order from Judge Merryday relative to the May 1997 lawsuit. Specifically, the order enjoined NOAA Fisheries from enforcing the 1999 regulations with respect to Atlantic shark commercial catch quotas and fish-counting methods (including the counting of dead discards and state commercial landings after Federal closures), which were different from the quotas and fish counting methods prescribed by the 1997 Atlantic shark regulations. A year later, on June 12, 2000, the court issued an order clarifying that NOAA Fisheries could proceed with implementation and enforcement of the 1999 prohibited species provisions (64 FR 29090, May 28, 1999).

On September 25, 2000, Judge Roberts of the United States District Court for the District of Columbia dismissed the Bluewater Fisherman's Association case and stated that the regulations were consistent with the Magnuson-Stevens Act and the Regulatory Flexibility Act. On September 20, 2001, Judge Roberts dismissed the Recreational Fishing Alliance case and stated that the recreational retention limits were consistent with the Magnuson-Stevens Act.

On November 21, 2000, SOFA *et al*. and NOAA Fisheries reached a settlement agreement for the May 1997 and June 1999 lawsuits. On December 7, 2000, Judge Merryday entered an order approving the settlement agreement and lifting the injunction. The settlement agreement

required, among other things, an independent (i.e., non-NOAA Fisheries) review of the 1998 LCS stock assessment (Table 1.4). The settlement agreement did not address any regulations affecting the pelagic shark, prohibited species, or recreational shark fisheries. Once the injunction was lifted, on January 1, 2001, the pelagic shark quotas adopted in the HMS FMP were implemented (66 FR 55). Additionally, on March 6, 2001, NOAA Fisheries published an emergency rule implementing the settlement agreement (66 FR 13441). This emergency rule expired on September 4, 2001, and established the LCS and SCS commercial quotas at 1997 levels.

1.1.5 The Peer Review of the 1998 LCS Stock Assessment

As noted above, the settlement agreement required, among other things, an independent peer review of the 1998 LCS stock assessment. The original settlement agreement determined that the Center for Independent Experts (CIE) would conduct the peer review. In May 2001, the CIE transmitted three peer reviews of the 1998 LCS stock assessment to NOAA Fisheries. Upon examination, NOAA Fisheries determined that the three CIE peer reviews did not conform to the terms of the settlement agreement, and therefore, were not complete.

Due to these irregularities, in July 2001, NOAA Fisheries and the plaintiffs revised certain sections of the settlement agreement and included a provision that stated that Natural Resources Consultants, Inc. (NRC) would conduct a second peer review. NOAA Fisheries received the results of the complete NRC peer reviews in October 2001. Three of the four NRC reviewers found that the scientific conclusions and scientific management recommendations contained in the 1998 Stock assessment report *were not* based on scientifically reasonable uses of appropriate fisheries stock assessment techniques and the best available biological fishery information relating to LCS. The settlement agreement stated that in this case, NOAA Fisheries will take the appropriate action to maintain the 1997 LCS quota and catch accounting/monitoring procedures, pending a new LCS stock assessment.

Taking into consideration the settlement agreement, the results of all the peer reviews, current catch rates, and the best available scientific information (not including the 1998 stock assessment projections), NOAA Fisheries implemented another emergency rule for the 2002 fishing year that suspended certain measures under the 1999 regulations pending completion of new LCS and SCS stock assessments and a peer review of the new LCS stock assessment (66 FR 67118, December 28, 2001; extended 67 FR 37354, May 29, 2002). Specifically, NOAA Fisheries maintained the 1997 LCS commercial quota (1,285 mt dw), maintained the 1997 SCS commercial quota (1,760 mt dw), suspended the commercial ridgeback LCS minimum size, suspended counting dead discards and state landings after a Federal closure against the quota, and replaced season-specific quota accounting methods with subsequent-season quota accounting methods. That emergency rule expired on December 30, 2002.

1.1.6 The 2002 SCS and LCS Stock Assessments

On May 8, 2002, NOAA Fisheries announced the availability of the first SCS stock assessment since 1992 (67 FR 30879). The Mote Marine Laboratory and the University of Florida provided

NOAA Fisheries with another SCS assessment in August 2002. Both of these stock assessments indicate that overfishing is occurring on finetooth sharks. The three other species in the SCS complex (Atlantic sharpnose, bonnethead, and blacknose) are not overfished and overfishing is not occurring. Because management of SCS and LCS is interrelated, NOAA Fisheries commenced SCS rulemaking when the 2002 LCS stock assessment was complete.

On May 28, 2002 (67 FR 36858), NOAA Fisheries announced the availability of a modeling document that explored the suggestions of the CIE and NRC peer reviews on LCS. At this time, NOAA Fisheries also announced the dates of a 2002 LCS stock assessment workshop that was held in June 2002. On October 17, 2002, NOAA Fisheries announced the availability of the 2002 LCS stock assessment and the workshop meeting report (67 FR 64098). The results of this stock assessment indicate that the LCS complex is still overfished and overfishing is occurring. Additionally, the 2002 LCS stock assessment found that sandbar sharks are no longer overfished but that overfishing is still occurring and that blacktip sharks are rebuilt and overfishing is not occurring.

Based on the results of both the 2002 SCS and LCS stock assessments, NOAA Fisheries implemented an emergency rule to ensure that the commercial management measures in place for the 2003 fishing year were based on the best available science (67 FR 78990, December 27, 2002; extended 68 FR 31987, May 29, 2003). Specifically, the emergency rule implemented the LCS ridgeback/non-ridgeback split, set the LCS and SCS quotas based on the results of stock assessments, suspended the commercial ridgeback LCS minimum size, and allowed both the season-specific quota adjustments and the counting of all mortality measures to go into place. Additionally, NOAA Fisheries announced its intent to conduct an environmental impact statement and amend the HMS FMP (67 FR 69180, November 15, 2002).

The emergency rule was intended as an interim measure to maintain the status of LCS and SCS pending the re-evaluation of management measures in the context of the rebuilding plan through this FMP amendment. The emergency rule for the 2003 fishing year implemented for the first time the classification system (ridgeback/non-ridgeback LCS) finalized in the HMS FMP. NOAA Fisheries also implemented for the first time a provision to count state landings after a Federal closure and to count dead discards against the quota. To calculate the commercial quotas for these groups, NOAA Fisheries took the average landings for individual species from 1999 through 2001 and either increased them or decreased them, as suggested by the stock assessment. Because the stock assessment suggested an increase in catch for blacktip sharks and no decrease in catch for sandbar sharks (the two primary species in the LCS fishery), this method resulted in an increase in the overall quota for the length of the emergency rule. During the comment period on the emergency rule and scoping for this amendment, NOAA Fisheries received comments regarding, among other things, the quota levels under the rule, concern over secondary species and discards, the ability of fishermen to target certain species, and impacts of the different season length for ridgeback and non-ridgeback LCS. NOAA Fisheries responded to these comments when extending the emergency rule and further considered these comments when examining the alternatives presented in this document.

NOAA Fisheries received the results of the peer review of the 2002 LCS stock assessment in December 2002. Unlike the peer reviews of the 1998 LCS stock assessment, these reviews were generally positive (Appendix 1).

1.1.7 Exempted Fishing Permits

Under 50 CFR 635.32, and consistent with 50 CFR 600.745, NOAA Fisheries may authorize for limited testing, public display, and scientific data collection purposes, the target or incidental harvest of species managed under an FMP or fishery regulations that would otherwise be prohibited. Exempted fishing may not be conducted unless authorized by an Exempted Fishing Permit (EFP) or a Scientific Research Permit (SRP) issued by NOAA Fisheries in accordance with criteria and procedures specified in those sections. As necessary, an EFP or SRP would exempt the named party(ies) from otherwise applicable regulations under 50 CFR part 635. Such exemptions could address fishery closures, possession of prohibited species, commercial permitting requirements, and retention and minimum size limits.

In the HMS FMP, NOAA Fisheries established a 60 mt ww shark public display quota for the purpose of collecting sharks for aquariums and other instances of public display. In order to collect sharks under this quota, fishermen must apply for an EFP. This allows them to collect sharks during closed seasons and also allows them to collect sharks that may be prohibited, such as sand tiger sharks. NOAA Fisheries also issues EFPs for the collection of other HMS for public display. This amendment selects an alternative that establishes a different permit system for fishermen who intend to collect HMS for public display. EFPs in general will be considered in a different amendment to the HMS FMP (July 9, 2003, 68 FR 40907).

1.1.8 Essential Fish Habitat

Under the Magnuson-Stevens Act, each FMP must describe and identify essential fish habitat (EFH) for the fishery, minimize to the extent practicable adverse effects on that EFH caused by fishing, and identify other actions to encourage the conservation and enhancement of EFH. In 1999, NOAA Fisheries identified EFH for all actively managed species of sharks as well as two habitat areas of particular concern (HAPC). NOAA Fisheries now has two new stock assessments for SCS and LCS. These stock assessments contain new information that warrant NOAA Fisheries' consideration of possible updates to EFH, particularly for species whose status has changed. This amendment considers these updates to EFH identifications for these species of sharks. Additionally, under 50 CFR Part 600, NOAA Fisheries must review all identified EFH areas every five years (67 FR 2343, January 17, 2002). NOAA Fisheries is planning to begin to conduct this five year review for all HMS within the next year (68 FR 40907, July 9, 2003).

1.2 NEED FOR ACTION

An amendment to the HMS FMP regarding shark management and the issuance of EFPs/SRPs is needed for a number of reasons:

- After reviewing all peer reviews of the 1998 LCS stock assessment, in the December 2001 emergency rule, NOAA Fisheries determined that the projections of the models used in the 1998 LCS stock assessment no longer constituted the best available science. Thus, a number of management measures in the 1999 HMS FMP are no longer appropriate. In December 2002, NOAA Fisheries implemented a number of commercial regulations for the 2003 fishing year via an emergency rule. With no other action, once this rule expires, management measures that are not based on the best available science would go into place.

- The 2002 SCS and LCS stock assessments indicated that the status of some species has changed. While the HMS FMP did include a framework process that would allow for changes in commercial quotas and recreational bag limits without an FMP amendment, any regulatory adjustment under this process would have to have been contemplated in the original FMP. Some of the actions under consideration now were not considered in the HMS FMP. For example, the quotas for non-ridgeback LCS were based on the assumption that blacktip sharks were overfished and needed a large reduction in fishing mortality. The 2002 LCS stock assessment shows that blacktip sharks are fully rebuilt and can withstand a 20- to 50-percent increase in catch while the LCS complex as a whole needs a 50-percent reduction to rebuild. The HMS FMP did not consider this possibility so any long-term changes to the non-ridgeback LCS quota must be done through an amendment.

- Additionally, management measures of all species groups and commercial and recreational fisheries are interconnected and changing one management measure could affect the expected results from other management measures. Thus, to some extent, NOAA Fisheries is reviewing overall management measures for sharks.

- Since establishing the 60 mt ww shark display quota in the HMS FMP, NOAA Fisheries has received a number of comments that suggest the collection of any HMS for public display could be improved through its own permit system rather than with EFPs. These types of changes were not considered in the HMS FMP.

1.3 OBJECTIVES

The objectives of this amendment fully incorporate all the objectives of the HMS FMP (Table 1.5) and also include:

- To clarify the type of permit needed for obtaining HMS for the purpose of public display.

- To establish criteria for changing via a framework rulemaking process the shark commercial and recreational management measures without an FMP amendment consistent with the best available science, the objectives of the HMS FMP, the Magnuson-Stevens Act, and other domestic laws. Such framework criteria could include, but are not limited to, changes to the commercial quota, the recreational bag limit, time/area closures, and additions or removals to the prohibited species list.

- To update, as necessary, the rebuilding plan for LCS.

- To establish the criteria that are used to change or modify HMS EFH identifications for the FMU.

- To update EFH information and identifications, as necessary, based on the 2002 SCS and LCS stock assessments.

Consistent with these objectives, the objectives in the HMS FMP, and the Magnuson-Stevens Act, NOAA Fisheries is not considering a "No Fishing Alternative" at this time for LCS. While such an alternative would rebuild the LCS complex and prevent overfishing of sharks in the shortest amount of time, this alternative would have severe negative economic impacts on fishermen and the communities (commercial- and recreational-based) that rely on them. Given that alternatives are available that would rebuild the LCS complex and prevent overfishing of sharks without those impacts, NOAA Fisheries does not feel that alternative is reasonable at this time. Additionally, by eliminating both the commercial and recreational fisheries, NOAA Fisheries would lose access to the fishery-dependent data that is needed to have reliable stock assessments. In other words, if this alternative were put in place to rebuild the LCS complex, NOAA Fisheries would no longer have as much data available to use in assessing whether or not the LCS complex remains overfished. Instead, in this amendment and consistent with the Magnuson-Stevens Act, NOAA Fisheries considered the biology of the stocks and attempted to balance the needs of the stocks (as determined by the 2002 stock assessments) with the needs of the fishermen and communities in order to obtain Optimum Yield from the fishery.

NOAA Fisheries held seven scoping meetings regarding an amendment to the HMS FMP in February and March 2003 (68 FR 3853, January 27, 2003). The alternatives and potential impacts considered in this document are based in part on the comments received during scoping (Appendix 2) and on the results of the 2002 SCS and LCS stock assessments. The draft Amendment 1 was available for public comment from August 1, 2003, to October 3, 2003 (Notice of Availability of DEIS 68 FR 45237, August 1, 2003; Proposed rule and Notice of Availability of Amendment 1 68 FR 45196, August 1, 2003; Comment period extension 68 FR 54885, September 19, 2003). During that time, NOAA Fisheries held six public hearings from Louisiana to New York (68 FR 47904, August 12, 2003; Rescheduling of two public hearings 68 FR 54885, September 19, 2003), held one Highly Migratory Species (HMS) Advisory Panel meeting (68 FR 51560, August 27, 2003), and received over 30 written public comments. NOAA Fisheries also attended four Fishery Management Council meetings (New England - 68 FR 38665, June 30, 2003; Mid-Atlantic - 68 FR 43089, July 21, 2003; and two for the Gulf of Mexico - 68 FR 38690, June 30, 2003; 68 FR 47911, August 12, 2003) and one Atlantic States Marine Fisheries Commission meeting. NOAA Fisheries was scheduled to attend the South Atlantic Fishery Management Council meeting in mid-September (68 FR 51997, August 29, 2003) that was canceled due to Hurricane Isabel (68 FR 55034, September 22, 2003) and was not able to attend a Caribbean Fishery Management Council meeting due to scheduling differences. A summary of the major comments received and NOAA Fisheries' response is in Appendix 5.

Due to time constraints (i.e., the need for new regulations by the January 1 opening of the season), this amendment will not address all issues in the shark fisheries or even all the issues

presented in the issues and options paper presented during scoping. However, this amendment should address some of the more pressing matters such as commercial quotas; recreational bag limits; size limits; prohibited species; and bycatch reduction. Other issues such as, but not limited to, the commercial trip limits; quotas for directed, incidental, and recreational permit holders; and season openings and closings will likely be addressed in future rulemakings (e.g., 68 FR 40907, July 9, 2003).

Table 1.1 List of Commonly Used Fishery Management Abbreviations, Acronyms, and Initialisms.

AA	Assistant Administrator for Fisheries
ACCSP	Atlantic Coastal Cooperative Statistics Program
ACS	Angler consumer surplus
ANPR	Advanced Notice of Proposed Rulemaking
AOCTRP	Atlantic Offshore Cetacean Take Reduction Plan
AOCTRT	Atlantic Offshore Cetacean Take Reduction Team
AP	Advisory Panel
APA	Administrators Procedure Act
ASMFC	Atlantic States Marine Fisheries Commission
ATCA	Atlantic Tunas Convention Act
B	Biomass
BAYS	Bigeye, albacore, yellowfin, skipjack tunas
BET	Bigeye tuna
BFT	Bluefin tuna
BiOp	Biological Opinion
B_{MSY}	Biomass expected to yield maximum sustainable yield
B_{OY}	Biomass expected to yield optimum yield
CFMC	Caribbean Fishery Management Council
CFL	Curved fork length
CFR	Code of Federal Regulations
CHB	Charter/Headboat
CIE	Center for Independent Experts
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CPUE	Catch per unit effort
CSFOP	Commercial shark fishery observer program
CZMA	Coastal Zone Management Act
DEIS	Draft Environmental Impact Statement
DPS	Distinct population segment
dw	Dressed weight
EA	Environmental Assessment
EEZ	Exclusive economic zone
EFH	Essential fish habitat

EFP	Exempted fishing permit
EIS	Environmental Impact Statement
EO	Executive Order
ESA	Endangered Species Act
F	Instantaneous fishing mortality
FAO	Food and Agriculture Organization
FEIS	Final Environmental Impact Statement
FL	Fork Length
FMP	Fishery Management Plan
F_{MSY}	Instantaneous fishing mortality rate expected to yield maximum sustainable yield
FMU	Fishery management unit
F_{OY}	Fishing mortality rate expected to yield optimum yield
FR	Federal Register
FRFA	Final regulatory flexibility analysis
GSAFDF	Gulf and South Atlantic Fishery Development Foundation
GMFMC	Gulf of Mexico Fishery Management Council
GSMFC	Gulf States Marine Fisheries Commission
HAPC	Habitat area of particular concern
HMS	Highly migratory species: Atlantic sharks, tunas, swordfish, and billfish
HMS FMP	Fishery Management Plan for Atlantic Tunas, Swordfish, and Sharks
ICCAT	International Commission for the Conservation of Atlantic Tunas
IPOA	International Plan of Action
IRFA	Initial regulatory flexibility analysis
ITQ	Individual transferable quota
ITS	Incidental take statement
LAP	Limited access permit
LCS	Large coastal sharks
LOA	Letter of acknowledgment
LPS	Large Pelagic Survey
LWTRP	Large Whale Take Reduction Plan
LWTRT	Large Whale Take Reduction Team
MAFMC	Mid-Atlantic Fishery Management Council
Magnuson-Stevens Act	Magnuson-Stevens Fishery Conservation and Management Act
MFMT	Maximum fishing mortality threshold
MMPA	Marine Mammal Protection Act

MPA	Marine protected area
MRFSS	Marine Recreational Fishing Statistics Survey
MSST	Minimum stock size threshold
MSY	Maximum sustainable yield
mt	Metric tons
NEFMC	New England Fishery Management Council
NEFSC	Northeast Fisheries Science Center
NEPA	National Environmental Policy Act
NERO	Northeast Regional Office
NGO	Non-governmental organization
nmi	Nautical mile
NOA	Notice of Availability
NOAA Fisheries	National Marine Fisheries Service
NOAA	National Oceanographic and Atmospheric Administration
NOI	Notice of Intent
NPOA	National Plan of Action
NRC	Natural Resources Consultants, Inc.
NS	National Standards
OSF	Office of Sustainable Fisheries
OY	Optimum yield
POP	Pelagic observer program
PR	Office of Protected Resources
PRA	Paperwork Reduction Act
Reg Flex Act	Regulatory Flexibility Act
RIR	Regulatory Impact Review
RPAs	Reasonable and Prudent Alternatives
RPMs	Reasonable and Prudent Measures
SAFE report	Stock Assessment and Fishery Evaluation report
SAFMC	South Atlantic Fishery Management Council
SCRS	Standing Committee for Research and Statistics
SCS	Small coastal sharks
SEFSC	Southeast Fisheries Science Center
SEIS	Supplemental environmental impact statement
SERO	Southeast Regional Office
SEW	Stock evaluation workshop
SFA	Sustainable Fisheries Act

SFL	Straight fork length
SK Program	Saltonstall-Kennedy Program
SRP	Scientific research permit
SSB	Spawning stock biomass
TAC	Total allowable catch
TAL	Total allowable landings
TCs	Terms and Conditions
TL	Total length
USFWS	United States Fish and Wildlife Service
VMS	Vessel monitoring system
WTP	Willingness to pay
ww	Whole weight

Table 1.2 Chronological List of Most of the Federal Register Publications Relating to Atlantic Sharks

Pre 1993

48 FR 3371	01/25/83	Preliminary management plan with optimum yield and total allowable level of foreign fishing for sharks
56 FR 20410	05/03/91	NOA of draft FMP; 8 hearings
57 FR 1250	01/13/92	NOA of Secretarial FMP
57 FR 24222	06/08/92	Proposed rule to implement FMP
57 FR 29859	07/07/92	Correction to 57 FR 24222

1993

58 FR 21931	04/26/93	Final rule and interim final rule implementing FMP
58 FR 27336	05/07/93	Correction to 58 FR 21931
58 FR 27482	05/10/93	LCS commercial fishery closure announcement
58 FR 40075	07/27/93	Adjusts 1993 second semi-annual quotas
58 FR 40076	07/27/93	LCS commercial fishery closure announcement
58 FR 46153	09/01/93	Notice of 13 public scoping meetings
58 FR 59008	11/05/93	Extension of comment period for 58 FR 46153
58 FR 68556	12/28/93	Interim final rule implementing trip limits

1994

59 FR 3321	01/21/94	Extension of comment period for 58 FR 68556
59 FR 8457	02/22/94	Notice of control date for entry
59 FR 25350	05/16/94	LCS commercial fishery closure announcement
59 FR 33450	06/29/94	Adjusts second semi-annual 1994 quota
59 FR 38943	08/01/94	LCS commercial fishery closure announcement
59 FR 44644	08/30/94	Reopens LCS fishery with new closure date
59 FR 48847	09/23/94	Notice of public scoping meetings
59 FR 51388	10/11/94	Rescission of LCS closure
59 FR 52277	10/17/94	Notice of additional scoping meetings
59 FR 52453	10/18/94	Final rule implementing interim final rule in 1993 FMP
59 FR 55066	11/03/94	LCS commercial fishery closure announcement

1995

60 FR 2071	01/06/95	Proposed rule to adjust quotas
60 FR 21468	05/02/95	Final rule indefinitely establishes LCS quota at 1994 level
60 FR 27042	05/22/95	LCS commercial fishery closure announcement
60 FR 30068	06/07/95	Announcement of Shark Operations Team meeting
60 FR 37023	07/19/95	Adjusts second semi-annual 1995 quota
60 FR 38785	07/28/95	ANPR - Options for Permit Moratoria
60 FR 44824	08/29/95	Extension of ANPR comment period
60 FR 49235	09/22/95	LCS commercial fishery closure announcement
60 FR 61243	11/29/95	Announces Limited Access Workshop

1996

61 FR 21978	05/13/96	LCS commercial fishery closure announcement
61 FR 37721	07/19/96	Announcement of Shark Operations Team meeting.

61 FR 39099	07/26/96	Adjusts second semi-annual 1996 quota
61 FR 43185	08/21/96	LCS commercial fishery closure announcement
61 FR 67295	12/20/96	Proposed rule to reduce Quotas/Bag Limits
61 FR 68202	12/27/96	Proposed rule to establish limited entry (Draft Amendment 1 to 1993 FMP)

1997

62 FR 724	01/06/97	NOA of Draft Amendment 1 to 1993 FMP
62 FR 1705	01/13/97	Notice of 11 public hearings for Amendment 1
62 FR 1872	01/14/97	Extension of comment period and notice of public hearings for proposed rule on quotas
62 FR 4239	01/29/97	Extension of comment period for proposed rule on quotas
62 FR 8679	02/26/97	Extension of comment period for Amendment 1 to 1993 FMP
62 FR 16647	04/07/97	Final rule reducing quotas/bag limits
62 FR 16656	04/07/97	LCS commercial fishery closure announcement
62 FR 26475	05/14/97	Announcement of Shark Operations Team meeting
62 FR 26428	05/14/97	Adjusts second semi-annual 1997 LCS quota
62 FR 27586	05/20/97	Notice of Intent to prepare an supplemental environmental impact statement
62 FR 27703	05/21/97	Technical Amendment regarding bag limits
62 FR 38942	07/21/97	LCS commercial fishery closure announcement

1998

63 FR 14837	03/27/98	LCS commercial fishery closure announcement
63 FR 19239	04/17/98	NOA of draft consideration of economic effects of 1997 quotas
63 FR 27708	05/20/98	NOA of final consideration of economic effects of 1997 quotas
63 FR 29355	05/29/98	Adjusts second semi-annual 1998 LCS quota
63 FR 41736	08/05/98	LCS commercial fishery closure announcement
63 FR 57093	10/26/98	NOA of draft HMS FMP

1999

64 FR 3154	01/20/99	Proposed rule for draft HMS FMP
64 FR 14154	03/24/99	LCS commercial fishery closure announcement
64 FR 29090	05/28/99	Final rule for HMS FMP
64 FR 30248	06/07/99	Fishing season notification
64 FR 37700	07/13/99	Technical amendment to HMS FMP final rule
64 FR 37883	07/14/99	Fishing season change notification
64 FR 47713	09/01/99	LCS fishery reopening
64 FR 52772	09/30/99	Notice of Availability of outline for National Plan of Action for sharks
64 FR 53949	10/05/99	LCS closure postponement
64 FR 66114	11/24/99	Fishing season notification

2000

65 FR 16186	03/27/00	Revised timeline for National Plan of Action for sharks
65 FR 35855	06/06/00	Fishing season notification and 2nd semi-annual LCS quota adjustment
65 FR 47986	08/04/00	Notice of Availability of National Plan of Action for sharks
65 FR 38440	06/21/00	Implementation of prohibited species provisions and closure change
65 FR 75867	12/05/00	Fishing season notification

2001

66 FR 55	01/02/01	Implementation of HMS FMP pelagic shark quotas
66 FR 10484	02/15/01	NOA of Final National Plan of Action for the Conservation and Management of Sharks
66 FR 13441	03/06/01	Emergency rule to implement settlement agreement
66 FR 33918	06/26/01	Fishing season notification and 2nd semi-annual LCS quota adjustment
66 FR 34401	06/28/01	Proposed rule to implement national finning ban
66 FR 46401	09/05/01	LCS fishing season extension
66 FR 67118	12/28/01	Emergency rule to implement measures based on results of peer review and fishing season notification

2002

67 FR 6194	02/11/02	Final rule implementing national shark finning ban
67 FR 8211	02/22/02	Correction to fishing season notification 66 FR 67118
67 FR 30879	05/08/02	Notice of availability of SCS stock assessment
67 FR 36858	05/28/02	Notice of availability of LCS sensitivity document and announcement of stock evaluation workshop in June
67 FR 37354	5/29/02	Extension of emergency rule and fishing season announcement
67 FR 64098	10/17/02	Notice of availability of LCS stock assessment and final meeting report
67 FR 69180	11/15/02	Notice of intent to conduct and environmental impact assessment and amend the HMS FMP
67 FR 72629	12/06/02	Proposed rule regarding EFPs
67 FR 78990	12/27/02	Emergency rule to implement measures based on stock assessments and fishing season notification

2003

68 FR 1024	01/08/03	Announcement of 4 public hearings on emergency rule
68 FR 1430	01/10/03	Extension of comment period for proposed rule on EFPs
68 FR 3853	01/27/03	Announcement of 7 scoping meetings and notice of availability of Issues and Options paper
68 FR 31983	05/29/03	Emergency rule extension and fishing season notification
68 FR 45196	08/01/03	Proposed rule and NOA for draft Amendment 1 to HMS FMP
68 FR 47904	08/12/03	Public hearing announcement for draft Amendment 1 to HMS FMP
68 FR 51560	08/27/03	Announcement of HMS AP meeting on draft Amendment 1 to HMS FMP
68 FR 54885	09/19/03	Rescheduling of public hearings and extending comment period for draft Amendment 1 to HMS FMP

Table 1.3 List of Large Coastal Shark Seasons, 1993-2003.

Year	Open dates	Quota (mt dw)
1993	Jan. 1 - May 15	1,218
	July 1 - July 31	875
1994	Jan. 1 - May 17	1,285
	July 1 - Aug 10 Sept. 1 - Nov. 4	1,318
1995	Jan. 1 - May 31	1,285
	July 1 - Sept. 30	968
1996	Jan. 1 - May 17	1,285
	July 1 - Aug. 31	1,168
1997	Jan. 1 - April 7	642
	July 1 - July 21	326
1998	Jan. 1 - Mar. 31	642
	July 1 - Aug. 4	600
1999	Jan. 1 - Mar. 31	642
	July 1 - July 28 Sept. 1 - Oct. 15	585
2000	Jan. 1 - Mar. 31	642
	July 1 - Aug. 15	542
2001	Jan. 1 - Mar. 24	642
	July 1 - Sept. 4	697
2002	Jan. 1 - April 15	735.5
	July 1 - Sept. 15	655.5
2003	Jan. 1 - April 15 (Ridgeback LCS) Jan. 1 - May 15 (Non-ridgeback LCS)	391.5 (Ridgeback LCS) 465.5 (Non-ridgeback LCS)
	July 1 - Sept. 15 (All LCS)	424 (Ridgeback LCS) 498 (Non-ridgeback LCS)

Table 1.4 NOAA Fisheries' Actions Taken to Comply with the Terms of the Court-Approved Settlement Agreement with SOFA *et al.*

Term of settlement agreement	Result
Independent review of the 1998 LCS stock assessment (Paragraphs 3 (a) through (d), revised settlement agreement)	In October 2001, Natural Resources Consultants Inc. provided NOAA Fisheries with four reviews. Three of the four reviews found that the scientific conclusions and scientific management recommendations contained in the 1998 LCS stock assessment were not based on scientifically reasonable uses of the appropriate fisheries stock assessment techniques and on the best available (at the time of the 1998 LCS stock assessment) biological and fishery information relating to LCS.
Maintain the 1997 LCS quotas, pending the completion of the independent review of the 1998 stock assessment. If the majority of the reviews find flaws in the stock assessment, maintain the 1997 LCS quotas pending rulemaking based on a new stock assessment. (Paragraph 3(e), revised settlement agreement)	In March 2001, NOAA Fisheries issued an emergency rule maintaining the 1997 LCS quota levels pending the completion of the peer review (March 6, 200, 66 FR 13441). Based on results of peer review of 1998 LCS stock assessment, in December 2001, NOAA Fisheries issued a second emergency rule maintaining the 1997 LCS quota levels pending the completion of a new stock assessment (December 28, 2001, 66 FR 67118). Based on results of the 2002 LCS stock assessment and its peer review, NOAA Fisheries issued a proposed rule and draft Amendment 1 on August 1, 2003 (68 FR 45196). A final rule will be issued based on the Final Amendment 1.
Conduct a new LCS stock assessment and obtain a peer review of that stock assessment (Paragraph 3(f), revised settlement agreement)	At the end of September 2002, NOAA Fisheries completed a new LCS stock assessment (67 FR 64098, October 17, 2002). NOAA Fisheries received the results of the completed peer review in December 2002. The results were generally positive (Appendix 1).
Work with SOFA *et al.* to obtain historical fin data (Paragraph 3(g))	Plaintiffs' and Defendant's attorneys subpoenaed historic shark records from fish dealers in New York and San Francisco. No documents were obtained through the subpoenas and NOAA Fisheries is unaware of any other dealers that may have records.
Maintain the 1997 SCS quotas pending the completion of a new stock assessment (Paragraph 4)	In the beginning of 2002, NOAA Fisheries completed a new SCS stock assessment (67 FR 30879, May 8, 2002). Based on results of the 2002 SCS stock assessment, NOAA Fisheries issued a proposed rule and draft Amendment 1 on August 1, 2003 (68 FR 45196). A final rule will be issued based on the Final Amendment 1.
Take appropriate action to adjust the pelagic shark quotas to make them consistent with regulations in the HMS FMP (Paragraph 5)	NOAA Fisheries implemented the pelagic shark quotas in the HMS FMP on January 2, 2001 (66 FR 55).

Table 1.5 List of Management Objectives in the HMS FMP. These objectives are not listed in any particular order.

- To prevent or end overfishing of Atlantic tuna, swordfish, and sharks and adopt the precautionary approach to fishery management;
- To rebuild overfished fisheries in as short a time as possible and control all components of fishing mortality, both directed and incidental, so as to ensure the long-term sustainability of the stocks and promote stock recovery of the management unit to the level at which the maximum sustainable yield can be supported on a continuing basis;
- To minimize, to the extent practicable, economic displacement and other adverse impacts on fishing communities during the transition from overfished fisheries to healthy ones;
- To minimize, to the extent practicable, bycatch of living marine resources and the mortality of such bycatch that cannot be avoided in the fisheries for Atlantic tunas, swordfish, and sharks;
- To establish a foundation for international negotiation on conservation and management measures to rebuild overfished fisheries and to promote achievement of optimum yield for these species throughout their range, both within and beyond the exclusive economic zone (EEZ). Optimum yield is the maximum sustainable yield from the fishery, reduced by any relevant social, economic, or ecological factors;
- To provide a framework, consistent with other applicable law, to take necessary action under ICCAT compliance recommendations;
- To provide the data necessary for assessing the fish stocks and managing the fisheries, including addressing inadequacies in current collection and ongoing collection of social, economic, and bycatch data about HMS fisheries;
- Consistent with other objectives of this FMP, to manage Atlantic HMS fisheries for continuing optimum yield so as to provide the greatest overall benefit to the Nation, particularly with respect to food production, providing recreational opportunities, preserving traditional fisheries, and taking into account the protection of marine ecosystems;
- To better coordinate domestic conservation and management of the fisheries for Atlantic tuna, swordfish, sharks, and billfish, considering the multispecies nature of many HMS fisheries, overlapping regional and individual participation, international management concerns, historical fishing patterns and participation, and other relevant factors;
- To simplify and streamline HMS management while actively seeking input from affected constituencies, the general public, and the HMS AP;
- To promote protection of areas identified as essential fish habitat for tuna, swordfish, and sharks;
- To reduce latent effort and overcapitalization in HMS commercial fisheries;
- To develop eligibility criteria for participation in the commercial shark and swordfish fisheries based on historical participation, including access for traditional swordfish handgear fishermen to participate fully as the stock recovers; and,
- To create a management system to make fleet capacity commensurate with resource status so as to achieve the dual goals of economic efficiency and biological conservation.

2.0 SUMMARY OF THE ALTERNATIVES

This section provides a description and basis for all alternatives considered in Amendment 1. The ecological, economic, and social impacts of these alternative are discussed in later chapters.

2.1 COMMERCIAL MANAGEMENT MEASURES

2.1.1 Large Coastal Shark (LCS) Classification

The following alternatives explore different possibilities for dividing the species in the LCS complex. These alternatives also consider the timing of fishery closures.

Alternative A1 Separate LCS groupings (Ridgeback/Non-ridgeback), different closure dates possible - (No Action)

This alternative would separate the LCS complex into ridgeback and non-ridgeback shark groupings and would establish commercial quotas for each grouping. Because separate quotas would be established for each grouping, it would be possible to have different closure dates in the event that one quota is filled before the other.

Many LCS species are characterized by a mid-dorsal ridge that is easily identified even after the fish has been headed, gutted, and finned. As such, the mid-dorsal ridge is useful as a diagnostic characteristic for management and enforcement purposes. Splitting LCS into two groupings could enable managers to be more responsive to the needs of individual species within each grouping, consistent with the recommendation from the 2002 LCS stock assessment regarding more species-specific management. For example, ridgeback LCS pup from March through August along the eastern seaboard, whereas non-ridgeback LCS pup from May through August primarily in the south Atlantic in Florida and Gulf of Mexico. Under this alternative, consideration could be given to closing the ridgeback LCS fishing season before the non-ridgeback LCS season, to reduce fishing mortality during ridgeback LCS pupping season.

Alternative A2 Separate LCS groupings (Ridgeback/Non-ridgeback), same closure date

This alternative is similar to alternative A1 in that the LCS complex would be separated into ridgeback and non-ridgeback shark groupings and commercial quotas would be established for each grouping. However, under this alternative, both groupings would close when the first of the two quotas is filled.

Similar to the alternative A1, alternative A2 also divides LCS based upon the mid-dorsal ridge characteristic. However, this alternative recognizes that directed shark fisheries exhibit mixed species catch composition. According to bottom longline observer data from 2000 to mid-2002, LCS comprise 66.2 percent of total shark catches (Burgess and Morgan, 2003). Of LCS catches, sandbar, tiger, and blacktip sharks represented 59 percent, 19 percent, and 8 percent respectively

(Burgess and Morgan, 2003). This mixed fishery information suggests that although fishermen can target certain species, increases in regulatory discards could occur during partial closures. This alternative provides managers the flexibility to address species-specific concerns within each grouping, and could also minimize regulatory discards by implementing a single closure for the LCS fishery.

Alternative A3 *Aggregate LCS, one closure date - Preferred Alternative*

This alternative aggregates LCS species into one group and establishes one commercial quota for the complex. Because there will be only one quota under this alternative, there will be only one closure date possible.

This alternative is based upon data which documents that directed shark fisheries exhibit mixed species catch composition. The Commercial Shark Fishery Observer Program (CSFOP), documented over 33 million hook hours of effort and yielded over 9,000 sharks representing 28 different species, including 6,461 LCS representing 14 species, 3,228 SCS representing two species, and 45 pelagic sharks representing two species between 2000 and mid-2002 (Burgess and Morgan, 2003). As noted above, most LCS catches were sandbar, tiger, and blacktip sharks. Under this alternative, species identification is not as important when estimating closure dates.

Alternative A4 Species-specific groupings, different closure dates possible

This alternative would establish species-specific commercial quotas. Under this alternative, closures would occur when the quotas for each individual species are filled. Because the management unit is comprised of many species and because market demands for individual species differ, it is likely that multiple closure dates would occur. The 2002 LCS stock assessment notes that risk-neutral management of the LCS complex may result in excessive regulation related to some species and excessive risk of overfishing on others (Cortes *et al*., 2002). To this end, the 2002 LCS stock assessment recommends that every effort be taken to manage on a species-specific basis (Cortes *et al*., 2002).

Other shark classification alternatives considered but not further analyzed at this time

Alternative A5 Aggregate complex, closure occurs when quota is reached for species of highest vulnerability

Similar to A3, this alternative would aggregate the LCS into one complex and would establish one quota for the aggregate. However, the quota would be set based on the level of effort the species of highest vulnerability could withstand. Under this alternative, the season for each complex would close when the quota for the species of highest vulnerability (e.g., species with overfished/overfishing status) is filled.

To date there is limited data available on individual LCS species beyond that of sandbar and blacktip. Without species-specific assessments, it is difficult to say which LCS species have

highest vulnerability or even what the quota should be for any individual species. Given this, NOAA Fisheries does not feel this alternative is a viable option at this time. NOAA Fisheries may consider this alternative in the future.

2.1.2 Quota Administration

The following alternatives define how commercial quotas will be temporally and spatially applied. These alternatives correspond to all shark groupings including LCS, SCS, and pelagic sharks. In all cases, NOAA Fisheries would announce the length of the fishing season prior to the start of the fishing season.

Alternative B1 Semi-annual season - (No Action)

This alternative would implement a semi-annual season (i.e., two per year) for commercial shark fisheries. Under this alternative, the first season would operate between the dates of January 1 and June 30. The second season would operate between the dates of July 1 and December 31 of each year. Both periods may be shortened to ensure that commercial quotas are not exceeded.

This alternative is consistent with traditional fishing practices. Semi-annual seasons have been in place since 1993 and seek to provide equitable access by all user groups to fish available at different times of the year.

Alternative B2 No regional quotas - (No Action)

This alternative would not implement regional quotas for commercial shark fisheries. This alternative has been in place since 1993 due to lacking regional data on which to base further consideration of such quotas to date.

Alternative B3 *Regional quotas - Preferred Alternative*

This alternative will implement regional quotas for the Gulf of Mexico (Texas - West coast Florida), South Atlantic (East coast Florida - North Carolina and the Caribbean), and North Atlantic (Virginia - Maine) commercial shark fisheries. This alternative is based upon regional differences in fisheries, shark pupping seasons, and fish availability. For example, catch rates for LCS caught on the west coast of Florida in winter are higher (3.56 sharks per 10,000 hook-hr) than catch rates of North Carolina (0.23 sharks per 10,000 hook-hr) (Burgess and Morgan, 2003). This information suggests that fish availability is higher off western Florida compared to North Carolina during winter months.

Regional quotas will be set on the basis of average historical landings (over the past three years) expressed as a percentage of average landings across all regions (See Tables 2.1 and 2.2). Averages were calculated in order to minimize uncertainty associated with inter-annual fluctuations in regional landings data as well as differences in reported landings, which were

derived from two separate databases. For years 1999-2001, the Gulf of Mexico, South Atlantic and North Atlantic accounted for four percent, 83 percent, and 13 percent of the total SCS landings, respectively. During the same time period, the Gulf of Mexico, South Atlantic, and North Atlantic accounted for 42 percent, 54 percent, and four percent of the total LCS landings, respectively. This alternative will divide annual quotas for LCS and SCS based upon these regional percentages and will further divide these quotas evenly by fishing season. Fishery participants will be allowed to fish in any region, provided that the season for the region in question is open and that the quota for that region has not been taken. The open season for each region will close when the quota for that region is taken.

Given that regional quotas will be based on average landings over the previous three calendar years, it is possible for percentages to change and vary over time. NOAA Fisheries will periodically assess changes to percentages in regional landings data. Should such changes require quota adjustments this will be carried out via a framework action.

Alternative B4 *Trimester season - Preferred Alternative*

This alternative will implement a trimester season (i.e., three per year) for commercial shark fisheries. Under this alternative, the first trimester season will operate between the dates of January 1 and April 30, the second trimester season will operate between May 1 and August 31, and the third trimester season will operate between September 1 and December 31. All three trimester seasons may be shortened to ensure that commercial quotas are not exceeded. The basis for this alternative is that there are temporal differences in fishing practices, fish availability, and pupping activity. Under this alternative, the annual quota will not need to be split equally between trimester seasons. Instead, this alternative will allow managers to establish quotas for each trimester based on markets, pupping season, and other relevant factors.

Alternative B5 Quarterly season

This alternative would implement a quarterly season for commercial sharks fisheries. This alternative divides the calendar year into four open seasons including (1) Q1 January 1 - March 31, (2) Q2 April 1 - June 30, (3) Q3 July 1 - September 30, and (4) Q4 October 1 - December 31. All four quarters may be shortened to ensure that commercial quotas are not exceeded. The basis for this alternative is that there are temporal differences in fishing practices, fish availability, and pupping activity. Under this alternative, the annual quota would not need to be split equally between quarters. Instead, this alternative would allow managers to set quotas for each quarter based on markets, pupping season, and other relevant factors.

2.1.3 Quota Basis

The following alternatives define the basis (i.e., process, methodology, and resulting quotas) for commercial quota specifications. The basis outlined for LCS depends to a large extent upon the classification selected (See Section 2.1.1). The specification outlined also depends in part on

both the rebuilding time frame (See Section 4.1) and stock assessment recommendations. Table 2.3 outlines the calculations used to determine quota specifications. These alternatives apply to all shark groupings including LCS, SCS, and pelagic sharks. NOAA Fisheries will assess the appropriateness of percent reductions and/or increases, as outlined in the following alternatives, as new information becomes available in future stock assessments. The quota basis for pelagic sharks will not change until such time as a stock assessment is completed. The quotas listed below would be split appropriately between the season and regions as described in alternatives B1-B5 above.

Alternative C1 Quota Basis from 1999 HMS FMP - (No Action)

This alternative would implement commercial quota levels of 620 mt dw (1,366,852 lb dw) for ridgeback LCS and 196 mt dw (432,102 lb dw) for non-ridgeback LCS, which are the quota levels established in the 1999 HMS FMP. As described in the HMS FMP, these quota levels were based on the rebuilding projections from the 1998 LCS stock assessment for sandbar and blacktip sharks. These quota levels have never been implemented.

Additionally, this alternative would implement a commercial quota of 359 mt dw (791,451 lb dw) for the SCS complex. This is the quota that was implemented in the 1999 HMS FMP and was 10-percent higher than the highest landings by commercial fishermen, including fishermen fishing in state waters. This management measure was a precautionary measure to prevent expansion of this fishery, pending a new stock assessment. At the time of the HMS FMP, the highest landings were in 1997 (320 mt dw/705,472 lb dw). Updating the landings through 2001 (highest 326 mt dw/718,700 lb dw in 2001) would result in the same quota level (See Table 2.4). This quota level has never been implemented.

Lastly, this alternative would establish a commercial quota of 92 mt dw (202,823 lb dw) for porbeagle, 273 mt dw (601,856 lb dw) for blue, and 488 mt dw (1,075,845 lb dw) for other pelagic sharks. The porbeagle shark quota is approximately 10-percent higher than the highest annual porbeagle landings (1990-1998). The blue shark quota is equivalent to the average weight of blue sharks discarded dead by longline fisheries targeting tunas and swordfish for the period 1987 to 1997. The pelagic shark quotas are identical to those that were implemented in the 1999 HMS FMP, pending a new stock assessment.

Under this alternative, dead discards and state landings after a Federal closure would be counted against the following years quota.

Alternative C2 *Quota based upon percentage of Maximum Sustainable Yield (MSY) - Preferred Alternative*

This alternative will implement commercial quota levels based on the MSY level calculated in the stock assessment. This MSY level is then reduced by an appropriate amount as recommended by the stock assessment or by 25 percent to calculate optimum yield (OY).

Optimum yield is split into three parts: commercial landings, recreational harvest, and dead discards. These three parts are calculated based on recent history of the fishery. The commercial quota is equal to the proportion of commercial landings from OY. Commercial landings include landings by federally permitted fishermen and state-permitted fishermen. Thus, this alternative sets a commercial landings quota using MSY to calculate OY as a proxies for total allowable catch (TAC) (See Figure 2.1). Under this alternative, dead discards and recreational landings are taken off before calculating the quota and will not be taken off the quota at the end of the season. Overharvests and/or underharvests as well as state landings by state-permitted fishermen after a Federal closure will be accounted for in the same season of the following year's quota. The quota will be adjusted after each stock assessment, as appropriate. Under this alternative, the commercial quota could be increased without a change in MSY if either dead discards or recreational harvest decrease. Alternatively, if dead discards or recreational harvest increase, then commercial quotas could decrease.

Given the current 2002 LCS stock assessment, this alternative, <u>if combined with either alternative A1 or A2</u>, would implement commercial quota levels of 1,017 mt dw (2,242,078 lb dw) for ridgeback LCS and 509 mt dw (1,122,141 lb dw) for non-ridgeback LCS (Table 2.3). The quota for ridgeback LCS is based upon catch-per-unit-effort (CPUE) data, which suggests that silky and tiger shark populations are not decreasing. As such, NOAA Fisheries feels that a 45-percent reduction (see below for explanation of 45-percent reduction) in addition to the other preferred alternatives is reasonable and should rebuild the LCS complex. The quota for non-ridgeback LCS is based upon a 50-percent reduction in catch as recommended in the 2002 LCS stock assessment. This reduction is also based upon declining CPUE trends for non-ridgeback LCS.

Given the current 2002 LCS stock assessment, this alternative, <u>if combined with preferred alternative A3</u>, will implement a commercial quota of 1,017 mt dw (2,242,078 lb dw) for the LCS aggregate. The LCS aggregate quota is based upon a 45-percent reduction of average maximum sustainable catch[1] (MSC) for LCS (Table 2.3), multiplied by the percent contribution of commercial catch to total catch for the LCS complex. The percent reduction has been revised based upon public comment received during public hearings on draft Amendment 1. NOAA Fisheries reduced the 50-percent recommended reduction by five percent after consider the following factors: (1) while the stock assessment did say that the LCS complex should be reduced by 50 percent, it also said that the reductions should be on species other than sandbar and blacktip; (2) observer data indicates that sandbar and blacktip sharks comprise approximately 67 percent of the LCS catch, indicating that a quota reduction would mostly apply to those species; (3) the peer reviews indicated that the complex assessment may not be as accurate as individual species because of biological differences between species; (4) CPUE data for silky, tiger, and scalloped hammerhead do not indicate a decline; and (5) the other preferred measures such as the time/area closure will reduce mortality and/or dead discards. NOAA Fisheries originally reduced the quota by 40 percent not 45 percent. However, based on public comment,

[1]MSC is used interchangeably with MSY in the 2002 LCS stock assessment.

NOAA Fisheries is revising the time/area closure. Additionally, after considering the advice from the SEFSC regarding draft Amendment 1, NOAA Fisheries felt that a more risk averse approach would be appropriate. Thus, NOAA Fisheries feels that a 45-percent reduction in addition to the other preferred alternatives is reasonable and will rebuild the LCS complex. This is consistent with the 1999 HMS FMP, which sets $F_{target} < F_{MSY}$ as the target control rule during rebuilding.

Given the current 2002 LCS stock assessment, this alternative, <u>if combined with alternative A4</u>, would implement commercial quota levels of 991 mt dw (2,184,759 lb dw) for sandbar sharks, 1,473 mt dw (3,247,376 lb dw) for blacktip sharks, and 95 mt dw (209,437 lb dw) for other LCS ridgeback and non-ridgeback sharks (See Table 2.3). The quotas for sandbar and blacktip sharks are based upon average MSC for each species, multiplied by 75 percent of MSC for each species. The 1999 HMS FMP sets $F_{target} = 0.75F_{MSY} = F_{OY}$ as the target control rule for healthy stocks. These quotas are further multiplied by the percent contribution of commercial catch to total catch for each of these species. The quota for other LCS is based upon the average MSC for all LCS, multiplied by the percent contribution of commercial catch to total catch for non-sandbar and non-blacktip sharks as well as all LCS, and further reduced by 45 percent, as recommended by the stock assessment and taking into consideration other factors described earlier in this section.

Given the current 2002 SCS stock assessment, this alternative would implement a commercial quota of 454 mt dw (1,000,888 lb dw) for the SCS complex. The SCS quota is based upon 75 percent of the average MSY for the complex, multiplied by the percent contribution of commercial catch to total catch for the SCS complex. The 1999 HMS FMP sets $F_{target} = 0.75F_{MSY} = F_{OY}$ as the target control rule for healthy stocks.

Under this alternative commercial quotas of 92 mt dw (202,823 lb dw) for porbeagle, 273 mt dw (601,856 lb dw) for blue, and 488 mt dw (1,075,845 lb dw) for other pelagic sharks, which were originally implemented in the 1999 HMS FMP, would be maintained pending a stock assessment. Once a stock assessment is conducted, NOAA Fisheries would either implement pelagic shark quotas consistent with an ICCAT recommendation, if applicable, or set pelagic shark quotas using the same method as described above for LCS and SCS.

Alternative C3 Quota based upon average landings for past three years

This alternative would implement commercial quota levels based on average landings, calculated over the past three years (1999-2001) from the latest stock assessment. Average landings would be reduced by an appropriate amount as recommended by the stock assessment. Overharvest and/or underharvests as well as state landings after a Federal closure would be accounted for in the same season of the following year's quota. The quota would be adjusted after each stock assessment, as appropriate.

Given the current 2002 LCS stock assessment, this alternative, <u>if combined with either alternative A1 or A2</u>, would implement commercial quota levels of 794 mt dw (1,750,452 lb dw)

for ridgeback LCS and 931 mt dw (2,052,483 lb dw) for non-ridgeback LCS (See Table 2.3). The quota for ridgeback LCS is based upon average landings of sandbar sharks (past three years), plus 50 percent of the unclassified shark average landings (past three years), plus addition of the other ridgeback species average landings (past three years). The quota for non-ridgeback LCS is based upon average landings of blacktip and spinner sharks (past three years), plus a 20 percent addition of blacktip and spinner average landings (past three years), plus a 50 percent of unclassified sharks average landings (past three years), plus a 50 percent addition of unclassified shark average landings (past three years), plus 50 percent subtraction of the other non-ridgeback species average landings (past three years). Similar quota levels were implemented under the 2003 emergency rule (67 FR 8990, December 27, 2002; extended 68 FR 31983, May 29, 2003).

Given the current 2002 LCS stock assessment, this alternative, <u>if combined with preferred alternative A3</u>, would implement commercial quota levels of 931 mt dw (2,052,483 lb dw) for the LCS aggregate (See Table 2.3). The LCS aggregate quota is based upon a 45-percent reduction of average landings for LCS (past three years). The 45-percent reduction is based on the 50 percent suggested in the stock assessment as modified by the factors considered in alternative C2 above.

Given the current 2002 LCS stock assessment, this alternative, <u>if combined with alternative A4</u>, would implement commercial quota levels of 635 mt dw (1,399,921 lb dw) for sandbar sharks, 740 mt dw (1,631,404 lb dw) for blacktip sharks, and 221 mt dw (487,217 lb dw) for other LCS ridgeback and non-ridgeback sharks (Table 2.3). The quota for sandbar sharks is based upon average landings of sandbar sharks (past three years). The quota for blacktip sharks is based upon a 20 percent addition of blacktip and spinner average landings (past three years). The quota for other LCS ridgeback and non-ridgeback sharks is based upon 50-percent reduction in average landings of other LCS non-ridgeback sharks (past three years).

Given the current 2002 SCS stock assessment, this alternative would implement a commercial quota of 300 mt dw (661,380 lb dw) for the SCS complex. This quota amount equates to the average SCS landings over the past three years.

Under this alternative commercial quotas of 92 mt dw (202,823 lb dw) for porbeagle, 273 mt dw (601,856 lb dw) for blue, and 488 mt dw (1,075,845 lb dw) for other pelagic sharks, which were originally implemented in the 1999 HMS FMP, would be maintained pending a stock assessment. Once a stock assessment is conducted, NOAA Fisheries would either implement pelagic shark quotas consistent with an ICCAT recommendation, if applicable, or set pelagic shark quotas using the same method as described herein for LCS and SCS.

<u>Other quota basis alternatives considered but not further analyzed at this time</u>

Alternative C4 Quota based upon maintaining constant fishing mortality (F) over time

This alternative would allocate the quota based upon maintaining a constant fishing mortality over time to reach F_{MSY} (in the case of rebuilding stocks) or F_{OY} (in the case of healthy stocks). Constant fishing mortality approaches (e.g., fixed amount, varying percentage) are inconsistent with current harvest management strategies focused on maintaining constant catch (varying amount, fixed percentage) over time (Cortes, pers. comm. 2003). Additionally, calculating a specific quota amount based on a percentage of F_{MSY} or F_{OY} is difficult and could be more inaccurate than calculating a quota based on MSY itself. Therefore this alternative is not being further analyzed at this time. NOAA Fisheries may reconsider this alternative in the future, if appropriate.

2.1.4 Commercial Minimum Size

The following alternatives consider minimum sizes for commercially harvested sharks.

Alternative D1 4.5 feet fork length for Ridgeback LCS - (No Action)

This alternative would implement a 4.5 feet (137 cm) fork length minimum size for commercially-caught ridgeback LCS. This alternative would not implement a minimum size for non-ridgeback LCS, SCS, or pelagic sharks. This alternative was adopted under the 1999 HMS FMP but never implemented.

This alternative is based upon existing data (Sminkey and Musick, 1995), which approximates 4.5 feet in fork length to the size of first maturity for female sandbar sharks, the primary species in the fishery. Additionally, sandbar sharks, unlike blacktip sharks, segregate by size. According to the 2002 stock assessment, sandbar sharks are not overfished, however overfishing is occurring (Cortes *et al*., 2002). Implementation of a minimum size is one option available to address this overfishing status.

Alternative D2 *No minimum size - Preferred Alternative*

This alternative will not implement a minimum size for any commercially-caught LCS, SCS, or pelagic shark. This alternative has been implemented in commercial fisheries since 1993. This alternative is based primarily upon observer data which show that the directed shark fishery is a mixed fishery (Burgess and Morgan, 2003). Observer data (2000-2001) document high mortality for spinner (36.7 percent alive), night (23.7 percent alive), dusky (18.8 percent alive), scalloped hammerhead (13.2 percent alive), blacktip (12.3 percent alive), silky (10.3 percent alive), and great hammerhead sharks (5.4 percent alive) following longline captures (Burgess and Morgan, 2003). While some species, such as sandbar, segregate by size and therefore may benefit from a size limit, other species do not. As such, observer data suggest that minimum sizes or catch-and-release measures enacted for those species could have little positive effect on reducing fishing mortality (Burgess and Morgan, 2003).

Alternative D3 5 feet fork length for all LCS

This alternative would implement a minimum size of five feet (152 cm) fork length for all commercially-caught LCS. This alternative would not implement a minimum size for SCS or pelagic sharks. This alternative is based upon existing data (Sminkey and Musick, 1995), which approximates five feet in fork length to the size above which all female sandbar sharks are sexually mature. As such, this alternative would give the majority of female sandbar sharks the opportunity to reproduce before recruiting to the commercial fishery. According to the 2002 stock assessment, sandbar sharks are not overfished, however overfishing is occurring (Cortes *et al*., 2002). Additionally, the 2002 LCS stock assessment recommended protection for juveniles and reproductive females (Cortes *et al*., 2002). This alternative may also provide protection for other LCS species, such as blacktip.

Alternative D4 — 5 feet fork length for Ridgeback LCS; 4.5 feet fork length for Non-ridgeback LCS

This alternative would implement minimum sizes of five feet fork length for commercially-caught ridgeback LCS and 4.5 feet fork length for commercially-caught non-ridgeback LCS. This alternative would not implement a minimum size for SCS or pelagic sharks. This alternative is based upon existing data, which approximates five feet in fork length to the size above which all female sandbar sharks are sexually mature and 4.5 feet in fork length to the median size at which female blacktip sharks become sexually mature (Sminkey and Musick, 1995; Carlson and Baremore, 2002). As such, this alternative would give all female sandbar sharks and the majority of blacktip females the opportunity to reproduce before recruiting to the commercial fishery. According to the 2002 stock assessment, sandbar sharks are not overfished, however overfishing is occurring (Cortes *et al*., 2002). Additionally, the 2002 LCS stock assessment recommended protection for juveniles and reproductive females (Cortes *et al*., 2002).

Alternative D5 — 4.5 feet fork length for Atlantic Non-ridgeback LCS; 4 feet fork length for Gulf of Mexico Non-ridgeback LCS

This alternative would implement minimum sizes for commercially caught non-ridgeback LCS only. Specifically, this alternative would implement a 4.5 feet fork length minimum size for non-ridgeback sharks caught in the Atlantic Ocean and a four feet fork length minimum size for non-ridgeback sharks caught in the Gulf of Mexico. This alternative would not implement a minimum size for SCS or pelagic sharks. Carlson and Baremore (2002) found that the median sizes at which female blacktip sharks become mature in the Atlantic and Gulf regions are 126.6 cm fork length and 117.3 cm fork length respectively. The 4.5 feet minimum size limit for non-ridgeback LCS brings the median size in the Atlantic region (126.6 cm or 4.15 feet) up to a rounded length and the 4.0 feet (117.3 cm or 3.8 feet) minimum size limit for Gulf region non-ridgeback sharks does the same for the median size in the Gulf region.

Alternative D6 — Minimum size for overfished species (or where overfishing is occurring) only

This alternative would implement minimum sizes for commercially-caught overfished species of LCS and SCS only. Based on the results of the 2002 LCS stock assessment, the LCS complex is overfished. As such, under this alternative, a minimum size of five feet fork length would be implemented for the LCS complex. The minimum size implemented for LCS would be removed when sufficient information is available to suggest that the complex is no longer overfished. Based upon the results of the 2002 SCS stock assessment, overfishing is occurring on finetooth sharks (Cortes, 2002). As such, a minimum size of 4.0 feet (e.g., 123 cm TL) fork length is suggested for finetooth to allow for 50 percent of all female finetooth to reach sexual maturity (Carlson *et al*., 2003) and lower fishing mortality on immature finetooth. Similarly, minimum sizes would be considered for other aggregates/species should scientific information suggest that additional aggregates/species are, in fact, overfished.

2.2 RECREATIONAL MANAGEMENT MEASURES

2.2.1 Recreational Retention Limits

Alternative E1 One shark per vessel per trip plus one Atlantic sharpnose shark per person per trip (No Action)

This alternative would maintain the current recreational retention limits of one shark per vessel per trip, inclusive of LCS, SCS, and pelagic sharks. It would also maintain the allowance for one Atlantic sharpnose shark per person per trip to accommodate charter and headboat operations. This retention limit was implemented in the HMS FMP, in part, to reduce the harvest of sandbar and blacktip sharks to aid in the rebuilding of overfished fisheries for LCS, and to address misidentification issues.

Alternative E2 *Existing catch limits (E1) plus the addition of one bonnethead shark per person per trip - Preferred Alternative*

This alternative would allow the retention of one bonnethead shark per person per trip in addition to the existing catch limits (E1). The existing retention limit will continue to aid in rebuilding LCS, which are overfished and still experiencing overfishing. Bonnethead sharks are an important recreational catch in some regions, are easy to identify, and, according to the 2002 SCS stock assessment, are not experiencing overfishing and are not overfished (Cortes, 2002).

Alternative E3 Existing catch limits (E1) plus the addition of one pelagic shark per vessel per trip

This alternative would allow the addition of one pelagic shark per vessel per trip to the existing catch limits (E1). This alternative could continue to aid in rebuilding LCS while also allowing anglers who fish outside the range of Atlantic sharpnose sharks the opportunity to land an additional shark per vessel per trip.

Alternative E4 Existing catch limits (E1) plus an allowance for vessels with HMS Angling permits participating in registered tournaments or HMS CHB permit holders on for-hire trips to retain one shark per person, up to two sharks per vessel, per trip, as well as one bonnethead shark per person per trip

In addition to existing catch limits (E1), this alternative would allow permitted charter/headboat vessels carrying multiple paying passengers or vessels with HMS Angling permits competing in registered tournaments to retain one additional shark per vessel per trip, up to two sharks per vessel per trip. It would create a retention limit similar to that in effect in the recreational swordfish fishery. It would also allow the retention of one bonnethead shark per person per trip, giving anglers a greater chance of landing a shark. Bonnethead sharks are an important recreational catch in some regions, they are easy to identify, and according to the 2002 SCS stock assessment, they are not experiencing overfishing and are not overfished (Cortes, 2002).

Alternative E5 Other retention limit that considers existing state recreational retention limits

This alternative would identify a retention limit that considers existing state recreational retention limits (Appendix 3). A retention limit similar to those that exist in most states could minimize confusion with Federal regulations and make enforcement less complicated.

Alternative E6 No retention, catch-and-release fishing for all recreational shark fisheries, inclusive of all LCS, pelagic species, and SCS.

This alternative would implement catch-and-release fishing for all recreational shark fisheries, inclusive of all LCS, SCS, and pelagic species. This alternative would require all sharks to be released in a manner that maximizes the probability of survival. This alternative would aid in rebuilding LCS and help prevent overfishing on SCS and pelagic sharks.

Alternative E7 No retention limit

Under this alternative, there would be no retention limit for recreational shark fisheries, inclusive of all LCS, SCS, and pelagic species. Any shark caught, could be retained.

2.2.2 Recreational Minimum Sizes

Alternative F1 4.5 feet fork length for all sharks, no size limit for Atlantic sharpnose sharks (No Action)

This alternative would maintain the existing size limit of 4.5 feet (137 cm) fork length for all sharks and no size limit for Atlantic sharpnose sharks. The 4.5 feet (137 cm) fork length size limit approximates the size of first maturity for female sandbar sharks. Sharks caught in

recreational fisheries are thought to have low post-release mortalities and the current 4.5 feet fork length size limit could minimize fishing mortality on the most sensitive stages/sizes by continuing catch-and-release fishing on juvenile and subadult sharks. The 2002 LCS stock assessment recommended protecting juveniles and reproductive females (Cortes *et al.*, 2002). The 2002 SCS stock assessment indicated that the current level of removals is sustainable for the small coastal shark aggregate and Atlantic sharpnose sharks. The assessment predicted that the stock biomass of Atlantic sharpnose sharks in any given year from 1972 - 2000 exceeded the biomass producing MSY (Cortes, 2002).

Alternative F2 *Existing size limits (F1) plus no size limit for bonnethead sharks - Preferred Alternative*

This alternative would allow the retention of bonnethead sharks with no minimum size in addition to the existing size limits (F1). Bonnethead sharks are an important recreational catch in some regions, are easy to identify, do not commonly reach the current 4.5 feet fork length minimum size, and according to the 2002 SCS stock assessment, are not experiencing overfishing and are not overfished (Cortes, 2002).

Alternative F3 5.0 feet fork length for all sharks, no size limit for Atlantic sharpnose and bonnethead sharks

This alternative would increase the existing size limit to 5.0 feet fork length for all sharks, maintain no size limit for Atlantic sharpnose sharks, and allow the retention of bonnethead sharks with no minimum size. The 5.0 feet fork length (152.4 cm) minimum size approximates the size above which all female sandbar sharks have been found to be mature. This limit would allow all female sandbar sharks to be sexually mature before recruiting to the recreational fishery. The 2002 LCS stock assessment recommended protecting juveniles and reproductive females (Cortes *et al.*, 2002). This alternative may provide increased protection for other shark species such as dusky sharks by essentially creating a catch-and-release fishery for juvenile and subadult stages. Sharks caught in recreational fisheries are thought to have low post release mortalities and the 5.0 feet fork length size limit could increase protection for many sensitive stages/sizes. The 2002 SCS stock assessment indicated that the current level of removals is sustainable for the small coastal shark aggregate and for the Atlantic sharpnose shark which has no minimum size. The assessment predicted that the stock biomass of Atlantic sharpnose sharks in any given year from 1972 - 2000 exceeded the biomass producing MSY (Cortes, 2002). Additionally, Atlantic sharpnose do not reach 5.0 feet fork length. No size limit for bonnethead sharks was included in this alternative because bonnethead sharks are an important recreational catch in some regions, do not reach 5.0 feet fork length, and according to the 2002 SCS stock assessment, are not experiencing overfishing, and are not overfished.

Alternative F4 5.0 feet fork length for all ridgeback LCS, 4.5 feet fork length all non-ridgeback LCS, SCS, and pelagic sharks, no size limit for Atlantic sharpnose and bonnethead sharks

This alternative would increase the existing size limit to 5.0 feet fork length for all ridgeback LCS, retain the 4.5 feet fork length size limit for all non-ridgeback LCS, SCS, and pelagic sharks, maintain no size limit for Atlantic sharpnose sharks, and allow the retention of bonnethead sharks with no minimum size. The 5.0 feet fork length (152.4 cm) minimum size for ridgeback LCS approximates the size above which all female sandbar sharks have been found to be mature. The 4.5 feet fork length (137 cm) minimum size limit for non-ridgeback is slightly larger than the median size at which female blacktip sharks become mature. These limits could allow all female sandbar sharks and a majority of female blacktip sharks to be sexually mature before recruiting to the recreational fishery. The 2002 LCS stock assessment recommended protecting juveniles and reproductive females (Cortes *et al.*, 2002). These limits may provide increased protection for other shark species such as dusky sharks by essentially creating a catch-and-release fishery for juvenile and subadult stages. Sharks caught in recreational fisheries are thought to have low post release mortalities and these size limits for ridgeback and non-ridgeback sharks will continue to minimize fishing mortality on the most sensitive stages/sizes. The 2002 SCS stock assessment indicated that the current level of removals is sustainable for the small coastal shark aggregate and for the Atlantic sharpnose shark which has no minimum size. The assessment predicted that the stock biomass of Atlantic sharpnose sharks in any given year from 1972 - 2000 exceeded the biomass producing MSY (Cortes, 2002). Additionally, Atlantic sharpnose sharks do not reach the 4.5 foot minimum size. No size limit for bonnethead sharks was included in this alternative because bonnethead sharks are an important recreational catch in some regions, do not commonly reach the current 4.5 feet fork length minimum size, and according to the 2002 SCS stock assessment, are not experiencing overfishing and are not overfished.

Alternative F5 — 4.5 feet fork length all sharks except no size limit for Atlantic sharpnose and bonnethead sharks and regional non-ridgeback LCS minimum sizes (4.5 feet fork length for all Atlantic non-ridgeback LCS, 4.0 feet fork length for all Gulf of Mexico non-ridgeback LCS)

This alternative would retain the 4.5 feet fork length minimum size limit for all sharks (including Atlantic non-ridgeback LCS, SCS, and pelagic sharks) and allow a minimum size of 4.0 feet fork length for non-ridgeback LCS in the Gulf region. This alternative allows for a smaller size limit for non-ridgeback LCS in the Gulf region while still allowing the majority of female blacktip sharks to be sexually mature before recruiting to the recreational fishery. The 4.5 feet fork length (137 cm) minimum size limit for Atlantic non-ridgeback LCS is slightly larger than the median size in the Atlantic region (126.6 cm) and the 4.0 feet fork length (122 cm) minimum size limit for Gulf region non-ridgeback LCS approximates the median size in the Gulf region (117.3 cm). The 2002 SCS stock assessment indicated that the current level of removals is sustainable for the small coastal shark aggregate and Atlantic sharpnose sharks. The assessment predicted that the stock biomass of Atlantic sharpnose sharks in any given year from 1972 - 2000 exceeded the biomass producing MSY (Cortes, 2002). Additionally, Atlantic sharpnose sharks do not reach the 4.5 foot minimum size. No size limit for bonnethead sharks was included in this alternative because bonnethead sharks are an important recreational catch in some regions, do not commonly

reach the current 4.5 feet fork length minimum size, and according to the 2002 SCS stock assessment, are not experiencing overfishing and are not overfished.

Alternative F6 No size limit for any sharks

Under this alternative, sharks in the LCS, SCS, or pelagic shark management groups of any size could be landed. This would allow anglers to land shark species that do not commonly reach the current minimum size limit (i.e., blacknose, bonnethead, and finetooth sharks).

2.2.3 Authorized Gears for Recreational Shark Fishing

Alternative G1 Any authorized gear (No Action)

This alternative would continue to allow any authorized gear to be used to fish for sharks recreationally. These gears are handgear, longline, and gillnet.

Alternative G2 *Only allow handline and rod and reel gear in the recreational shark fishery - Preferred Alternative*

This alternative would limit the allowable gears in the recreational shark fishery to handline and rod and reel gear. This alternative would promote consistency within HMS recreational fisheries. Presently, fishermen may use gears traditionally considered to be commercial gears to land sharks recreationally provided that they have an HMS Angling permit. Under alternative G2, vessels that have been issued both an HMS charter/headboat permit and a shark limited access permit would be able to use commercial gear types as long as the vessel is not on a for-hire trip.

2.3 DEEPWATER AND OTHER SHARKS

Alternative H1 Retain established species group (No Action)

This alternative would maintain the current deepwater/other species group in the management unit. The deepwater/other species are not subject to permit and reporting requirements, retention limits, or quotas as established in the HMS FMP. They were included in the management unit in the HMS FMP in order to extend the ban on finning to all Atlantic shark species.

Alternative H2 *Remove species group from management unit; data collection only - Preferred Alternative*

This alternative would remove the deepwater/other species group from the management unit and require data collection only. This alternative was identified because there are no significant landings of species in this group and the Shark Finning Prohibition Act now protects these species from being finned.

2.4 PROHIBITED SPECIES

Alternative I1 Retain established species group (19 species) (No Action)

This alternative maintains the current prohibited species group, which includes the 19 species identified in the HMS FMP. The HMS FMP prohibited the retention of these species because they were known to be vulnerable to overfishing, uncommon, or seriously depleted. NOAA Fisheries has provided the maximum protection possible to these species within its fisheries management jurisdiction.

Alternative I2 Return to the five species in 1997; white, sand tiger, bigeye sand tiger, whale, and basking sharks

This alternative would return to the 1997 prohibition on the possession of whale, basking, sand tiger, bigeye sand tiger, and white sharks within Federal waters. These five species were identified as highly susceptible to overexploitation and the prohibition on possession was a precautionary measure to ensure that directed fisheries did not develop. This alternative would allow dusky sharks and other occasionally-caught sharks currently in the prohibited species group to be landed, counted against trip limits, and utilized.

Alternative I3 Retain established prohibited species group (I1) and add finetooth shark

This alternative would add the finetooth shark to the prohibited species group. The 2002 SCS stock assessment indicated that finetooth sharks, although not overfished, are experiencing overfishing (Cortes, 2002). Although finetooth sharks are common bycatch in other non-HMS fisheries, this alternative may help reduce mortality of this species.

Alternative I4 Retain established species group (I1) and remove dusky shark

This alternative would remove the dusky shark from the prohibited species group. Dusky sharks have a high bycatch mortality and are usually dead when gear is retrieved. Fishermen find it difficult to avoid interacting with them and allowing dusky sharks to be retained and counted against trip limits and quotas could reduce overall effort in the fishery.

Alternative I5 Retain established species group (I1) and add the deepwater/other species

This alternative would add the species presently in the deepwater/other group to the prohibited species group. This alternative was included to be proactive and take a precautionary approach to managing these species. There are only minor landings of these species through bycatch in other fisheries.

Alternative I6 *Retain established prohibited species group (I1) and establish criteria for the addition and removal of species to/from the prohibited species group - Preferred Alternative*

This alternative would establish criteria for the addition and removal of species to/from the prohibited species group. A species could be added to the prohibited species list if at least two of the following criteria are met: (1) There is sufficient biological information to indicate the stock warrants protection, such as indications of depletion or low reproductive potential or the species is on the ESA candidate list; (2) the species is rarely encountered or observed caught in HMS fisheries; (3) the species is not commonly encountered or observed caught as bycatch in fishing operations; or (4) the species is difficult to distinguish from other prohibited species (i.e., look-alike issue). Alternatively, a species could be removed from the prohibited species list if it meets only one criterion.

For example, if after review of available data, a shark species was found to be depleted (criterion 1) and was rarely encountered (criterion 2), NOAA Fisheries could add the species to the prohibited species list using the regulatory framework adjustment process. Conversely, if a shark species was shown to meet only one criterion, for example, it is rarely caught in HMS fisheries (criterion 2) but stock assessments show few signs of depletion (e.g., HMS gear types are not efficient at catching the shark species or the species is caught in areas not fished by HMS fishermen), it is not observed caught as bycatch in other fisheries, and does not look like other prohibited species, the species could be removed from the prohibited species list using the same regulatory framework adjustment process.

This alternative would clarify reasons for prohibiting species, ease the administrative burden of addition and removal of species, and allow for more rapid and adaptive management of the species. Additions to or removals from the prohibited species list will be accomplished through a framework rulemaking process, as necessary.

2.5 BYCATCH REDUCTION MEASURES

2.5.1 Gear Restrictions

Alternative J1 Gillnet - net checks, ALWTRP, observers; Bottom longline - post guidelines (No Action)

This alternative would maintain the existing requirements on shark gillnet and bottom longline vessels. Currently, vessels participating in the shark gillnet fishery have observer, net check, and Atlantic Large Whale Take Reduction Plan (ALWTRP) requirements. Bottom longline vessels are required to post sea turtle handling and release guidelines.

Alternative J2 Existing bottom longline bycatch reduction measures (J1) plus closing the shark gillnet fishery permanently/Remove gear from list of authorized gear types

This alternative would close the shark gillnet fishery permanently and would remove gillnet gear from the list of authorized gear types. This would end the need for observer coverage in the shark gillnet fishery and eliminate the associated costs and financial burden for fishermen as well as the administrative burden for NOAA Fisheries. It would eliminate bycatch and bycatch mortality of protected resources associated with this fishery and could reduce fishing effort in the right whale critical habitat. It could also reduce bycatch of other HMS and non-HMS species.

Alternative J3 Existing bycatch reduction measures (J1) and allow only strikenet method in shark gillnet fishery

This alternative would require that vessels operating in the shark gillnet fishery set gear using the strikenet method only. The shark strikenet fishery produces little bycatch (no observed protected species interactions/the majority of catch is target species) and could allow for a reduction in current observer coverage levels in the shark gillnet fishery outside right whale calving season. Alternative J3 would allow incidental shark landings from vessels participating in other gillnet fisheries, such as the mackerel fishery, to minimize discards. This alternative was preferred in draft Amendment 1. As described in Chapter 4, NOAA Fisheries is not selecting it in the final Amendment, but will consider other options to reduce bycatch in this fishery in a future rulemaking.

Alternative J4 *Existing bycatch reduction measures (J1) plus requiring Vessel Monitoring Systems (VMS) on shark gillnet vessels during right whale calving season and requiring VMS on directed bottom longline shark fishing vessels operating near the time/area closure off North Carolina - Preferred Alternative*

This alternative would require VMS on shark gillnet vessels during right whale calving season and would require VMS on directed bottom longline shark fishing vessels operating near the time/area closure off North Carolina. This alternative is consistent with the rationale for requiring VMS on pelagic longline vessels (i.e., enforcement of time/area closures) and would show when vessels are operating in closed areas, could allow vessels to transit closed areas without special gear stowage procedures, and would allow for the collection of real-time data. Monitoring and enforcement are essential components of fisheries management. Monitoring fishing vessels facilitates enforcement of NOAA Fisheries' conservation and management regulations by enabling detection of violations. Monitoring also promotes compliance by having a general deterrent effect. Lack of proper monitoring and enforcement makes it difficult to gauge the effectiveness of conservation and management measures and could compromise their success. In the case of overfished stocks (LCS), successful monitoring and enforcement of time/area closures is necessary to prevent further overfishing and subsequent decline to

dangerously low stock levels. VMS is considered a very successful aid to enforcement in other fisheries where it is used. If used in conjunction with closed areas, alternative J4 could enhance rebuilding to maximum sustainable yield levels for LCS. VMS may also allow more finely defined closure areas. This alternative would have substantial costs for fishermen required to obtain a VMS unit, although it could reduce the need for observer coverage in the shark gillnet fishery and lessen those associated costs. This alternative may also reduce administrative burden for NOAA Fisheries, including enforcement costs. It also promotes the safety of life at sea by providing optional communication and emergency location features in some NOAA-approved VMS units.

Alternative J5 *Existing bycatch reduction measures (J1) plus requiring the use of non-stainless steel corrodible hooks, the possession of release equipment on vessels with shark bottom longline gear (line cutters, dipnets, and, when approved, dehooking devices), and that bottom longline vessels move 1 nautical mile after an interaction with a protected species - Preferred Alternative*

This alternative would require the use of non-stainless steel corrodible hooks aboard shark bottom longline fishing vessels. Corrodible hooks could reduce post release mortality of turtles, marine mammals, sharks, and finfish by reducing the amount of time a hook remains embedded in an animal. This alternative is similar to requirements in the pelagic longline fishery and would require the possession of release equipment (line cutters, dipnets, and, when approved, dehooking devices) on vessels with shark bottom longline gear to facilitate removal of entangled or hooked animals. This equipment is inexpensive, relatively simple to use, and may reduce the post release mortality of turtles, marine mammals, sharks and other fishes. This alternative is also similar to requirements in the pelagic longline fishery in that it would require all bottom longline vessels to move one nautical mile after an interaction with a protected species to reduce the probability of another interaction.

Alternative J6 Existing bycatch reduction measures (J1) plus limiting shark bottom longline gear to a maximum of 10 miles of mainline, limiting soak time to 10 hours or less, and requiring the use of non-stainless steel corrodible circle hooks

This alternative would cap the allowable length of shark bottom longline gear to 10 miles, establish a 10 hour maximum soak time, and require that all shark bottom longlines be rigged with non-stainless steel corrodible circle hooks.

Periodically, fishermen are forced to cease gear haul-back operations, leave the remainder of their longline gear and catch in the water, and return to port for offloading because they have reached the 4,000 lb trip limit or for other reasons. Capping the allowable length of each shark bottom longline gear in the water could reduce the chances of one set catching more than the 4,000 lb trip limit and could reduce the mortality of species remaining attached to the gear. The

CSFOP observed nine trips from 1994 - 2002 that reached the 4,000 lb trip limit with one set. Of those nine trips, three could only be partially retrieved due to reaching the trip limit. These sets used 12.0, 6.0, and 13.3 miles of mainline with an average of 10.4 miles. (G. Burgess, pers. comm., 2003).

This alternative would also establish a 10 hour maximum soak time. Shorter soak times could allow incidental catch and bycatch to be released sooner and with less injury. This could lead to increased survivability of protected and non-target species. In a recent analysis performed by the Virginia Institute of Marine Science, researchers found that soak time influenced hooking mortality of dusky sharks. The researchers found that hooking mortality for dusky sharks was 85 percent for soak times greater than 20 hours, 79 percent for soak times greater than 15 hours, and 57 percent for soak times less than 15 hours. Dusky sharks were found to have the lowest hooking mortality (five percent) on sets with soak times less than 10 hours (Romine *et al.*, 2001).

This alternative would also require that all shark bottom longlines be rigged with non-stainless steel corrodible circle hooks. The use or possession of straight shank ("J") hooks, or any variation of stainless steel hook, would be prohibited on shark bottom longline vessels. Circle hooks generally lodge in the corner of the mouth rather than in the throat or gut. Sharks and finfish that are not retained are more likely to be released with less injury. Protected species would also likely benefit from reduced injuries, as circle hooks are less likely to hook in the throat or gut. Circle hooks have been found to significantly reduce the rate of hook ingestion by loggerhead turtles and reduce the associated post-hooking mortality (Watson, *et al.*, 2003).

Alternative J7 Existing bycatch reduction measures (J1) plus requiring the retention of all sharks caught in commercial shark fisheries; no discards allowed

This alternative would require all sharks caught in commercial shark fisheries to be retained and landed. It could virtually eliminate the bycatch of sharks in the commercial shark fishery. This alternative could reduce the fishing effort needed to reach trip limits and fill quotas, thus reducing potential interactions with protected species. It would also negate the need for prohibited species (Alternatives I1 through I6)).

Alternative J8 Existing bycatch reduction measures (J1) plus requiring commercial and recreational fishermen to attend workshops on present regulations, species identification, and release techniques

This alternative would require both commercial and recreational fishermen to attend workshops discussing regulations, identification of shark (and possibly other) species, as well as marine mammal, sawfish, and sea turtle release techniques. By attending workshops, fishermen could gain a better understanding of current regulations and the intent behind them, and be able to comply with regulations more easily if they possessed better information on shark species identification. Discussions and demonstrations of release techniques for protected species could help to reduce bycatch mortality.

Alternative J9 Existing bycatch reduction measures (J1) and close all LCS fisheries when the quota for either LCS subgroup is reached

This alternative would close all LCS fisheries when the quota for either the ridgeback or non-ridgeback shark subgroups is filled, if subgroups are established. This alternative is easier to enforce than separate closures, and may provide increased protection for species in the subgroup for which the quota has been reached. It could decrease regulatory discards, reduce mortality of LCS, decrease protected resource interactions, and decrease mortality of non-target species. This alternative is further analyzed under alternative A2 and is not discussed further.

2.5.2 Time/Area Closures

Alternative K1 No time/area closures (No Action)

This alternative would not implement any time/area closures. This is the no action alternative that the fishery has been operating under since the 1993 FMP. Currently, there are no time or area closures (other than directed LCS closures related to quotas) specific to the commercial or recreational harvest of Atlantic sharks. This action maintains the current management structure and does not close any particular areas or times to directed or incidental shark fisheries. This action allows directed and incidental fisheries to continue to retain Atlantic sharks within the bounds of implemented regulations (species management groups, commercial quotas and retention limits, recreational retention limits, prohibited species, fishing seasons).

Bycatch issues would be addressed through other means such as quotas, trip limits, gear restrictions, and length of seasons. Additionally, although several coastal bays and estuaries have been identified as important pupping and nursery areas for sandbar and dusky sharks (notably Delaware Bay, DE, Chesapeake Bay, MD, Great Bay, NJ), these areas are primarily within state waters and outside of NOAA Fisheries' jurisdiction. Under this alternative, NOAA Fisheries would continue to work with Atlantic and Gulf of Mexico states and Regional Fishery Management Councils and Commissions to develop consistent state and Federal shark regulations.

Alternative K2 *Time/area closure for sandbar and dusky shark nursery and pupping areas off of North Carolina during the winter fishery - Preferred Alternative*

This alternative will implement a time/area closure for sandbar and dusky shark nursery and pupping areas encompassing EFH and HAPC areas identified off of North Carolina from January through July. Alternative K2 would close an area from Oregon Inlet, North Carolina at 35°41' North, offshore to 74°51' West, then following the 60 fathom contour to 35°30' North and 74°46' W, and continuing along the 60 fathom contour south to 33°51' North and 76°24' West to all directed shark bottom longline fishing from January through July. The closure encompasses approximately 4,490 nm^2 (Figure 2.2). The area has been revised from the original area proposed

in the draft Amendment. A detailed analysis of the revised time/area closure and associated impacts is provided in Chapter 4.6.2.

The area will be closed to all vessels issued a directed shark limited access permit that have bottom longline gear on board. This area has been identified as an important nursery and pupping ground for sandbar and dusky sharks and closing this area to bottom longline fishing would reduce the bycatch of neonates and juveniles which are known to be concentrated in this area. Closing this area is also consistent with the 2002 LCS stock assessment which identified dusky sharks as highly susceptible to overexploitation due to low population growth rates, and recommended a reduction in fishing mortality, particularly for prohibited species. Dusky shark populations are considered especially susceptible to mortality of the juvenile stages.

Dusky sharks are one of the slowest growing sharks found in inshore waters to the outer reaches of the continental shelf and are often caught on bottom longlines, making them highly vulnerable to overfishing. Female dusky sharks reach sexual maturity at about 17 years and 300 cm. Data indicate that a higher percentage of dusky sharks are being taken in North Carolina waters from January through July than in any other area of the Atlantic or Gulf of Mexico. The size of catches ranges from neonate (<110 cm) to juvenile (110-299 cm) to adult (>300 cm) stages. Of the dusky sharks observed caught in the North Carolina winter fishery, 26 percent were discarded or released as bycatch. Despite being on the prohibited species list, many are being observed landed.

Shark bottom longline observer data also show high rates of neonate and juvenile sandbar sharks less than 137 cm fork length (FL) being caught in from January through July off of North Carolina. The 137 cm FL corresponds to the recreational minimum size limit for sharks which is 4.5 feet FL. It also corresponds to the female smallest size at maturity. For instance, one data series for the winter fishery off North Carolina in 2001 shows approximately 83 percent of 1188 sandbar sharks observed caught were less than 137 cm, with an average length of approximately 120 cm. Sandbar shark pups are born from March to early August and measure about 60 cm at birth. Sandbar neonates size range is < 71 cm and juveniles range from 71-147 cm total length (TL).

Alternative K3 Time/area closure for all shark nursery and pupping areas during pupping season based on EFH identifications for neonate and juvenile sharks

This alternative would implement a time/area closure for all shark nursery and pupping areas based on EFH identified areas for neonate and juvenile sharks. The presence of important pupping and nursery areas in many coastal bays and estuaries is the basis for this alternative. Nursery and pupping areas are located from Cape Canaveral, FL, to Great Bay, NJ, on the East coast, and from Tampa Bay, FL, to Brownsville, TX, on the Gulf coast. Although many of the important nursery and pupping areas are in state waters and outside of NOAA Fisheries' jurisdiction, there are some areas that are within NOAA Fisheries' jurisdiction. The LCS complex as a whole is overfished and overfishing is occurring, and this alternative would reduce

the bycatch of neonate and juvenile sharks, would help address overfishing, and would maximize protection of these critical early life stages. Fishing would continue in non-EFH identified areas.

The LCS stock assessment noted that juvenile survival is the vital rate that most affects overall population growth rates, thus lending support to protection of early life stages.

Other time/area closure alternatives considered but not further analyzed at this time.

Alternative K4 Time/area closure for finetooth shark pupping and nursery areas in EFH identified off St. Andrews Bay, Florida

This alternative would implement a time/area closure for finetooth shark pupping and nursery areas identified as EFH in the 1999 HMS FMP and where tagging and research studies continue to show large numbers of neonate and juvenile finetooth sharks. According to the 2002 SCS stock assessment, finetooth sharks are experiencing overfishing, and under the Magnuson-Stevens Act, NOAA Fisheries needs to act to prevent overfishing. A time/area closure could accomplish this goal. However, of the areas identified as EFH for juvenile and subadult sharks, all are in nearshore waters and coastal bays and estuaries, and accordingly, are outside of NOAA Fisheries' jurisdiction. Additionally, all observed takes of finetooth sharks are in state waters. NOAA Fisheries intends to continue working with Atlantic and Gulf of Mexico states, the Regional Fishery Management Councils, and the Atlantic States Marine Fisheries Commission to implement shark harvest regulations that will meet conservation objectives. Therefore, this alternative was considered but not further analyzed at this time.

Alternative K5 Time/area closure to protect smalltooth sawfish critical habitat

The smalltooth sawfish was recently listed as an endangered species (68 FR 15674, April 1, 2003). However, NOAA Fisheries determined that the designation of critical habitat for the sawfish is not determinable at this time. Without information about critical habitat, NOAA Fisheries does not have sufficient information to identify an appropriate time/area closure. Once a recovery plan is developed and critical habitat identified, NOAA Fisheries will reconsider a closure to protect sawfish habitat. This alternative was considered but not further analyzed at this time.

2.6 ESSENTIAL FISH HABITAT

Alternative L1 Maintain current EFH identified areas (No Action)

This alternative would maintain current EFH identified areas. This is the no action alternative that the fishery has been operating under since the 1999 HMS FMP, which identified shark EFH areas. This alternative would be employed if there were no new information available with which to update EFH identified in the 1999 HMS FMP.

Alternative L2 Identify EFH for the fishery management unit (FMU) based on the entire geographic range of the species

This alternative would identify EFH based on the entire geographic range of the species, resulting in the widest possible extent of EFH. This alternative would implement the most precautionary approach to identifying EFH. All areas where a species is known to be present would be identified as EFH. This alternative is based on the premise that the most cautious approach possible should be taken in identifying EFH areas.

Alternative L3 Existing EFH and, as appropriate, identify EFH for the FMU for each species and life stages as those habitats necessary for spawning, breeding, feeding, or growth to maturity

This alternative would identify EFH for each species and life stage as those habitats necessary for spawning, feeding, breeding, or growth to maturity, based on new information available since the 1999 HMS FMP. If no new information is available, then the existing EFH identifications would be maintained. This alternative would include 100 percent of the observed distribution, as opposed to alternative L2 which represents 100 percent of the entire geographic range, and would thus represent an area reduced in size from alternative L2. The basis for this alternative is to evaluate each species and life stage individually to ultimately comprise the EFH identification for the fishery. This alternative would identify a subset of the entire geographic range of the species which encompasses those habitats considered most important to spawning, breeding, feeding and growth to maturity. This would result in a higher degree of confidence that the area is EFH and does not include marginal habitat. From a management perspective, a narrowing of EFH as described above, could result in a higher level of protection and a greater ability to enhance and conserve EFH.

Alternative L4 *Existing EFH and, as appropriate, increase or decrease the EFH areas identified for individual species in the FMU based on special needs - Preferred Alternative*

This alternative would increase or decrease the geographic scope of EFH as new information becomes available for each species in the FMU based on the specific needs of the species. This alternative would begin with 100 percent of the observed distribution in alternative L3 above and expand or reduce the area based on the status of the stock. If new information is not available, the existing EFH areas would be maintained. The basis for this alternative is to provide flexibility to increase or decrease the extent of EFH based on the status of the stock. Since overfished resources are considered to be at greater risk, the percentage of habitat identified as EFH for overfished species would be greater than that of fully fished or not overfished species. For species that are not overfished the EFH area may be refined or narrowed to those areas considered essential and not beyond.

This alternative could lead to identification of EFH based on a percent of the observed distribution. For example, for overfished species, 90 percent of the observed range of distribution could be identified as EFH, whereas 75 percent of the range of distribution might be identified as EFH for species that are not overfished. Assigning percentages to a given species' distribution provides a more objective approach to identifying EFH based on the status or health of the stock. The EFH regulations at 50 CFR 600.815 (a)(1)(iv)(C) specify that "If a species is overfished and habitat loss or degradation may be contributing to the species being identified as overfished, all habitats currently used by the species may be considered essential..." Thus, habitat loss would have to be evaluated before all of the species' habitat could be identified as EFH. This alternative differs from the other alternatives by allowing for an expanded range of EFH to be re-evaluated for refinement once the species is not considered overfished.

2.7 EXEMPTED FISHING PERMIT (EFP) ADMINISTRATION

The following alternatives define governance systems under which EFPs could be issued and administered.

Alternative M1 Maintain combined permitting system for scientific research, exempted fishing, and public display - (No Action)

This alternative would maintain a combined permitting system for shark scientific research, educational/public display, and exempted fishing permits. NOAA Fisheries would monitor and track all sources of mortality by counting "takes" against the 60 mt ww shark quota and would continue to authorize takes for public display with exempted fishing permits. This alternative has been in place since 1999.

Alternative M2 *Develop separate display permitting system for HMS, apart from research or exempted fishing permits - Preferred Alternative*

This alternative will require creation and implementation of a separate display permitting system, which would operate apart from exempted fishing activities focusing on scientific research. This alternative is an administrative change that will allow managers to separate "for profit activities" or public displays for educational purposes from that of scientific research. Under this alternative, HMS taken for public display, research, or exempted fishing purposes will continue to be applied against the 60 mt ww shark quota or other appropriate quota and applicants would continue to apply under the existing system. NOAA Fisheries will continue to work with the states to account for collections in state waters.

Other EFP alternatives considered but not further analyzed at this time

Due to the need for additional public comment, NOAA Fisheries has decided to postpone action on the following alternatives until a future HMS FMP amendment (68 FR 40907, July 9, 2003). Given that these issues will be considered further in a forthcoming plan amendment, comments are requested on the following possible alternative options.

1. Exempted Fishing Permit (EFP) Application Requirements

The following alternative options outline possible application requirements that applicants would have to meet before an EFP will be issued. These alternatives, which are not mutually exclusive, would apply to all HMS including Atlantic tuna, swordfish, billfish, and shark.

Alternative N1	Applications must contain information specified in 50 CFR Part 635.32 and 50 CFR Part 600.745 (No Action)
Alternative N2	Require mandatory background checks on vessels listed in application and authorize NOAA Fisheries with right to deny permit on basis of previous fisheries violation
Alternative N3	Require mandatory permit application form

2. Exempted Fishing Permit (EFP) Quota Basis

The following alternative options would define the basis for EFP quotas specifications for all HMS. The specification outlined herein depends to a large extent upon the species selected for research/display, stock status of that species, and, where appropriate, ICCAT quota recommendations for research activities. These alternatives would apply to all HMS including Atlantic tuna, swordfish, billfish, and shark.

Alternative O1	Shark quota = 60 mt; No EFP quota for Tuna, swordfish and billfish quotas because EFPs are issued consistent with ICCAT quota recommendations - (No Action)
Alternative O2	Shark display quota based upon average number of fish authorized[2] over the past three years; Tuna, swordfish and billfish quotas based upon ICCAT quota recommendations (numbers of fish or pounds, as appropriate) or average number of fish authorized over the past three years, which ever is less
Alternative O3	Shark display quota based upon average number of fish requested[3] over the past three years; Tuna, swordfish and billfish quotas based upon ICCAT quota recommendations (numbers of fish or pounds, as appropriate) or average number of fish requested over the past three years, which ever is less

[2]Authorized by NOAA Fisheries via EFPs

[3]Requested by the applicant in previous EFP applications.

Alternative O4	Shark display quota based upon average number of fish authorized during 2002 (most recent calendar year); Tuna, swordfish and billfish quotas based upon ICCAT quota recommendations (numbers of fish or pounds, as appropriate) or average number of fish authorized over the past three years, which ever is less
Alternative O5	Shark display quota based upon average number of fish requested during 2002 (most recent calendar year); Tuna, swordfish and billfish quotas based upon ICCAT quota recommendations (numbers of fish or pounds, as appropriate) or average number of fish authorized over the past three years, which ever is less

Table 2.1 Commercial Landings (lb dw) of SCS by Region and Year. Source: Cortes pers. comm., 2003.

	Landings (lb dw)							
	Gulf of Mexico[4]		South Atlantic[5]		North Atlantic[6]		Totals	
	Canvass[7]	QMS[8]	Canvass	QMS	Canvass	QMS	Canvas	QMS
1999	36,300	62,353	1,080,213	589,948		74,149	1,116,513	726,450
2000	35,605	49,221	1,038,847	392,554		115,147	1,074,452	556,922
2001	26,865	2,626	1,328,419	483,221		210,219	1,355,284	696,066
Total	98,770	114,200	3,447,479	1,465,723	0	399,515	3,546,249	1,979,438
Average	32,923	38,067	1,149,160	488,574	0	133,172	1,182,083	659,813
Total Combined	212,970		4,913,202		399,515		5,525,687	
Average Combined	35,495		818,867		133,172		987,534	
% (Based on Average Combined Landings)	4		83		13		100	

[4]Gulf of Mexico includes landings from Florida West coast, Louisiana, and Texas.

[5]South Atlantic includes landings from Florida East coast, Georgia, South Carolina, and North Carolina. South Atlantic also contains landings for the Caribbean including Puerto Rico and the Virgin Islands.

[6]North Atlantic includes landings from Virginia, Delaware, Maryland, New Jersey, New York, Rhode Island, Massachusetts, and New Hampshire.

[7]Canvass is a data collection system where states report landings directly to NOAA Fisheries. Dressed weights were obtained from round weights using conversion factors (1.39 for all states).

[8]Quota Monitoring System (QMS) allows dealers to report landings directly to NOAA Fisheries.

Table 2.2 Commercial Landings (lb dw) of LCS by Region and Year. Source: Cortes pers. comm., 2003.

	Landings (lb dw)							
	Gulf of Mexico[9]		South Atlantic[10]		North Atlantic[11]		Totals	
	Canvass[12]	QMS[13]	Canvass	QMS	Canvass	QMS	Canvas	QMS
1999	1,592,299	1,515,989	987,793	4,054,605	123,324	29,338	2,703,416	5,599,932
2000	1,062,680	1,338,762	956,331	1,658,124	238,425	65,904	2,257,436	3,062,790
2001	1,354,003	727,278	885,533	1,378,304	75,147	176,365	2,314,683	2,281,947
Total	4,008,982	3,582,029	2,829,657	7,091,033	436,896	271,607	7,275,535	10,944,669
Average	1,336,327	1,194,010	943,219	2,363,678	145,632	90,536	2,425,178	3,648,223
Total Combined	7,591,011		9,920,690		708,503		18,220,204	
Average Combined	1,265,169		1,653,448		118,084		3,036,701	
% (Based on Average Combined Landings)	42		54		4		100	

[9]Gulf of Mexico includes landings from Florida West coast, Louisiana, and Texas.

[10]South Atlantic includes landings from Florida East coast, Georgia, South Carolina, and North Carolina. South Atlantic also contains landings for the Caribbean including Puerto Rico and the Virgin Islands.

[11]North Atlantic includes landings from Virginia, Delaware, Maryland, New Jersey, New York, Rhode Island, Massachusetts, and New Hampshire.

[12]Canvass is a data collection system where states report landings directly to NOAA Fisheries. Dressed weights were obtained from round weights using conversion factors (2 for NC and 1.39 for other states).

[13]Quota Monitoring System (QMS) allows dealers to report landings directly to NOAA Fisheries.

Table 2.3 Process for Calculating Quota [14] Alternatives

Alternative		A3 (*Preferred* - LCS Classification)	A1 (*No Action)* & A2 (Separate LCS groupings)	A4 (Species-specific LCS Classification)
		Complex	Grouping	Species Specific
- 1999 HMS FMP)	LCS	NA	‣ LCS Ridgebacks = HMS FMP = **620 mt dw** ‣ LCS Non-ridgebacks = HMS FMP = **196 mt dw**	NA
	SCS		‣ SCS = HMS FMP = **359 mt dw**	
	Pelagic		‣ Pelagic sharks = HMS FMP = (**92 mt dw Porbeagle; 273 mt dw blue; 488 mt dw other pelagic sharks**)	
C1				
- MSY)	LSC	‣ LCS = 344,000 (Table 2.8) *0.33 (% of total catch; Table 2.5) *0.55 (LCS stock assessment, peer reviews, observer data, CPUE) = 62,436 fish * 35.9 lbs (2001 average weight; Cortes and Neer, 2002) = 2,241,452.4 lbs/2,204.6 = **1,017 mt dw**	‣ LCS Ridgebacks = (See Complex) = **1,017 mt dw** ‣ LCS Nonridgebacks = 1,017 * 0.5 (stock assessment, peer reviews, observer data, CPUE) = **509 mt dw**	‣ Sandbar = 133,000 (Table 2.8) * 0.75 (HMS FMP Optimum Yield) = 99,750 fish * 0.61 = 60,847.5 fish * 35.9 lbs (2001 average weight; Cortes and Neer, 2002)= 2,184,425.25 lbs/2,204.6 = **991 mt dw** ‣ Blacktip = 389,000 (Table 2.8) * 0.75 (HMS FMP Optimum Yield) = 291,750 fish * 0.31 (% of total catch; Table 2.5)= 90,442.5 fish * 35.9 lbs (2001 average weight; Cortes and Neer, 2002) = 324,6885.75 lbs/2,204.6 = **1,473 mt dw** ‣ Other LCS= 344,000 (Table 2.8) *0.093 (non-sandbar and non-blacktip % of commercial; Table 2.5) = 31,992 fish *0.33 (% total catch; Table 2.5) = 10,557.36 fish *0.55 (LCS stock assessment, peer reviews, observer data, CPUE) = 5,806.548 fish * 35.9 lbs (2001 average weight; Cortes and Neer, 2002) = 208,455.0732 lbs/2,204.6 = **95 mt dw**
	SCS	‣ SCS = 2,087 (Table 2.8) * 0.75 (HMS FMP Optimum Yield) = 1,565.25 mt dw * 0.29 % commercial (Table 2.6) = **454 mt dw**		
	Pelagic	‣ Pelagic Porbeagle = **92 mt dw** ‣ Pelagic Blue = **273 mt dw** ‣ Pelagic Other = **488 mt dw**		

[14] Quotas listed in Table 2.3 do not account for over and/or under-harvests of quota in the previous year.

Table 2.3 Process for Calculating Quota Alternatives (continued)

Alternative		A3 (*Preferred* - LCS Classification)	A1 (*No Action)* & A2 (Separate LCS groupings)	A4 (Species-specific LCS Classification)
		Complex	Grouping	Species Specific
C3 (Average Landings)	LCS	‣ LCS = 1,692.7 (Table 2.4) * 0.55 (LCS stock assessment, peer reviews, observer data, CPUE) = **931 mt dw**	‣ LCS Ridgebacks = 634.5 (Table 2.4) + [276.6 * 0.5] (Table 2.4; LCS stock assessment) = 772.8 + 21 (addition of other ridgeback species 3 year average; Table 2.4) = **794 mt dw** ‣ LCS Nonridgebacks = 616.6 + 123.3(Table 2.4; LCS stock assessment) = 739.9 + 138.3 = 878.2 +27.7 (20% addition of unclassified sharks; Table 2.4) = 905.9 + 25 (50% subtraction of other nonridgeback species 3 year average; Table 2.4) = **931 mt dw**	‣ Sandbar = (Sandbar average) = **635 mt dw** ‣ Blacktip = 616.6 (Table 2.4) *0.2 = 123.32 + 616.6 (Table 2.4) = **740 mt dw** ‣ Other LCS = 1,692.7 - (634.5+ 616.6) (Table 2.4) = 441.6 *0.5 (LCS stock assessment) = **221 mt dw**
	SCS	‣ SCS = **300 mt dw** (Table 2.7)		
	Pelagic Sharks	‣ Pelagic Porbeagle = **92 mt dw** (HMS FMP) ‣ Pelagic Blue = **273 mt dw** (HMS FMP) ‣ Pelagic Other = **488 mt dw** (HMS FMP)		

Table 2.4 **Commercial Landings (mt dw) of LCS from 1999 Through 2001.** Source: NOAA Fisheries, 2003; Cortes and Neer, 2002.

Year	Sandbar	Blacktip and Spinner	Unclassified	Ridgeback LCS (includes unclassified)	Non-ridgeback LCS (includes unclassified)	Total LCS
1999	589.7	584.1	443.8	829.2	852.9	1,778.0
2000	676.7	747.7	49.3	727.0	820.3	1,684.0
2001	637.0	518.1	336.6	824.0	741.4	1,616.0
Total	1,903.4	1,849.8	829.7	2,380.2	2,414.6	5,078.0
3 year average	634.5	616.6	276.6	793.4	804.9	1,692.7

Table 2.5 **Catch History of LCS, Sandbar, and Blacktip (Baseline Scenario).** Source: Cortes *et al.*, 2002. LCS averages (numbers of fish in thousands) were obtained from Table 4 in the LCS 2002 stock assessment. Sandbar averages (numbers of fish) were obtained from Table 5 in the LCS 2002 stock assessment. Blacktip averages (numbers of fish) were obtained from Table 6 in the LCS 2002 stock assessment.

	LCS		Sandbar		Blacktip		Non-Sandbar/Blacktip	
	Avg (1999-2001)	*% of Total*	*Avg (1999-2001)*	*% of Total*	*Avg (1999-2001)*	*% of Total*	*Avg (1999-2001)*	*% of Total*
Commercial (Landings)	107.3	33%	47,082	61%	50,215	31%	10,003	12%
Recreational (Catch)	124.5	38%	22,392	29%	52,622	33%	49,486	57%
Bycatch	93.1	29%	7,824	10%	58,065	36%	27,211	31%
Total	324.9	100%	77,298	100%	160,902	100%	86,700	100%

Table 2.6 **Catch History of SCS, Atlantic Sharpnose, Blacknose, Bonnethead, and Finetooth Sharks.** Source: SCS commercial and recreational averages (lb dw) were obtained from Table 1 in the SCS 2002 stock assessment (Cortes, 2002). Commercial and recreational averages (lb dw) for Atlantic sharpnose, blacknose, bonnethead, and finetooth were obtained from Table 2 in the SCS 2002 stock assessment (Cortes, 2002). Bycatch estimates for SCS (lb dw) in the Gulf of Mexico shrimp trawl fishery are derived from Table 12 in the SCS stock assessment (Cortes, 2002).

	SCS		Atlantic Sharpnose		Blacknose		Bonnethead		Finetooth	
	Avg (1999-2000)	*% of Total*	*Avg (1999-2000)*	*% of Total*	*Avg (1999-2000)*	*% of Total*	*Avg (1999-2000)*	*% of Total*	*Avg (1999-2000)*	*% of Total*
Commercial (Landings)	652,000	29%	186,912	15%	157,007	94%	63,704	19%	237,764	99%
Recreational (Catch)	358,000	16%	205,667	17%	9,836	6%	80,023	23%	2,337	1%
Bycatch	1,256,622	55%	848,771	68%	-		198,414	58%	-	
Total	2,266,622	100%	1,241,349	100%	166,843	100%	342,141	100%	240,100	100%

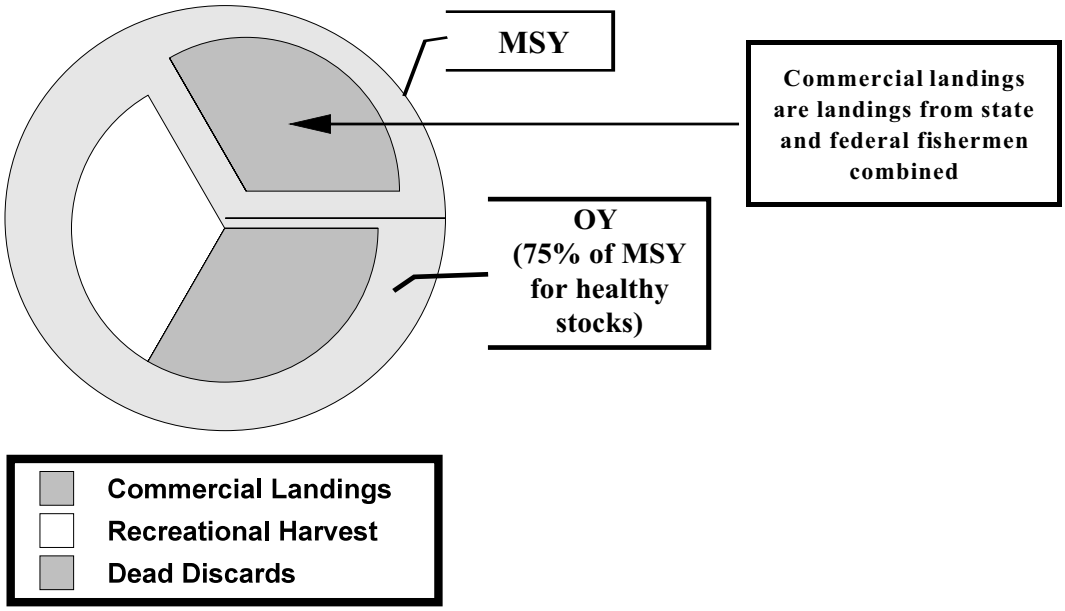
Table 2.7 **Commercial Landings (mt dw) of SCS from 1999 Through 2001.** Source: NOAA Fisheries, 2003; Cortes and Neer, 2002.

Year	Atlantic sharpnose	Blacknose	Bonnethead	Finetooth	Total SCS
1999	108.7	59.1	24.4	111.8	305
2000	64.6	80.8	31.5	91.9	269
2001	88.6	73.0	28.6	136.0	326
Total	261.9	212.9	84.4	339.6	900
3 year average	87.3	71.0	28.1	113.2	300

Table 2.8 Average[15] MSY and MSC for SCS and LCS (respectively). Source: Cortes *et al.*, 2002 and Cortes, 2002.

	Average Maximum Sustainable Yield (MSY, mt dw)	Average Maximum Sustainable Catch (MSC, thousands of fish)
LCS Complex	N/A	344
Sandbar Sharks	N/A	133[16]
Blacktip	N/A	389[17]
SCS Complex	2,087	N/A
Sharpnose	2,200	N/A
Bonnethead	522	N/A
Blacknose	227	N/A
Finetooth	71	N/A

Figure 2.1 Diagram Illustrating Alternative C2.

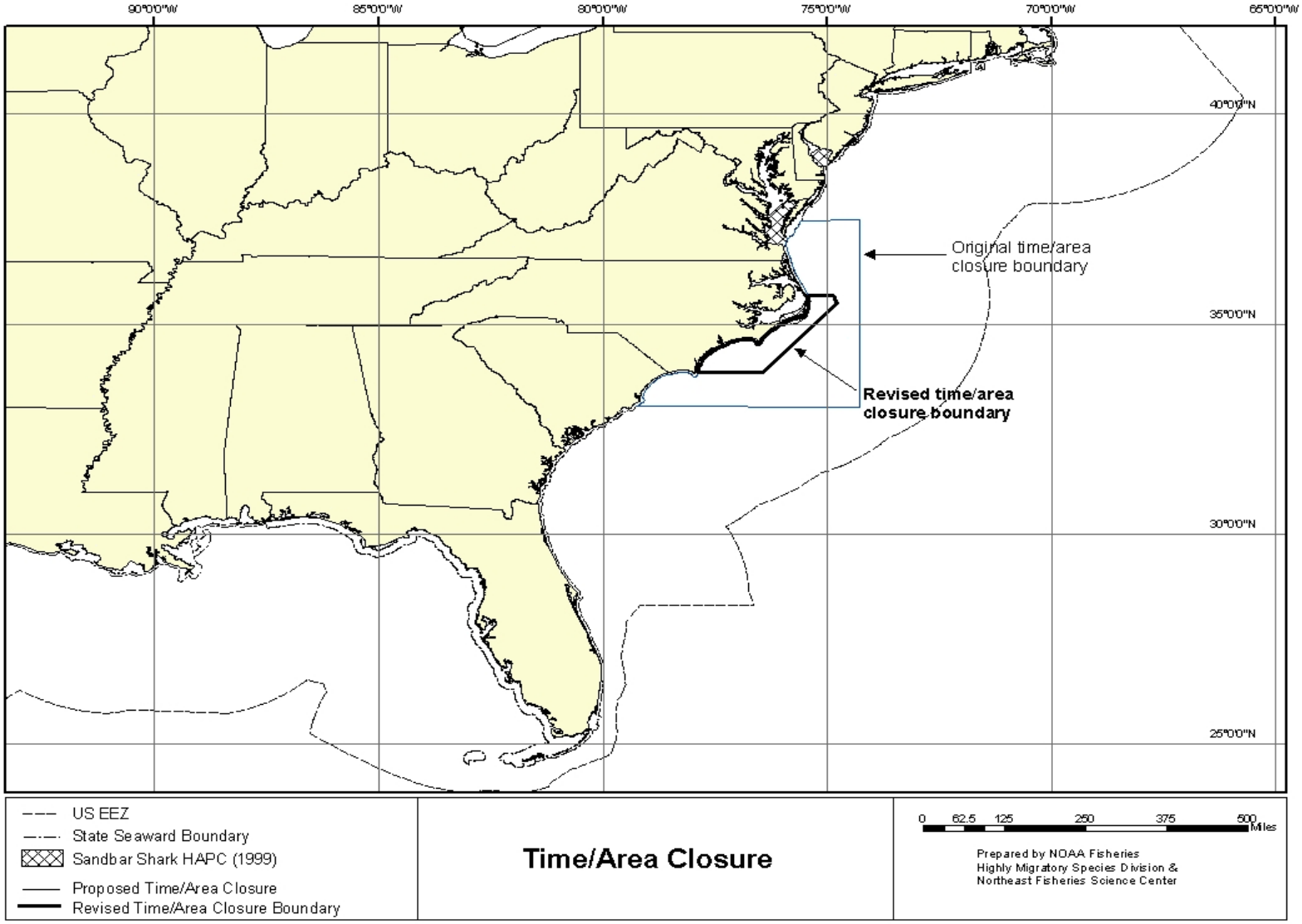


[15]Averages are across all model outputs unless noted otherwise.

[16]Sandbar average MSC is across all surplus production model outputs only.

[17]Blacktip average MSC is across all surplus production model outputs only.

Figure 2.2 Time/Area closure off North Carolina showing the original and revised boundaries.



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3.0 DESCRIPTION OF AFFECTED ENVIRONMENT

3.1 INTRODUCTION

Sharks belong to the class Chondrichthyes (cartilaginous fishes) that also includes rays, skates, and deepwater chimaeras (ratfishes). From an evolutionary perspective, sharks are an old group of fishes characterized by skeletons lacking true bones. The earliest known sharks have been identified from fossils in the rocks of the Devonian period, over 400 million years ago. These primitive sharks were small creatures, about 60 to 100 cm long, that were preyed upon by larger armored fishes that dominated the seas. Sharks have survived competition for eons, evolving into the large and aggressive predators that dominate the seas today. The life span of sharks in the wild is not known, but it is believed that many species may live 30 to 40 years or longer.

Since sharks have evolved primarily as apex predators, they are not equipped to withstand predation themselves - especially in the form of intense exploitation. Relative to other marine fish, sharks have a very low reproductive potential. Several important commercial species, including large coastal carcharhinids such as sandbar (Casey *et al*., 1985; Sminkey and Musick, 1995; Heist *et al*., 1995), lemon (Brown and Gruber, 1988), and bull sharks (Branstetter and Stiles, 1987), do not reach maturity until 12 to 18 years of age. Various factors determine this low reproductive rate: slow growth, late sexual maturity, one- to two-year reproductive cycles, a small number of young per brood, and specific requirements for nursery areas. These biological factors leave many species of sharks vulnerable to overfishing.

There is extreme diversity among the 350 species of sharks, ranging from tiny pygmy sharks of only 20 cm in length to the giant whale sharks, over 12 meters in length. There are fast-moving, streamlined species such as mako and thresher sharks, and sharks with flattened, ray-like bodies, such as angel sharks. The most commonly known sharks are large apex predators including the white, mako, tiger, bull, and great hammerhead. Some shark species reproduce by laying eggs, others nourish their embryos through a placenta. Despite their diversity in size, feeding habits, behavior and reproduction, many of these adaptations have contributed greatly to the evolutionary success of sharks.

Sharks are generally aggressive predators feeding near the top of the food web. They have extremely sensitive smell receptors, eyes that can adapt to dim light, lateral line receptors that sense movement in the water, and electroreceptors that can detect prey buried in the sand even in the absence of scent or visual clues. In addition to their finely-tuned senses, sharks are armed with a formidable set of teeth and jaws. The teeth are replaced often, so sharks always have a sharp set capable of inflicting a clean bite. The tiger shark eats large turtles, and the tiny cookiecutter shark feeds by carving plugs of flesh out of large fishes and whales. Only basking sharks, whale sharks, and megamouth sharks feed by filtering small organisms from the water.

The most significant reproductive adaptations of sharks are internal fertilization and the production of fully developed young or “pups.” These pups are large at birth, effectively

reducing the number of potential predators and enhancing their chances of survival. During mating, the male shark inseminates the female with copulatory organs, known as claspers, that develop on the pelvic fins. In most species, the embryos spend their entire developmental period protected within their mother's body, although some species lay eggs. The number of young produced by most shark species in each litter is small, usually ranging from two to 25, although large females of some species can produce litters of 100 or more pups. The production of fully-developed pups requires great amounts of nutrients to nourish the developing embryo. Traditionally, these adaptations have been grouped into three modes of reproduction: oviparity, ovoviviparity, and viviparity.

Oviparity is the most primitive condition, although it is still different from the reproductive strategy of bony fishes. Oviparous sharks lay large eggs that contain sufficient yolk to nourish the embryo and allow it to emerge fully developed. These eggs are enclosed in leathery cases that are deposited on the sea bottom, usually attached to plants or rocks. There is no parental care or brooding in sharks. The only protection for the embryo is its tough leathery case, composed of protein fibers. The development of these eggs is temperature-dependent and hatching usually occurs in a few months to a year. The pups of oviparous sharks are somewhat small because their growth is limited by the amount of nutrients stored in the egg. The embryos of the oviparous whale shark, the largest living fish, measure only 36 cm. Oviparity is found in four families of sharks: bullhead sharks (*Heterodontidae*), cat sharks (*Scyliorhinidae*), whale sharks (*Rhincodontidae*), and some species of nurse sharks (*Ginglymostomatidae)*.

Ovoviviparity, also known as aplacental viviparity, is the most common mode of reproduction in sharks. The eggs of ovoviviparous sharks hatch in the uterus before the embryos are fully developed. The embryos continue to grow in the uterus, nourished by the yolk sac, without forming a placental connection with the mother. The size of the litter is highly variable, depending on the reproductive strategy of the species. In some ovoviviparous sharks, such as the sand tiger, the yolk is absorbed very early in development. Thereafter, the embryos nourish themselves by swallowing unfertilized eggs and smaller embryos in the uterus, in a form of embryonic cannibalism called oophagy. Having eaten its smaller siblings, usually only one embryo survives in each of the two uteri. Ovoviviparous sharks include cow, frill, sand tiger, goblin, mackerel, basking, thresher, false cat sharks, saw, angel, squaloid, some nurse sharks, some smooth dogfishes, and some cat sharks.

Viviparity, or placental viviparity, is the most advanced mode of reproduction. The embryos of viviparous sharks are initially dependent on stored yolk but are later nourished by the mother through a placental connection. Once connected to the blood supply of the mother, the embryo has an abundant and continuous supply of nutrients. The embryo can thus be nurtured to a relatively large size at birth. Most placental sharks produce broods of two to a dozen, with a few exceptional pelagic species producing 20 to 40 young. Smooth dogfishes, requiem sharks, and hammerheads are all viviparous sharks.

In spite of the diversity of adaptations, sharks generally have a low reproductive potential. Most species of sharks have gestation periods and ovarian cycles that each last about a year. These two cycles may or may not run concurrently. In most of the larger carcharhinid sharks, the cycles follow sequentially. Most of these species reproduce only once every two years. In other species, such as hammerheads and sharpnose sharks, the ovarian cycle and the gestation periods run concurrently. Females carry developing embryos and developing eggs at the same time; these species reproduce yearly. Other species have even longer gestation periods. The spiny dogfish has a gestation period of about 24 months, the longest known of any living vertebrate.

Adults usually congregate in specific areas to mate and females travel to specific nursery areas to pup. These nurseries are discrete geographic areas, usually in waters shallower than those inhabited by the adults. Frequently the nursery areas are in highly productive coastal or estuarine waters where abundant small fishes and crustaceans provide food for the growing pups. These areas also may have fewer large predators, thus enhancing the chances of survival of the young sharks. In temperate zones, the young leave the nursery with the onset of winter; in tropical areas, young sharks may stay in the nursery area for a few years.

Shark habitat can be described in four broad categories: (1) coastal, (2) pelagic, (3) coastal-pelagic, and (4) deep-dwelling. Coastal species inhabit estuaries, the nearshore and waters of the continental shelves, e.g., blacktip, finetooth, bull, lemon, and sharpnose sharks (which are thought to enter wetland tidal creeks). Pelagic species, on the other hand, range widely in the upper zones of the oceans, often traveling over entire ocean basins. Examples include mako, blue, and oceanic whitetip sharks. Coastal-pelagic species are intermediate in that they occur both inshore and beyond the continental shelves, but have not demonstrated mid-ocean or transoceanic movements. Sandbar, scalloped hammerhead, and dusky sharks are examples of coastal-pelagic species. Deep-dwelling species, e.g., most cat sharks and gulper sharks, inhabit the dark, cold waters of the continental slopes and deeper waters of the ocean basins. For additional information on the life history and habitat of each shark species in the management unit, see Chapters 5 and 6 of the HMS FMP and Chapter 10 of this document.

Seventy-three species of sharks are known to inhabit the waters along the U.S. Atlantic coast, including the Gulf of Mexico and the waters around Puerto Rico and the U.S. Virgin Islands. Seventy-two species are managed under this FMP; spiny dogfish also occur along the U.S. coast, however management for this species is under the authority of the Atlantic States Marine Fisheries Commission as well as the New England and Mid-Atlantic Fishery Management Councils. Based on a combination of ecology and fishery dynamics the sharks in the management unit have been divided into five species groups for management: (1) large coastal species, (2) small coastal species, (3) pelagic species, (4) prohibited species, and (5) deepwater/other species (See Table 3.1 for a classification of species in the management unit). This Amendment to the HMS FMP is proposing to remove deepwater/other species from the management unit.

3.2 STATUS OF THE STOCKS

The methods used to determine the status of HMS are fully described in Chapter 3 of the HMS FMP and in a paper describing the technical guidance for implementing National Standard 1 of the Magnuson-Stevens Act (Restrepo *et al.*, 1998). In summary, a species is considered overfished when the current biomass (B) is less than the minimum stock size threshold. The minimum stock size threshold is determined based on the natural mortality of the stock and the biomass at Maximum Sustainable Yield (B_{MSY}). The MSY is the maximum long-term average yield that can be produced by a stock on a continuing basis. Overfishing is occurring on a species if the current fishing mortality (F) is greater than the fishing mortality at MSY (F_{MSY}). When one or both of these measures occur, a species is declared overfished and action to rebuild the stock and/or prevent overfishing is needed within one year. A species is considered rebuilt when B is greater than B_{MSY} and F is less than F_{MSY}. A species is considered healthy when B is greater than or equal to the biomass at optimum yield (B_{OY}) and F is less than or equal to the fishing mortality at optimum yield (F_{OY}).

3.2.1 Large Coastal Sharks (LCS)

The latest Shark Evaluation Workshop (SEW) was held in June 2002. Discussions focused on the availability of four additional years worth of catch estimates, biological data, catch rate series, and the types of models that should be used. The modeling itself was performed after the SEW and incorporated new catch and effort estimates for the years 1998-2001 as well as over 20 catch-per-unit-effort (CPUE) series for LCS, sandbar, and blacktip sharks (See Table 3.2).

A variety of stock assessment models were used to investigate the population dynamics of LCS including: (1) a non-equilibrium Schaefer biomass dynamic model using the sampling/importance re-sampling (SIR) algorithm (Bayesian SPM) and several weighting schemes; (2) a non-equilibrium Schaefer state-space surplus production model (SSSPM) using a Markov Chain Monte Carlo (MCMC) method for numerical integration; (3) a lagged recruitment, survival, and growth (SSLRSG) state-space model; (4) the maximum likelihood estimation model (MLE); and (5) a fully age-structured, state-space population dynamic model (ASPM). General descriptions of these models can be found in Table 3.3 and in the stock assessment. The use of multiple approaches in evaluating stock status can reduce uncertainty in the best available data and can balance individual model strengths and weaknesses.

Due to concerns that catch series may underestimate mortality from the commercial fishery, four separate catch scenarios were considered to evaluate catch histories: updated, baseline, and the alternative scenarios. The updated catch scenario was comprised of catches used in the 1998 SEW, including data through 1997, and additional catches for 1998-2001. The baseline catch scenario included similar information and discards from the menhaden fishery, and Mexican catches, bottom longline discards back to 1981, and commercial and recreational catches back to 1981. The alternative scenario reconstructed historical catches back in time (calendar years 1960 - 2001) and applied to the LCS complex only. The age-structured models for sandbar and

blacktip shark included both updated and baseline scenarios in which specific catch series were linked to specific catchability and selectivity parameters. The alternative scenarios were used for sandbar and blacktip shark catch history evaluation.

Three different time periods were considered in the analysis of the catch rate series, including: (1) the whole period from 1974 through 2001, (2) the period following implementation of the 1993 FMP, and (3) the period of time since the 1998 assessment. For LCS, two out of three catch rate indices (i.e., Virginia LL, Crooke LL, and Port Salerno) show a general decline from 1978 to 1990 (See Figure 3.1). Most of the series (i.e., Virginia LL, Shark observer, Large Pelagic Survey, and NMFS LL SE) following the implementation of the 1993 FMP indicate increasing trends in LCS catch rates. However from 1998-2001, series data indicate a flat trajectory in LCS catch rates.

For sandbar sharks, the Virginia LL (1974-2001) and the early Rec (1981-1992)/late Rec (1993-1998) series suggest a declining trend which is then followed by an increasing trend in latter years (See Figure 3.2). Increasing catch rates are exhibited by series spanning 1993 forward in time (i.e., Virginia LL, SC LL recent, PLL, BLL Logs ST, Shark observer, and late Rec). Similar to that of LCS, sandbar shark series for recent years hold a flat trajectory, with deviations present in the PLL, shark observer, and LPS series, which noted increasing trends, and in the late rec series, which shows a decline.

For blacktip shark, the early rec (1981-1993) series fluctuated without trend relative to catch rates. For the period following implementation of the 1993 FMP, only the BLL Logs St series showed an increasing trend. Recent data (1998-2001) illustrate decreasing trends based upon shark observer and late Rec series, whereas PLL and BLL Logs St, and NMFS LL SE indicate a slight increase in catch rates (See Figure 3.3).

Catch rate analyses were also performed with age-specific catch series for sandbar and blacktip shark. In both cases, series data were divided into age segments including juvenile, adult, and all ages combined. For sandbar sharks, trends in juvenile (ages 0-12) catch rates indicate increases in the early 1980's followed by decreases in the early 1990s and subsequent increases in the latter half of the decade (See Figure 3.4a). Adult (ages 13+) sandbar shark catch rates present conflicting information where the Virginia LL series suggests decreasing trends and yet PLL series indicate increases from 1994 to 2001 (See Figure 3.4b). In reviewing catch rates for sandbar sharks, all ages combined, trends were generally conflicting, with Virginia LL, LPS, NMFS LL NE Early and late, and the NMFS LL SE pointing towards decreasing catch rates, while Shark observer, Driftnet observer, and BLL Logs ST present increasing rates.

For blacktip sharks, trends in juvenile (ages 0-5) catch rates indicate increasing trends early in the time series, but decreasing trends from the mid-1990's through 2001 (See Figure 3.5a). Blacktip adult (ages 6+) catch rates illustrate a slightly decreasing trend from 1992-2001 (See Figure 3.5b). In reviewing catch rates for blacktip sharks, all ages combined, trends were conflicting,

with BLL Logs ST, NMFS LL SE, and NMFS LL NE Early and late pointing towards increasing trends, while Shark observer and Driftnet observer series showed decreasing trends.

Catch rates were also analyzed for other species included in the LCS complex such as tiger, hammerhead, dusky, and silky shark. Generally, commercial data indicate increasing catch rates for tiger shark (Brown and Cramer, 2002; Cortes *et al.*, 2002) as well as decreasing trends for dusky shark, sand tiger shark, and hammerhead shark (Brown, 2002; Cortes *et al.*, 2002; Brown and Cramer, 2002). Recreational catch data for hammerhead and bull shark point towards declining trends for both species (Cortes *et al.*, 2002).

Considering the outputs of all model analyses combined, the assessment results were considerably more pessimistic for the LCS aggregate as compared to those for individual species within the complex (i.e., sandbar and blacktip sharks). While results illustrate improvements in the LCS complex since 1998, all of the models and catch scenarios described above, with the exception of the Bayesian SPM scenario which used only fishery-independent CPUE series, indicate that overfishing may be occurring and that the LCS complex may be overfished. Tables 3.4 and 3.5 provide biomass and fishing mortality estimates used to make these determinations. As such, the stock assessment finds that at least a 50-percent reduction in 2000 catch levels for the complex could be required for the biomass to reach maximum sustainable yield (MSY) in 10, 20 or 30 years (See Figure 3.6). Furthermore, a 20-percent reduction in 2000 catch levels for the complex would result in less than a 50-percent probability of achieving MSY even after 30 years of implementation under those catch levels. Overall, the stock assessment found that the LCS complex as a whole is overfished and overfishing is occurring (Cortes *et al.*, 2002).

Model results for evaluating sandbar and blacktip sharks were at times conflicting, given model sensitivity to catch series and weighting methodologies employed. Nonetheless, sandbar and blacktip results point to biomass levels at or above those required to produce MSY (See Figures 3.7 and 3.8). Reductions in fishing mortality on sandbar sharks may be necessary to help mitigate overfishing concerns, however no such reductions were recommended for blacktip sharks, which could withstand an increase of 20-50-percent in total allowable catch (TAC) and continue to maintain the stock at or above MSY in the future with a 47 to 59-percent probability.

The assessment acknowledges that the results between the complex and sandbar and blacktip sharks may be considered conflicting, given that sandbar and blacktip sharks comprise the majority of LCS commercial harvests. Specifically, sandbar and blacktip sharks make up approximately 44 percent of the total commercial catch (Burgess and Morgan, 2003) and over 70 percent of the landings (Cortes and Neer, 2002). The remainder of the catch is comprised mostly of tiger, scalloped hammerhead, silky, and sand tiger, with catch composition varying by region (Burgess and Morgan, 2003). These species are less marketable and are often released, so they are reflected in the overall catch but not the landings. Nonetheless, the complex represents a variety of species beyond sandbar and blacktip shark, some of which are in apparent decline.

In December 2002, the peer review process of the 2002 LCS stock assessment was completed as required by a court settlement agreement. The peer reviews were conducted by three separate non-NOAA Fisheries reviewers who were asked to respond to five questions regarding the appropriateness of specific modeling approaches and the selection there of, consideration of available data and the quality of data sets, application of available data in selected models, reliability of projections, and the effects of various catch scenarios on stock trajectories. Peer review findings were generally positive in that reviewers agreed that a state-of-the-art assessment was performed and that the best available science was employed (See Appendix 2). Reviewers noted assessment strengths including (1) compilation of several indices of abundance, (2) consideration of multiple stock assessment models, including Bayesian analyses, (3) discussion of myriad alternative harvest policies, and (4) analytical changes to address concerns raised by previous reviewers. Further investigation of catch series indices, assessment of individual species within the LCS complex, investigation of age and age-sex-area assessment models, consideration of alternative harvest policies in contrast to the current constant-catch policy, and NOAA Fisheries support for observer programs to obtain fishery independent estimates of abundance were among the recommendations offered for improvements to future stock assessment for LCS.

3.2.2 Small Coastal Sharks

A stock assessment for small coastal sharks (SCS) was also conducted in 2002. This was the first assessment since 1992 and as such the assessment included new information regarding SCS age and growth, reproduction, and population dynamics. Additional information relative to commercial and recreational catches as well as extended bycatch estimates for the shrimp trawl fishery were also considered.

Trends in catch were analyzed for the SCS complex as well as the four species comprising this aggregate grouping. Overall, SCS commercial landings exceeded recreational harvest in all years since 1996, with the exception of 2000 (See Table 3.6). Of the four species of SCS analyzed, bonnetheads contributed to over 50 percent of all SCS commercial landings in 1995, but Atlantic sharpnose and finetooth sharks each accounted for over 30 percent of the commercial landings in years 1996-1999 and 1998-2000 respectively (See Table 3.7). Atlantic sharpnose dominated recreational catch in all years between 1995 and 2000 (See Table 3.7).

A total of 41 CPUE series (See Table 3.8) were available for catch rate analysis. Of the nine series available for the SCS complex, five indicated a declining trend. Five out of 13 series available for Atlantic sharpnose suggested a declining trend. Three out of five series available for bonnethead illustrated a declining trend and five out of eight series available for blacknose shark pointed towards increasing trends, although none of the slopes for blacknose were statistically significant. Finetooth catch rates, noted an increasing trend in three out of five of the series comparisons. Catch rate trends, in general, were characterized by flat slopes which suggest that relative abundance of SCS stocks has remained stable despite current exploitation. Table 3.9 provides summarized catch rate analysis details.

A variety of stock assessment models were employed to investigate the population dynamics of SCS, Atlantic sharpnose, bonnethead, blacknose, and finetooth sharks including: (1) Bayesian Surplus Production Model using the SIR algorithm, (2) Bayesian Surplus Production Model using State-Space methodology and the Gibbs sampler, and (3) Bayesian LRSG Model using State-Space methodology and the Gibbs sampler. General descriptions of these models can be found in Table 3.3 and in the stock assessment.

The SCS assessment results, considering all model outputs combined, suggest that biomass levels are at or above those which could produce MSY (See Table 3.10). Therefore, current levels of removal are sustainable for these stocks and they are not considered overfished. In general, biomass and fishing mortality trajectories for the complex and the individual species followed similar trends, where biomass was above 1 and mortality was below 1. Finetooth sharks were the only exception, in that fishing mortality in the final five years of data considered was above the mortality level associated with producing MSY. As such, finetooth sharks are not overfished however, overfishing is occurring (See Table 3.11).

Also, in 2002, researchers at the Mote Marine Laboratory and the University of Florida, conducted a stock assessment for SCS using similar data but different models. The results were similar to the NOAA Fisheries assessment in that current biomass levels for Atlantic sharpnose, bonnethead, and blacknose were at least 69 percent of the biomass in 1972 while the current biomass level for finetooth sharks was only 9 percent the level in 1972 (Simpfendorfer and Burgess, 2002). Both stock assessments note that the data used for finetooth sharks is not as high a quality as the data used for Atlantic sharpnose due to shorter catch-per-unit-effort (CPUE) and catch series, lack of bycatch estimates, and no catches reported in some years.

3.2.3 Pelagic Sharks

Pelagic sharks are subject to exploitation by many different nations and exhibit trans-oceanic migration patterns. As a result, ICCAT's Standing Committee on Research and Statistics (SCRS) Subcommittee on Bycatch has recommended that ICCAT take the lead in conducting stock assessments for pelagic sharks.

An ICCAT meeting was held in September 2001 to review available statistics for Atlantic and Mediterranean pelagic sharks. Newly available biological and fishery information presented for review included age and growth, length/weight relationships, species identification, species composition of catch, catch per unit effort, mortality (both natural and fishing estimates for blue sharks), bycatch, and tagging and migration studies. Landings estimates, which incorporated data for both the Atlantic and Mediterranean populations of blue shark, suggested that landings declined in 2000 (3,652 mt) following a peak of 32,654 mt in 1999 (See Table 3.12). Landings of porbeagles peaked in 1997, with an estimated total of 1,450 mt, and have slowly declined each year since that time period (1998-2000). Similarly, landing estimates for Shortfin mako also peaked in 1997 (5,057 mt) and have declined by 83 percent (863 mt in 2000) since that time. Meeting participants expressed concern regarding the lack of information pertaining to the

number of fleets catching sharks, landing statistics, and dead discards for sharks. A summary of available and lacking data elements by region and species is summarized in Table 3.13. Due to concerns about data availability for pelagic sharks, meeting participants recommended that future assessment discussions occur no earlier than May 2002.

Recently, the SCRS decided to conduct an assessment of Atlantic pelagic sharks beginning in 2004. Emphasis will be placed on blue, shortfin mako, and porbeagle sharks. Several models such as non-equilibrium production and statistical age/length-structured models will be considered to analyze the population dynamics of pelagic shark species.

3.2.4 Prohibited Shark Species

In 1999, NOAA Fisheries prohibited possession of 19 species of sharks (See Table 3.1). These species were identified as highly susceptible to overexploitation and the prohibition on possession was a precautionary measure to ensure that directed fisheries did not develop. Three species on the prohibited list (i.e., dusky, night, and sand tiger) are also on the Candidate Species List under the Endangered Species Act (ESA).

To date there is sparse information available regarding status of individual prohibited species. For the most part, many species that were LCS before 1999 continue to be considered as part of the LCS complex in the latest LCS stock assessment. In 2001, NOAA Fisheries contracted Virginia Institute of Marine Science (VIMS) to conduct a status review under ESA of the dusky shark (Romine *et al.,* 2002). Additionally, VIMS continues to conduct a fisheries independent longline study off Virginia, which provides valuable information regarding the status of dusky shark. Specifically, relative abundance data (1974-2000) indicates increasing trends in abundance from 1997-2000, despite declines from 1980-1992 (Romine *et al.*, 2002). Catch data, which suggests increasing catch rates from 1994 to 1999, provides evidence that greater numbers of small dusky sharks are being caught. This finding is important considering that hooking mortality increases as shark size decreases. Romine *et al.* (2002) noted that mortality for dusky sharks less than 100 cm fork length was 79 percent as compared with 37 percent in sexually mature animals (Romine *et al.,* 2002). These data, when combined with other life history information and analyzed by a demographic model, suggest that dusky shark populations will continue to decline so long as fishery-induced mortality is incurred (Romine *et al.,* 2002).

NOAA Fisheries will be conducting status reviews for night and sand tiger sharks shortly.

3.2.5 Deepwater Sharks and Other Species

Deepwater and other shark species were included for data reporting purposes under the original shark FMP. To date, there is sparse information available on the status of deepwater and other species of shark. This is primarily due to the fact that these species are rarely caught or encountered except as bycatch in non-HMS fisheries.

3.3 FISHERY PARTICIPANTS AND GEAR TYPES

3.3.1 Description of Atlantic Shark Fisheries

3.3.1.1 Commercial Shark Fisheries

History

In the early years of the 20th century, a Pacific shark fishery supplied limited demands for fresh shark fillets and fish meal as well as a more substantial market for dried fins of soupfin sharks. 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. A shark fishery in the Caribbean Sea, off the coast of Florida, and in the Gulf of Mexico developed in response to this demand (Wagner, 1966). At this time, shark fishing gear included gillnets, hook and line, anchored bottom longlines, floating longlines, and benthic lines for deepwater fishing. These gear types are 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 (Wagner, 1966).

A small fishery for porbeagle existed in the early 1960s off the U.S. Atlantic coast involving Norwegian fishermen. Between the World Wars, Norwegians and Danes had pioneered fishing for porbeagles in the North Sea and in the region of the Shetland, Orkney, and the Faroe islands. In the late 1940s, these fishermen caught from 1,360 to 2,720 metric tons (mt) yearly, with lesser amounts in the early 1950s (Rae, 1962). The subsequent scarcity of porbeagles in their fishing area forced the Norwegians to explore other grounds, and around 1960, they began fishing the Newfoundland Banks and the waters east of New York. Between 1961 and 1964, their catch increased from 1,800 to 9,300 mt, then declined to 200 mt (Casey *et al*., 1978).

Shark fisheries developed rapidly in the late 1970s due to increased demand for their meat, fins, and cartilage. At the 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. While organized intensive shark fisheries have fluctuated, more localized shark fisheries have existed for many years.

Catches - Bottom Longline Gear

From 2000 through mid-2002, observed catches of sharks in the bottom longline fishery were dominated by large coastal sharks (66.2 percent), with small coastal sharks comprising 32.4

percent and pelagic sharks comprising less than three percent (Burgess and Morgan, 2003). Sandbar, tiger, and blacktip sharks combined dominated the large coastal shark catch at 59.0, 19.2, and 8.1 percent respectively (Burgess and Morgan, 2003). The remainder of the LCS catch was comprised mainly of scalloped hammerhead (3.4 percent), sand tiger (2.3 percent), silky (2.0 percent), dusky (1.5 percent), spinner (1.1 percent), and nurse sharks (1.0 percent). Individually, bull, great hammerhead, night, lemon, white, bignose, and smooth hammerhead sharks accounted for less than one percent of the total observed LCS catch (Burgess and Morgan, 2003). The actual catch composition varies by region. These species are less marketable and are often released so they are reflected in the overall catch but not the landings.

From 2000 to mid-2002, observed catches of SCS in the bottom longline fishery were dominated by Atlantic sharpnose sharks (96.1 percent), while blacknose and bonnethead sharks accounted for 3.8 and 0.2 percent respectively (Burgess and Morgan, 2003).

A total of 45 pelagic sharks were observed caught in the directed shark bottom longline fishery during the 2000 to mid-2002 study period. Of those 45 pelagic sharks caught, 29 shortfin mako sharks and nine blue sharks were retained. The remaining 16 pelagic sharks were tagged and released (Burgess and Morgan, 2003).

Catches - Gillnet Gear

In 2002, observed strikenet catch in the shark gillnet fishery during the non-right whale calving season consisted of three shark species (100.0 percent of total catch): blacknose (53.1 percent), blacktip (46.8 percent), and bonnethead sharks (0.1 percent). Observed driftnet catch during the 2002 non-right whale calving season consisted of 12 species of shark (84.9 percent of total catch). The driftnet shark catch was dominated by Atlantic sharpnose sharks (68.9 percent). The remainder of the catch consisted of finetooth (14.0 percent), blacknose (8.1 percent), blacktip (5.4 percent), and bonnethead sharks (2.9 percent). Individually, scalloped hammerhead, spinner, great hammerhead, tiger, sandbar, and lemon sharks each accounted for less than 0.5 percent of the total driftnet shark catch (Carlson and Baremore, 2002a).

During the 2002 right whale calving season, observed strikenet catch consisted of four species of shark (99.3 percent of total catch). The strikenet shark catch was dominated by blacktip sharks (99.4 percent). Individually, blacknose, spinner, and great hammerhead sharks accounted for less than 0.5 percent of the total strikenet shark catch. Observed driftnet catch during the 2002 right whale calving season consisted of 10 species of shark (90.7 percent of total catch). The driftnet shark catch consisted of Atlantic sharpnose (31.6 percent), blacktip (29.8 percent), blacknose (25.6 percent), bonnethead (6.7 percent), spinner (2.2 percent), finetooth (2.1 percent), and great hammerhead sharks (1.3 percent). Individually, scalloped hammerhead, tiger, and common thresher sharks accounted for less than one percent of the total driftnet shark catch (Carlson and Baremore, 2002b).

Catches - Pelagic Longline Gear

From May 1992 through December 2000, Pelagic Observer Program (POP) personnel recorded a total of 155,172 fish, marine mammals, sea turtles and birds from 4,462 observed sets. Of this catch, approximately 27 percent was sharks and rays. During the study period, 25,676 pelagic sharks (16.5 percent of total catch), 5,150 LCS (3.3 percent of total catch), 202 SCS (0.1 percent of total catch), and 3,006 sharks currently prohibited (2.0 percent of total catch) were observed caught (Beerkircher *et al.*, 2002).

The observed pelagic longline shark catch consisted of six pelagic species. The observed pelagic shark catch was dominated by blue sharks (89.5 percent). The remainder of the pelagic shark catch consisted mainly of shortfin mako (6.3 percent), mako spp. (2.1 percent) and oceanic whitetip sharks (1.4 percent). Individually, porbeagle, thresher spp., and common thresher sharks accounted for less than one percent of the total pelagic shark catch (Beerkircher *et al.*, 2002).

Of the pelagic sharks observed caught in the pelagic longline fishery, the following were recorded as dead; 3,647 blue, 492 shortfin mako, 155 mako spp., 108 oceanic whitetip, 28 common thresher, 14 porbeagle, and 13 thresher spp.. These statistics represent; 15.9 percent of all blue, 30.3 percent of all shortfin mako, 28.8 percent of all mako spp., 30.1 percent of all oceanic whitetip, 29.8 percent of all common thresher, 42.4 percent of all porbeagle, and 37.1 percent of all thresher spp. observed caught (Beerkircher *et al.*, 2002).

The observed pelagic longline shark catch consisted of 11 LCS species. Silky sharks dominated the observed pelagic longline catch of LCS (52.0 percent). The remainder of the LCS catch consisted mainly of sandbar (13.0 percent), tiger (10.6 percent), scalloped hammerhead (10.3 percent), hammerhead spp. (9.2 percent), blacktip (2.1 percent), and great hammerhead sharks (1.6 percent). Individually, bull, smooth hammerhead, lemon, nurse, and spinner sharks accounted for less than one percent of the total LCS catch (Beerkircher *et al.*, 2002).

Of the LCS observed caught in the pelagic longline fishery, the following were recorded as dead; 1,665 silky, 300 scalloped hammerhead, 205 hammerhead spp., 113 sandbar, 74 blacktip, 48 great hammerhead, 20 tiger, 12 bull, seven spinner, and four smooth hammerhead sharks. These statistics represent; 62.2 percent of all silky, 56.7 percent of all scalloped hammerhead, 43.2 percent of all hammerhead spp., 16.9 percent of all sandbar, 67.3 percent of all blacktip, 60.0 percent of all great hammerhead, 3.6 percent of all tiger, 35.3 percent of all bull, 35.0 percent of all spinner, and 80.0 percent of all smooth hammerhead sharks observed caught (Beerkircher *et al.*, 2002).

Atlantic sharpnose sharks accounted for 100 percent of the observed pelagic longline catch of SCS. Of the 202 Atlantic sharpnose sharks caught, 111 were recorded as dead (55 percent) (Beerkircher *et al.*, 2002).

During the period of May 1992 through December 2000, 3,006 sharks that are currently in the prohibited species group were observed caught in the pelagic longline fishery. Dusky sharks dominated the observed catch (59.2 percent of prohibited species caught). The remainder of the catch consisted mainly of night (23.2 percent), bigeye thresher (12.4 percent), longfin mako (3.5 percent), and bignose sharks (1.3 percent). Individually, basking, Caribbean reef, and sand tiger sharks accounted for less than one percent of the total prohibited species catch (Beerkircher *et al.*, 2002).

Of the prohibited species observed caught in the pelagic longline fishery, the following were recorded as dead; 719 dusky, 540 night, 156 bigeye thresher, 48 longfin mako, 26 bignose, two Caribbean reef, and one sand tiger shark. These statistics represent; 40.4 percent of all dusky, 77.6 percent of all night, 41.7 percent of bigeye thresher, 45.7 percent of longfin mako, 66.7 percent of bignose, 28.6 percent of all Carribean reef, and 25.0 percent of all sand tiger sharks observed caught (Beerkircher *et al.*, 2002).

Landings

An estimated 1,684 and 1,616 mt dressed weight (dw) of U.S. Atlantic LCS were landed in 2000 and 2001 respectively. Sandbar and blacktip sharks combined, accounted for approximately 84 and 71 percent of the 2000 and 2001 LCS landings, respectively (Cortes and Neer, 2002). In 2000 and 2001, approximately three and 21 percent of the landings were reported as unclassified sharks (Cortes and Neer, 2002). Approximately 84 to 91 percent of LCS landings came from the southeast region, mainly Louisiana, Florida, and North Carolina (Cortes and Neer, 2002). Observer data indicates that LCS discarded from the fishery accounts for approximately 5.7 percent of the total mortality (Cortes and Neer, 2002)

An estimated 269 and 326 mt dw of U.S Atlantic SCS were landed in 2000 and 2001 respectively (Cortes and Neer, 2002). Data from the directed shark fishery observer program indicates that small coastal sharks are generally not landed (1.6 percent), but are used for bait (98.3 percent) (Burgess and Morgan, 2003). Commercial landings of small coastal sharks represent only a small fraction of all catches, because they are also caught as bycatch and discarded in a variety of fisheries. The majority of small coastal sharks taken in commercial fisheries are landed in the southeastern region. Of the small coastal sharks caught during 1995 - 2000, the majority were caught in the South Atlantic region. In those years, gillnets were the dominant type of gear catching small coastal sharks. Atlantic sharpnose sharks accounted for over one third of all small coastal shark landings from 1996 - 1999. Finetooth sharks accounted for over one-third of the landings in 1998 - 2000. Commercial landings of small coastal sharks peaked in 1999 at 330 mt (Cortes, 2002).

An estimated 159 and 165 mt dw of U.S. Atlantic pelagic sharks were landed in 2000 and 2001 respectively (Cortes and Neer, 2002). Shortfin mako and thresher sharks are the two pelagic shark species most frequently landed (Cortes and Neer, 2002). According to Cortes and Neer (2002) approximately 56 - 64 percent of pelagic shark landings occurred in the southeast region

during the period 1998 - 2001. In 1998 and 1999, pelagic sharks were mostly landed in North Carolina (57 percent and 48 percent respectively), Florida (23 percent and 38 percent respectively), and Louisiana (15 percent and 7 percent respectively). In 2000, most pelagic sharks were landed in North Carolina (34 percent), and Florida (33 percent), followed by South Carolina (10 percent), and Louisiana (8 percent). In 2001, the majority of pelagic sharks were landed in Florida (56 percent), Texas (19 percent), and South Carolina (13 percent) (Cortes and Neer, 2002).

Permits

Fishermen who wish to sell sharks caught in Federal waters must possess a Federal shark permit (directed or incidental). As part of the HMS FMP, NOAA Fisheries 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 permit holders before limited access, to 607 in October of 2003. The limited access system is fully described in Chapter 4 of the HMS FMP.

As of October 17, 2003, approximately 351 fishermen had active incidental commercial shark limited access permits and 256 had active directed commercial shark limited access permits. In the directed category, vessels range in length from 14 to 87 feet, with an average length of 45.7 feet. Vessels range in length from 15 to 123 feet in the incidental category, with an average length of 50.1 feet. The addresses of these permit holders range from Texas through Maine with nearly half of the permit holders located in Florida.

Since 1997, the LCS fishing season has generally been open for three months (January-March) in the first fishing season and a few weeks (July-August) in the second season. 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. Many participants in the commercial shark fishery are engaged in the longline fishery for swordfish and tuna, the hook and line fisheries, or the snapper-grouper or reef fish fisheries. The NOAA Fisheries permit databases indicate that approximately 98 percent of permitted shark fishermen hold fishing permits in other fisheries.

Bycatch

Commercial fishermen use a number of gear types to target sharks, including bottom longline, pelagic longline, gillnet, and rod and reel. Different gear types can be used to target different species of sharks. For example, bottom longline gear is generally used to target LCS while pelagic longline gear is used to target pelagic sharks. Other gear types such as shrimp trawls catch sharks incidentally. All of these gears catch many species of fish. Some of the species captured are marketable and thus are retained, while others are discarded for economic or

regulatory reasons. Non-shark species encountered on gear targeting sharks are snappers, groupers, red drum, cobia/dolphin, swordfish, tunas, billfish, wahoo, king and Spanish mackerel, little tunny, crevalle jack, and other finfish species. Sometimes fishermen also catch sea turtles, marine mammals, and sea birds, known collectively as "protected" species. All of these species are Federally managed, and NOAA Fisheries seeks to control the mortality that results from fishing effort. NOAA Fisheries also seeks to control the likelihood of mortality, injury, or other forms of take of protected species. For more information on bycatch, refer to section 3.5.

Regulations

Commercial regulations in 2003 for LCS include quotas, a trip limit of 4,000 lbs dw LCS for directed permits, and a trip limit of five LCS and 16 SCS and pelagic species combined for incidental permit holders. The commercial regulations for pelagic sharks include separate quotas for porbeagle and blue sharks and a trip limit of 16 pelagic and SCS for incidental permits. The commercial regulations for SCS include a trip limit of 16 pelagic and SCS for incidental permits. All three categories involve limited access permitting and reporting requirements, observer coverage requirements, a ban on finning, no filleting at sea, prohibited species, and authorized gears. While the LCS fishing season has generally been open for only a few months a year, the SCS and pelagic shark fisheries have never closed and their quotas have not been reached.

Monitoring and Reporting

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.

NOAA Fisheries collects shark data through reports from owners/operators of permitted vessels under a mandatory commercial logbook program, the Commercial Shark Fishery Observer Program (CSFOP), the Pelagic Observer Program (POP), 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 NOAA Fisheries began to collect economic data such as volume and cost of fishing inputs 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 NOAA Fisheries twice a month for all sharks.

Species-specific catch and landings statistics for sharks are problematic, since there are many similar species and identification of dressed sharks is difficult. To increase species-specific reporting, NOAA Fisheries is developing a field guide for sharks to assist fishermen in the identification of species for the required catch reports.

The University of Florida and The Florida Museum of Natural History are continuing an observer program of the directed bottom longline commercial shark fishery in the Atlantic and Gulf of Mexico to enhance the reliability of management strategies for the shark fishery. Since 1994, the CSFOP has been monitoring and reporting on commercial bottom longline shark fishery catches. This program has been funded by the U.S. Department of Commerce through the Marine Fisheries Initiative (MARFIN) and Saltonstall-Kennedy (S-K) granting programs and more recently with contracts through NOAA Fisheries (Burgess and Morgan, 2003). The CSFOP provides baseline characterization information, by region, on the species composition, relative abundance, and size composition within species for the large coastal and small coastal bottom longline shark fisheries.

As of January 2002, the observer coverage requirements in the bottom longline fishery for sharks changed from voluntary participation to mandatory participation if selected. Vessels are selected, on a random basis, if they have a current directed shark permit and if they have reported fishing for sharks in the past. Selections are also made to ensure that areas that have more fishing effort will have more vessels selected. NOAA Fisheries has selected over 30 vessels each season since January 2002. From 2000 to mid-2002, three CSFOP observers logged 244 sea days on 66 shark fishing trips aboard 17 different fishing vessels in the Atlantic Ocean. The fishing areas observed include North Carolina to Florida, and the eastern Gulf of Mexico off Florida (Burgess and Morgan, 2003). During this time period, the CSFOP documented 33,177,457 hook-hours of effort that yielded 9,972 sharks of 28 different species. Of the 9,972 sharks observed, there were 6,461 LCS (14 species), 3,228 SCS (2 species), and 45 pelagic sharks (2 species) (Burgess and Morgan, 2003).

NOAA Fisheries initiated sampling of the U.S. large pelagic fisheries longline fleet in 1992, as mandated by the U.S. Swordfish Fisheries Management Plan and subsequently by the HMS FMP (Beerkircher *et al.*, 2002). The June 14, 2001 Biological Opinion (BiOp) requires that five percent of the pelagic longline trips be selected for observer coverage. In addition, ICCAT requires five percent observer coverage for all trips targeting yellowfin tuna and/or bigeye tuna (NOAA Fisheries, 2003a). The POP is located at the Southeast Fisheries Science Center (SEFSC) Miami laboratory and places scientific observers aboard vessels participating in the Atlantic large pelagic fishery. Since 1992, observer coverage has been provided by NOAA Fisheries-employed observers, independent contracted personnel, and personnel supplied by contracting companies. The POP observers record detailed information concerning gear characteristics, location, time of set and retrieval, environmental conditions, status of marine life caught (alive or dead, kept or discarded), as well as morphometric measures and sex identification. The POP observers also record incidental interactions with sea turtles, marine mammals, and sea birds (Beerkircher *et al.*, 2002).

From May 1992 through December 2000, 638 pelagic longline trips aboard 206 different vessels were observed by NOAA Fisheries observers. In total, the POP observers logged 7,898 days-at-sea and observed 4,462 sets (Beerkircher *et al.*, 2002). Five hundred ninety-one pelagic longline

sets were observed and recorded by NOAA Fisheries observers in 2001 (NOAA Fisheries, 2003a).

From May 1992 through December 2000, POP personnel recorded a total of 155,172 fish, marine mammals, sea turtles and birds caught. Of this catch, approximately 27 percent was sharks and rays. During the study period, 25,676 pelagic sharks (16.5 percent of total catch), 5,150 LCS (3.3 percent of total catch), 202 SCS (0.1 percent of total catch), and 3,006 prohibited species (2.0 percent of total catch) were observed caught (Beerkircher *et al.*, 2002).

The Atlantic Large Whale Take Reduction Plan (ALWTRP) and the June 14, 2001, BiOp issued under section 7 of the Endangered Species Act mandate 100 percent observer coverage of the southeast shark gillnet fishery during right whale calving season. An interim final rule published in March 2001 (66 FR 17370) established a level of observer coverage outside of right whale calving season that would attain a sample size needed to provide estimates of sea turtle or marine mammal interactions. This rule was formalized with the rule that closed the Northeast Distant Statistical Reporting Area (NED) (67 FR 45393, July 9, 2002). It was determined that a 52.8 percent sampling fraction would be required outside of the right whale calving season. However, due to increased numbers of sea turtle strandings in May, 2002, 100 percent observer coverage was provided for all shark gillnet vessels fishing in the north Florida/Georgia area from May 8 through June 15, 2002 (Carlson and Baremore, 2002a).

The shark gillnet fishery observer program is coordinated by the NOAA Fisheries SEFSC. Observers are deployed on vessels participating in the shark gillnet fishery and collect information specific to shark gillnet gear set in both the driftnet and strikenet fashion. For each set and haul back, 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. As the nets are retrieved, observers record species caught, estimate lengths and weights, and disposition (kept, discarded alive, or discarded dead) (Carlson and Lee, 1999).

3.3.1.2 Commercial Shark Fisheries by Gear Type

Below is a description of Atlantic shark fisheries by gear-type. Please refer to section 2.4 and 2.5 of the HMS FMP and section 4.5 of the latest SAFE report for additional information. Additional information specific to the pelagic longline fishery can be found in the Final Supplemental Environmental Impact Statement for the Reduction of Bycatch, Bycatch Mortality, and Incidental Catch in the Atlantic Pelagic Longline Fishery; in the Final Supplemental Environmental Impact Statement to Reduce Sea Turtle Bycatch and Bycatch Mortality in the Atlantic HMS Fisheries; or in the June 14, 2001, BiOp.

Bottom Longline Fishery

The Atlantic bottom longline fishery targets LCS, with landings dominated by sandbar and blacktip sharks. Bottom longlines were the primary commercial gear-type used to catch LCS

from 1987-2001 in all regions (Cortes and Neer, 2002). Gear characteristics vary by region, but in general, a ten-mile long monofilament bottom longline, containing about 750 hooks, is fished overnight. Skates, sharks, or various finfishes are used as bait (GSAFDF, 1997). The 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. According to the most recent observer data report, Carolina region fishermen set more hooks (639 hooks/set) and fished longer (13.6 hr/set) than Florida Gulf fishermen (599 hooks/set, 12.3 hr/set) and Florida East Coast fishermen (382 hooks/set, 9.0 hrs/set) (Burgess and Morgan, 2003).

Commercial shark fishing effort is generally concentrated in the southeastern United States and Gulf of Mexico (Cortes and Neer, 2002). As with all HMS fisheries, some shark fishery participants move from their home ports to active fishing areas as the seasons change. McHugh and Murray (1997) found in a survey of shark fishery participants that the largest concentration of bottom longline fishing vessels is found along the central Gulf coast of Florida, with the John's Pass - Madeira Beach area considered the center of directed shark fishing activities. Cortes and Neer, 2002, found that 84 - 91 percent of the 1998 - 2001 U.S. Atlantic shark landings came from the southeast region. Approximately 84 - 91 percent of LCS, 56-64 percent of pelagic sharks, and nearly all of SCS landings came from the southeast region (Cortes and Neer, 2002). Estimates of total landings and dead discards for the large coastal shark species group from 1981 to 2001 can be seen in Table 3.14.

CSFOP data from the 2000 to mid-2002 study period show that the large coastal sharks comprised 66.2 percent of the total catch. Sandbar sharks dominated the observed catches in the Carolina and Florida Gulf Coast regions. In the Carolina region, sandbar sharks comprised 67.4 percent of the total catch and 77.2 percent of the large coastal shark catch. In the Florida Gulf region, sandbar sharks comprised 62.0 percent of the total catch and 66.5 percent of the large coastal catch (Burgess and Morgan, 2003).

In the Florida East Coast region, sandbar sharks comprised 17.2 percent of the total observed catch, and 37.1 percent of the large coastal shark catch. Tiger sharks comprised 17.1 percent of the total observed catch and 37.0 percent of the large coastal shark catch, while blacktip sharks comprised 7.9 percent of total observed catch and 17.2 percent of the large coastal catch (Burgess and Morgan, 2003).

CSFOP data also show that the SCS comprised 32.4 percent of the total observed catch. The small coastal catch was dominated by Atlantic sharpnose shark (96.6 percent). The remainder of the small coastal catch consisted of blacknose (3.8 percent), and bonnethead sharks (0.2 percent) (Burgess and Morgan, 2003).

The Atlantic sharpnose and the blacknose sharks were the most commonly captured small coastal sharks, but only in the Florida East Coast region were the Atlantic sharpnose and blacknose shark major contributors to the catch. The Atlantic sharpnose shark was the most frequently caught

shark in the Florida East Coast region and accounted for 51.6 percent of the total observed catch, and 96.0 percent of the small coastal catch in that region (Burgess and Morgan, 2003).

During the 2000 to mid-2002 study period, pelagic sharks represented only 0.5 percent of the total catch. Shortfin mako sharks comprised 0.3 percent of the total observed catch and 76.3 percent of the pelagic shark catch. A total of 45 pelagic sharks were observed caught in the directed shark bottom longline fishery. Of those 45 pelagic sharks caught, 29 shortfin mako sharks and nine blue sharks were retained. The remaining 16 pelagic sharks were tagged and released (Burgess and Morgan, 2003).

As reported in the 2003 HMS SAFE Report, the 2002 observed catches of sharks in the directed bottom longline fishery were dominated by large coastal sharks (72 percent), with small coastal sharks comprising 28 percent and pelagic sharks comprising 0.3 percent (Table 3.15). Sandbar sharks dominated the large coastal catch and landings (34.7 and 47.0 percent, respectively), followed by blacktip sharks (23.1 and 30.5 percent, respectively), tiger sharks (19.5 and 6.5 percent, respectively), and nurse sharks (7.4 and 0 percent, respectively). Tiger sharks represent 62.6 percent of large coastal sharks tagged and released (Table 3.15) (NOAA Fisheries, 2003a).

In 2002, Atlantic sharpnose sharks dominated the observed bottom longline catches of small coastal sharks at 73.6 percent (Table 3.15). Approximately 76.3 percent of small coastal sharks are used for bait in this fishery (371 out of 1,562 individuals were landed). Only 18 pelagic sharks were caught, 17 of which were landed and all of which were shortfin mako (Table 3.15) (NOAA Fisheries, 2003a).

Pelagic Longline Fishery

The U.S. pelagic longline fishery for Atlantic HMS primarily targets swordfish, yellowfin tuna, or bigeye tuna in various areas and seasons and catches sharks incidentally. Although this gear can be modified (i.e., depth of set, hook type, etc.) to target swordfish, tuna, or sharks, like other hook and line fisheries, it is a multi-species fishery. Longline gear sometimes attracts and hooks non-target finfish with no commercial value, as well as species that cannot be retained by commercial fishermen, such as billfish or some species of sharks. Pelagic longlines may also interact with protected species such as marine mammals, sea turtles and sea birds.

Pelagic longline gear is composed of several parts. The primary mainline can vary from five to 40 miles in length, with approximately 20 to 30 hooks per mile. The depth of the mainline is determined by ocean currents and the length of the floatline, which connects the mainline to several buoys and periodic markers with radar reflectors and radio beacons. Lightsticks, which contain chemicals that emit a glowing light, are often used to attract bait fish which may, in turn, attract pelagic predators. When targeting swordfish, the lines generally are deployed at sunset and hauled in at sunrise to take advantage of the nocturnal near-surface feeding habits of the large pelagic species (Berkeley *et al*., 1981). In general, longlines targeting tuna are set in the morning, deeper in the water column, and hauled in the evening. Except for vessels of the distant

water fleet which undertake extended trips, fishing vessels preferentially target swordfish during periods when the moon is full to take advantage of increased densities of pelagic species near the surface.

From May 1992 through December 2000, POP personnel recorded a total of 155,172 fish, marine mammals, sea turtles and birds caught by pelagic longline gear. Of this catch, approximately 27 percent was sharks and rays. During the study period, 25,676 pelagic sharks (16.5 percent of total catch), 5,150 LCS (3.3 percent of total catch), 202 SCS (0.1 percent of total catch), and 3,006 shark species currently prohibited (2.0 percent of total catch) were observed caught (Beerkircher *et al.*, 2002).

Approximately 132 mt whole weight (ww) of LCS and 154 mt ww of pelagic sharks (primarily blue sharks) were discarded dead in pelagic longline fisheries in 2001 (Cramer, 2002). Between 1996 and 1998, approximately 15,600 LCS were discarded dead by pelagic longline vessels (Table 3.14).

Gillnet Fishery

The southeast shark drift gillnet fishery is comprised of about five vessels that use nets typically 456 to 2,280 meters long and 6.1 to 15.2 meters deep, with stretched mesh from 12.7 to 22.9 cm. The entire process (time net was first set through time the haulback was completed) averaged 8.9 hours in 2002 (Carlson and Baremore, 2002a). A total of 69 drift gillnet sets were observed in 2002. During non-right whale season (28 sets), the observed drift gillnet catch consisted of 12 shark species (84.9 percent of total catch), 26 bony fish and rays, and one species of marine mammal (Carlson and Baremore, 2002a). During right whale season (41 sets), the observed drift gillnet catch consisted of 10 species of shark (90.7 percent of total catch), 26 species of teleosts and rays and two species of sea turtle (Carlson and Baremore, 2002b). The total observed drift gillnet shark catch for 2002 can be seen in Table 3.16.

Shark fishermen also use gillnet gear in a strikenet fashion. This can be done with a small second vessel actively setting the net around a school of sharks or the drift gillnet vessel actively setting the net in the wake of a shrimp vessel. Vessels fishing in a strikenet fashion used nets 364.8 meters long, 30.4 meters deep, and with mesh size 22.9 cm (Carlson and Baremore, 2002a). A total of 38 strikenet sets were observed in 2002. The total observed strikenet shark catch for 2002 can be seen in Table 3.17.

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.

To reduce bycatch of right whales, NOAA Fisheries implemented a restricted area from November 15 through March 31, where only gillnets used in a strikenet fashion can operate during times when right whales are usually present (67 FR 59471, September 23, 2002).

Operation in this area at that time requires 100 percent observer coverage. NOAA Fisheries also designated an area open to shark gillnet fishing vessels fishing in a driftnet fashion but only under condition that they carry an observer at all times during right whale calving season. Outside of the right whale calving season, observer coverage to produce reliable estimates of bycatch is required.

Vessel operators intending to use gillnets in the "observer area" during right whale calving season must notify NOAA Fisheries at least 48 hours in advance of departure to arrange for observer coverage. Observations of right whales in the observer area or restricted area outside of this period, are rare, and a broader closure period was not considered necessary to meet the objectives of the Marine Mammal Protection Act (MMPA). After these requirements were implemented, NOAA Fisheries extended observer requirements to include all shark gillnet vessels at all times. The objective of that regulation was to collect bycatch information for all species (including turtles and finfish), consistent with requirements of the Magnuson-Stevens Act. NOAA Fisheries modified the requirement to have 100 percent observer coverage at all times (66 FR 17370, March 30, 2001; 67 FR 45393, July 9, 2002), by reducing the level required to a statistically significant level outside of right whale calving season (100 percent observer coverage is still required during the right whale calving season from November 15 through March 31). This modification of observer coverage reduced administrative costs while maintaining statistically significant and adequate levels of coverage to provide reasonable estimates of sea turtle and marine mammal takes outside the right whale calving season. The level of observer coverage necessary to maintain statistical significance will be reevaluated annually and adjusted accordingly.

Gear provisions were also implemented to further the goals of the MMPA. NOAA Fisheries restricted the way gillnets used in a strikenet fashion are set in the southeast gillnet fishery to minimize the risk of entanglement. In addition, shark gillnets must be marked to identify the fishery and region the gear is fished. Strikenetting in the restricted area is permitted during right whale season only if: (1) no nets are set at night or when visibility is less than 500 yards (460 m), (2) each set is made under the observation of a spotter plane, (3) no net is set within three miles of a right whale, humpback or a fin whale, and (4) if a whale comes within three miles of set gear, the gear is removed from the water immediately. These measures were designed to minimize the risk of entangling any large whale.

3.3.1.3 Recreational Atlantic Shark Fisheries

History

Recreational fishing for Atlantic sharks occurs in Federal and state waters from New England to the Gulf of Mexico and Caribbean Sea. In the past, sharks were often called "the poor man's marlin." Recreational shark fishing with rod and reel is now a popular sport at all social and economic levels, largely because of accessibility to the resource. Sharks can be caught virtually anywhere in salt water, with even large specimens available in the nearshore area to surf anglers

or small boaters. Most recreational shark fishing takes place from small to medium-size vessels. Makos, white sharks, and large pelagic sharks are generally accessible only to those aboard ocean-going vessels. Recreational shark fisheries are exploited primarily by private vessels and charter/headboats although there are some shore-based fishermen active in the Florida Keys.

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 blacktip in the Carolinas, and makos and large white sharks at Montauk, NY. Many charter vessels also fish for sharks out of ports in Ocean City, MD and Wachapreague, VA. 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, TX.

Landings

Recreational shark landings estimates are obtained from several data collection programs including the Marine Recreational Fishing Statistics Survey (MRFSS), NMFS Headboat Survey, and the Texas Parks and Wildlife Recreational Fishing Survey. Recreational shark harvests of large coastal sharks have declined by 80 percent from the peak recorded catches in 1983 (Table 3.18). Blacktip and sandbar sharks dominate the catches of large coastal sharks by 36 and 27 percent respectively (Table 3.19). Recreational harvests of small coastal sharks have fluctuated between 34,900 and 189,500 fish per year since the mid 1980s, with Atlantic sharpnose comprising about 60 percent of the catch in recent years (Table 3.18 and Table 3.20). 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 6,200 fish in 1994. Recreational harvests of blue sharks accounted for 47 and 53 percent of the total catches of pelagic sharks in 1999 and 2000 (Table 3.21).

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).

Regulations

The 1993 FMP for Atlantic sharks established a recreational trip limit of four sharks per vessel for large coastal and pelagic species groups and a daily bag limit of five small coastal sharks per person per day. In 1997, NOAA Fisheries combined the recreational retention limit into an all-shark limit of two fish per vessel per trip with an allowance for two Atlantic sharpnose sharks per person per trip. This measure was designed to reduce fishing mortality by 50 percent as recommended by the 1996 LCS stock assessment, address concerns that juvenile large coastal sharks were being misidentified as small coastal sharks, and to allow anglers on

charter/partyboats the opportunity to land a shark (Atlantic sharpnose). The 1999 HMS FMP further reduced the recreational retention limit to one shark per vessel per trip, established a minimum size limit of 4.5 feet fork length for all sharks, and reduced the allowance for Atlantic sharpnose sharks to one per person per trip with no minimum size restriction. Sharks that are not retained by the angler must be released in a manner to ensure the maximum possibility of survival. Recreational fishing for white sharks is catch and release only. Sharks that are kept must be kept whole through landing. They may be gutted and bled, but the head, tail, and fins must be attached to the carcass.

Permits

NOAA Fisheries has recently implemented an Atlantic HMS recreational fishing permit (67 FR 77437, December 18, 2002). The HMS Angling category permit became effective March 2003. NOAA Fisheries now requires the owners of vessels that target, retain, or possess HMS in Federal waters of the Atlantic, Gulf of Mexico, and U.S. Caribbean to obtain this Federal vessel permit. The HMS Angling category permit allows all anglers aboard permitted vessels to fish for HMS and is required to fish for, retain or possess, including catch-and-release fishing, any federally regulated HMS; sharks, swordfish, white and blue marlin, sailfish, spearfish, and federally regulated Atlantic tunas (bluefin, yellowfin, bigeye, skipjack, and albacore). As of September 30, 2003, there were 18,249 HMS Angling category permit holders.

Monitoring and Reporting

By definition, recreational landings of Atlantic HMS are those that are not marketed through commercial channels, therefore it is not possible to monitor anglers' catches through ex-vessel transactions as in the commercial fishery. Instead, NOAA Fisheries conducts statistical sampling surveys of the recreational fisheries. These survey programs have been used for well over a decade. The two primary survey vehicles of the recreational sector conducted by NOAA Fisheries are the Marine Recreational Fishing Statistics Survey (MRFSS) and the Large Pelagic Survey (LPS).

The MRFSS is a survey designed to provide regional and state-wide estimates of recreational catch for marine fish species in the Atlantic. It was not designed to account for the unique characteristics of HMS fisheries, although information on these species is occasionally collected by the survey. The MRFSS does not cover the state of Texas nor does it cover the charter/headboat fisheries. Therefore, data from the charter/headboat sector of the fishery are provided by an independent survey in the State of Texas and by the NMFS Headboat Survey in the southeast United States. NOAA Fisheries is in the process of implementing and evaluating a new For-Hire Survey for the charter/headboat sector on the Atlantic coast. A similar survey has been conducted in the Gulf of Mexico since January 2000. Information collected by the MRFSS on recreational shark landings is used to estimate the number of fishing trips, the number and species of sharks caught and/or landed, the weight of these sharks, and the number of persons fishing. Shark species are identified to the extent possible.

The MRFSS estimates three types of catch:

1. Fish that are available for identification, enumeration, weighing, and measuring by dockside interviewers are called Type A catch or *landings*;

2. Fish not brought ashore in whole form but used as bait, filleted, or discarded dead are called Type B1 catch (Type A and Type B1 catch together comprise *harvest*);

3. Fish released alive are called Type B2 catch; and

4. The sum of Catch Type A, Catch Type B1, and Catch Type B2 is called *total catch*.

The MRFSS estimates of recreational landings and harvest are calculated using Type A and B1 catches only. Estimates of Type B2 catches are not included. Thus, estimates of "catch" are actually estimates of immediate recreational fishing mortality as landings or harvest. A complete accounting of fishing mortality would include post-release mortality associated with Type B2 fish. Quantitative estimates of post-release or delayed mortality of HMS in recreational fisheries are not available at this time.

The Large Pelagic Survey was designed to estimate annual recreational catches of bluefin tuna from North Carolina through Massachusetts in the summer months and to evaluate abundance trends of bluefin tuna by monitoring catch and effort associated with all sizes of bluefin tuna. Although it was designed for bluefin tuna, the Large Pelagic Survey also collects catch information on other highly migratory species and is used to estimate catch information and monitor catch per unit effort trends. There are two phases to this survey: (1) dockside interviews and observation to obtain number, species, and sizes of fish caught during a trip; and (2) a telephone survey directed at those people who possess an HMS permit to obtain the amount of effort during the prior reporting period and corroborative information about the number of fish captured.

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

information allows NOAA Fisheries scientists to travel to selected tournaments to collect data on age/growth and sexual maturity that are used in stock assessments.

3.3.2 Economic Aspects of Shark Fisheries

3.3.2.1 Fishing Costs and Revenues for Atlantic Commercial Fishermen

In general, a vessel owner will need to pay for supplies and provisions for each fishing trip (e.g. hooks, bait, light sticks, ice, fuel, groceries, etc.), vessel and gear repairs as needed, crew members (the number of crew members may change depending on the type of fishing trip and the gear used), and for the proper permits (the information here does not include the price of the permit which is small for an annual renewal but may be large for someone trying to enter a limited access fishery). Fishing trips themselves can be expensive and there is no guarantee that the revenues from the harvest will be enough to cover the owner's expenses for that trip.

There is demand for shark meat and fins in markets throughout the United States, Asia, and Europe. Ex-vessel prices for sharks vary, depending on a variety of factors including: quality of the fish, weight of the fish, the supply of fish, and consumer demand. The average ex-vessel prices per pound dressed weight (dw) for 1996 and 2001 by shark species group, major gear type, and area are summarized in Table 3.22. The average ex-vessel prices per pound dw for 1996 and 2001 by species group and area are summarized in Table 3.23.

From 1996 to 2001, the average ex-vessel price for large coastal sharks increased in the Gulf of Mexico, Mid-Atlantic and North Atlantic regions and decreased slightly in the South Atlantic region (Table 3.23). Average prices changed across regions and gear-type (Table 3.22). Also from 1996 to 2001, the average ex-vessel price for pelagic sharks decreased in the South, Mid-, and North Atlantic regions. The highest average prices were found with a variety of gears, mainly longline and handgear (Table 3.22). Small coastal sharks have the lowest average ex-vessel price of all shark species but this price generally increased in all regions (Table 3.23).

The average ex-vessel price for shark fins has generally increased (Table 3.22). No data was available in 1996 in the Gulf of Mexico or in 2001 in the Mid or North Atlantic regions (Table 3.23).

In general, the most valuable species include shortfin mako, thresher, porbeagle, and requiem sharks (Weber and Fordham, 1997). Weber and Fordham (1997) reported regional preferences for shark fins. In Hong Kong, processors seek the fins of hammerhead, tiger, oceanic whitetip, blacktip, dusky and blue sharks, while the fins of thresher, nurse sharks, and ray and skate wings have minimal value. In Taiwan, fin traders prefer the hammerhead, dusky, and blacktip reef sharks, and place a lower value on the thresher and blue sharks. In the United States domestic market, buyers generally prefer hammerhead and sandbar shark fins, followed by the dusky, tiger, blacktip, bull, and silky sharks (Weber and Fordham, 1997).

In addition to markets for shark meat and fins, there is extensive world trade in other shark products including leather, cartilage, liver oil, and jaws. While smaller sharks are preferred for human consumption, due to the greater ease of storage and lower concentrations of urea and mercury in the flesh, larger sharks are more often used for dried fins and leather products. It is difficult to process sharks for both meat and skins, primarily because skins must be processed immediately to preserve their quality (Rose, 1996). Shark cartilage is processed into tablets for cancer treatment. Liver oil is also used in pharmaceuticals, lubricants, and cosmetics.

Pelagic longline

The amount of economic data available for this gear type is increasing although current information is needed. Since 1996, NOAA Fisheries has been collecting economic information on a per trip basis through submission of voluntary forms in the pelagic logbook maintained in the Southeast Fisheries Science Center. Compared to the number of logbook reports, few economic data have been collected. In 2003, NOAA Fisheries initiated mandatory cost earnings reporting for selected vessels in order to improve the economic data available for all HMS fisheries. Mandatory submission of this economic data is needed for NOAA Fisheries to accurately assess the economic impacts of proposed fishery management regulations on fishermen and their communities as required by the National Environmental Policy Act (NEPA), Executive Order 12866, the Regulatory Flexibility Act (RFA), and National Standards 7 and 8 of the Magnuson-Stevens Act. Specifically, this information will be used to conduct cost-benefit analyses and develop regulatory impact analyses of proposed regulations in an effort to help NOAA Fisheries develop and improve fishery management strategies.

Larkin *et al.* (2000) examined 1996 logbooks and the 1996 voluntary forms and found that net returns to a vessel owner varied substantially depending on the vessel size and the fishing behavior (i.e. sets per trip, fishing location, season, target species). They found that out of 3,255 pelagic longline trips reported, 642 pelagic longline trips provided the voluntary economic information. From all trips, four species (swordfish, yellowfin tuna, dolphin fish, and sandbar sharks) comprised 77 percent of all species landed and accounted for 84 percent of the total gross revenues for the fleet. Generally, vessels that were between 46 and 64 feet in length, had between 10 and 21 sets per trip, fished in the second quarter, fished in the Caribbean, or had more than 75 percent of their gross revenues from swordfish had the highest net return to the owner (ranging from $3,187 to $13,097 per trip). Vessels that were less than 45 feet in length, had between one and three sets per trip, fished in the first quarter, fished between North Carolina and Miami, FL, or had between 25 and 50 percent of their gross revenues from swordfish had the lowest net return to the owner (ranging from $642 to $1,885 per trip).

Larkin *et al*. (in press) used the above data in a cost function model to determine if and how captains decide on levels of effort in order to minimize variable costs per trip. They found that on average increasing the price of bait increased the demand for light sticks (i.e. these inputs are complements); changing the price of fuel did not affect any purchase decisions; and for every additional 10 feet in length, vessel operators demanded an additional 149 light sticks, 319 pounds

of bait, and 540 gallons of fuel per trip. They also found that on average increasing swordfish landings required additional light sticks, bait and fuel. Increasing tuna landings reduced the demand for light sticks while increasing the demand for bait and fuel. Additionally, some inputs (i.e. light sticks, bait demand, and fuel demand) varied significantly with region, quarter, number of sets, and target species. They also found that if the price of light sticks or bait increases, the quantity demanded falls, particularly for light sticks (i.e. own-price elasticities are negative). However, elasticities could also change depending on region, target species, or number of trips but did not change between seasons.

Porter *et al*. (2001) conducted a survey of 147 vessels along the Atlantic and Gulf of Mexico (110 surveys were completed) in 1998 regarding 1997 operations. The survey consisted of 55 questions divided into five categories (vessel characteristics, fishing and targeting strategies, demographics, comments about regulations, and economic information of variable and fixed costs). The vessels interviewed were diverse in vessel size and target species (swordfish, tuna, mixed). Information was also used from trip tickets and logbooks. They found that on average, the average vessel received approximately $250,000 annual gross revenues, annual variable costs were approximately $190,000, and annual fixed costs were approximately $50,000. Thus, vessels were left with approximately $8,000 to cover depreciation on the vessel and the vessel owner lost approximately $3,500 per year. On a per trip level, gross revenues averaged $22,000 and trip expenses, including labor, were $16,000. Labor cost the owner the most (43 percent) followed by gear. Generally trip returns were divided so the vessel owner received 43 percent and the captain and crew 57 percent. Along with other studies, Porter *et al*. (2001) noted differences between region, vessel size, and target species. Porter *et al*. (2001) also noted that 1997 was probably a financially poor year due to a reduction in swordfish quota and a subsequent closure of the fishery.

In all, these studies are consistent with Larkin *et al*. (1998) and Ward and Hanson (1999) in that characteristics of fishing trips can influence the success of the trip and that pelagic longline fishermen do not have large profits. Additional information specific to the pelagic longline fishery can be found in the Final Supplemental Environmental Impact Statement for the Reduction of Bycatch, Bycatch Mortality, and Incidental Catch in the Atlantic Pelagic Longline Fishery, and in the Environmental Assessment and Regulatory Impact Review to Reduce Sea Turtle Bycatch and Bycatch Mortality in the Atlantic Pelagic Longline Fishery or in the June 14, 2001, BiOp.

Bottom Longline

Nearly all Atlantic shark fishermen operate in the multispecies longline fishery where gear requirements are substantially similar. McHugh and Murray (1997) compared the proportion of catch per trip by value for a sample of directed shark fishing vessels in surveys conducted over two periods, one before and one after implementation of the shark FMP in April 1993. Survey data reveal that the share of sharks, in total trip catch value, declined from 90.8 percent to 62.1 percent. In contrast, the share of grouper, in total value, increased from 6.9 percent to 34 percent.

The 1993 finning prohibition and quota cuts, along with the 1994 commercial retention limit, likely played a role in this changing composition, although a more important factor may have been the increase in grouper prices while shark prices were relatively stable or declining. Examination of the trips by share of shark in total volume of catch indicates that there has been a notable shift in the concentration of activity away from shark products toward more diversified trips (McHugh and Murray, 1997).

McHugh and Murray (1997) estimated profits per fishing trip for shark vessels as the owner's share of total catch minus all expenses other than those for food, which are normally taken out of the crew's share of the revenues. For the entire fishery, per-day profit rates were calculated, with a seven-day trip averaging $1,589 (for comparison with figures provided below). When examined by vessel category, vessels in the 40 to 49 foot range averaged $1,975 in profits per seven-day trip ($282.18 in profits per day). A regression analysis shows that trip profitability is unrelated to the proportion of catch which is shark. Profits were also positively related to dummy variables for the 1994 and 1995 seasons, possibly indicating that the more efficient highliners remained in the fishery following implementation of the commercial retention limit. There is anecdotal evidence (supported in McHugh and Murray, 1997) that the implementation of the commercial retention limit rule resulted in the exit of some of the larger vessels from the shark fishery.

Additional data are needed for this fishery. NOAA Fisheries began collection of cost-earnings information for this fishery in 2003. As described earlier, this economic data is needed in order to accurately assess the economic impacts of management measures.

Gillnets

Currently, the only fishermen allowed to use this gear in HMS fisheries are fishermen targeting sharks. NOAA Fisheries knows of five vessels that actively participated in this fishery in recent years. NOAA Fisheries has very little economic information on the fishing costs related to this gear type. However, it is expected that the cost per trip would be less than those of a pelagic or bottom longline fishing trip because the trips are usually shorter in duration (an average of 18 hours per trip), vessels do not fish far offshore (within 30 nautical miles from port), and the gear does not need hooks, bait, or light sticks. Other costs may be incurred as the holes in the gear need to be repaired regularly. Based on recent landings and average ex-vessel prices, NOAA Fisheries estimates that most drift gillnet vessels fishing for sharks have gross revenues per trip of $380 to $9,000 with an average of $3,700.

Additionally, some shark drift gillnet vessels fish in a strike-net method. This method usually requires the use of a small vessel (used to run the net around the school of sharks) and can require the use of a spotter plane. While the cost per trip is higher than the traditional drift gillnet method, bycatch in this method is extremely low, catch rates of the target species is high, and vessels can complete a set in less time. NOAA Fisheries estimates that the smaller vessel could cost between $2,000 and $14,000 to buy. Because these second vessels need to be sturdy enough

to hold the gillnet and move quicky around the school of sharks, it is likely that vessel owners would need to re-fit any vessel bought for this purpose. Additionally, a second vessel requires additional fuel and maintenance costs. Spotter planes in other fisheries are paid based on the percentage of the proceeds from the trip, generally 10 to 25 percent of gross revenues. Thus, given the average gross revenues per trip, converting a drift gillnet vessel to a strikenet vessel could be prohibitive unless the vessel is fishing for other species as well.

3.3.2.2 Costs and Revenues for Atlantic Dealers

NOAA Fisheries does not currently have information regarding the costs to HMS dealers. In general, dealer costs include: purchasing fish; paying employees to process the fish; rent or mortgage on the appropriate building; and supplies to process the fish. Some dealers may provide loans to vessel owners for vessel repairs, fuel, ice, bait, etc. In general, outlays and revenues of dealers are not as variable or unpredictable as those of a vessel owner; however, dealer costs may fluctuate depending upon supply of fish, labor costs and equipment repair.

Although NOAA Fisheries does not have specifics regarding HMS dealers, there is some information on the number of employees for processors and wholesalers in the United States provided in the HMS FMP. Table 3.24 provides a summary of available information. Recent trends indicate that while the number of fish processing facilities have decreased, the number of employees have increased. Florida and New York appear to have the largest number of processing facilities and employees on the Atlantic coast.

NOAA Fisheries also has information regarding the mark-up percentage paid by consumers. A mark-up or margin is the difference between the price paid for the product by the consumer and the wholesale or dockside value for an equivalent weight of the product. This information is presented in Table 3.25. In both 1996 and 2001, the mark up was over 90 percent.

Dealers and shoreside processors purchasing sharks directly from fishing vessels are required to obtain a NOAA Fisheries dealer permit. Similar to vessel permits, dealers often have permits for more than one species. As of October 2002, there were 267 dealers permitted to purchase Atlantic sharks. Based on information in the dealer database, dealer addresses ranged from Texas through Maine with 100 dealers (37 percent) based in Florida, 21 (8 percent) in North Carolina, 19 (7 percent) in Louisiana, 19 (7 percent) in Massachusetts, and 13 in South Carolina (5 percent).

3.3.2.3 Economics of Recreational Fisheries

Although NOAA Fisheries believes that recreational fisheries have a large influence on the economies of coastal communities, NOAA Fisheries has little current information on the costs and expenditures of anglers or the businesses that rely on them. An economic survey conducted

by the U.S. Fish and Wildlife Service[1] in 2001 found that 9.1 million saltwater anglers went on approximately 72 million fishing trips and spent approximately $8.4 billion (USFWS, 2002). Expenditures included lodging, transportation to and from the coastal community, vessel fees, equipment rental, bait, auxiliary purchases (e.g. binoculars, cameras, film, foul weather clothing, etc.), and fishing licenses. Saltwater anglers spent $4.5 billion on trip related costs and $3.9 billion on equipment. Approximately 76 percent of the saltwater anglers surveyed fished in their home state (USFWS, 2002). The next USFWS survey is expected in 2006.

The American Sportfishing Association (ASA) also has a report listing the 2001 economic impact of sportfishing on specific states. This report states that all sportfishing has an overall economic importance of $116 billion dollars. Florida, Texas, North Carolina, New York, and Alabama are among the top 10 states in terms of overall economic impact for both saltwater and freshwater fishing. Florida is also one of the top states in terms of economic impact of saltwater fishing with $2.9 billion in angler expenditures, $5.4 billion in overall economic impact, $1.5 billion in salaries and wages related to fishing, and 59,418 fishing related jobs. After California, Texas and New Jersey were the next highest states in terms of economic impact (ASA, 2001).

In general, most anglers do not target HMS. In 2001, over 12 million people made 84 million marine recreational fishing trips in the United States and caught over 442 million fish (over 57 percent were released alive). Along the Atlantic and Gulf of Mexico, over 9.4 million participants took over 75.8 million trips and caught a total of more than 407 million fish. Of the trips that occurred in the Atlantic, 24 percent were made in east Florida, 14 percent in New Jersey, and 13 percent in North Carolina. The most commonly caught species by number in the Atlantic were summer flounder, Atlantic croaker, bluefish, black sea bass, and striped bass. The top five most commonly caught fish by weight included yellowfin tuna, the only HMS in that list. The most commonly caught species in federally managed waters were black sea bass, dolphin, Atlantic cod, summer flounder, Atlantic mackerel, and bluefish. Of the trips that occurred in the Gulf of Mexico, 72 percent originated in Florida, 16 percent in Louisiana, and 12 percent in Alabama and Mississippi. The most commonly caught species by number were spotted and sand seatrouts, red drum, white grunt, blue runner, Spanish mackerel, and Atlantic croaker. No HMS made the top five list for most commonly caught species by weight in the Gulf of Mexico. The most commonly caught species by number in federally managed waters were white grunt, red snapper, black sea bass, dolphin, and greater amberjack (NOAA Fisheries, 2002).

3.3.2.4 Willingness to Pay to Fish for Atlantic HMS

The most recent data NOAA Fisheries has comes from a 1994 survey of anglers in New England and the Mid-Atlantic (Hicks *et al.*, 1999). The data collected were used to estimate expenditures and economic value of the various groups of recreational fisheries in this area. One category of

[1] This survey interviewed over 77,000 households during phase 1 and approximately 25,070 sports persons during phase 2. The response rate during phase two of the survey was 75 percent.
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fishing, called "Big Game" consisted primarily of HMS, including sharks, billfish, and tunas. Although this study is not an exhaustive picture of the entire HMS recreational fishery, the results provide considerable insight into the absolute and relative values of the recreational fisheries for HMS. Overall average willingness to pay (WTP) for a one-day fishing trip ranged from a low of less than a dollar in New Hampshire to a high of $42 in Virginia. Aggregate WTP (average WTP times the number of trips) ranged from $18,000 in New Hampshire to nearly $1 million in Virginia. Using model results, it was possible to estimate the WTP for a one fish increase in the expected catch rate across all sites in the choice set. The highest average value was attributed to big game fish, ranging from $5.00 to $7.00 per trip (about $5.40 on average), in addition to the value of the trip. The marginal value of an increase in catch per trip was highest for big game fish, and lowest for bottom fish.

The 1994 survey results also indicated that boat fees were responsible for the greatest percentage of expenditures. Roughly 70 percent and 53 percent of total expenditures went for private/rental boats and charter/party boats, respectively. Travel expenses were the smallest portion of expenditures, although travel costs for those fishing on party/charter vessels were about twice as high as for those fishing on private/rental boats ($28 *vs*. $16).

Angler WTP depends, in part, on the species sought and on the location. Fisher and Ditton (1992) found that anglers were willing to pay an additional $105 per trip rather than stop fishing for sharks and that 32 percent of shark anglers said that no other species would be an acceptable substitute for sharks.

While these results are useful in considering the economic value of HMS recreational fisheries, specific surveys focusing on HMS are preferable in order to consider the particular nature of these fisheries. NOAA Fisheries will continue to pursue options for funding economic surveys of the recreational HMS fisheries.

3.3.2.5 Atlantic HMS Tournaments

A recent search for HMS tournaments on the web found a number of tournaments targeting HMS. This search found that HMS tournaments charge large fees for a team ($395 to $5000). This entry fee would pay for a maximum of two to six anglers per team during the course of the tournament. Additional anglers could join the team at a reduced rate of between $50-$450. The team entry fee did not appear to be directly proportional to the number of anglers per team, but rather with the amount of money available for prizes and, possibly, the species being targeted. For example, in 2001 and 2002, Bisbee's Black and Blue Marlin Jackpot Tournament had a $5,000 entry fee for teams consisting of a maximum of four anglers. This tournament awarded a total of $1.7 million in both 2001 and 2002. Conversely, the $15,000 New Jersey Shark tournament has an entry fee of $395 for a team with a maximum of five anglers. This tournament awarded a total of $15,000 in prizes with a possibility of a $50,000 bonus if a state record is landed. The number of vessels and participants at each tournament is also diverse. The

smallest tournament found on the web had 18 vessels and 58 anglers participating. Some of the larger tournaments had between 250 and 400 vessels and over 1,300 anglers participating.

In general, it appears that billfish and tuna tournaments charge higher entry fees and award more prize money than shark tournaments although all species have a wide range. The web search found that while some tournaments award between $500 and $50,000 in prizes (third through first place) others award much larger prizes ranging from $81,000 to $840,000 in prizes. Some tournaments hand out equipment such as new cars, boats, fishing tackle with, or instead of, monetary prizes. The total amount of prize money distributed at any one tournament ranged from $9,500 to $2,385,900.

Most tournaments also have a type of betting called a "calcutta" where anglers pay between $200 to $5,000 to win more money than the advertised tournament prizes for a particular fish. Tournament participants do not have to enter calcuttas. Tournaments with calcuttas generally offer different levels depending on the amount of money an angler is willing to put down. Calcutta prize money is distributed based on the percentage of the total amount entered into that calcutta. Therefore, first place winner of a low level calcutta (entry fee ~$200) could win less than a last place winner in a high level calcutta (entry fee~$1000). On the web pages, it was not always clear if the total amount of prizes distributed by the tournament included prize money from the calcuttas or the estimated price of any equipment. As such, the range of prizes discussed above could be a combination of fish prize money, calcutta prize money, and equipment/trophies.

Tournaments can bring in a lot of money for the surrounding communities and local businesses. Besides the entry fee to the tournament and possibly the calcutta, anglers also pay for marina space and gas (if they have their own vessel), vessel rental (if they do not have their own vessel), meals and awards dinners (if not covered by the entry fee), hotel, fishing equipment, travel costs to and from the tournament, camera equipment, and other miscellaneous expenses.

3.3.2.6 Atlantic HMS Charter and Party Boat Operations

Currently, specific information on the economic impact of HMS charter/headboat operations is sparse. Most of the data, as reported in the HMS FMP, are related to the bluefin tuna fishery and other tunas. There are, however, limited data on charter/headboats in general. In 2001, HMS required all charter/headboat vessels fishing for Atlantic HMS to have a permit. This information indicates that a few thousand vessels either target, or feel they could catch, Atlantic HMS. As of September 30, 2003, there were 4,041 Atlantic HMS charter/headboat permit holders.

In 1998, a survey was completed of a number of charterboats (96 of an estimated 430) and party boats (21 out of 23) throughout Alabama, Mississippi, Louisiana, and Texas (Sutton *et al*., 1999). This study provides some economic information related to HMS. They defined charter boats as for-hire vessels that carry six or fewer passengers in addition to the crew while party boats are

for-hire vessels that carry more than six passengers (up to 150 passengers). They found that the average charter boat base fees were $417 for a half day trip, $762 for a full day trip, and $1,993 for an overnight trip and 60 percent of all trips were taken May through August. The average party boat base fees were $41 for a half day trip, $64 for a full day trip, and $200 for an overnight trip and 48 percent were taken May through August. They found that 55 percent of charter boat operators reported targeting tuna at least once, 38 percent targeted sharks at least once, 41 percent reported targeting billfish at least once. Percentages by state are summarized in Table 3.26. Snapper (49 percent), king mackerel (10 percent) red drum (6 percent), cobia (6 percent), tuna (5 percent) and speckled trout (5 percent) were the species that received the largest percentage of effort by charter boat operators.

In the Sutton *et al*. study, party boat operators did not frequently target sharks, tunas or billfish. A total of 65 percent of party boat operators reported targeting sharks at least once; 55 percent indicated they had targeted tunas at least one time. Ninety percent reported that they did not target billfish. Snapper (70 percent), king mackerel (12 percent), amberjack (5 percent) and sharks (5 percent) were the species that received the largest percentage of effort by party boat operators. The economic information estimated in this study can be found in Table 3.27.

Holland *et al*. (1999) conducted a similar study on charter (boats that carry six or less passengers and charge for the entire boat) and headboats (boats that carry 10 or more passengers and charge by the person) in Florida, Georgia, South Carolina, and North Carolina. The survey interviewed 403 charter operators (24 percent of the estimated number of charter boats) and 52 headboat operators (35 percent of the estimated number of headboats). The average fees for charter and headboats are listed in Table 3.28. Charterboat and headboat operators did not target HMS as frequently as they did other species such as mackerel, grouper, snapper, dolphin, and red drum. The percentage of charter and headboat operators who report targeting HMS can be found in Table 3.29. Table 3.30 shows the economic information regarding these businesses. Unlike similar businesses in the Gulf of Mexico, the Holland study indicates that these businesses appear to be profitable except for charter boats in Florida which are, on average, unprofitable.

Overall, charter/headboats appear to provide a substantial amount of employment and are economically important to coastal communities. Although HMS are targeted, they do not appear to be the primary objective for the majority of operations, and as such, HMS charter/headboat fisheries probably do not contribute as substantially to the economies of these communities compared to other fisheries such as mackerel and snapper.

3.3.2.7 Other Recreational Fishing Costs Information

In addition to charterboat fees, recreational anglers can incur other costs associated with fishing. These may include the costs of owning, outfitting, and operating personal vessels used for fishing. NOAA Fisheries has no current data on the cost of recreational boat ownership and operating costs.

3.3.3 Fish Processing, Industry, and Trade

Over the past several years, the United States has taken steps to use international trade information to further domestic conservation policy related to Atlantic HMS. While this process is slow, it is important to note that by working multi-laterally, management actions taken by the United States are strengthened and provide protection from a challenge before the World Trade Organization. U.S. actions related to trade must be consistent not just with domestic fisheries legislation, but also with the General Agreements of Tariffs and Trade (GATT).

Because there are "missing links" surrounding the capture, processing, and trade of Atlantic HMS, NOAA Fisheries cannot re-create information about stock production based on trade data. Nevertheless, trade data is used to update information on international and domestic activities related to these fisheries and to question compliance with ICCAT management measures. Sharks are not included in ICCAT recommendations, however, in December 2000, a bill was signed that required the Secretary of Commerce to ban shark finning in the United States and to begin discussions on developing international agreements to prohibit shark finning.

3.3.3.1 Overview of U.S. Trade Activities for HMS

It is unknown how many U.S. companies depend on HMS fisheries, other than those who buy fish directly from U.S. fishermen and those who import bluefin tuna or swordfish. The proportion of those companies that depend solely on Atlantic HMS versus those that handle other seafood and/or products is also unknown. This section provides a summary of the most recent trade data that NOAA Fisheries has analyzed, as well as a brief description of the processing and trade industries employed in transitioning Atlantic HMS from the ocean to the plate.

Processing and Wholesale Sectors

Quantitatively, NOAA Fisheries has limited information on the processing sector, i.e., the amount of HMS products sold in processed forms. In addition, knowledge regarding the utilization of Atlantic HMS is largely limited to the major product forms. The utilization of sharks is also not well known since trade statistics frequently do not indicate product forms such as skins and leather, jaws, fishmeal and fertilizer, liver oil, and cartilage (Rose, 1996). Domestically-landed sandbar and blacktip shark meat may be sold to supermarkets and processors of frozen fish products. NOAA Fisheries continues to work with industry to collect information specific to U.S. and foreign processing of Atlantic HMS to better track markets, conserve stocks, and manage sustainable fisheries.

The U.S. processing and wholesale sectors are dependent upon both U.S. and international HMS fisheries. Individuals involved in these businesses buy the seafood, cut it into pieces that transform it into a consumer product, and then sell it to restaurants or retail outlets. Employment varies widely among processing firms. Often employment is seasonal unless the firms also process imported seafood or a wide range of domestic seafood. The majority of firms handle

other types of seafood and are not solely dependent on HMS. Other participants in the commercial trade sector include brokers, freight forwarders, and carriers (primarily commercial airlines, trucking, and shipping companies). Swordfish, tunas, and sharks are important commodities on world markets, generating significant amounts in export earnings in recent years.

NOAA Fisheries has recently observed that many seafood dealers that buy and sell HMS and other seafood products expand their operations into internet-powered trading platforms specifically designed to meet the needs of other seafood professionals. Through these platforms, interested parties can conduct very detailed negotiations with many trading partners simultaneously. Buyers and sellers can bargain over all relevant elements of a market transaction (not just price) and can specify the product needed to buy or sell in detail, using seafood-specific terminology. The platforms are purportedly easy to use because they mimic the pattern of traditional negotiations in the seafood industry. NOAA Fisheries expects that the use of the internet will change the way HMS trade occurs in the future. NOAA Fisheries staff intends to continue to learn about the new technologies being used by our constituents.

3.3.3.2 Shark Exports

Existing programs at NOAA Fisheries monitor exports of fish products and provide Bureau of the Census data online for the public at www.st.nmfs.gov/st1/trade/index. Census defines exports of "domestic" merchandise to include commodities which are grown, produced, or manufactured in the United States (e.g., fish caught by U.S. fishermen). For statistical purposes, domestic exports also include commodities of foreign origin which have been altered in the United States from the form in which they were imported, or which have been enhanced in value by further manufacture in the United States. The value of an export is the f.a.s. (free alongside ship) value defined as the value at the port of export based on a transaction price including inland freight, insurance, and other charges incurred in placing the merchandise alongside the carrier. It excludes the cost of loading the merchandise, freight, insurance, and other charges or transportation costs beyond the port of exportation.

NOAA Fisheries collects trade data on the export of sharks, although not in the level of detail found in the Bluefin Statistical Document program. Some regional entities, including the Food and Agriculture Organization of the United Nations (FAO), work to conserve sharks worldwide and gather trade information on shark species. Shark exports are not identified by species code with the exception of dogfish. In addition, they are not identified by specific product code other than fresh or frozen meat and fins. Shark shipments are not identified with respect to the flag of the harvesting vessel or the ocean of origin. Due to the popular trade in shark fins and their high relative value compared to shark meat, shark fins are tracked as a specific product code by U.S. Customs. In 2002, exported shark fins averaged $28.00/kg ($12.70/lb). In comparison, exported shark fins averaged $8.54/kg ($3.87/lb) in 1999 and $8.95/kg ($4.06/lb) in 1998. In 2002, exported fresh and frozen shark meat averaged $1.52/kg ($0.69/lb) and $2.38/kg ($1.08/lb), respectively. Table 3.31 indicates the magnitude of shark exports by the United States from 1997-2002. Errors in the Bureau of Census data for dried shark fin exports for the years 2000

and 2001 prevent its inclusion in the table and discussion. Corrected data will be made available when it is received by NOAA Fisheries.

Sharks are targeted in the coastal Pacific ocean by the driftnet thresher fishery and are caught incidental to the Bering Sea groundfish (trawl) fishery, and tuna and swordfish longline fisheries in the Western Pacific ocean. However, the Atlantic fishery catches a large number of sandbar and blacktip sharks which are thought to be sold domestically. As a result, it is unknown what percentage of total exports can be attributed to the Atlantic fishery.

Note that exports of fresh and frozen shark increased substantially in 2002. The volume of non-specific frozen shark exports increased in 2002 by 55 percent from 2001, and the volume of non-specific fresh shark exports increased by 191 percent in 2002. The average price quoted for exports of fresh shark remained relatively constant from 1999-2000, $1.82/kg ($0.83/lb) in 2000, but has decreased slightly in 2001 and 2002 to $1.64/kg ($0.74/lb) and $1.52/kg ($0.69/lb), respectively. Frozen shark product decreased in value slightly in 2000 to $2.35/kg ($1.07/lb) from $2.97/kg ($1.35/lb) in 1999, then increased significantly to $3.69/kg ($1.67/lb) in 2001. In 2002 frozen shark product decreased to $2.38/kg ($1.08/lb).

It should be noted that there is no tracking of other shark products besides meat and fins. Therefore, NOAA Fisheries cannot track trade in shark leather, oil, or shark cartilage products. Additionally, the United States has reported its imports of shark fins since 1964, but has only recently obtained a tariff code for exporting shark fins. Until that time, they were classified under a general heading.

Consistent with the directives of Section 5 of the Shark Finning Prohibition Act, the Department of Commerce and the Department of State have initiated an ongoing consultation regarding the development of international agreements. Discussions have focused on possible bilateral, multilateral, and regional agreements with other nations. The law calls for the U.S. to pursue an international ban on shark finning, and to encourage improved data collection (including biological data, stock abundance and bycatch levels, and information on the nature and extent of shark finning and trade). The Secretary of Commerce is required to annually provide Congress with a list of nations whose vessels conduct shark finning, including estimates of harvest and value of fins, and recommendations to ensure that U.S. actions are consistent with international obligations. Determining the nature and extent of shark finning is the first step toward reaching agreements that will decrease the practice of finning worldwide.

3.3.3.3 Shark Imports

All seafood import shipments are required to be accompanied by a 7501 Customs entry form. The information submitted on this form is analyzed by NOAA Fisheries and those data are available online at www.st.nmfs.gov/st1/trade/index. As mentioned on the web page, two methods are used to track imports: "general" imports are reported when a commodity enters the country, and "consumption" imports consist of entries into the United States for immediate

consumption combined with withdrawals from Customs bonded warehouses. "Consumption" import data reflect the actual entry of commodities originating outside the United States into U.S. channels of consumption. These are the data used by NOAA Fisheries.

The United States imports both fresh and frozen shark meat. These imports and shark fins can be tracked using data from the Customs 7501 entry form. NOAA Fisheries does not require importers to submit additional data regarding shark shipments. These meat products are reported to be high-quality and are supplied to restaurants and other seafood dealers that import other high-quality seafood products (Rose, 1996). NOAA Fisheries does not have specific product information on imported shark meat such as the proportion of fillets, steaks, or loins. NOAA Fisheries also has no data on imports of the condition of shark fins; i.e., wet, dried, or further processed products such as canned shark fin soup. The United States may be an important trans-shipment port for shark fins; shark fins may be imported wet and then exported dried. It is also probable that U.S.-caught shark fins are exported to Hong Kong or Singapore for processing, then imported back into the United States for consumption by urban-dwelling Chinese Americans (Rose, 1996). There is no longer a separate tariff code for shark leather, making it impossible to track imports of shark leather through analysis data from the Customs 7501 entry form. Imports of frozen sharks have increased by nearly 54 percent since 1997 while imports of shark fins have decreased by approximately 50 percent (by weight) (Table 3.32).

In 2002, dried shark fin imports decreased by 11,523 kg, non-specific fresh shark decreased by 11,588 kg, and non-specific frozen shark imports decreased by 32,017 kg. Imported shark fins averaged $26.16/kg ($11.86/lb), increasing from $21.45/kg ($9.73/lb) in 2001. Fresh shark averaged $1.56/kg ($0.71/lb), increasing slightly from $1.52/kg ($0.69/lb) in 2001. Prices for non-specific frozen shark decreased from $14.38/kg ($6.52/lb) in 2001 to $11.88/kg ($5.39/lb) in 2002. The average price for imported dried shark fins increased by 22 percent from the average price in 2001. The Shark Finning Prohibition Act was enacted in December of 2000 and fully implemented in February 2002, therefore, decreases in shark fin trade are to be expected.

3.4 HABITAT

This section of Chapter 3 and Chapter 10 identify and describe habitats, including essential fish habitat (EFH), for some of the sharks covered by this FMP Amendment, on behalf of the Secretary of Commerce and in accordance with the Magnuson-Stevens Act. Chapter 10 contains all of the mandatory elements for updating EFH identification, description and conservation, including descriptions of the locations and characteristics of EFH for five of the managed species in text with referenced tables and maps. In addition, Chapter 10 considers threats to EFH from fishing activities and potential threats to EFH from non-fishing activities, and identifies options for the conservation and enhancement of shark EFH that should be considered in the planning of projects that may adversely affect those habitats. These measures are representative of the conservation and enhancement measures that may be recommended by NOAA Fisheries during consultation with Federal action agencies, as required by section 305(b) of the Magnuson-Stevens Act, on projects that may potentially impact shark EFH. Chapters 5 and 6 of the HMS FMP contain EFH identification information for the rest of the managed shark species.

3.4.1 Regulatory Requirements

Section 303(a)(7) of the Magnuson-Stevens Act, 16 U.S.C. §§ 1801 *et seq*., as amended by the Sustainable Fisheries Act in 1996, requires that FMPs describe and identify EFH, minimize to the extent practicable adverse effects on such habitat caused by fishing, and identify other actions to encourage the conservation and enhancement of such habitat. The Magnuson-Stevens Act defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." (16 U.S.C. § 1802 (10)). The EFH regulations (at 50 C.F.R. 600 Subpart J) provide additional interpretation of the definition of essential fish habitat: "'Waters' include aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include aquatic areas historically used by fish where appropriate; 'substrate' includes sediment, hard bottom, structures underlying the waters, and associated biological communities; 'necessary' means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and 'spawning, breeding, feeding, or growth to maturity' covers a species' full life cycle."

The EFH regulations (67 FR 2343, January 17, 2002) require NOAA Fisheries to periodically review and revise or amend the EFH provisions as warranted based on available information. The EFH regulations further require NOAA Fisheries to review all EFH information at least once every 5 years. EFH, including habitat areas of particular concern (HAPCs), for sharks were identified in the 1999 HMS FMP. This Amendment does not constitute the comprehensive 5-year review of EFH for all HMS, including sharks, required by the regulations. The complete review of EFH for all HMS will likely be addressed in a future rulemaking. However, this Amendment does provide an update to EFH for several species of sharks for which there has either been a change in management status, or for which new information has become available. These species include the sandbar, blacktip, dusky, finetooth, and nurse sharks.

3.4.1.1 Description and Identification of EFH

The EFH regulations require that EFH be described and identified within the U.S. Exclusive Economic Zone (EEZ) for all life stages of each species in a fishery management unit. FMPs must describe EFH in text and tables that provide information on the biological requirements for each life history stage of the species. According to the EFH regulations, an initial inventory of available environmental and fisheries data sources should be undertaken to compile information necessary to describe and identify EFH and to identify major species-specific habitat data gaps. Available information should be evaluated through a hierarchical analysis based on: distribution data for some or all portions of the geographic range of a species (Level 1); habitat-related densities or relative abundances (Level 2); growth, reproduction, or survival rate comparisons between habitats (Level 3); and habitat-dependent production rates (Level 4). This information should be interpreted with a risk-averse approach to ensure that adequate areas are protected as EFH for the managed species. Habitats that satisfy the criteria in the Magnuson-Stevens Act and HMS EFH regulations have been identified and described as EFH.

For this FMP Amendment, NOAA Fisheries scientists at the Northeast Fisheries Science Center (NEFSC) and the Southeast Fisheries Science Center (SEFSC) conducted a review of the most recent life history and EFH information available for some species of sharks, with an emphasis on the factors that influence distribution of the species. NOAA Fisheries scientists at NEFSC completed a thorough review of shark nursery grounds of the Gulf of Mexico and the East Coast waters of the U.S. (McCandless *et al*., 2003). Information was available in the form of fishery-independent sources (directed research investigations) fishery-dependent sources (capture and bycatch reporting), and observer data.

Chapter 10 contains all of the required provisions as specified in the EFH regulations, covering all life stages of the species managed under this FMP for which information is available.

3.4.1.2 Fishing Activities That May Adversely Affect EFH

The EFH regulations and the Magnuson-Stevens Act require the fishery management councils (Councils) and NOAA Fisheries, on behalf of the Secretary of Commerce, to minimize adverse effects on EFH from fishing activities to the extent practicable. Adverse effects from fishing may include physical, chemical, or biological alterations of the substrate, and loss of or injury to benthic organisms, prey species and their habitat, and other components of the ecosystem. Based on an assessment of the potential adverse effects of all fishing equipment types used within an area identified as EFH, the Council should act if there is evidence that a fishing practice is having an identifiable adverse effect on the EFH.

An assessment was made of the gears and practices in order to determine whether HMS fishing activities cause adverse impacts on EFH. Impacts of HMS and non-HMS fishing gears and practices were analyzed by examining published literature and anecdotal evidence of potential impacts or comparable impacts from other fisheries (Section 10.4). Based on this assessment, NOAA Fisheries considers the fishing gears and methods of the HMS fisheries do not appear to have adverse impacts on HMS EFH. Even if there were any adverse impacts, such impacts are not expected to be "more than minimal and not temporary in nature" (50 CFR 600.815(a)(2)(ii)). There is the possibility that other (non-HMS) fisheries may adversely impact HMS EFH, and some HMS gear may impact other EFH; however, the degree of that impact is difficult to ascertain from the data currently available. Although, at this time, there is no evidence that HMS fishing practices are causing adverse impacts on EFH, two conservation recommendations are included in Section 10.4 as a precautionary measure in the event that impacts may be occurring but are currently unverified. NOAA Fisheries is aware that other actions may be required in the future as a greater understanding of the impacts of fishing gear on fish habitat is gained. Future management measures could include fishing gear or practice restrictions, additional time/area closures, or harvest limits on the take of species that provide structural habitat or of prey species. Areas that are currently closed to fishing should be used as experimental control areas to research the effects of fishing gears on habitat.

3.4.1.3 Non-Fishing Activities That May Adversely Affect EFH and Respective Conservation Measures

Section 600.815 (a)(4) of the EFH regulations requires that FMPs identify non-fishing related activities that may adversely affect EFH of managed species, either quantitatively or qualitatively, or both. In addition, Section 600.815 (a)(6) requires that FMPs recommend conservation measures describing options to avoid, minimize, or compensate for the adverse effects identified.

Broad categories of activities that may adversely affect HMS EFH include, but are not limited to: (1) actions that physically alter structural components or substrate, e.g., dredging, filling, excavations, water diversions, impoundments and other hydrologic modifications; and (2) actions that result in changes in habitat quality, e.g., point source discharges, activities that contribute to non-point-source pollution and increased sedimentation, introduction of potentially hazardous materials, or activities that diminish or disrupt the functions of EFH. If these actions are persistent or intense enough they can result in major changes in habitat quantity as well as quality, conversion of habitats, or in complete abandonment of habitats by some species.

As required under the EFH regulations, Chapter 10 identifies non-fishing activities that may adversely affect HMS EFH. In many cases these activities are regulated under particular statutory authorities. As long as they are regulated within those guidelines, their potential to adversely affect EFH may be reduced, although not necessarily eliminated. Many of the standards that are used to regulate these activities are based on human health needs and do not consider long-term impacts on fish and fish habitats. Additionally, if the activity fails to meet or is operated outside of its permitted standards, it may adversely affect EFH. The EFH regulations require NOAA Fisheries to identify actions with the potential to adversely affect EFH, including the biological, chemical and physical nature of the impact. The EFH regulations also recommend the examination of cumulative impacts on EFH. It is possible that many permitted actions operating within their regulatory bounds may cause adverse impacts on EFH. Chapter 10 lists a broad range of activities to ensure that their potential to adversely affect HMS EFH will be adequately considered.

The review of HMS habitat use undertaken for Chapter 10 identified both benthic and water column habitats in coastal, estuarine and offshore areas as EFH, although in many cases the particular habitat characteristics that control species habitat use are not clearly identified. Many of these factors seem to be related to water quality, e.g., temperature, salinity, and dissolved oxygen.

In addition to identifying activities having the potential to adversely affect EFH, the Magnuson-Stevens Act requires the inclusion of measures to conserve and enhance EFH. Each activity discussed in Chapter 10 is followed by actions to encourage conservation to avoid, minimize or mitigate adverse impacts on EFH. These include examples of both general and specific conservation actions that might be appropriate for NOAA Fisheries to recommend when

consulting on similar proposed activities. In some cases the actions are based on site-specific activities, in others the actions represent broad policy-type guidelines. During EFH consultations, NOAA Fisheries will evaluate each project based on its merits and potential threat to EFH, and the appropriate conservation measures will be assessed at that time. The Federal action agency with the statutory authority to regulate the proposed action must weigh all comments and decide on the appropriate action, modifications, or mitigation before proceeding with a project. The conservation actions included in this FMP provide examples of NOAA Fisheries' recommendations that potentially could be made regarding particular projects. They are intended to assist Federal and state agencies and other entities during the planning process when adverse impacts on EFH can be minimized most effectively, and may be incorporated into project designs and goals in order to help conserve EFH.

Maps geographically depicting threats to EFH should be included in an FMP. At the present time, however, the information for producing accurate maps depicting threats to HMS EFH is not available. The use of Geographic Information Systems (GIS) for mapping EFH distributions will allow the addition of this information as it becomes available.

3.4.1.4 Cumulative Impacts Analysis

The EFH regulations require that to the extent feasible and practicable, FMPs and FMP amendments should analyze how fishing and non-fishing activities influence habitat function on an ecosystem or watershed scale. At this time the technology is not available to provide a site-specific analysis of cumulative impacts for each area that has been identified as EFH for HMS, although the use of GIS technology to map EFH will facilitate the investigation of cumulative impacts in the future.

3.4.1.5 Habitat Areas of Particular Concern

The EFH regulations suggest that FMPs and FMP amendments identify HAPCs within EFH for habitats that satisfy the criteria of being sensitive or vulnerable to environmental stresses, are rare, or are particularly important ecologically. HAPCs represent subsets of identified EFH areas based upon the importance of their ecological function, their sensitivity to human-induced environmental degradation, development activities that serve as stressors on the habitat, and the rarity of the habitat. These areas should be identified to provide additional focus for conservation efforts.

Because of the lack of specific, detailed information regarding HMS habitat associations, the 1999 HMS FMP identified HAPC for only one HMS. The HAPC areas identified were for sandbar shark nursery and pupping grounds in Great Bay, NJ, Chesapeake Bay, MD, and the Outer Banks, NC in areas of Pamlico Sound. As information becomes available in the future, it may become possible to identify additional HAPCs within HMS EFH.

3.4.1.6 Research and Information Needs

The EFH regulations suggest that FMPs and FMP amendments should contain recommendations, preferably in priority order, for research efforts that have been identified as necessary for carrying out the EFH management mandate. The 1999 HMS FMP contained numerous recommendations for data needs, and many of these are being addressed through ongoing research efforts and data collection. For example, the highest priority recommendation was to continue the delineation of shark nurseries and establish geographic boundaries of the summer nurseries of commercially important species. To address this, in 2002, NOAA scientists with the NEFSC completed a research project to delineate shark nursery areas on the Atlantic East coast and the Gulf of Mexico (McCandless *et al*., 2003).

Chapter 10 contains a listing of research and information needs that should be addressed in order to improve the ability to conserve and manage habitat concerns under the EFH mandate. These efforts vary from the gathering of additional information from diverse sources in order to better map the distributions of EFH, to long range research projects that will provide additional life history information for use in better defining the environmental parameters that influence the distribution of the HMS.

3.4.2 Habitat Types and Distributions

The following section is intended to provide a general overview of the various habitats with which sharks are most frequently associated. Specific environmental parameters such as temperature, salinity, depth, and dissolved oxygen that are associated with particular species or life stages of sharks are described in detail in Chapter 10.

Sharks are found in wide variety of coastal and ocean habitats including estuaries, nearshore areas, the continental shelf, continental slope, and open ocean. Many species are migratory and, like all other marine species, are affected by the condition of the habitat. Degraded habitat may impact sharks by altering their ecological patterns and reducing the availability of prey species. Analysis of habitats utilized by sharks has led to the identification of various habitats essential to the productivity of the species. Atlantic sharks are broadly distributed as adults but have been found to utilize specific estuaries as pupping and nursery areas during pupping season and throughout their neonate (newborn) life stages which may vary from a few to many months.

As described earlier in this chapter, sharks and the habitat they occupy can be divided into four broad categories: (1) coastal, (2) pelagic, (3) coastal-pelagic, and (4) deep dwelling. Coastal species tend to inhabit nearshore areas and the continental shelves. Examples include blacktip, finetooth, and sharpnose sharks. Pelagic species, on the other hand, range widely in the upper zones of the oceans, often traveling over entire ocean basins. Examples include mako, blue, and oceanic whitetip sharks. Coastal-pelagic species are intermediate in that they occur both inshore and beyond the continental shelves, but have not demonstrated mid-ocean or transoceanic movements. Sandbar, scalloped hammerhead, and dusky sharks are examples of coastal-pelagic

species. Deep-dwelling species inhabit the dark, cold waters of the continental slopes and deeper waters of the ocean basins. Examples of this category include the cat sharks and gulper sharks. There may be overlap in the habitats frequented by the different categories depending on the life stages and associated habitat preferences or requirements.

Since coastal and coastal pelagic species frequently appear near shore and have pupping and nursery areas near shore, much more is known about their habitat requirements, particularly for early life history stages. Much less is known about the habitat requirements, spawning areas, and other details of pelagic and deep dwelling species. The following sections provide an overview of the habitat characteristics of the major ecosystems which Atlantic sharks occupy. Detailed information about specific habitat requirements by species and life stage are provided in Chapter 10.

3.4.2.1 Atlantic Ocean

(Material in this section is largely a summary of information in MMS, 1992; 1996. Original sources of information are referenced in those documents)

Coastal and Estuarine Habitat

During early life stages, estuaries and coastal environments provide important nursery habitat for many species of sharks. Females of many coastal and coastal-pelagic sharks travel to specific nursery areas to give birth to pups (neonates) at certain times of the year. These nurseries are discrete geographic areas, usually in shallow, coastal waters. Shark nursery areas are frequently located in highly productive coastal or estuarine waters (Castro, 1987). Examples include Great Bay, New Jersey, Chesapeake Bay, Maryland and Delaware Bay, Delaware which provide important nursery habitat for sandbar sharks, and Bull's Bay, South Carolina, and Terrebone Bay, Louisiana which are important blacktip shark nursery areas. Studies suggest that these inshore nursery areas provide the advantages of low predation (Branstetter, 1990) and high forage abundance (Rountree and Able, 1996).

Natural and human-induced alterations of this fragile environment have modified freshwater inflow and altered or removed much of the suitable habitat. The amount of remaining wetlands suitable for shark production had not been quantified, however, Alexander *et al*. (1986) estimated that over the last 25 years, coastal wetlands have been depleted at an average rate of 80 sq km per year. In some areas, this rate may be even higher. Aside from direct loss of habitat, estuaries have also been impacted by decline in water quality.

The degree to which habitat alterations have affected sharks is unknown. Turner and Boesch (1987) examined the relationship between wetland habitat area and the yield of fishery species dependent on coastal bays and estuaries, noting apparent stock declines following wetland loss, and stock increases following wetland gains. While most of the studies related to shrimp production, other similar trends may exist for other species. Thus, production of some shark

species may well be at risk for loss of habitat. Further research is needed to determine the degree to which shark nursery habitat may be correlated with wetland acreage, and the degree to which shark nurseries may be affected by continued loss of this habitat.

In determining EFH for sharks, consideration has been given to habitat associations for all life stages. Although they typically range throughout open ocean waters, many sharks move inshore, including coastal estuaries, at some time during their life cycles. For example, several species of Atlantic sharks are broadly distributed as adults but have been found to utilize specific estuaries and shallow coastal areas during pupping. Typically, the neonates remain in these same areas throughout their early life stages, which may vary from a few to many months. Many of these estuaries and shallow coastal areas used for pupping have been characterized only in general terms (e.g., salinity, temperature and/or season). Associations with particular bottom types are often undefined, and this lack of information has been identified as an important research need.

Recent tagging studies have shown that some sharks return to summer nursery areas in subsequent years. Grubbs and Musick (2003) demonstrated that juvenile sandbar sharks returned to their summer nursery grounds in the Chesapeake Bay following at least one winter migration out of the Bay. This provides some of the first evidence of philopatry or natal homing in sharks. Coastal areas in North Carolina and South Carolina were also demonstrated to be important overwintering grounds that may be used repeatedly as secondary nurseries by juvenile sandbar sharks.

Estuaries are highly productive, yet fragile, environments that support a great diversity of fish and wildlife species, including sharks. Many commercially valuable fish and shellfish stocks are dependent on these areas during some stage of their development. In the vicinity of North Carolina, Virginia, and Maryland, approximately 90 percent of the commercially valuable fish species are dependent on the estuaries for at least part of their life cycle.

Estuaries contain a number of important habitats which thrive in the mixture of salt and fresh water, and provide a number of functions for aquatic and terrestrial organisms. Coastal wetlands such as salt marshes, tidal freshwater marshes and forested and non-forested non-tidal wetlands are common in mid-Atlantic estuaries. Submerged aquatic vegetation is a diverse group of rooted vascular plants that range from saline to fresh water. Their distributions are indicative of water quality, as they require a delicate balance of sediments, nutrients, and light to survive. Tidal flats, which are exposed to air during low tides, are nondescript habitats that often are important in nutrient cycling and to seabirds as forage grounds.

Along the Atlantic seaboard coastal wetlands are located predominantly south of New York because these coastal areas have not been glaciated. Nearly 75 percent of the Atlantic coast salt marshes are found in the states of North Carolina, South Carolina, and Georgia. These three states contain approximately nine million acres of salt marsh.

Wetland vegetation plays an important role in nutrient cycling, and provides stability to coastal habitats by preventing the erosion of sediments and by absorbing the energy of storms. The dominant salt marsh vegetation along much of the Atlantic coast includes the cordgrasses (*Spartina* sp.), salt grass (*Distichlis spicata*), needle rushes (*Juncus roemerianus*), and other salt tolerant species. Because of the unique adaptations necessary for plants to survive in salt water environments, species diversity is much lower than in freshwater environments.

There are 13,900 square miles of estuarine habitat along the Atlantic coast, of which approximately 68 percent (9,400 square miles) occurs north of the Virginia/ North Carolina border, with Chesapeake Bay contributing significantly to the total. The dominant submerged aquatic vegetation in these estuaries are eelgrass (*Zostera marina*) and widgeongrass (*Ruppia maritima*). South of the Gulf of Maine, where there is a wider coastal plain and greater agriculture activity, estuaries carry higher sediment and nutrient loads. The increased fertility and generally higher water temperatures resulting from these nutrient loads allow these estuaries to support greater numbers of fish and other aquatic organisms.

South of the Virginia/North Carolina border, there are approximately 4,500 square miles of estuarine habitat. The Currituck, Albemarle, and Pamlico Sounds, which together constitute the largest estuarine system along the entire Atlantic coast, make up a large portion of these southern estuaries. A unique feature of these sounds is that they are partially enclosed and protected by a chain of fringing islands, the Outer Banks, located 32 to 48 km from the mainland. Dominant submerged aquatic vegetation in most of the southern estuaries are eelgrass, widgeongrass, and shoalgrass (*Halodule wrightii*).

Because of their low tidal flushing rates, estuaries are generally more susceptible to pollution than other coastal water bodies. The severity of the problem varies depending on the extent of tidal flushing. An indication of the potential efficiency of tidal flushing is tidal range. With the exception of estuaries along the coasts of North Carolina and south Florida, most estuaries along the Atlantic coast are mesotidal, having tidal ranges from two to four meters. Estuaries along the coasts of North Carolina and south Florida are classified as microtidal, having tidal ranges less than two meters. Since microtidal estuaries exhibit poor tidal flushing capacity, North Carolina and south Florida estuaries are more susceptible to water pollution than are other estuaries along the Atlantic coast.

In Maryland and Virginia, the primary problems reported are excessive nutrients (nitrates and phosphates), particularly in the Chesapeake Bay and adjoining estuarine areas. Other problems included elevated bacterial and suspended sediment levels. Non-point sources of pollution are considered one of the main causes of pollution. Elevated bacterial levels were also listed as a local coastal pollution problem in Maryland.

In North Carolina, the primary problems listed for estuarine areas were enrichment in organics and nutrients, fecal coliform bacteria, and low dissolved oxygen. Insufficient sewage treatment, wide-spread use of septic systems in coastal areas, as well as agricultural runoff are considered to

be major causes of these pollution problems. Oil spills from vessel collisions and groundings, as well as illegal dumping of waste oil, are a common cause of local, short-term water quality problems, especially in estuaries along the north and mid-Atlantic coasts. These sources of pollution and habitat degradation may have a negative impact on sharks populations, particularly during vulnerable early life stages.

Many of the coastal bays and estuaries along the East coast and Gulf of Mexico are described in greater detail in the 1999 HMS FMP (Chapter 5), including the distribution, size, depth, freshwater inflow, habitat types, tidal range and salinity for each of the major estuaries and bays on the Atlantic East coast and Gulf coast, and are not repeated here.

Continental Shelf and Slope Areas

Moving away from the coast, the next major geologic features encountered are the continental shelf and slope areas. The continental shelf is characterized by depths ranging from a few meters to approximately 60 meters, with a variety of bottom habitat types. The continental shelf is habitat for some of the most important commercial shark species, including sandbar, blacktip, and tiger sharks. Far less research has been done in this area than on the coasts and estuaries, and consequently much less is known about the specific habitat requirements of sharks that occur in this area. Many of the commercially harvested sharks species are caught on bottom longlines suggesting that benthic habitat may play an important role in the feeding ecology, behavior, and development of these species.

The shelf area of the Mid-Atlantic Bight averages about 100 km (approximately 60 miles) in width, reaching a maximum of 150 km (approximately 90 miles) near Georges Bank and a minimum of 50 km (approximately 30 miles) offshore Cape Hatteras. Current speeds are strongest at the narrowest part of the shelf where wind-driven current variability is highest. The distribution of marine species, including sharks along the Atlantic seaboard may be strongly influenced by currents, the warm Gulf Stream in the middle and south portions of the region, and generally by the combination of high summer and low winter temperatures.

The continental shelf in the South Atlantic Bight varies in width from 50 km (32 miles) off Cape Canaveral, FL to a maximum of 120 km (75 mi) off Savannah, GA and a minimum of 30 km (19 miles) off Cape Hatteras. The shelf is divided into three cross-shelf zones. Waters on the inner shelf (0 to 20 m [0 to 66 feet]) interact extensively with rivers, coastal sounds, and estuaries. This interaction tends to form a band of low-salinity, stratified water near the coast that responds quickly to local wind-forcing and seasonal atmospheric changes. Mid-shelf (20 to 40 m [66 to 132 feet]) current flow is strongly influenced by local wind events with frequencies of two days to two weeks. In this region, vertically well mixed conditions in fall and winter contrast with vertically stratified conditions in the spring and summer. Gulf Stream frontal disturbances (e.g., meanders and cyclonic cold core rings) that occur on time scales of two days to two weeks dominate currents on the outer shelf (40 to 60 m [132 to 197 feet]).

The mid-Atlantic area from Cape Cod to Cape Hatteras represents a transition zone between northern cold-temperate waters of the north and the warm-temperate waters to the south. Water temperatures in the mid-Atlantic vary greatly by season. Consequently, many of the fish species of importance in the mid-Atlantic area, including sharks, migrate seasonally, whereas the major species in the other three areas are typically resident throughout the year (MMS, 1992; 1996). The shelf-edge habitat may range in water depth between 40 and 100 m (131 and 328 feet). The bottom topography varies from smooth sand to mud to areas of high relief with associated corals and sponges. The fish species found in this area include parrotfish (*Scaridae*) and the deepwater species of the snapper-grouper assemblage.

The continental slope generally has smooth mud bottoms in water depths of 100 to 200 m (328 to 656 feet). Many of the species in this zone are representatives of cold water northern species exhibiting tropical submergence (i.e., being located in deeper, cooler water as latitude decreases).

A topographic irregularity southeast of Charleston, SC, known as the Charleston Bump, is an area of productive sea floor which rises abruptly from 700 to 300 m (2,300 to 980 feet) within a distance of about 20 km, and at an angle which is approximately transverse to both the general isobath pattern and the Gulf Stream currents. The Charleston Gyre is a persistent oceanographic feature that forms in the lee of the Charleston Bump. It is a location in which larval swordfish have been commonly found and may serve as nursery habitat.

Physical Oceanography

Many Atlantic sharks spend their entire lives in the pelagic, or open ocean environment. These sharks are highly mobile and physiologically adapted to traveling great distances with minimal effort. Much of what is known about the association between sharks and their migrations across vast open ocean habitat comes from tagging studies. The greatest distance a tagged shark has been known to travel was a blue shark which was tagged off the northeastern coast of the United States and recovered south of the equator 3,740 miles away (Kohler *et al*., 1998).

While the open ocean may appear featureless, there are major oceanographic features such as currents, temperature gradients, eddies, and fronts that occur on a large scale and may influence the distribution patterns of many oceanic species, including sharks. For instance, the Gulf Stream produces meanders, filaments, and warm and cold core rings that significantly affect the physical oceanography of the continental shelf and slope. These features tend to aggregate both predators and prey and are frequently targeted by commercial fishing vessels. This western boundary current has its origins in the tropical Atlantic Ocean (i.e., the Caribbean Sea). The Gulf Stream system is made up of the Yucatan Current that enters the Gulf of Mexico through the Yucatan Straits; the Loop Current which is the Yucatan Current after it separates from Campeche Bank and penetrates the Gulf of Mexico in a clockwise flowing loop; the Florida Current, as it travels through the Straits of Florida and along the continental slope into the South Atlantic Bight; and the Antilles Current as it follows the continental slope (Bahamian Bank) northeast to

Cape Hatteras. From Cape Hatteras it leaves the slope environment and flows into the deeper waters of the Atlantic Ocean.

The flow of the Gulf Stream as it leaves the Straits of Florida reaches maximum speeds of about 200 cm/s. During strong events, maximum current speeds greater than 250 cm/s have been recorded offshore of Cape Hatteras. The width of the Gulf Stream at the ocean surface ranges from 80 to 100 km (50 to 63 miles) and extends to depths of between 800 and 1,200 m (2,624 to 3,937 feet).

As a meander passes, the Gulf Stream boundary oscillates sequentially onshore (crest) and offshore (trough). A meander can cause the Gulf Stream to shift slightly shoreward or well offshore into deeper waters. The Gulf Stream behaves in two distinct meander modes (small and large), with the size of the meanders decreasing as they move northward along the coast. During the large meander mode the Gulf Stream front is seaward of the shelf break, with its meanders having large amplitudes. Additionally, frontal eddies and accompanying warm-water filaments are larger and closer to shore. During the small meander mode the Gulf Stream front is at the shelf break. Frontal eddies and warm-water filaments associated with small amplitude meanders are smaller and farther from shore. Since HMS tend to follow the edge of the Gulf Stream, their distance from shore can be greatly influenced by the patterns of meanders and eddies.

Meanders have definite circulation patterns and conditions superimposed on the statistical mean (average) condition. As a meander trough migrates in the direction of the Gulf Stream's flow, it upwells cool nutrient-rich water, which at times may move onto the shelf and may evolve into an eddy. These boundary features move south-southwest. As warm-water filaments, they transfer momentum, mass, heat, and nutrients to the waters of the shelf break.

Gulf Stream filaments are mesoscale events which occur regularly offshore the southeast United States. The filament is a tongue of water extending from the Gulf Stream pointing to the south. These form when meanders cause the extrusion of a warm surface filament of Gulf Stream water onto the outer shelf. The cul-de-sac formed by this extrusion contains a cold core that consists of a mix of outer-shelf water and nutrient-rich water. This water mix is a result of upwelling as the filament/meander passes along the slope. The period from genesis to decay typically is about two to three weeks.

The Charleston Gyre is a permanent oceanographic feature of the South Atlantic Bight, caused by the interaction of the Gulf Stream waters with the topographically irregular Charleston Bump. The gyre produces an upwelling of nutrients, which contributes significantly to primary and secondary productivity of the Bight. The degree of upwelling varies with the seasonal position and velocity of the Gulf Stream currents.

Offshore water quality in the Atlantic is controlled by oceanic circulation, which, in the mid-Atlantic is dominated by the Gulf Stream and by oceanic gyres. A shoreward, tidal and wind-driven circulation dominates as the primary means of pollutant transport between estuaries and

the nearshore. Water quality in nearshore water masses adjacent to estuarine plumes and in water masses within estuaries is also influenced by density-driven circulation. Suspended sediment concentration can also be used as an indication of water quality. For the Atlantic coastal areas, suspended sediment concentration varies with respect to depth and distance from shore, the variability being greatest in the mid-Atlantic and south Atlantic. Re-suspended bottom sediment is the principal source of suspended sediments in offshore waters.

3.4.3.2. Gulf of Mexico

(Material in this section is largely a summary of information in MMS, 1996; Field *et al.*, 1991; and NOAA 1997c. Original sources of information are referenced in those documents.)

The Gulf of Mexico supports a great diversity of fish resources that are related to a variety of ecological factors, such as salinity, primary productivity, and bottom type. These factors differ widely across the Gulf of Mexico and between inshore and offshore waters. Characteristic fish resources are not randomly distributed; high densities of fish resources are associated with particular habitat types (e.g., east Mississippi Delta area, Florida Big Bend sea grass beds, Florida Middle Grounds, mid-outer shelf, and the De Soto Canyon area). The highest values of surface primary production are found in the upwelling area north of the Yucatan Channel and in the De Soto Canyon region. In terms of general biological productivity, the western Gulf is considered to be more productive in the oceanic region than is the eastern Gulf. Productivity of areas where HMS are known to occur varies between the eastern and western Gulf, depending on the influence of the Loop Current.

Coastal and Estuarine Habitats

There are 5.62 million hectares (ha) of estuarine habitat among the five states bordering the Gulf. This includes 3.2 million ha of open water, 2.43 million ha of emergent tidal vegetation (including about 162,000 ha of mangroves), and 324,000 ha of submerged vegetation. Estuaries are found from east Texas through Louisiana, Mississippi, Alabama, and northwest Florida and encompass more than 23,938 square miles of water surface area. Estuaries of the Gulf of Mexico export considerable quantities of organic material, thereby enriching the adjacent continental shelf areas, and many of these estuaries provide important habitat for species such as fine-tooth, blacktip, bonnethead, spinner, and other Atlantic sharks.

The importance of wetlands to the coastal environment has been well documented. Coastal wetlands are characterized by high organic productivity, high detritus production, and efficient nutrient recycling. Wetlands provide habitat for a great number and wide diversity of invertebrates, fishes, reptiles, birds, and mammals. Inshore and estuarine areas bordered by wetlands are particularly important as pupping and nursery grounds for juvenile stages of many important invertebrate and fish species including many species of Atlantic sharks.

Coastal wetland habitat types that occur along the Gulf Coast include mangroves, non-forested wetlands (fresh, brackish, and saline marshes), and forested wetlands. Marshes and mangroves form an interface between marine and terrestrial habitats, while forested wetlands occur inland from marsh areas. Wetland habitats may occupy narrow bands or vast expanses, and can consist of sharply delineated zones of different species, monospecific stands of a single species, or mixed plant species communities.

Continental Shelf and Slope Areas

The Gulf of Mexico is a semi-enclosed, subtropical sea with a surface area of approximately 1.6 million square km. The main physiographic regions of the Gulf basin are the continental shelf, continental slope, and associated canyons, the Yucatan and Florida Straits, and the abyssal plains. The U.S. continental shelf is narrowest, at only 16 km (9.9 miles) wide, off the Mississippi River. The continental shelf width varies significantly from about 350 km (217 miles) offshore west Florida, 156 km (97 miles) off Galveston, TX, decreasing to 88 km (55 miles) off Port Isabel near the Mexican border. The depth of the central abyss ranges to 4,000 m (13,000 feet). The Gulf is unique because it has two entrances: the Yucatan Strait and the Straits of Florida. The Gulf's general circulation is dominated by the Loop Current and its associated eddies. The Loop current is caused by differences between the sill depths of the two straits. Coastal and shelf circulation, on the other hand is driven by several forcing mechanisms: wind stress, freshwater input, buoyancy and mass fluxes, and transfer of momentum and energy through the seaward boundary.

In the Gulf, the continental shelf extends seaward from the shoreline to about the 200-m water depth and is characterized by a gentle slope of less than one degree. The continental slope extends from the shelf edge to the continental rise, usually at about the 2,000-m (6,500 feet) water depth. The topography of the slope in the Gulf is uneven and is broken by canyons, troughs, and escarpments. The gradient on the slope is characteristically one to six degrees, but may exceed 20 degrees in some places, particularly along escarpments. The continental rise is the apron of sediment accumulated at the base of the slope. The incline is gentle with slopes of less than one degree. The abyssal plain is the basin floor at the base of the continental rise.

Physical Oceanography

The Gulf receives large amounts of freshwater runoff from the Mississippi River as well as from a host of other drainage systems. In recent years, large amount of nutrient laden runoff from the Mississippi River have resulted in large hypoxic or low oxygen areas in the Gulf. This "dead zone" may affect up to 16,500 square kilometers during the summer, resulting in unfavorable habitat conditions for a wide variety of species.

Sea surface salinities along the north Gulf vary seasonally. During months of low freshwater input, salinities near the coastline range between 29 to 32 ppt. High freshwater input conditions during the spring and summer months result in strong horizontal gradients and inner shelf

salinities less than 20 ppt. The mixed layer in the open Gulf, from the surface to a depth of approximately 100 to 150 m (330 to 495 feet), is characterized by salinities between 36.0 and 36.5 ppt.

The Loop Current is a highly variable current entering the Gulf through the Yucatan Straits and exiting through the Straits of Florida (as a component of the Gulf Stream) after tracing an arc that may intrude as far north as the Mississippi-Alabama shelf. This current has been detected down to about 1,000 m below the surface. Below that level there is evidence of a countercurrent. When the Loop Current extends into or near shelf areas, instabilities, such as eddies, may develop that can push warm water onto the shelf or entrain cold water from the shelf. These eddies consist of warm water rotating in a clockwise fashion. Major Loop Current eddies have diameters on the order of 300 to 400 km (186 to 249 miles) and may extend to a depth of about 1,000 m. Once these eddies are free from the Loop Current, they travel into the western Gulf along various paths to a region between 25° N to 28° N and 93° W to 96° W. As eddies travel westward a decrease in size occurs due to mixing with resident waters and friction with the slope and shelf bottoms. The life of an individual eddy, until its eventual assimilation by regional circulation in the west Gulf, is about one year. Along the Louisiana/Texas slope, eddies are frequently observed to affect local current patterns, hydrographic properties, and possibly the biota of fixed oil and gas platforms or hard bottoms. Once an eddy is shed, the Loop Current undergoes major dimensional adjustments and reorganization.

Sea-surface temperatures in the Gulf range from nearly constant throughout (isothermal) (29 to 30°C) in August to a sharp horizontal gradient in January, (25°C in the Loop Current core to 14 to 15° C along the northern shelves). Surface salinities along the northern Gulf are seasonal. During months of low freshwater input, salinities near the coastline range between 29 to 32 ppt. High freshwater inputs (spring-summer months) are characterized by strong horizontal salinity gradients and inner shelf values of less than 20 ppt. The vertical distribution of temperature reveals that in January, the thermocline depth is about 30 to 61 m (98 to 200 feet) in the northeast Gulf and 91 to 107 m (298 to 350 feet) in the northwest Gulf. In May, the thermocline depth is about 46 m (150 feet) throughout the entire Gulf.

3.4.3.3 U.S. Caribbean

(Material in this section is largely a summary of information in Appeldoorn and Meyers, 1993. Original sources of information are referenced in that document.)

The waters of the Caribbean region include the coastal waters surrounding the U.S. Virgin Islands and Puerto Rico. The territory of the U.S. Virgin Islands includes roughly 63 islands, the largest of which are St. Thomas (83 square km or 32 square miles), St. John (52 square km or 20 square miles), and St. Croix (207 square km or 80 square miles). The commonwealth of Puerto Rico includes many islands, the largest of which is Puerto Rico. To the south lie numerous cays covered with sand, coral, and mangroves. To the west lie Mona, Monito, and Desecheo Islands. To the northeast lies the chain of islands called La Cordillera. To the southeast lies Vieques

Island. All of these Caribbean islands, with the exception of St. Croix, are part of a volcanic chain of islands formed by the subduction of one tectonic plate beneath another. Tremendously diverse habitat (rocky shores, sandy beaches, mangroves, seagrasses, algal plains, and coral reefs) and the consistent light and temperature regimes characteristic of the tropics are conducive to high species diversity (Appledoorn and Meyers, 1993).

The waters of the Florida Keys and southeast Florida are intrinsically linked with the waters of the Gulf of Mexico and the waters of the Caribbean to the west, south, and east, and to the waters of the South Atlantic Bight to the north. These waters represent a transition from insular to continental regimes and from tropical to temperate regimes. This zone, therefore, contains one of the richest floral and faunal complexes.

Coastal and Estuarine Habitats

Although the U.S. waters of the Caribbean are relatively nutrient poor, and therefore have low rates of primary and secondary productivity, they display some of the greatest diversity of any part of the south Atlantic region. High and diverse concentrations of biota are found where habitat is abundant. Coral reefs, sea grass beds, and mangrove ecosystems are the most productive of the habitat types found in the Caribbean, but other areas such as soft-bottom lagoons, algal hard grounds, mud flats, salt ponds, sandy beaches, and rocky shores are also important in overall productivity. These diverse habitats allow for a variety of floral and faunal populations.

Offshore, between the sea grass beds and the coral reefs and in deeper waters, sandy bottoms and algal plains dominate. These areas may be sparsely or densely vegetated with a canopy of up to one meter of red and brown algae. Algal plains are not areas of active sand transport. These are algae-dominated sandy bottoms, often covered with carbonate nodules. They occur primarily in deep water (> 15 m or 50 feet) and account for roughly 70 percent of the area of the insular shelf of the U.S. Virgin Islands. Algal plains support a variety of organisms including algae, sponges, gorgonians, solitary corals, molluscs, fish, and worms, and may serve as critical juvenile habitat for commercially important (and diminishing) species such as queen triggerfish and spiny lobsters.

Coral reefs and other coral communities are some of the most important ecological (and economic) coastal resources in the Caribbean. They act as barriers to storm waves and provide habitat for a wide variety of marine organisms, including most of the economically important species of fish and shellfish. They are the primary source for carbonate sand, and serve as the basis for much of the tourism. Coral communities are made by the build up of calcium carbonate produced by living animals, coral polyps, in symbiosis with a dinoflagellate, known as zooxanthellae. During summer and early fall, most of the coral building organisms are at or near the upper temperature limit for survival and so are living under natural conditions of stress. Further increase in local or global temperature could prove devastating.

Sea grass beds are highly productive ecosystems that are quite extensive in the Caribbean; some of the largest sea grass beds in the world lie beyond the shore on both sides of the Keys. Sea grass beds often occur in close association with shallow-water coral reefs. Turtle grass (*Thalassia testudinium*), manatee grass (*Syringodium filiforme*), and shoal grass (*Halodule wrightii*) are the three most abundant species. Seagrasses are flowering plants that spread through the growth of roots and rhizomes. Seagrasses act to trap and stabilize sediments, reduce shoreline erosion, and buffer coral reefs; they provide food for fish, sea turtles (heavy grazers), conch, and urchins; they provide shelter and habitat for many adult species and numerous juvenile species who rely on the sea grass beds as nursery areas; and they provide attachment surfaces for calcareous algae.

Mangrove habitats are very productive coastal systems that support a wide variety of organisms. The mangrove food web is based largely on the release of nutrients from the decomposition of mangrove leaves, and in part on the trapping of terrestrial material. Red mangroves (*Rhizophora mangle*), with their distinctive aerial prop roots, grow along the shoreline, often in mono-specific stands. The roots of the red mangroves help to trap sediments and pollutants associated with terrestrial runoff and help to buffer the shore from storm waves. Red mangrove forests support a diverse community of sponges, tunicates, algae, larvae, and corals, as well as juvenile and adult fish and shellfish. Black mangroves (*Aveicennia germinans*) and white mangroves (*Laguncularia racemosa*) grow landward of the red mangroves. They also act as important sediment traps. Exposed and sheltered mangrove shorelines are common throughout the U.S. Caribbean.

Throughout the U.S. Caribbean, both rocky shores and sandy beaches are common. While many of these beaches are high-energy and extremely dynamic, buffering by reefs and seagrasses allows some salt-tolerant plants to colonize the beach periphery. Birds, sea turtles, crabs, clams, worms, and urchins use the intertidal areas.

Salt ponds, common in the U.S. Virgin Islands, are formed when mangroves or fringing coral reefs grow or storm debris is deposited, effectively isolating a portion of a bay. The resulting "pond" undergoes significant fluctuations of salinity with changes in relative evaporation and runoff. The biota associated with salt ponds, are, therefore very specialized, and usually somewhat limited. Salt ponds are extremely important in trapping terrestrial sediments before they reach the coastal waters.

Insular Shelf and Slope Areas

Puerto Rico and the U.S. Virgin Islands contain a wide variety of coastal marine habitats, including coral and rock reefs, sea grass beds, mangrove lagoons, sand and algal plains, soft bottom areas, and sandy beaches. These habitats are, however, very patchily distributed. Nearshore waters range from zero to 20 m in depth, and outer shelf waters range from 20 to 30 m in depth, the depth of the shelf break. Along the north coast the insular shelf is very narrow (two to three km wide), seas are generally rough, and few good harbors are present. The coast is a

mixture of coral and rock reefs, and sandy beaches. The east coast has an extensive shelf that extends to the British Virgin Islands. Depth ranges from 18 to 30 m. Much of the bottom is sandy, commonly with algal and sponge communities. The southeast coast has a narrow shelf (eight km wide). About 25 km to the southeast is Grappler Bank, a small seamount with its summit at a depth of 70 m. The central south coast broadens slightly to 15 km and an extensive sea grass bed extends nine kilometers offshore to Caja de Muertos Island. Further westward, the shelf narrows again to just two km before widening at the southwest corner to over 10 kilometers. The entirety of the southern shelf is characterized by hard or sand-algal bottoms with emergent coral reefs, grass beds, and shelf edge. Along the southern portion of the west coast the expanse of shelf continues to widen, reaching 25 km at its maximum. A broad expanse of the shelf is found between 14 and 27 meters where habitats are similar to those of the south coast. To the north, along the west coast, the shelf rapidly narrows to two to three kilometers.

Physical Oceanography

U.S. Caribbean waters are primarily influenced by the westward flowing North Equatorial Current, the predominant hydrological driving force in the Caribbean region. It flows from east to west along the north boundary of the Caribbean plateau and splits at the Lesser Antilles, flowing westward along the north coasts of the islands.

The north branch of the Caribbean Current flows west into the Caribbean Basin at roughly 0.5 m (1.7 feet) per second. It is located about 100 km south of the islands, but its position varies seasonally. During the winter it is found further to the south than in summer. Flow along the south coast of Puerto Rico is generally westerly, but this is offset by gyres formed between the Caribbean Current and the island. The Antilles Current flows to the west along the northern edge of the Bahamas Bank and links the waters of the Caribbean to those of southeast Florida.

Coastal surface water temperatures remain fairly constant throughout the year and average between 26° and 30°C. Salinity of coastal waters is purely oceanic and so is usually around 36 ppt. However, in the enclosed or semi-enclosed embayments salinity may vary widely depending on fluvial and evaporational influences.

It is believed that no up-welling occurs in the waters of the U.S. Caribbean (except perhaps during storm events) and, since the waters are relatively stratified, they are severely nutrient-limited. In tropical waters nitrogen is the principal limiting nutrient.

3.5 BYCATCH, INCIDENTAL CATCH, AND PROTECTED SPECIES

Atlantic HMS fisheries encounter many species of sharks and finfish during fishing operations. Some of these species are marketable, while others are discarded for economic or regulatory reasons. Sharks are also caught incidental to non-HMS fisheries such as in the shrimp trawl and menhaden purse seine fisheries. If such a vessel has a shark permit, the vessel may land the shark. Otherwise the shark must be discarded. Bycatch and incidental catch of non-targeted

species such as sea turtles, marine mammals, and seabirds, known collectively as "protected" species, may also occur. A description of known data accounting for the frequency of such interactions is outlined below.

3.5.1 Atlantic Sharks

Bycatch of sharks occurs in many fisheries, including trawl, set-net, and hook and line fisheries. Estimates of shark dead discards from the pelagic longline fishery range from 4,300 to 9,000 fish in 1998 and 1999 (Cramer, 1999; Cramer and Adams, 2000; Cortes *et al.*, 2002). Pelagic longline dead discards combined represented about 2.8 percent of total mortality of LCS in 2001 (Cortes *et al.*, 2002) (See Table 3.14). Observer data collected from the directed bottom longline shark fishery indicate that LCS discarded dead represent approximately 5.7 percent of the total mortality of these species in that fishery from 1994 through 2001 (Cortes *et al.*, 2002).

Observer data in the Gulf of Mexico menhaden fishery for the period 1994-1995 indicate that 75 percent of the sharks encountered died (de Silva *et al.*, 2001; Cortes, 2000). Based on estimates from the de Silva *et al.* (2001) study, approximately 26,200 and 24,000 LCS were discarded dead in 1994 and 1995, respectively. The average numbers of sharks caught in the menhaden fishery during these two years were used as estimates of bycatch for all other years (25,100). Blacktip sharks made up 35.3 percent of the total shark bycatch observed during 1994-95, and an additional group described as "mixed blacktip and spinner sharks" made up 20.1 percent of the total. Based on these estimates, in 2001, the Gulf of Mexico menhaden fishery accounted for approximately 7.5 percent of the total mortality of LCS (See Table 3.14). Gear modifications implemented by the Gulf of Mexico menhaden fishing industry since the de Silva *et al.* (2001) study was conducted may have had some effect on the magnitude of the shark bycatch (Rester and Condrey, 1999). Further quantification of the current magnitude of the shark bycatch would be needed to evaluate the effectiveness of the gear modifications. In any event, consideration of discard estimates from the Gulf menhaden fishery had virtually no effect on results of the LCS stock assessment (Cortes *et al.* 2002).

Annual estimates of small coastal shark bycatch in the Gulf of Mexico shrimp fishery range from 1,500,000 lbs dw in 1972 to 1,257,000 lbs dw in 2000, with a high of 3,123,000 lbs dw in 1987 (Cortes, 2002).

3.5.2 Other Finfish

Bycatch of other finfish including, but not limited to, little tunny, Atlantic bonito, crevalle jack, great barracuda, cobia and king mackerel is known to occur in shark bottom longline and gillnet fisheries.

Observer data collected in 1998 from shark bottom longline fisheries indicate that approximately 6,277 sharks were caught compared to 594 other fish (8.6 percent of total catch) (Burgess and Johns, 1998). Similar data collected during 2000, 2001, and 2002 (season 1 only) suggest that

bycatch of other finfish varies by region (Burgess and Morgan, 2003). In Florida waters, bycatch primarily includes groupers, jacks, and snappers. By comparison, bycatch in North Carolina commonly involves stingrays, skates, rays, swordfish, wahoo, tuna, and great barracuda (Burgess and Morgan, 2003). Regional differences in bycatch are often associated with fishery differences in targeted species.

During the 2002 right whale calving season, observed drift gillnet sets caught 26 species of teleosts and rays (9.2 percent of the total number of animals caught were teleosts and rays) (See Table 3.33) (Carlson and Baremore, 2002a). Three teleost and ray species made up 56.2 percent by number of the overall non-shark catch: little tunny (29.2 percent), king mackerel (15.2 percent), and great barracuda (11.8 percent). The highest proportion of species discarded dead (for those species with observed catch greater than 10 individuals) was for Atlantic sailfish (97.7 percent; 42 out of 43 discarded dead), and cobia (25.7 percent; 17 out of 66 discarded dead). Remoras had the highest live discard proportion (72.2 percent; 8 out of 11 discarded alive) (Carlson and Baremore, 2002a).

Outside of the 2002 right whale calving season, observed drift gillnet catch consisted of 26 species of teleosts and rays (See Table 3.34). Five species of teleosts and one species of ray made up 90.6 percent by number of the overall non-shark catch. Little tunny (44.1 percent), king mackerel (20.8 percent), great barracuda (12.5 percent), Atlantic moonfish (9.4 percent), and cobia (3.8 percent) dominated the bycatch (See Table 3.34) (Carlson and Baremore, 2002b). During drift gillnet fishing, the highest proportion of species discarded dead (for species with greater than 10 individuals) was for tarpon, crevalle jack, king mackerel, and red drum. Cownose rays and red drum had the highest proportion of discarded alive with 78.1 percent and 50.0 percent, respectively (See Table 3.34) (Carlson and Baremore, 2002b).

Observed catch in strikenet sets outside of the 2002 right whale calving season consisted of three species of sharks (Carlson and Baremore, 2002b). No other fish or protected species were observed caught (See Table 3.35).

3.5.3 Marine Mammals

Under the Marine Mammal Protection Act (MMPA) (16 U.S.C. 1361 et seq.) the Atlantic Ocean, Caribbean, and Gulf of Mexico pelagic longline fishery is classified as a Category I fishery (frequent serious injuries and mortalities incidental to commercial fishing) and the southeastern Atlantic shark gillnet fishery is classified as Category II (occasional serious injuries and mortalities). The Gulf of Maine and mid-Atlantic tuna, swordfish, and shark hook-and-line/harpoon, southeastern mid-Atlantic and Gulf of Mexico shark bottom longline, and mid-Atlantic, southeastern Atlantic, and Gulf of Mexico pelagic hook-and-line/harpoon fisheries are all classified as Category III (remote likelihood or no known serious injuries or mortalities. The same listings have been adopted for 2003 (68 FR 41725, July 15, 2003). Additionally, the 2001 HMS BiOp concluded that the continued operation of these fisheries would not adversely affect marine mammals. A new Biological Opinion for Atlantic shark fisheries (NOAA Fisheries,

2003a) was prepared in October of 2003 in response to the proposed measures in Amendment 1. It concluded that the continued operation of the shark fisheries would not adversely affect marine mammals.

In accordance with the MMPA, NOAA Fisheries published stock assessment reports for Atlantic and Gulf of Mexico marine mammals in September 2002. Species such as bottlenose dolphin, north Atlantic right whale, Atlantic spotted dolphin, humpback whale, minke whale, harbor porpoise, long-finned pilot whale, short finned pilot whale, white-sided dolphin, common dolphin, harbor seal, and harp seal are sometimes hooked during commercial fishing operations and fishermen are required to report takes of mammals to NOAA Fisheries in a marine mammal logbook (68 FR 41725, July 15, 2003). Observations in 1996 through 2000 have been extrapolated to estimate serious injury and mortality of 784 marine mammals, including 242 Risso's dolphin, 514 long and short-finned pilot whales, and 28 pygmy sperm whales by pelagic longline fisheries (Waring *et al.*, 2002). The shark bottom longline fishery has been observed to interact with two delphinid species between 1994 and 2002 (Burgess pers. comm., 2003). Bycatch estimates for the shark bottom longline fishery have not been extrapolated for marine mammals. Observed takes of marine mammals in the Southeast Atlantic shark gillnet fishery during 1999-2002, totaled 10 bottlenose dolphins and four spotted dolphins (See Table 3.39). Extrapolated observations from these data suggest serious injury and mortality of 25 bottlenose dolphin and one Atlantic spotted dolphin in the shark gillnet fishery from 1999 through 2002 (Garrison, 2003).

In April 1999, NOAA Fisheries implemented a restricted area in the South Atlantic to reduce the bycatch of right whales (64 FR 7529, Feb. 16, 1999). Only gillnets used in a strikenet fashion can be fished from November 15 through March 31, when right whales are usually present. Fishing in this area during that time requires 100 percent observer coverage. NOAA Fisheries also designated an area open to shark gillnet vessels fishing in a driftnet fashion but only under the condition that they carry an observer at all times during right whale calving season. Outside of the right whale calving season, observer coverage to produce reliable estimates of bycatch is required.

Vessel operators intending to use gillnets in the "observer area" during right whale season must notify NOAA Fisheries at least 48 hours in advance of departure to arrange for observer coverage. Observations of right whales in the observer area or restricted area outside this period, are rare, and a broader closure period, was not considered necessary to meet the objectives of the MMPA. After these requirements were implemented, NOAA Fisheries extended observer requirements to include all shark gillnet vessels at all times. The objective of that regulation was to collect bycatch information for all species (including turtles and finfish), consistent with requirements of the Magnuson-Stevens Act. In March 2001, the observer coverage for this fishery during non-right whale calving season was reduced to a level that would ensure a statistically significant level of coverage (66 FR 17370, March 30, 2001).

Gear provisions were also implemented to further the goals of the MMPA. NOAA Fisheries restricted the way gillnets used in a strikenet fashion are set in the southeast gillnet fishery to minimize the risk of entanglement (67 FR 45393, July 9, 2002). In addition, shark gillnets must be marked to identify the fishery and region in which the gear is fished. Strikenetting in the restricted area is permitted during right whale season only if: (1) no nets are set at night or when visibility is less than 500 yards (460 m), (2) each set is made under the observation of a spotter plane, (3) no net is set within 3 miles of a right, humpback or fin whale, and (4) if a whale comes within 3 miles of set gear, the gear is removed from the water immediately. These measures were designed to minimize the risk of entangling any large whale.

During the 2002 right whale calving season, no marine mammal interactions occurred in 41 separate drift gillnet sets (Carlson and Baremore, 2002a). Observed strikenet sets, during the 2002 right whale calving season, caught no marine mammals (See Table 3.35) (Carlson and Baremore, 2002a). Outside of right whale calving season, observed drift gillnet catch in 2002 consisted of one species of marine mammal, which was discarded dead (See Table 3.34). Observed catch in strikenet sets outside of right whale calving season consisted of three species of sharks (Carlson and Baremore, 2002b). No marine mammals were observed caught.

3.5.4 Sea Turtles

This section provides a summary of background information from the June 14, 2001, Biological Opinion and the October 29, 2003, Biological Opinion (NOAA Fisheries, 2001a; 2003a). Please refer to Section 3.5 of the HMS FMP (NMFS, 1999) and Section 8.0 of the latest SAFE (NOAA Fisheries, 2003b) report for additional information. Additional information specific to the pelagic longline fishery can be found in the Final Supplemental Environmental Impact Statement for the Reduction of Bycatch, Bycatch Mortality, and Incidental Catch in the Atlantic Pelagic Longline Fishery, and in the Environmental Assessment and Regulatory Impact Review to Reduce Sea Turtle Bycatch and Bycatch Mortality in the Atlantic Pelagic Longline Fishery. For reference, the status of Atlantic sea turtles can be found in Table 3.36. The latest Biological Opinion, undertaken in response to the preferred measures in draft Amendment 1, found that the selected actions are not likely to jeopardize the continued existence of the endangered Kemp's Ridley, green, hawksbill, and leatherback sea turtles, and the threatened loggerhead sea turtle (NOAA Fisheries, 2003a). Critical habitat has not been designated for these species in the action area, therefore, none will be affected. Further detail on the October 2003 Biological Opinion is provided in Section 4.10.

Loggerhead sea turtles

Western Atlantic, Caribbean, and Gulf of Mexico loggerhead sea turtles represent differing proportions of five western north Atlantic subpopulations, as well as unidentified subpopulations from the eastern Atlantic. These animals are protected by ESA and NOAA Fisheries enacted additional measures in 2002 to reduce commercial fishing interactions, including gear requirements and a closed area applicable to the pelagic longline fishery.

Loggerhead sea turtles are primarily exposed to pelagic longline gear in the pelagic juvenile stage. According to observer records, an estimated 7,891 loggerhead sea turtles were caught by the U.S. Atlantic tuna and swordfish longline fisheries between 1992-1999, of which 66 were estimated to be released dead (See Table 3.37) (NOAA Fisheries SEFSC, 2001). An additional 1,256 loggerhead sea turtles were estimated to have been caught in 2000 (Yeung, 2001). The U.S. fleet accounts for a small proportion (5 to 8 percent) of the total hooks fished in the Atlantic Ocean compared to other nations, including Taipei, Brazil, Trinidad, Morocco, Cyprus, Venezuela, Korea, Mexico, Cuba, United Kingdom, Bermuda, People's Republic of China, Grenada, Canada, Belize, France, and Ireland (Carocci and Majkowski, 1998). Reports of incidental takes of turtles are incomplete for many of these nations (see NOAA Fisheries SEFSC, 2001 for a complete description of take records). Projections based on known takes for the 23 actively fishing countries, after accounting for the unobserved fraction, likely result in an estimate of thousands of animals taken annually over different life stages.

In the bottom longline fishery a total of 43 sea turtles out of 862 observed sets, were caught from 1994 through 2002 (See Figures 3.9 and 3.10) (Burgess and Morgan, 2003; NOAA Fisheries, 2003a). Of the 43 observed sea turtles, 31 were loggerhead sea turtles of which 17 were released alive. Another nine loggerheads were released in an unknown condition and five were released dead. Based on extrapolation of observer data, it was estimated that a total of 2,003 loggerhead sea turtles were taken in the shark bottom longline fishery from 1994 through 2002 (NOAA Fisheries, 2003a). An additional 503 unidentified sea turtles were estimated to have been taken. On average, 222 loggerhead sea turtles and 56 unidentified sea turtles were taken annually during this time period in the shark bottom longline fishery.

Furthermore, this analysis only estimates takes without discriminating between live and dead releases. Of the observed takes in the shark bottom longline fishery, 23 percent were lethal. Based on this information it is estimated that 51 loggerhead turtles (222 x 0.23) will be killed as a result of an interaction with a bottom longline. The highest estimate of post release mortality is 42 percent for sea turtles that ingested the hook (the percent mortality is lower depending on how the animal was hooked) (NOAA Fisheries, 2001a). Being conservative and assuming all sea turtles ingest the hook, 42 percent of those released alive will die as a result of their interaction with the bottom longline. This results in another 72 loggerhead sea turtles (222-51=171 then 171 x 0.42) estimated to be killed. Therefore, it is estimated that 123 loggerheads will be killed (72 + 51) per year.

In the shark gillnet fishery, loggerhead sea turtles are rarely caught. During the 1999 right whale calving season no loggerhead sea turtles were caught in this fishery (Carlson and Lee, 1999). No loggerhead sea turtles were observed caught with strikenets during the 2000-2002 right whale calving seasons (Carlson, 2000; Carlson and Baremore, 2001; Carlson and Baremore, 2002a). However, three loggerhead sea turtles have been observed caught with drift gillnets during right whale calving season, one each year from 2000 to 2002 (See Table 3.39) (Carlson, 2000; Carlson and Baremore, 2001; Carlson and Baremore, 2002a; Garrison, 2003).

During the 2000 and 2001 non-right whale calving seasons, no loggerhead sea turtles were observed caught in gillnets fished in a strikenet method and one loggerhead sea turtle was observed caught and released alive in gillnets fished in a driftnet method (See Table 3.39) (Carlson and Baremore, 2001). No loggerhead sea turtles were caught outside of the right whale calving season in 2002 (Carlson and Baremore, 2002b).

Expanded take estimates for sea turtles were developed for the shark drift gillnet fishery for the October 2003 BiOp (NOAA Fisheries, 2003a). Estimates were based on analysis of observer data from NOAA Fisheries' Southeast Fisheries Science Center. Observer data gathered from 1999-2002 were used to estimate takes in the drift gillnet fishery. Prior to 1999, observer coverage was limited and inconsistent. However, since 1999 a much higher degree of observer coverage has occurred, including very high coverage in the southern Florida area during the right whale calving season (November 15 - March 30) when sea turtle takes are known to be much more likely. The estimated takes of loggerhead sea turtles by year, were as follows: 1999 - none; 2000 - one mortality and 4.4 live takes; 2001 - one live take; and 2002 - 1.7 live takes (NOAA Fisheries, 2003a).

Because of the high degree of variability in takes which is associated with variability in water temperatures, sea turtle abundances, and other factors that cannot be predicted, a 5-year estimated take was utilized for the incidental take statement (ITS) instead of a 1-year average estimated take. Over a 5-year period the expected take of loggerhead sea turtles from the drift gillnet fishery would be 10 total captures of which one would be expected to be killed (NOAA Fisheries, 2003a).

Leatherback sea turtles

Female leatherback sea turtles nest from the southeastern United States to southern Brazil in the western Atlantic and from Mauritania to Angola in the eastern Atlantic. The most significant nesting beaches in the Atlantic, and perhaps in the world, are in French Guiana and Surinam (NOAA Fisheries SEFSC, 2001). When they leave the nesting beaches, leatherback sea turtles move offshore but eventually utilize both coastal and pelagic waters. The leatherback is the largest living turtle and it ranges farther than any other sea turtle species, exhibiting broad thermal tolerances (NOAA Fisheries and USFWS, 1995). Leatherback sea turtles feed primarily on cnidarians (medusae, siphonophores) and tunicates (salps, pyrosomas) and are often found in association with jellyfish.

Leatherback sea turtles are exposed to pelagic fisheries throughout their life cycle. According to observer records, an estimated 6,363 leatherback sea turtles were caught by the U.S. Atlantic tuna and swordfish longline fisheries between 1992-1999, of which 88 were released dead (See Table 3.37) (NOAA Fisheries SEFSC, 2001). An additional 769 leatherback sea turtles were estimated to have been caught in 2000 (Yeung, 2001). Leatherback sea turtles make up a significant portion of takes in the Gulf of Mexico and south Atlantic areas, but are more often released alive. The U.S. fleet accounts for five to eight percent of the hooks fished in the Atlantic Ocean.

In the bottom longline fishery a total of 43 sea turtles have been observed from 1994 through 2002 (See Figure 3.10) (Burgess and Morgan, 2003; NOAA Fisheries, 2003a). Four of the 43 observed sea turtles were leatherback sea turtles and three of these were released with their condition unknown. One leatherback was released dead. Based on extrapolation of observer data, it was estimated that 269 leatherback sea turtles were taken in the shark bottom longline fishery from 1994 through 2002 (NOAA Fisheries, 2003a). On average, 30 leatherback sea turtles each year were taken by the shark bottom longline fishery during 1994 through 2002. This analysis only estimates takes without discriminating between live and dead releases. Of the observed leatherback takes, 25 percent were lethal. Applying the observed mortality rate of 25 percent to the total leatherback takes and an additional 42 percent post-release mortality estimate due to hook ingestion to the remaining, results in an estimated total number of leatherbacks killed as a result of the selected action at 17 per year. The leatherback mortality is very conservative because it is known that leatherbacks rarely ingest or bite hooks, but are usually foul hooked on their flippers or carapaces, reducing the likelihood of post-hooking release mortality. However, leatherback-specific data for this fishery is not available and therefore the most conservative estimate is used.

In the shark gillnet fishery, leatherback sea turtles are sporadically caught. During the 1999 right whale calving season two leatherback sea turtles were caught in this fishery, and both were released alive (Carlson and Lee, 1999). No leatherback sea turtles were observed caught with strikenets during the 2000 - 2002 right whale calving seasons (Carlson, 2000; Carlson and Baremore, 2001; Carlson and Baremore, 2002a). Leatherback sea turtles have been observed caught in shark drift gillnets including fourteen in 2001 and two in 2002 (See Table 3.39) (Carlson, 2000; Carlson and Baremore, 2001; Carlson and Baremore, 2002a; Garrison, 2003). NOAA Fisheries temporarily closed the shark gillnet fishery (strikenetting was allowed) from March 9 to April 9, 2001, due to the increased number of leatherback interactions that year (66 FR 15045, March 15, 2001).

During the 2000 and 2001 non-right whale calving seasons, no leatherback sea turtles were observed caught in gillnets fished in strikenet or driftnet methods (Carlson and Baremore, 2001). No leatherback sea turtles were caught outside of the right whale calving season in 2002 (Carlson and Baremore, 2002b).

Expanded take estimates for sea turtles were developed for the shark drift gillnet fishery for the October 2003 BiOp (NOAA Fisheries, 2003a). Estimates were based on the analysis of observer data from the NOAA Fisheries' Southeast Fisheries Science Center. Observer data gathered from 1999-2002 were used to estimate takes in the drift gillnet fishery. Prior to 1999, observer coverage was limited and inconsistent. However, since 1999 a much higher degree of observer coverage has occurred, including very high coverage in the southern Florida area during the right whale calving season (November 15 - March 30) when sea turtle takes are known to be much more likely. The estimated takes of leatherback sea turtles by year, were as follows: 1999 - none; 2000 - none; 2001 - two mortalities and 12 live takes; and 2002 - 3.4 live takes (NOAA Fisheries, 2003a).

Because of the high degree of variability in takes which is associated with variability in water temperatures, sea turtle abundances, and other factors that cannot be predicted, a 5-year estimated take was utilized for the incidental take statement (ITS) instead of a 1-year average estimated take. Over a 5-year period the expected take of leatherback sea turtles from the drift gillnet fishery would be 22 total captures of which three would be expected to be killed (NOAA Fisheries, 2003a).

3.5.5 Seabirds

Seabirds forage on the surface but can also pursue prey fish swimming at shallow depths which makes seabirds somewhat susceptible to driftnets, shallow set longlines, and longline gear being deployed. As such, they are possibly at the highest risk during the process of setting and hauling fishing gear. Many seabird populations are especially slow to recover from mortality because their reproductive potential is low (one egg per year and late sexual maturation).

Concerns such as these have resulted in protection of seabirds under the Migratory Bird Treaty Act, protection of endangered seabirds under the Endangered Species Act, and protection of all migratory birds under Executive Order 13186. The United States has also developed a National Plan of Action in response to the Food and Agriculture Organization International Plan of Action to Reduce Incidental Seabird Takes in Longline Fisheries.

Observer data for the Atlantic pelagic longline fishery from 1992 through 2002 indicate that seabird bycatch is relatively low (See Table 3.38). Since 1992, a total of 113 seabird interactions have been observed, with 77 seabirds observed killed in the Atlantic pelagic longline fishery. No expanded estimates of seabird bycatch or catch rates are available for the pelagic longline fishery. Observed bycatch has ranged from 1 to 18 seabirds observed dead per year and 0 to 15 seabirds observed released alive per year from 1992 through 2002.

In the Atlantic shark bottom longline fishery, one pelican has been observed killed from 1994 through 2002. The pelican was caught in January 1995 off the Florida Gulf Coast (between 25 18.68 N, 81 35.47 W and 25 19.11 N, 81 23.83 W) (G. Burgess, pers. comm., 2003). No expanded estimates of seabird bycatch or catch rates are available for the bottom longline fishery.

NOAA Fisheries has not identified a need to implement gear modifications to reduce takes of seabirds in Atlantic HMS longline fisheries. Takes of seabirds are minimal in these fisheries in the Atlantic, probably due to night setting of the longlines or fishing in areas where there are not significant numbers of birds. Interested readers can refer to Alexander *et al.* (1997), for additional possibilities of mitigating measures for seabird mortality in longline fisheries. No seabirds have been observed caught in the shark gillnet fishery.

3.5.6 Sawfish

Sawfish, like sharks, skates and rays, belong to a class of fish called elasmobranchs, whose skeletons are made of cartilage. Sawfish are actually modified rays with a shark-like body, and gill slits on their ventral side. Early sawfish arose around 100 million years ago, but these first sawfish are actually distant cousins to the modern day sawfishes, which first appeared around 56 million years ago. Sawfish get their name from their "saws" - long, flat snouts edged with pairs of teeth which are used to locate, stun and kill prey. Their diet includes mostly fish but also some crustaceans.

Sawfish species inhabit shallow coastal waters of tropical seas and estuaries throughout the world. They are usually found in shallow waters very close to shore over muddy and sandy bottoms. They are often found in sheltered bays, on shallow banks, and in estuaries or river mouths. Certain species of sawfish are known to ascend inland in large river systems, and they are among the few elasmobranchs that are known from freshwater systems in many parts of the world.

As of April 1, 2003, NOAA Fisheries listed smalltooth sawfish as an endangered species (68 FR 15674) under the Endangered Species Act (ESA). After reviewing the best scientific and commercial information, the status review team determined that the continued existence of the U.S. DPS (Distinct Population Segment) of smalltooth sawfish is in danger of extinction throughout all or a significant portion of its range from a combination of the following four listing factors: the present or threatened destruction, modification, or curtailment of habitat or range; overutilization for commercial, recreational, scientific, or educational purposes; inadequacy of existing regulatory mechanisms; and other natural or manmade factors affecting its continued existence.

To date there has been only one observed catch of a smalltooth sawfish in shark gillnet fisheries. The sawfish was taken on June 25, 2003, in a gillnet set off of southeast Florida and it was released alive (Carlson pers. comm., 2003). The set was characteristic of a typical drift gillnet set, with gear extending 30 to 40 feet deep in 50 to 60 feet of water. Prior to this event it was speculated that the depth at which drift gillnets are set above the sea floor may preclude smalltooth sawfish from being caught. Although sometimes described as a lethargic demersal species, smalltooth sawfish feed mostly on schooling fishing, thus they would occur higher in the water column during feeding activity. In fact, smalltooth sawfish and Atlantic sharks may be attracted to the same schools of fish, potentially making smalltooth sawfish quite vulnerable if present in the area fished. The previous absence of smalltooth sawfish incidental capture records is more likely attributed to the relatively low effort in this fishery and the rarity of smalltooth sawfish, especially in Federal waters. These factors may result in little overlap of the species with the gear.

The recently observed smalltooth sawfish was cut from the net and released alive with no visible injuries. This indicates that smalltooth sawfish can be removed safely if entangled gear is sacrificed.

As discussed previously, gillnets are also used to "strikenet". When strike gillnetting fishers target and encircle specific schools of sharks after visually detecting them (usually by spotter pilot). Given the large and or distinct morphology of smalltooth sawfish, this species would likely be detected visually, as well as distinguished from shark species, thus avoided. This fishing method has been shown to also reduce potential encounters by limiting the time that gear is in the water. Strike gillnet sets are typically only one to two hours in contrast to six to 10 hours for each drift gillnet set. Endangered and threatened species, or protected marine mammals for that matter, have never been observed taken in strikenet sets.

Given the high rate of observer coverage in the shark gillnet fishery, NOAA Fisheries believes that smalltooth sawfish takes in this fishery are very rare. The fact that there were no smalltooth sawfish caught during 2001 when 100 percent of the fishing effort was observed, indicates that smalltooth sawfish takes (observed or total) most likely do not occur on annual basis. Based on this information, the 2003 BiOp estimates that one incidental capture of a sawfish (released alive) over the next five years, will occur as a result of the use of gillnets in this fishery (NOAA Fisheries, 2003a).

However, sawfish have been observed caught (seven known interactions, six released alive, one released in unknown condition) in shark bottom longline fisheries from 1994 through 2002 (See Figure 3.11) (Morgan pers. comm., 2003). Based on these observations, expanded sawfish take estimates for 1994-2002 were developed for the shark bottom longline fishery (NOAA Fisheries, 2003a). A total of 466 sawfish were estimated to have been taken in this fishery during 1994-2002, resulting in an average of 52 per year. Additionally, it is important to note that all of the sawfish takes observed, except for one, were released alive.

3.5.7 NOAA Fisheries National Bycatch Strategy and HMS Bycatch Implementation Plan

The NOAA Fisheries National Bycatch Strategy is based on the 1998 NOAA Fisheries Report, *Managing the Nation's Bycatch* (NOAA 1998), which contains the Agency's national bycatch goal, "to implement conservation and management measures for living marine resources that will minimize, to the extent practicable, bycatch and the mortality of bycatch that cannot be avoided." The national strategy contains six components, the first of which is to assess the progress towards meeting the national bycatch goal, its supporting objectives and strategies, and regional recommendations as set forth in *Managing the Nation's Bycatch* (NOAA, 1998). This includes meeting the bycatch reduction requirements of relevant statutes including National Standard 9 of the Magnuson-Stevens Act, the MMPA, and the ESA. The National Bycatch Strategy is available on the NOAA Fisheries' bycatch website at www.nmfs.noaa.gov/bycatch.html. The HMS Division is in the process of developing an implementation plan to improve upon and possibly expand current bycatch reduction efforts in HMS fisheries under this guidance.

Table 3.1 Sharks in the Management Unit by Species Groups. Source: NMFS, 1999.

Large Coastal Sharks	
Ridgeback Species	
Sandbar	*Carcharhinus plumbeus*
Silky	*Carcharhinus falciformis*
Tiger	*Galeocerdo cuvier*
Non-Ridgeback Species	
Blacktip	*Cancharhinus limbatus*
Spinner	*Carcharhinus brevipinna*
Bull	*Carcharhinus leucas*
Lemon	*Negaprion brevirostris*
Nurse	*Ginglymostoma cirratum*
Scalloped hammerhead	*Sphyrna lewini*
Great hammerhead	*Sphyrna mokarran*
Smooth hammerhead	*Sphyrna zygaena*

Prohibited Species	
Sand tiger	*Odontaspis taurus*
Bigeye sand tiger	*Odontaspis noronhai*
Whale	*Rhincodon typus*
Basking	*Cetorhinus maximus*
White	*Carcharodon carcharias*
Dusky	*Carcharhinus obscurus*
Bignose	*Carcharhinus altimus*
Galapagos	*Carcharhinus galapagensis*
Night	*Carcharhinus signatus*
Caribbean reef	*Carcharhinus perezi*
Narrowtooth	*Carcharhinus brachyurus*
Caribbean sharpnose	*Rhizoprionodon porosus*
Smalltail	*Carcharhinus porosus*
Atlantic angel	*Squatina dumerili*
Longfin mako	*Isurus paucus*
Bigeye thresher	*Alopias superciliosus*
Sevengill	*Heptranchias perlo*
Sixgill	*Hexanchus griseus*
Bigeye sixgill	*Hexanchus vitulus*

Small Coastal Sharks	
Atlantic sharpnose	*Rhizoprionodon terraenovae*
Finetooth	*Carcharhinus isodon*
Blacknose	*Carcharhinus acronotus*
Bonnethead	*Sphyrna tiburo*

Pelagic Sharks	
Blue	*Prionace glauca*
Oceanic whitetip	*Carcharhinus longimanus*
Porbeagle	*Lamna nasus*
Shortfin mako	*Isurus oxyrinchus*
Thresher	*Alopias vulpinus*

Deepwater and Other Species (Data Collection Only)	
Iceland catshark	*Apristurus laurussoni*
Smallfin catshark	*Apristurus parvipinnis*
Deepwater catshark	*Apristurus profundorum*
Broadgill catshark	*Apristurus riveri*
Marbled catshark	*Galeus arae*
Blotched catshark	*Scyliorhinus meadi*
Chain dogfish	*Scyliorhinus retifer*
Dwarf catshark	*Scyliorhinus torrei*
Japanese gulper shark	*Centrophorus acus*
Gulper shark	*Centrophorus granulosus*
Little gulper shark	*Centrophorus uyato*
Kitefin shark	*Dalatias licha*
Flatnose gulper shark	*Deania profundorum*
Portuguese shark	*Centroscymnus coelolepis*
Greenland shark	*Somniosus microcephalus*
Lined lanternshark	*Etmopterus bullisi*
Broadband dogfish	*Etmopterus gracilispinnis*
Caribbean lanternshark	*Etmopterus hillianus*
Great lanternshark	*Etmopterus princeps*
Smooth lanternshark	*Etmopterus pusillus*
Fringefin lanternshark	*Etmopterus schultzi*
Green lanternshark	*Etmopterus virens*
Cookiecutter shark	*Isistius brasiliensis*
Bigtooth cookiecutter	*Isistius plutodus*
Smallmouth velvet Dogfish	*Scymnodon obscurus*
Pygmy shark	*Squaliolus laticaudus*
Roughskin spiny dogfish	*Squalus asper*
Blainville's dogfish	*Squalus blainvillei*
Cuban dogfish	*Squalus cubensis*
Bramble shark	*Echinorhinus brucus*
American sawshark	*Pristiophorus schroederi*
Florida smoothhound	*Mustelus norrisi*
Smooth dogfish	*Mustelus canis*

Table 3.2 Summary of Catch Series Available for the 2002 LCS Stock Assessment. Source: Cortes *et al.*, 2002. FI: Fishery Independent

LCS Species			Series Name	Year(s)	Fishery/Type
Aggregate	Sandbar	Blacktip			
✔			Brannon	86-91	Commercial
✔			Hudson	85-91	Recreational
✔			Crooke LL	75-89	Commercial
✔	✔	✔	Shark Observer	94-01	Commercial
✔			Jax.	74;89;90	Recreational
✔			NC#	88-89	Commercial
✔	✔	✔	SC LL Recent	95-01	FI
✔	✔		SC LL Early	83;94	FI
✔			Port Salerno	76-90	Recreational
✔			Tampa Bay	85-90	Recreational
✔	✔		VA LL	74-01	FI
✔	✔		Large Pelagic Survey	86-01	Recreational
✔			Charterboat	89-95	Recreational
✔	✔	✔	Pelagic log	86-01	Commercial
✔	✔	✔	Early Rec.	81-93	Recreational
✔	✔	✔	Late Rec.	94-00	Recreational
✔	✔	✔	NMFS LL NE Recent	96;98;01	FI
✔	✔	✔	NMFS LL NE Early	89;91	FI
✔	✔	✔	NMFS LL SE	95-97; 99-01	FI
✔		✔	Gillnet observer	93-95;98-01	Commercial
✔	✔		NE Trawl	72-01	FI
✔			SE Trawl	7x-01	FI
✔		✔	PC LL	93-00	FI
✔		✔	PC Gillnet	96-01	FI
✔	✔	✔	Bottom LL Logs	96-01	Commercial
		✔	Mote Gillnet	95-01	FI

Table 3.3 Stock Assessment Models Utilized in 2002 LCS and SCS Stock Assessments. Source: Cortes *et al.*, 2002; Cortes, 2002.

Model	Description	Informational Basis (Data Input)	Stock Assessment
Bayesian SPM	Model used to describe fluctuations in resource abundance by accounting for existing biomass, recruitment, growth, catch, and natural mortality	Time series of catch, fishing effort, and prior information (i.e., intrinsic rate of increase, catch in years with zero catch observations, carrying capacity, abundance in year 1)	✔(1996 - LCS) ✔(1998 - LCS) ✔(2002 - LCS/SCS)
SSPM/MCMC	Model used to relate observed catch rates to unobserved states (i.e., biomass)	Time series of catch, fishing effort, and prior information (i.e., intrinsic rate of increase, catch in years with zero catch observations, carrying capacity, abundance in year 1)	✔(2002 - LCS/SCS)
SSLRSG	Model used to account for the lag in time between birth and subsequent recruitment to the adult stock as well as age structure effects on population dynamics	Time series of catch, fishing effort, and prior information (i.e., intrinsic rate of increase, catch in years with zero catch observations, carrying capacity, abundance in year 1)	✔(2002 - LCS/SCS)
MLE	Model used to process recruitment, immigration, emigration, and all mortality except that due to fishing	Time series of fishing effort, annual estimate of catch and its variance or average individual weight and its variance, and total annual yield	✔(1992 - SCS/LCS) ✔(1996 - LCS) ✔(2002 - LCS)
ASPM	Model used to describe fluctuations in resource abundance by accounting for existing biomass, recruitment, growth (age-specific), catch (demographic representation), and natural mortality	Time series of catch, fishing effort, prior information (i.e., natural mortality, catchability, effort), selectivity, historical fishing mortality values, maturity ogive, and fecundity, survival, length and weight at age	✔(2002 - LCS)

Table 3.4 Summary Table of the Status of the Biomass of Large Coastal Sharks. Sources: 2002 LCS stock assessment; E. Cortes, personal communication; L. Brooks, personal communication. SPM=surplus production model (thousands of fish); ASPM=age structured surplus production model (numbers of fish); SSLRSG=state-space lagged recruitment, survival, and growth model;. Only models shown in figures 71, 73, and 76 of the 2002 LCS stock assessment are summarized below.

Species / Model		Current Biomass N_{2001}	N_{MSY}	Current Relative Biomass Level N_{2001}/N_{MSY}	Biomass Target $B_{OY} = 125\% B_{MSY}$	Outlook
LCS Complex	SPM	2,940 - 10,156	4,469 - 8,371	0.46 - 1.18	5,586 - 10,464	STOCK IS OVERFISHED. $B_{2001}<B_{MSY}$ The majority of the models, including the models not summarized here, indicate that the resource is overfished. Even in the models where the resource is not overfished, the rebuilding target (B_{OY}) has not been met.
Sandbar	SPM	1,027 - 2,588	786 - 1,890	0.77 - 2.22	983 - 2,363	STOCK IS NOT OVERFISHED; REBUILDING IS STILL NEEDED. $B_{2001} \geq B_{MSY}$; $B_{2001}<B_{OY}$ The models have conflicting results. These conflicts are due, in part, to the sensitivity of certain models to catch or CPUE series. The Bayesian SPM models and SSLRSG models appear to correspond with each other, have good convergence[1], and fit well with CPUE data. These models generally indicate that the biomass is at or above B_{MSY} levels and below B_{OY} levels.
Sandbar	ASPM	4.48E5 - 4.86E8	6.78E5 - 1.5E12	3.25E-4 - 1.68	8.48E5 - 1.88E12	
Blacktip	SPM	5,587 - 8,034	3,430 - 5,417	1.20 - 1.45	4,288 - 6,771	STOCK IS NOT OVERFISHED AND IS REBUILT. $B_{2001} \geq B_{OY}$ The majority of the models indicate that biomass levels exceed B_{MSY} and B_{OY}. Some of the models that were very optimistic had difficulty converging. The other models were sensitive to the catch series.
Blacktip	ASPM	1.35E6 - 3.16E7	1.71E6 - 2.64E6	0.79 - 1.66	2.14E6 - 3.30E6	

1Convergence indicates that the algorithm has become stable and come to an optimal solution.

Table 3.5 **Summary Table of the Status of the Fishing Mortality on Large Coastal Sharks.** Sources: 2002 LCS stock assessment; E. Cortes, personal communication. SPM=surplus production model (thousands of fish); ASPM=age-structured surplus production model (numbers of fish). Only models shown in figures 71, 73, and 76 of the 2002 LCS stock assessment are summarized below.

Species / Model		Current F F_{2001}	Maximum Fishing Mortality Threshold MFFT = F_{MSY}	Current Relative Fishing Mortality Rate F_{2001}/F_{MSY}	Fishing Mortality Target $F_{OY} = 0.75F_{MSY}$	Outlook
Large Coastal Complex	SPM	0.07 - 0.21	0.05 - 0.10	0.89 - 4.48	0.05 - 0.08	OVERFISHING $F_{2001}>F_{MSY}$ The majority of the models indicate that current F levels exceed F_{MSY}.
Sandbar	SPM	0.10 - 0.70	0.07 - 0.46	1.08 - 1.68	0.05 - 0.34	OVERFISHING $F_{2001}>F_{MSY}$ The majority of the models indicate the overfishing is occurring. Most of the models that indicate overfishing also indicated that biomass levels are at or above MSY.
	ASPM	0.0001 - 0.2	0.05 - 0.09	0.00156 - 2.45	0.03 - 0.07	
Blacktip	SPM	0.04 - 0.08	0.07 - 0.18	0.42 - 0.82	0.05 - 0.14	NOT OVERFISHING $F_{2001}<F_{OY}$ The majority of the models indicate that current fishing rates are below F_{OY}. Most of these models are the same models that indicate biomass levels are above B_{MSY}.
	ASPM	0.01 - 0.21	0.06 - 0.12	0.13 - 1.72	0.04 - 0.09	

Table 3.6 Estimates (In Pounds Dressed Weight) of Total Landings for Small Coastal Sharks. Source: Cortes, 2002.

Year	Commercial Landings (lb dw)	Rec. Catches (lb dw)	Total (lb dw)
1995	538.5	431.1	969.6
1996	484.8	241.3	726.1
1997	704.9	259.9	964.8
1998	631.9	508.3	1140.2
1999	727.3	280.3	1007.6
2000	577.2	434.7	1011.9

Table 3.7 Estimates of Total Landings for Atlantic Sharpnose, Blacknose, Bonnethead, and Finetooth Sharks. Source: Cortes, 2002.

Species/Year		Commercial (lb dw)	Recreational Catches (lb dw)	Total (lb dw)
Atlantic Sharpnose	1995	93,663	368,213	461,876
	1996	165,406	182,955	348,361
	1997	256,562	192,056	448,618
	1998	230,920	442,887	673,807
	1999	244,356	195,768	440,124
	2000	129,467	305,565	435,032
Blacknose	1995	96,487	8,664	105,151
	1996	144,433	15,192	159,625
	1997	202,781	19,050	221,831
	1998	119,689	23,207	142,896
	1999	137,619	5,343	142,962
	2000	176,394	14,329	190,723
Bonnethead	1995	295,026	42,382	337,408
	1996	78,638	32,887	111,525
	1997	75,787	31,794	107,581
	1998	13,949	50,812	64,761
	1999	58,150	73,878	132,028
	2000	69,258	86,167	155,425
Finetooth	1995	50,193	4,519	54,712
	1996	94,134	2,326	96,460
	1997	169,733	12,103	181,836
	1998	267,224	8,27	268,051
	1999	285,214	2,81	285,495
	2000	190,313	4,392	194,705

Table 3.8 Summary of Catch Series Available for 2002 SCS Stock Assessment. Source: Cortes, 2002; Cortes pers. comm., 2003.

SCS Species					Series Name	Year(s)	Fishery/Type
Aggregate	Atl.Shar	Bonnethead	Blacknose	Finetooth			
✔	✔				Oregon II	72-00	FI
✔	✔				SCDNR LL	95-00	FI
✔	✔	✔	✔	✔	Rec	81-98	FD
✔	✔		✔	✔	NMFS LL PC	93-00	FI
✔	✔	✔	✔	✔	NMFS GN PC	96-01	FI
✔	✔	✔	✔	✔	DGNOP	93-01	FD
✔	✔	✔			SEAMAP	89-01	FI
✔	✔				VIMS	74-01	FI
✔	✔				NEFSC Bottom Trawl	68-00	FI
✔	✔				NMFS LL SE ATL	95-00	FI
✔	✔		✔		NMFS LL SE EGM	95-00	FI
✔	✔		✔	✔	NMFS LL SE WGM	95-00	FI
✔	✔				NMFS LL NE	86, 89, 91, 96, 98, 01	

Table 3.9 **Trends in Catch Rates of Small Coastal Sharks.** Source: Cortes, 2002. Slopes were obtained from linear regressions of relative catch rates on year. Slopes significantly different from 0 are denoted as * (5% level), ** (1% level), and *** (0.1% level).

Species	Series	Slope	SE	P Value	r^2
SCS	Oregon II[1]	-0.0213**	0.0065	0.0027	0.29
	SCDNR LL[1]	-0.0078	0.0137	0.6022	0.07
	Recreational	0.0398**	0.0124	0.0054	0.39
	NMFS LL PC[1]	0.0435	0.0346	0.2556	0.21
	NMFS GN OC	-0.0734	0.0769	0.3939	0.18
	DGNOP[2]	0.0588*	0.0148	0.0108	0.76
	SEAMAP	0.0389	0.0191	0.0668	0.27
	VIMS LL[2]	-0.0101	0.0115	0.3914	0.04
	NEFSC Trawl[1]	-0.0142**	0.0045	0.0045	0.23
Atlantic Sharpnose	Oregon II[1]	-0.0168*	0.0073	0.0291	0.16
	VIMS LL[2]	-0.0103	0.0115	0.3805	0.04
	SCDNR LL[1]	-0.0067	0.0164	0.7048	0.04
	NMFS NE LL[2]	-0.1100	0.0891	0.2845	0.28
	Recretaional	0.0640**	0.0169	0.0016	0.47
	NMFS SE LL ATL[2]	0.2566	0.1359	0.1997	0.64
	NMFS SE LL EGM[2]	0.1006	0.1853	0.6251	0.09
	NMFS SE LL WGM[2]	0.0986	0.0877	0.3425	0.30
	NMFS LL PC[1]	0.0532	0.0430	0.2625	0.20
	NMFS GN PC[1]	-0.0177	0.0368	0.6557	0.05
	DGNOP[12]	0.0614	0.0319	0.1125	0.42
	SEAMAP	0.0337	0.0214	0.1439	0.18
	NEFSC Trawl[2]	0.0059	0.0222	0.7927	0.004
Bonnethead	Oregon II	-0.1337***	0.0236	0.0000052	0.54
	Recreational	-0.0195	0.0206	0.3578	0.05
	NMFS GN PC[1]	-0.0498	0.0706	0.5193	0.11
	DGNOP[12]	0.0145	0.0112	0.2532	0.25
	SEAMAP	0.0100	0.0343	0.7761	0.01
Blacknose	Recreational	0.0574	0.0400	0.1710	0.11
	NMFS SE LL EGM[12]	0.0687	0.0300	0.1060	0.64
	NMFS SE LL WGM[12]	0.0712	0.0557	0.2913	0.35
	NMFS LL PC	0.1742	0.1326	0.2370	0.22
	NMFS GN PC	-0.2570	0.1607	0.1849	0.39
	Oregon II	-0.0382	0.0416	0.3666	0.03
	DGNOP[2]	0.0310	0.0339	0.4031	0.14
	SCDNR LL	-0.0702	0.0747	0.4004	0.18
Finetooth	Recreational	0.0431	0.0781	0.5884	0.02
	NMFS SE LL WGM[2]	0.3448	0.3982	0.5456	0.43
	NMFS LL PC[1]	-0.2350	0.1255	0.1103	0.37
	NMFS GN PC	-0.1061	0.1259	0.4471	0.15
	DGNOP[2]	0.0338*	0.0113	0.0305	0.64

[1] Indicates that the dependent variable (catch rate) was log-transformed.
[2] Indicates that there are missing data for some years.

Table 3.10 Summary Table of the Status of the Biomass of Small Coastal Sharks. Sources: 2002 SCS stock assessment; E. Cortes, personal communication.

Species	Current Biomass B_{2001}	B_{MSY}	Current Relative Biomass Level B_{2001}/B_{MSY}	Minimum Stock Size Threshold MSST = $(1-M)B_{MSY}$ if M<0.5 MSST = 0.5 B_{MSY} if M>=0.5	Minimum Biomass Flag Bflag = $(1-M)B_{OY}$	Biomass Target B_{OY} = 125% B_{MSY}	MSY	Outlook
Sharpnose	72.7 - 73.2	23 - 43.3	1.69 - 3.16	11.5 - 33.4	9.0 - 41.8	28.75 - 54.12	7.8 mill lb dw to 1.9 mill lb dw	Stock not overfished $B_{2001} > B_{OY}$
Bonnethead	12.8 - 13.4	4.6 - 9.2	1.46 - 2.78	2.3 - 7.3	0.8 - 9.2	5.75 - 11.50	1.8 mill lb dw to 0.5 mill lb dw	Stock not overfished $B_{2001} > B_{OY}$
Blacknose	10.4	3.3 - 5.4	1.92 - 3.15	1.6 - 4.5	2.0 - 5.6	4.12 - 6.75	0.8 mill lb dw to 0.2 mill lb dw	Stock not overfished $B_{2001} > B_{OY}$
Finetooth	1.9 - 2.3	0.8 - 1.65	1.39 - 2.37	0.4 - 1.4	0.5 - 1.7	1.00 - 2.06	0.26 mill lb dw to 0.05 mill lb dw	Stock not overfished $B_{2001} > B_{OY}$
SCS aggregate	77.1 - 83.8	32.3 - 60.75	1.38 - 2.39	16.2 - 50.2	12.4 - 62.7	40.38 - 75.94	7.0 mill lb dw to 2.2 mill lb dw	Stock not overfished $B_{20010} > B_{OY}$

Table 3.11 Summary Table of the Status of the Fishing Mortality on Small Coastal Sharks. Sources: 2002 SCS stock assessment; E. Cortes, personal communication.

Species	Current F F_{2000}	Maximum Fishing Mortality Threshold MFFT = F_{MSY}	Current Relative fishing Mortality Rate F_{2000}/F_{MSY}	Fishing Mortality Target $F_{OY} = 0.75F_{MSY}$	Outlook
Sharpnose	0.02 - 0.06	0.04 - 0.42	0.14 - 0.42	0.03 - 0.31	Not overfishing
Bonnethead	0.03 - 0.18	0.05 - 0.53	0.35 - 0.56	0.04 - 0.40	Not overfishing
Blacknose	0.02 - 0.19	0.03 - 0.32	0.61 - 0.65	0.02 - 0.24	Not overfishing
Finetooth	0.13 - 1.50	0.03 - 0.44	3.42 - 4.13	0.02 - 0.33	OVERFISHING
SCS aggregate	0.03 - 0.24	0.04 - 0.28	0.24 - 0.78	0.03 - 0.21	Not overfishing but $F_{2000} >= F_{OY}$

Table 3.12 Landings Estimates (mt ww) for All Countries Available in the ICCAT Database for Three Shark Species. Source: ICCAT, 2001. Note estimates exclude landings that were in numbers or dressed weight.

Year	Porbeagle	Blue	Shortfin Mako
1982	0		
1983			
1984	0		
1985	0		
1986	0	1	
1987	1	526	
1988	2	421	
1989	3	480	
1990	2	2129	193
1991	6	3029	314
1992	4	1768	246
1993	51	6886	1111
1994	110	7845	1023
1995	1417	8134	1113
1996	1101	8116	1343
1997	1450	11247	5057
1998	1048	32313	3901
1999	974	32654	3573
2000	918	3652	863

Table 3.13 **Summary of Available Data for Pelagic Sharks.** Source: ICCAT, 2001. NA = North Atlantic; SA = South Atlantic; MED = Mediterranean; NWA = Northwest Atlantic; NEA = Northeast Atlantic; SWA = Southwest Atlantic; SEA = Southeast Atlantic. Checks mark indicates information is available, whereas bullets note that some information is available. Blanks indicate questionable or lacking data.

		Blue shark			Shortfin Mako shark			Porbeagle shark			
		NA	SA	MED	NA	SA	MED	NWA	NEA	SWA	SEA
Life History	Growth (length at age)	✔	✔					✔			
	Length/Weight	✔	✔		✔	✔		✔	✔		
	Natural Mortality/Survival by age	✔	✔		✔			✔			
	Maximum age observed	✔	✔					✔			
	Stock Identification	●	●		●	●		✔	✔		
	Migration rates between stocks							✔	✔		
	Locations of pupping areas	✔	✔		✔	✔				✔	
	Stock/recruit relationship							✔			
	Intrinsic rate of increase (r)	✔			✔			✔			
	Unfished biomass (K)							✔			
Reproductive	Age at maturity	✔	✔					✔			
	Pups per female	✔	✔		✔	✔		✔	✔		
	Inter-spawning interval	✔			✔			✔			
	Gestation period	✔	✔		✔	✔		✔	✔		
	Sex ratio of pups	✔	✔		✔	✔		✔	✔		
	Maternal size/Litter size	✔	✔			✔		✔			
Catch	Number of fleets catching sharks	●	●	●	●	●	●	✔	✔	●	●

		Blue shark			Shortfin Mako shark			Porbeagle shark			
		NA	SA	MED	NA	SA	MED	NWA	NEA	SWA	SEA
	Total catch	●	●	●	●	●	●	✔	●	●	●
	Length or age composition	●	●		●	●		✔	●		●
	Sex ratio	●	●		●	●		✔	●		●
	Selectivity by age or size by gear							●			
	Conversions of whole/dressed weight, etc.	✔	✔		✔	✔		✔		✔	
	Locations of catch/bycatch (5 x 5 degrees)	●	●		●	●		✔		●	●
	Dead discard rate or total amount	●	●		●	●		✔			
	Live discard survival	✔			✔			✔			
	Bycatch rate (shark catch as % of tuna catch)	●	●		●	●		✔			●
CPUE series	Index of targeting vs. bycatch fisheries	●	●		●	●		✔			●
	Gear indices, etc.	●	●		●	●		✔			●

Table 3.14 Estimates of Total Landings and Dead Discards for Large Coastal Sharks: 1981-2001 (Numbers of Fish in Thousands). Source: Cortes *et al.*, 2002.

Year	Commercial Landings	Pelagic Longline Discards	Recreational Catches	Unreported	Bottom Longline Discards	Mexican Catches	Menhaden Fishery bycatch	Total
1981	16.2	0.9	265.0	N/A	0.9	120.0	25.1	428.1
1982	16.2	0.9	413.9	N/A	0.9	81.9	25.1	538.9
1983	17.5	0.9	746.6	N/A	1.0	85.4	25.1	876.5
1984	23.9	1.3	254.6	N/A	1.4	120.7	25.1	426.9
1985	22.2	1.2	365.6	N/A	1.3	87.7	25.1	503.1
1986	54.0	2.9	426.1	24.9	3.1	81.8	25.1	617.9
1987	104.7	9.7	314.4	70.3	5.9	80.2	25.1	610.3
1988	274.6	11.4	300.6	113.3	15.5	89.3	25.1	829.8
1989	351.0	10.5	221.1	96.3	19.9	105.6	25.1	829.4
1990	267.5	8.0	213.2	52.1	15.1	122.2	25.1	703.3
1991	200.2	7.5	293.4	11.3	11.3	95.7	25.1	644.5
1992	215.2	20.9	304.9	N/A	12.2	103.4	25.1	681.6
1993	169.4	7.3	249.0	N/A	11.3	119.8	25.1	581.9
1994	228.0	8.8	160.9	N/A	16.3	110.7	26.2	550.9
1995	222.4	5.2	176.3	N/A	13.9	96.0	24.0	537.8
1996	160.6	5.7	188.5	N/A	7.6	106.1	25.1	493.6
1997	130.6	5.6	165.1	N/A	8.3	83.1	25.1	417.8
1998	174.9	4.3	169.8	N/A	9.9	74.1	25.1	458.1
1999	111.5	9.0	90.1	N/A	3.8	57.1	25.1	297.5
2000	111.2	9.4	140.4	N/A	4.8	52.1	25.1	343.0
2001	99.2	9.4	142.0	N/A	6.3	52.1	25.1	334.1

Table 3.15 Directed Bottom Longline Shark Observed Catch and Disposition for 2002. Source: NOAA Fisheries, 2003a.

	FLORIDA EAST COAST				FLORIDA GULF COAST				CAROLINAS and GEORGIA				TOTAL			
Species	**Caught**	**Kept**	**Other Kill***	**Tagged/ Released**	**Caught**	**Kept**	**Other Kill***	**Tagged/ Released**	**Caught**	**Kept**	**Other Kill***	**Tagged/ Released**	**Caught**	**Kept**	**Other Kill***	**Tagged/ Released**
Sandbar	291	287			582	573	4	1	536	525	3	2	1409	1385	7	3
Blacktip	215	208	7		571	542	24	1	151	148	2		937	898	33	1
Dusky	2		1	1	6		3	3	17		14	3	25		18	7
Silky	8	8			69	48	13	8	13	5	8		90	61	21	8
Bull	16	14			53	48			4	3			72	65		
Bignose					1			1					1			1
Spinner	6	4	2		46	39	4	1	4	3	1		56	46	7	1
Night					17	2	15		1			1	18	2	15	1
Lemon	18	17			130	123			4	4			152	144		
Scalloped HH	59	41	18		66	49	16		11	8	2	1	136	98	36	
Great HH	4	1	3		56	50	6		7	4	3		67	55	12	
Nurse	29			28	267			264	5			5	301			297
Tiger	139	34	5	97	137	37	10	92	515	127	43	345	791	193	58	534
Sand tiger	1			1									1			1
White																
Unidentified																
Atlantic sharpnose	315	3	312		321	68	251	2	513	111	402		1149	182	965	2
Bonnethead	1		1										1		1	
Blacknose	22	13	9		355	155	197	4	33	20	13		411	188	219	4

	FLORIDA EAST COAST				FLORIDA GULF COAST				CAROLINAS and GEORGIA				TOTAL			
Species	**Caught**	**Kept**	**Other Kill***	**Tagged/ Released**	**Caught**	**Kept**	**Other Kill***	**Tagged/ Released**	**Caught**	**Kept**	**Other Kill***	**Tagged/ Released**	**Caught**	**Kept**	**Other Kill***	**Tagged/ Released**
Finetooth									1	1			1	1		
Thresher																
Shortfin mako									18	17			18	17		
LCS	788	614	36	125	2001	1506	95	371	1268	827	76	357	4057	2947	207	853
SCS	338	16	322	0	676	223	448	6	547	132	415	0	1562	371	1185	6
Pelagic									18	17			18	17		
Total	**1126**	**630**	**358**	**125**	**2677**	**1729**	**543**	**377**	**1833**	**976**	**491**	**357**	**5637**	**3335**	**1392**	**859**

*NOTE: Other Kill means that the species was used for bait, biological samples, or personal purposes.

Table 3.16 Total Drift Gillnet Shark Catch by Species During All Observed Trips, 2002.
RW = right whale calving season; NRW = non-right whale calving season.
Source: Carlson and Baremore, 2002a; Carlson and Baremore, 2002b.

Species	Total Number Caught		Kept (%)		Discarded Alive (%)		Discarded Dead (%)	
	RW	NRW	RW	NRW	RW	NRW	RW	NRW
Atlantic sharpnose shark	1,885	7,332	97.9	98.9	0.5	0.4	1.6	0.7
Blacknose shark	1,531	859	99.9	100.0	0.1	0.0	0.0	0.0
Blacktip shark	1,777	572	98.4	1.2	0.0	30.9	1.6	67.8
Finetooth shark	125	1,490	100.0	100.0	0.0	0.0	0.0	0.0
Bonnethead shark	402	305	97.5	100.0	0.2	0.0	2.3	0.0
Scalloped hammerhead shark	38	37	97.3	2.7	0.0	5.4	2.7	91.9
Tiger shark	3	2	66.6	50.0	0.0	50.0	33.4	0.0
Spinner shark	132	17	100.0	23.6	0.0	5.8	0.0	70.6
Sandbar shark	0	2	0.0	0.0	0.0	0.0	0.0	100.0
Lemon shark	0	1	0.0	0.0	0.0	0.0	0.0	100.0
Great hammerhead shark	75	18	61.4	0.0	0.0	0.0	38.6	100.0
Common thresher shark	1	0	100.0	0.0	0.0	0.0	0.0	0.0

Table 3.17 Total Strikenet Shark Catch by Species During All Observed Trips, 2002.
RW = right whale calving season; NRW = non-right whale calving season.
Source: Carlson and Baremore, 2002a; Carlson and Baremore, 2002b.

Species	Total Number Caught		Kept (%)		Discarded Alive (%)		Discarded Dead (%)	
	RW	NRW	RW	NRW	RW	NRW	RW	NRW
Blacknose shark	13	620	100.0	100.0	0.0	0.0	0.0	0.0
Blacktip shark	4,179	547	99.8	99.8	0.2	0.2	0.0	0.0
Bonnethead shark	0	1	0.0	100.0	0.0	0.0	0.0	100.0
Spinner shark	13	0	100.0	0.0	0.0	0.0	0.0	0.0
Great hammerhead shark	1	0	0.0	0.0	0.0	0.0	100.0	0.0

Table 3.18 Estimates of Recreational Catches by Shark Grouping. Note: Recreational catches are reported in numbers of fish in thousands. Source: NMFS, 1999; Cortes, 1999; Cortes *et al.*, 2002; and Cortes, 2002.

Year	Large Coastal Sharks	Small Coastal Sharks	Pelagic Sharks	Total
1981	265.0	--	--	265.0
1982	413.9	--	--	413.9
1983	746.6	--	--	746.6
1984	254.6	--	--	254.6
1985	365.6	--	93.0	365.6
1986	426.1	34.9	42.1	503.1
1987	314.4	48.8	37.3	400.5
1988	300.6	82.4	33.4	416.4
1989	221.1	62.3	22.6	306
1990	213.2	47.3	15.4	275.9
1991	293.4	137.0	11.6	442
1992	304.9	116.2	16.4	437.5
1993	249.0	78.7	31.3	359
1994	160.9	103.2	6.2	270.3
1995	176.3	135.1	32.9	344.3
1996	188.5	112.7	20.8	322
1997	165.1	97.0	8.4	270.5
1998	169.8	77.9	7.7	255.4
1999	91.0	115.9	11.1	218
2000	140.4	184.7	13.3	338.4
2001	142.0	189.5	3.8	335.3

Table 3.19 Recreational Harvest Estimates of U.S. Atlantic Large Coastal Sharks by Species for 1999, 2000, and 2001. Note: Recreational catches are reported in numbers of fish. Source: Cortes and Neer, 2002.

Species	Large Coastal Sharks		
	1999	2000	2001
Blacktip	34,962	74,055	48,848
Bull	3,107	6,045	3,751
Dusky	5,570	2,397	5,703
Great Hammerhead	352	921	3,367
Hammerhead, genus	75	3,693	--
Lemon	146	2,801	5,946
Night	50	--	--
Nurse	1,503	2,138	4,280
Reef	3	182	182
Requiem family	3,975	6,349	11,397
Requiem genus	8,978	11,600	4,887
Sandbar	20,553	10,743	35,880
Sand Tiger	--	--	604
Scalloped Hammerhead	1,349	3,517	1,108
Silky	3,863	5,109	4,070
Smooth Hammerhead	1	--	703
Spinner	6,391	6,355	2,896
Tiger	153	1,479	784
Total	91,031	137,384	134,406

Table 3.20 Recreational Harvest Estimates of U.S. Atlantic Small Coastal Sharks by Species for 1999, 2000, and 2001. Note: Recreational catches are reported in numbers of fish. Source: Cortes and Neer, 2002.

Species	Small Coastal Sharks		
	1999	2000	2001
Atlantic Sharpnose	68,621	114,973	109,114
Blacknose	6,019	10,463	15,059
Bonnethead	41,128	57,405	58,600
Finetooth	78	1,786	6,729
Smalltail	4	29	--
Total	115,850	184,656	189,502

Table 3.21 Recreational Harvest Estimates of U.S. Atlantic Pelagic Sharks by Species for 1999, 2000, and 2001. Note: Recreational catches are reported in numbers of fish. Source: Cortes and Neer, 2002.

Species	Pelagic Sharks		
	1999	2000	2001
Blue	5,218	7,010	950
Shortfin Mako	1,383	5,808	2,882
Thresher	5,512	528	--
Total	11,113	13,346	3,832

Table 3.22 Average Ex-vessel Prices per lb. dw for Atlantic Sharks by Gear and Area. 2001 dollars are converted to 1996 dollars using the consumer price index conversion factor of 0.886. Source: Dealer weigh out slips from the Southeast Fisheries Science Center and Northeast Fisheries Science Center. HND=Handline, harpoon, and trolls, PLL=Pelagic longline, BLL=Bottom longline, Net=Gillnets and pound nets, TWL=Trawls. Gulf of Mexico includes: TX, LA, MS, AL, and the west coast of FL. S. Atlantic includes: east coast of FL. GA, SC, and NC dealers reporting to Southeast Fisheries Science Center. Mid-Atlantic includes: NC dealers reporting to Northeast Fisheries Science Center, VA, MD, DE, NJ, NY, and CT. N. Atlantic includes: RI, MA, NH, and ME.

Species	Gear	Gulf of Mexico		S. Atlantic		Mid-Atlantic		N. Atlantic	
		1996	2001	1996	2001	1996	2001	1996	2001
Large Coastal Sharks	HND	$0.23	$0.45	$0.72	$0.85	$0.74	$0.78	-	$0.44
	PLL	-	$0.40	$1.54	$1.50	$0.58	$2.32	$1.03	$1.07
	BLL	$0.60	$0.39	$0.73	$0.79	$0.54	$0.49	$0.99	$1.27
	NET	$0.38	$0.44	$1.30	$1.32	$0.45	$0.79	$0.83	$0.88
	TWL	$0.15	$0.22	$0.86	$0.45	$0.47	$0.49	$0.80	$0.82
Pelagic sharks	HND	-	$1.31	$0.82	$0.63	$1.47	$1.12	$1.60	$1.22
	PLL	-	$1.17	$0.68	$0.84	$1.25	$1.38	$1.26	$1.21
	BLL	-	$1.26	$0.59	$0.69	$1.47	$0.86	$1.85	-
	NET	-	-	$0.33	$0.32	$0.99	$0.90	$1.12	$0.87
	TWL	-	-	-	$0.23	$1.00	$0.61	$0.96	$1.05
Small Coastal sharks	HND	-	$0.33	$0.25	$0.41	-	$0.35	-	-
	PLL	-	$0.66	-	$0.56	$0.25	$0.43	-	-
	BLL	-	$0.54	-	$0.47	-	$0.45	-	-
	NET	-	$0.40	$0.25	$0.48	-	$0.39	-	$1.34
	TWL	-	-	-	$0.20	-	$0.84	-	
	TRP	-	$0.66	-	-		-	-	
Shark fins	HND	-	$14.09	$14.00	$17.50	$2.74	-	-	-
	PLL	-	$18.68	-	$10.14	$7.79	-	$4.25	-
	BLL	-	$19.05	$14.00	$19.68	$8.00	-	$3.00	-
	NET	-	$9.76	-	$9.39	$4.77	-	$1.96	-
	TWL	-	-	$9.11	$10.78	$1.99	-	$2.32	-

Table 3.23 Average Ex-vessel Prices per lb. For Atlantic Sharks by Area. 2001 dollars are converted to 1996 dollars using the consumer price index conversion factor of 0.886.

Species	Gulf of Mexico		S. Atlantic		Mid-Atlantic		N. Atlantic	
	1996	2001	1996	2001	1996	2001	1996	2001
Large coastal sharks	$0.21	$0.39	$1.02	$0.99	$0.55	$0.97	$0.88	$0.90
Pelagic sharks	-	$1.26	$0.62	$0.60	$1.21	$0.97	$1.31	$1.09
Small coastal sharks	-	$0.51	$0.25	$0.46	$0.25	$0.49	-	$1.34
Shark fins	-	$18.52	$10.74	$16.33	$4.60	-	$2.69	-

Table 3.24 The Number of Plants and Employees for Atlantic Processors and Wholesalers, by State, in 1996 and 2000. Source: NOAA Fisheries, 1998; NOAA Fisheries, 2002. 2001 data is not yet available.

State	1996		2000	
	Number of plants	Number of employees	Number of plants	Number of employees
Maine	267	3,353	270	2,953
New Hampshire	37	455	37	425
Massachusetts	374	4,964	345	5,025
Rhode Island	82	793	69	790
Connecticut	44	339	44	429
New York	339	2,622	362	2,779
New Jersey	150	2,090	131	2,072
Pennsylvania	68	2,017	71	2,400
Delaware	-	-	(2)	(2)
District of Columbia	7	73	(2)	(2)
Maryland	126	1,889	99	1,626
Virginia	129	2,115	113	2,087
N. Carolina	145	2,064	140	1,952
S. Carolina	37	337	30	177
Georgia	66	1,649	61	1,788
Florida	504	5,794	464	6,111
Alabama	144	2,425	125	2,194
Mississippi	64	1,142	70	2,887
Louisiana	311	4,280	268	3,344
Texas	136	2,384	142	3,061
Total	3,030	40,785	2,845	42,104

Table 3.25 Summary of the Mark-up and Consumer Expenditure for the Primary Wholesale and Processing of Domestic Commercial Marine Fishery Products on a Nationwide Basis: 1996 and 2001. Source: NOAA Fisheries, 1997 and NOAA Fisheries, 2002.

	1996	2001
Purchase of Fishery inputs	$5,377,442	$6,281,066
Percent mark-up of fishery inputs	96.6%	99.9%
Total mark-up	$5,192,619	$6,271,680
Total value of fishery inputs	$10,570,061	$12,555,745

Table 3.26 The Percent of Charter Boat Operators in Alabama, Louisiana, Mississippi, and Texas Who Reported Targeting HMS at Least Once. Source: Sutton *et al*., 1999.

Target		Alabama	Louisiana	Mississippi	Texas
Tuna	Yes	61.9	66.7	6.3	65.2
	No	38.1	33.3	93.8	32.6
	Incidental	0.0	0.0	0.0	2.2
Sharks	Yes	4.5	16.7	75.0	67.4
	No	95.5	66.7	18.8	42.7
	Incidental	0.0	16.7	6.3	32.6
Billfish	Yes	61.9	41.7	6.3	43.5
	No	38.1	58.3	93.8	56.5
	Incidental	0.0	0.0	0.0	0.0

Table 3.27 The Financial Operations and Economic Impact of Charter and Party Boat Operators in Alabama, Louisiana, Mississippi, and Texas. Source: Sutton *et al*., 1999.

		Charter boats	Party boats
Average capital investment	Hull and superstructure	$97,713	$214,922
	Engine	$9,058	$2,571
	Electronics	$5,231	$7,429
	Other equipment and tackle	$7,298	$6,686
Annual costs	Wages and Salaries	$19,725	$64,064
	New hull or superstructure	$18,300	$23,076
	Maintenance and repair	$8,584	$26,919
	Engine	$4,890	$15,153
	Insurance	$3,799	$11,491
	Other costs	$6,020	$28,404
Average annual gross revenues		$68,934	$137,308
Average annual net revenues (includes capital expenses - e.g. purchase of new hull)		-$12,099	-$128,703
Average annual operating profit (does not include capital expenses - e.g. purchase of new hull)		$14,650	-$73,064
Economic output	Alabama	$13.8 M	$0.8 M
	Mississippi	$6.6 M	-
	Louisiana	$4.4 M	-
	Texas	$17.6 M	$3.5 M
Employment generated	Alabama	$5.6 M (282 jobs)	$0.3 M (16 jobs)
	Mississippi	$2.1 M (211 jobs)	-
	Louisiana	$1.8 M (118 jobs)	-
	Texas	$6.1 M (385 jobs)	$1.7 M (77 jobs)

Table 3.28 The Average Fees for Charter and Headboats in Florida, Georgia, South Carolina, and North Carolina. Source: Holland *et al*., 1999.

State	Length of trip	Charter boat	Headboat
Florida	Half-day	$348	$29
	Full day	$554	$45
	Overnight	$1,349	--
Georgia	Half-day	$320	--
	Full day	$562	--
	Overnight	$1000-$2000	--
South Carolina	Half-day	$296	$34
	Full day	$661	$61
	Overnight	$1000-$2000	--
North Carolina	Half-day	$292	$34
	Full day	$701	$61
	Overnight	$1000-$2000	--

Table 3.29 The Percent of Charter and Headboat Operators in Florida, Georgia, South Carolina, and North Carolina Who Reported Targeting HMS at Least Once. Source: Holland *et al*., 1999.

Target species	Florida		Georgia		S. Carolina		N. Carolina	
	Charter	Head	Charter	Head	Charter	Head	Charter	Head
Tuna	8.5	0.0	8.3	-	0.0	-	60.0	-
Sharks	22.6	9.7	33.3	-	35.0	-	23.3	-
Billfish	9.9	0.0	8.3	-	20.0	-	40.0	-

Table 3.30 The Financial Operations and Economic Impact of Charter and Party Boat Operators in Florida, Georgia, South Carolina, and North Carolina. Source: Holland *et al*., 1999.

		Charter boats		Party boats	
		Florida	Other states	Florida	Other states
Average capital investment	Hull and superstructure	$90,989	$39,445	$214,158	$178,833
	Engine	$40,518	$5,900	$40,000	$38,181
	Electronics	$5,568	$5,900	$5,560	$6,277
	Other equipment and tackle	$5,878	$4,463	$9,183	$3,600
Annual costs	Wages and Salaries	$25,810	$17,928	$52,000	$33,077
	New hull or superstructure	$3,020	$793-1,340	$3,333	$0.00
	Maintenance and repair	$5,720	$4,991-6,910	$13,385	$16,577
	Engine	$6,334	$172-2,738	$9,450	$14,545
	Insurance	$2,970	--	$8,570	–
	Other costs	$24,723	$971-18,883	$48,999	$40,846
Average annual gross revenues		$56,264	$26,304-$60,135	$140,714	$123,000
Average annual net revenues (Gross revenues - Annual costs)		-$12,313	$3,069-13,237	$4,977	$17,955
Economic output		$128 M	$34.4 M	$23.4 M	$5.8 M
Employment generated		$31 M (3,074 jobs)	$15.6 M (1,066 jobs)	$5.8 M (450 jobs)	$2.2 (81 jobs)

Table 3.31 1997-2002 U.S. Exports of Shark Products (kg). Source: NOAA Fisheries, 2003b.

Year	Shark Fins Dried (kg, US$)		Non-specified Fresh Shark (kg, US$)		Non-specified Frozen Shark (kg, US$)		Total for all Products (kg, US$)	
1997	NA*	NA*	459,542	920,887	439,992	884,588	899,534	1,805,475
1998	141,149	1,264,077	524,249	814,319	102,939	250,107	768,337	2,328,503
1999	106,723	911,671	270,343	487,610	155,275	461,362	532,341	1,860,643
2000	NA**	NA**	430,725	784,704	345,942	814,456	776,667•	1,599,160•
2001	NA**	NA**	332,948	545,568	634,060	2,341,215	967,008•	2,886,783•
2002	123,890	3,468,458	968,915	1,477,305	982,774	2,340,756	2,075,579	7, 286,519

* There was no product code for the export of shark fins prior to 1998. Therefore, any exported shark fins may have been identified as unspecified shark product or as unspecified dried fish.

** Table will be updated as values become available.

•Values do not include dried shark fin data.

Table 3.32 1997-2002 U.S. Imports of Shark Products. Source: NOAA Fisheries, 2003b.

Year	Shark Fins Dried		Non-specified Fresh Shark		Non-specified Frozen Shark		Total For All Products	
	kg	US$	kg	US$	kg	US$	kg	US$
1997	77,626	3,060,438	1,191,044	3,044,984	59,641	914,783	1,328,278	7,020,205
1998	62,169	1,698,646	947,545	2,160,985	148,167	1,125,994	1,157,881	4,985,625
1999	59,872	2,104,846	1,095,119	2,038,016	105,398	621,499	1,260,389	4,764,361
2000	66,107	2,355,575	1,066,144	1,859,203	90,166	575,226	1,222,417	4,790,004
2001	50,664	1,086,716	913,421	1,389,054	123,809	1,780,726	1,087,894	4,256,496
2002	39,141	1,023,914	797,538	1,240,650	91,792	1,090,428	928,471	3,354,992

Table 3.33 Total Teleost and Ray Bycatch in NOAA Fisheries Observed Drift Gillnet Sets During 2002 Right Whale Calving Season. Source: Carlson, 2002a.

Species	Total Number Caught	Kept (%)	Discard Alive (%)	Discard Dead (%)
King mackerel	93	75.3	0.0	24.7
Cownose ray	6	33.3	66.6	0.0
Cobia	66	68.2	6.1	25.7
Great barracuda	72	100.0	0.0	0.0
Bluefish	9	44.4	0.0	55.5
Spanish mackerel	16	87.5	0.0	12.5
Little tunny	178	96.1	0.0	3.9
Spotted eagle ray	9	0.0	100.0	0.0
Crevalle jack	41	97.5	2.5	0.0
Remora	11	0.0	72.7	27.3
Atlantic manta ray	2	0.0	100.0	0.0
Tripletail	3	100.0	0.0	0.0
Atlantic sailfish	43	0.0	2.3	97.7
Wahoo	2	100.0	0.0	0.0
Atlantic thread herring	3	0.0	33.3	66.7
Blackfin tuna	4	100.0	0.0	0.0
Blue runner	2	100.0	0.0	0.0
Tarpon	3	0.0	33.3	66.7
Gag grouper	1	100.0	0.0	0.0
Atlantic bumper	2	0.0	50.0	50.0
Dolphin	3	100.0	0.0	0.0
Atlantic bonito	20	100.0	0.0	0.0
Atlantic moonfish	3	66.7	0.0	33.3
Devil ray	6	0.0	33.3	66.7
Permit	2	100.0	0.0	0.0
Sea basses	2	0.0	0.0	100.0
Silver perch	1	100.0	0.0	0.0
Jacks	1	100.0	0.0	0.0

Table 3.34 Total Bycatch in NOAA Fisheries Observed Drift Gillnet Sets Outside of 2002 Right Whale Calving Seasons. Source: Carlson, 2002b.

Species	Total Number Caught	Kept (%)	Discard Alive (%)	Discard Dead (%)
Little tunny	817	94.5	0.0	5.5
King mackerel	386	41.7	1.0	57.3
Barracuda	231	100.0	0.0	0.0
Blue runner	21	100.0	0.0	0.0
Cownose ray	32	0.0	78.1	21.9
Cobia	72	80.5	7.0	12.5
Remora	21	0.0	90.5	9.5
Atlantic moonfish	174	72.4	22.4	5.2
Crevalle jack	29	3.5	24.1	72.4
Atlantic sailfish	4	0.0	0.0	100.0
Blackfin tuna	1	100.0	0.0	0.0
Spotted eagle ray	1	0.0	100.0	0.0
Manta ray	3	0.0	100.0	0.0
African pompano	2	100.0	0.0	0.0
Tarpon	22	0.0	22.7	77.3
Spanish mackerel	3	100.0	0.0	0.0
Red Drum	28	0.0	50.0	50.0
Bullet	21	100.0	0.0	0.0
Permit	6	0.0	16.6	83.4
Dolphin	2	100.0	0.0	0.0
Atlantic Sturgeon	1	0.0	100.0	0.0
Balloonfish	1	100.0	0.0	0.0
Skipjack tuna	1	100.0	0.0	0.0
Atlantic manta ray	1	0.0	0.0	100.0
Devil ray	1	100.0	0.0	0.0
Bottlenose dolphin	1	0.0	0.0	100.0

Table 3.35 Total Bycatch in NOAA Fisheries Observed Strikenet Sets During 2002 Right Whale Season. Source: Carlson and Baremore, 2002a.

Species	Total Number Caught	Kept (%)	Discard Alive (%)	Discard Dead (%)
Great barracuda	26	84.6	11.6	3.8
Cownose ray	1	0.0	100.0	0.0
Houndfish	1	0.0	100.0	0.0

Table 3.36 Status of Atlantic sea turtle populations: Species taken in HMS fisheries 1992-1997. Source: NOAA Fisheries, 2001a.

Species/Stock	Status: trend in U.S. nesting population
Loggerhead: Northern sub-population	Threatened: stable or declining
Leatherback	Endangered: loss of some nesting populations, otherwise stable
Green	Endangered: increasing
Kemp's Ridley	Endangered: thought to be increasing
Hawksbill	Endangered: unknown if there is a recent trend

Table 3.37 Annual estimates of total marine turtle bycatch and the subset that were dead when released in the U.S. pelagic longline fishery. Source: NOAA Fisheries, 2001a.

Species	Loggerhead		Leatherback		Green		Hawksbill		Kemp's Ridley		Unidentified		Sum Total
Year	Total	Dead *	Total	Dead *	Total	Dead *	Total	Dead*	Total	Dead *	Total	Dead*	
1992	293	0	914	88	87	30	20	0	1	0	26	0	1,341
1993	417	9	1,054	0	31	0					31	0	1,533
1994	1,344	31	837	0	33	0			26	0	34	0	2,274
1995	2,439	0	934	0	40	0					171	0	3,584
1996	917	2	904	0	16	2					2	0	1,839
1997	384	0	308	0			16	0	22	0	47	0	777
1998	1,106	1	400	0	14	1	17	0			1	0	1,538
1999	991	23	1,012	0							66	0	2,069
Total	7,891	66	6,363	88	221	33	53	0	49	0	378	0	14,955

* Does not account for fishing related mortality that may occur after release.

Table 3.38 Seabird Bycatch in the Atlantic Pelagic Longline Fishery from 1992 to 2002. MAB - Mid-Atlantic Bight, SAB - South Atlantic Bight, NEC - Northeast Coastal, GOM - Gulf of Mexico. Source: NOAA Fisheries, 2003b.

Year	Month	Area	Type of Bird	Number observed	Status
1992	October	MAB	Gull	4	Dead
	October	MAB	Shearwater, Greater	2	Dead
1993	February	SAB	Gannet, Northern	2	Alive
	February	MAB	Gannet, Northern	2	Alive
	February	MAB	Gull, Black Backed	1	Alive
	February	MAB	Gull, Black Backed	3	Dead
	November	MAB	Gull	1	Alive
1994	June	MAB	Shearwater, Greater	3	Dead
	August	MAB	Shearwater, Greater	1	Dead
	November	MAB	Gull	4	Dead
	December	MAB	Gull, Herring	7	Dead
1995	July	MAB	Seabird	5	Dead
	August	GOM	Seabird	1	Dead
	October	MAB	Storm Petrel	1	Dead
	November	NEC	Gannet, Northern	2	Alive
	November	NEC	Gull	1	Alive
1997	June	SAB	Seabird	11	Dead
	July	MAB	Seabird	1	Dead
	July	NEC	Seabird	15	Alive
	July	NEC	Seabird	6	Dead
1998	February	MAB	Seabird	7	Dead
	July	NEC	Seabird	1	Dead
1999	June	SAB	Seabird	1	Dead
2000	June	SAB	Gull, Laughing-	1	Alive
	November	NEC	Gannet, Northern	1	Dead
2001	June	NEC	Shearwater, Greater	7	Dead
	July	NEC	Shearwater, Greater	1	Dead

Year	Month	Area	Type of Bird	Number observed	Status
2002	July	NEC	Seabird	1	Dead
	August	NED	Shearwater, Greater	1	Dead
	August	NED	Seabird	1	Dead
	September	NED	Shearwater, Greater	3	Dead
	September	NED	Seabird	3	Alive
	September	NED	Shearwater SPP	1	Dead
	October	NED	Gannet Northern	1	Alive
	October	NED	Shearwater SPP	1	Dead
	October	NED	Seabird	2	Dead
	October	MAB	Gull	3	Alive
	October	MAB	Gull	1	Dead
	November	MAB	Gull	3	Alive

Table 3.39 Summary of Catch/Bycatch Observed in Shark Gillnet Fisheries 1999-2002, during and outside of right whale calving season. Sources: Carlson and Lee, 1999; NOAA Fisheries 2000, 2001, 2002, 2003.

Year/ Source	Right Whale Calving Season		Non-Right Whale Calving Season		Total Protected Resources Interactions
	Drift Gillnet	Strikenet	Drift Gillnet	Strikenet	
1999 (SAFE 2000)	20 sets/20 trips 12 spp shark: 1,110 LCS & 1,498 SCS; 21 spp teleost & ray; 4 bottlenose dolphin; 2 leatherbacks; 47 tarpon; 23 king mackerel				4 bottlenose dolphin; 2 leatherbacks
2000 (SAFE 2001)	14 spp shark: 3,290 LCS & 2,553 SCS; 33 spp teleost & ray; 1 loggerhead; 1 spotted dolphin; 1 bottlenose dolphin; 35 tarpon; 36 king mackerel	2 spp shark: 909 LCS (BT) & 1 other shark; 2 spp teleost & ray			1 loggerhead; 1 spotted dolphin; 1 bottlenose dolphin
2000 & 2001 (SAFE 2002)	70 sets (2001) 12 spp shark: 5,238 LCS & 9,570 SCS; 34 spp teleost & ray; 14 leatherbacks; 1 loggerhead; 1 hawksbill; 4 bottlenose dolphin; 3 spotted dolphin; 99 red drum; 343 king mackerel; 2 tarpon	12 sets/32 trips (2001) 4 spp shark: 3,039 LCS & 1 SCS; 3 spp teleost & ray	37 sets (15 in 2000; 22 in 2001) 10 spp shark: 444 LCS & 9,701 SCS; 25 spp teleost & ray; 1 loggerhead; 1,059 king mackerel; 3 tarpon	8 sets (3 in 2000; 5 in 2001) 4 spp shark: 64 LCS & 115 SCS; 1 spp ray	2 loggerheads; 14 leatherbacks; 1 hawksbill; 4 bottlenose dolphin; 3 spotted dolphin
2002 (SAFE 2003)	41 sets 10 spp shark: 2,026 LCS & 3,943 SCS; 26 spp teleost & ray; 2 leatherbacks; 1 loggerhead; 93 king mackerel; 3 tarpon	24 sets/85 trips 4 spp shark: 4,193 LCS & 13 SCS; 3 spp teleost & ray	28 sets (Apr-Oct) & 14 sets (Aug-Oct) 12 spp shark: 649 LCS & 9,986 SCS; 26 spp teleost & ray; 1 bottlenose dolphin	3 spp shark: 547 LCS & 621 SCS	2 leatherbacks; 1 loggerhead; 1 bottlenose dolphin
Total Protected Resources	3 loggerheads; 18 leatherbacks; 1 hawksbill; 4 spotted dolphin; 9 bottlenose dolphin		1 loggerhead; 1 bottlenose dolphin		4 loggerheads; 18 leatherbacks; 1 hawksbill; 10 bottlenose dolphin; 4 spotted dolphin

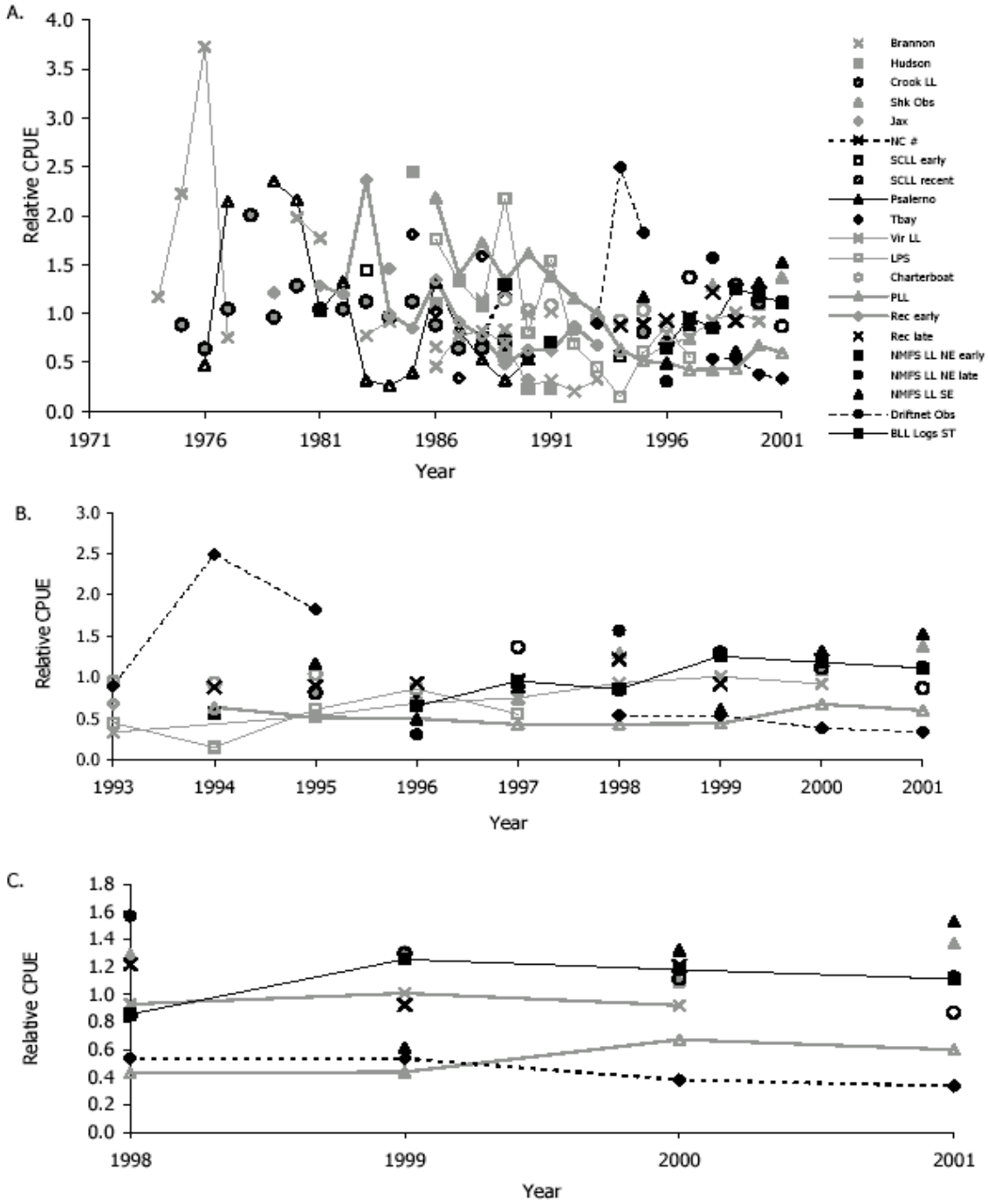


Figure 3.1 Large Coastal Shark Complex CPUE Series: A) 1974-2001, B) 1993-2001, C) 1998-2001. Series are scaled (divided by the mean) to appear on a common scale. Source: Cortes *et al.*, 2002.

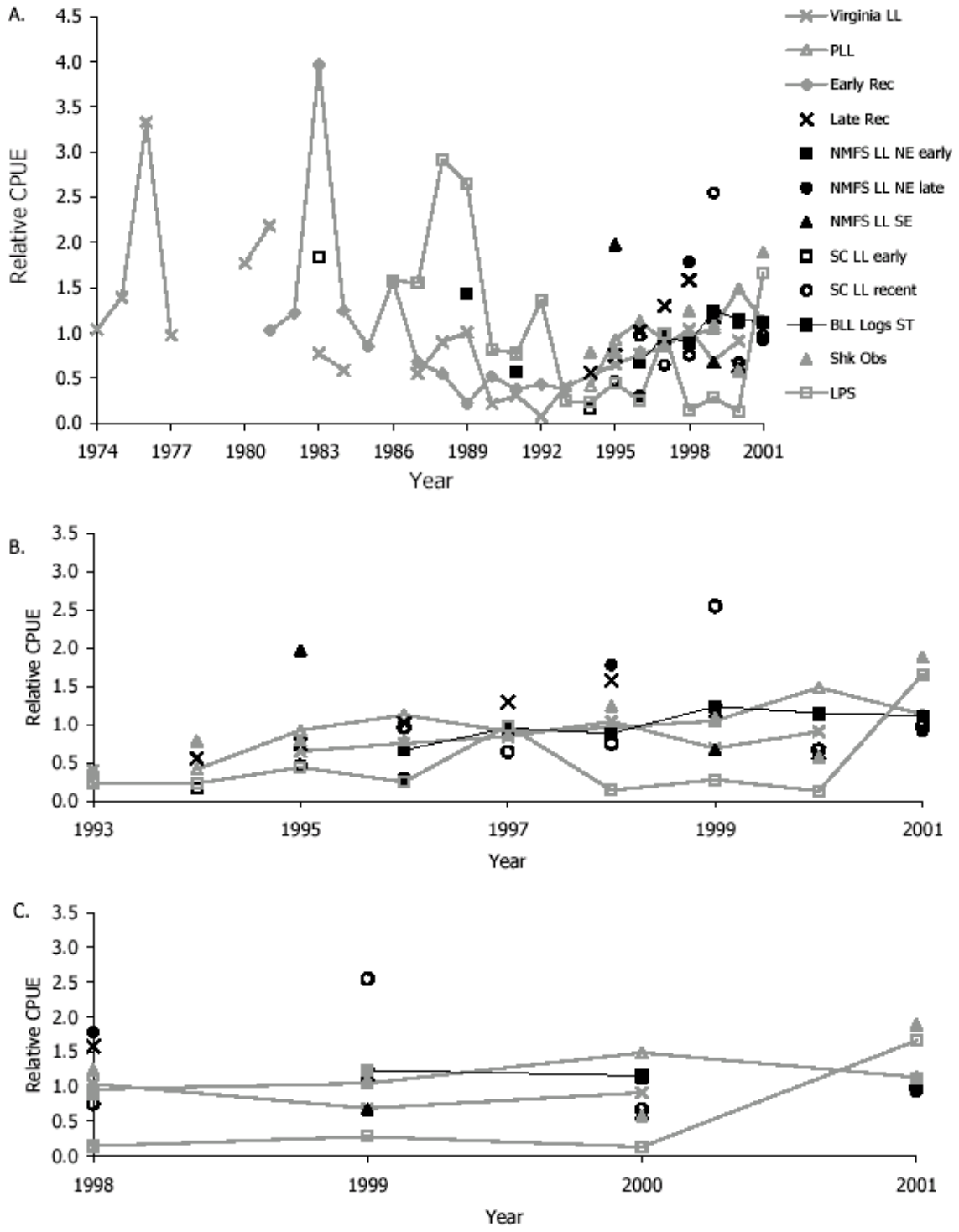


Figure 3.2 Sandbar Shark CPUE Series: A) 1974-2001, B) 1993-2001, C) 1998-2001. Series are scaled (divided by the mean) to appear on a common scale. Source: Cortes *et al.*, 2002.

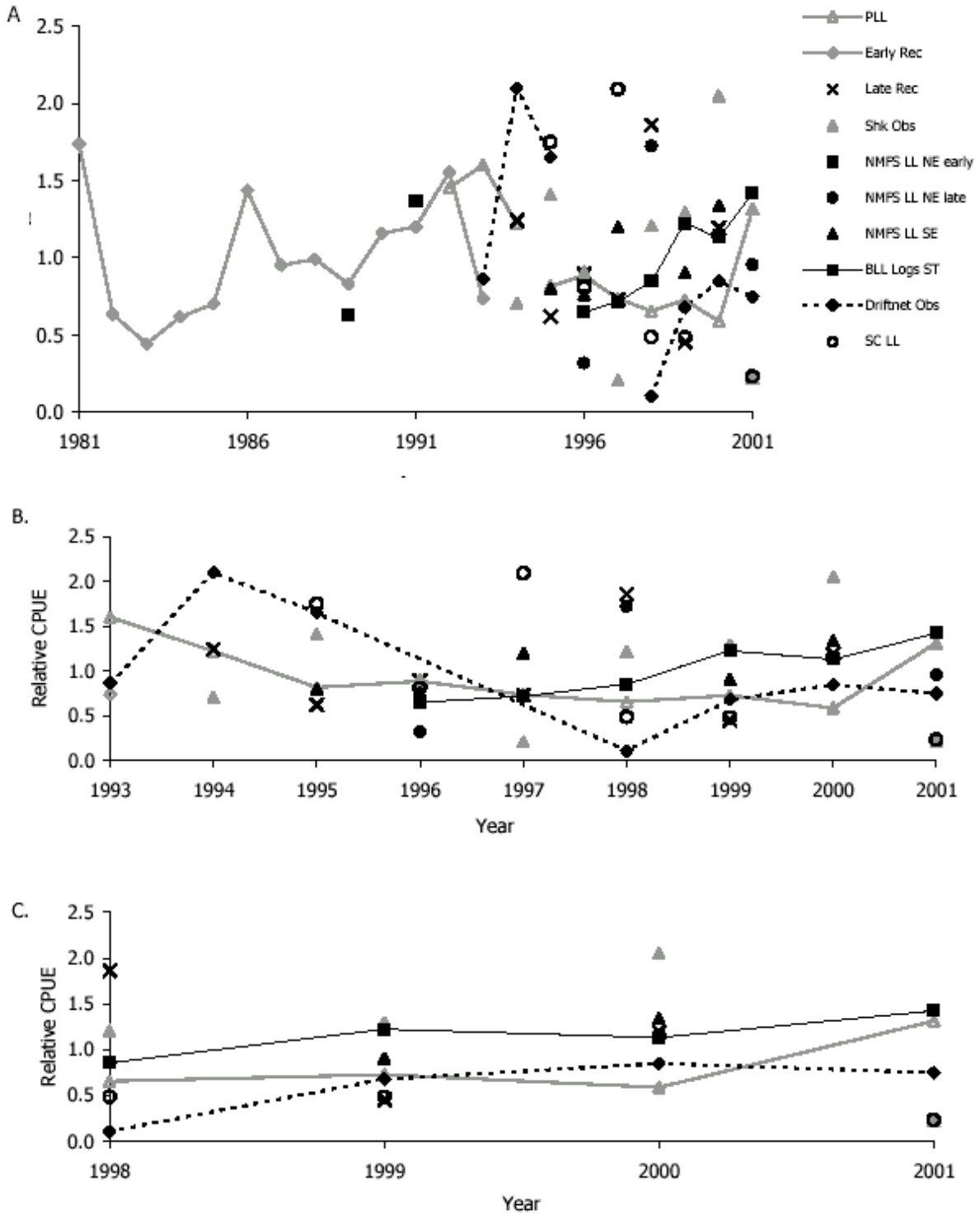


Figure 3.3 **Blacktip Shark CPUE Series: A) 1974-2001, B) 1993-2001, C) 1998-2001.** Series are scaled (divided by the mean) to appear on a common scale. Source: Cortes *et al.*, 2002.

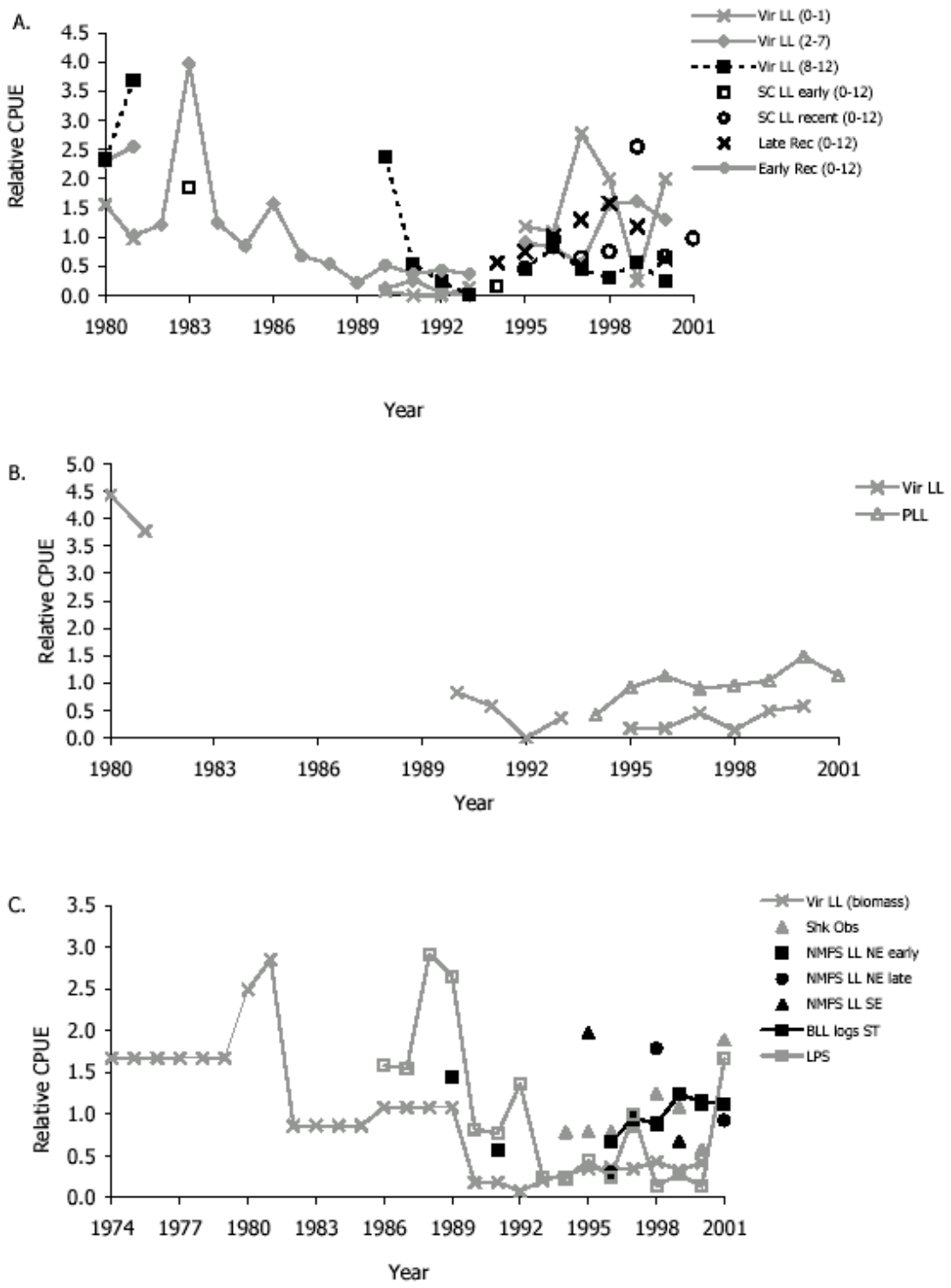


Figure 3.4 **Age-specific CPUE Series for the Sandbar Shark: A) Juveniles (Ages 0-12), B) Adults (Ages 13 and Older), C) All Ages Combined.** Source: Cortes *et al.*, 2002.

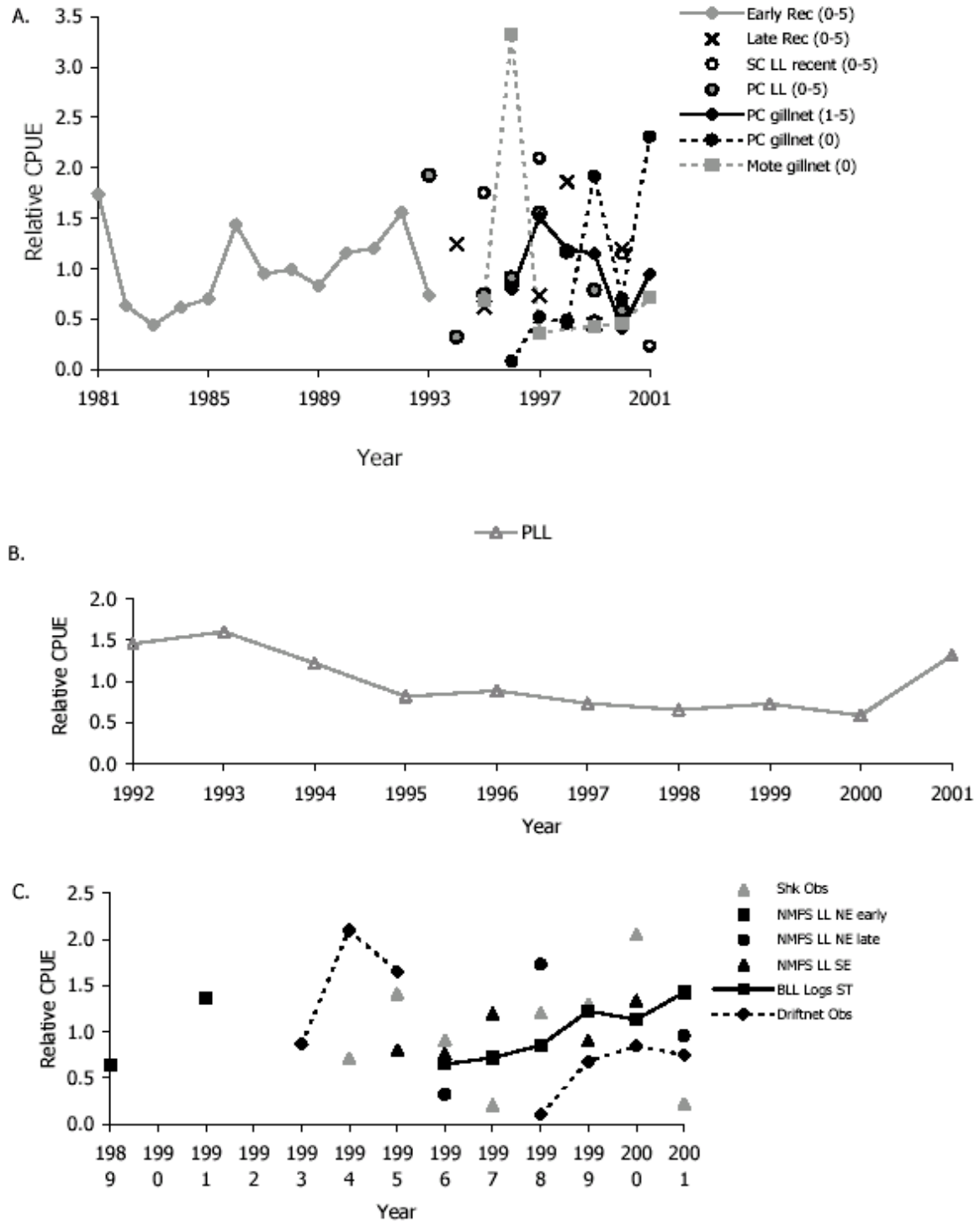


Figure 3.5 Age-specific CPUE Series for the Blacktip Shark: A) Juveniles (Ages 0-5), B) Adults (Ages 6 and Older), C) All Ages Combined. Source: Cortes *et al.*, 2002.

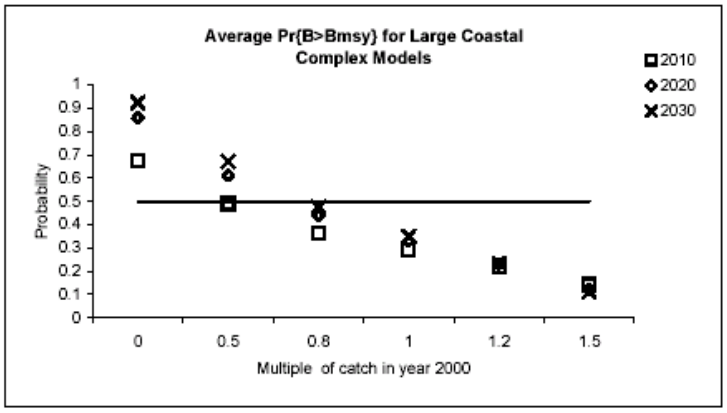


Figure 3.6 Summary Plot for Large Coastal Shark Complex of the Mean Probability That B>B_{MSY} Obtained in Six Main Scenarios Using the Bayesian SPM with the SIR Algorithm. The scenarios include: LCU (updated scenario), LCB_FD (baseline scenario with only fishery-dependent indices), LCB_FI (baseline with only fishery-independent indices), LCB (baseline scenario), LCB_all (baseline with all available indices), and LCA (alternative catch scenario). Mean probabilities are shown for three different time horizons (10, 20, and 30 years) under each of six different harvest policies (expressed as a multiple of the 2000 catch). The solid horizontal line denotes 50 percent probability. Source: Cortes *et al.*, 2002.

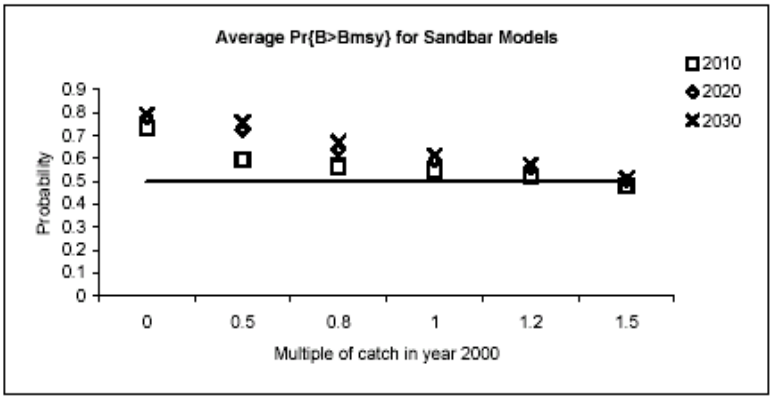


Figure 3.7 Summary Plot for Sandbar Shark of the Mean Probability That B>B_{MSY} Obtained in Five Main Scenarios Using the Bayesian SPM with the SIR Algorithm and Five Main Scenarios Using the ASPM Model. The scenarios for the Bayesian SPM include: SBU (updated scenario), SBB_FD (baseline scenario with only fishery-dependent indices), SBB_FI (baseline with only fishery0independent indices), SBB (baseline scenario), and SBB_all (baseline with all available indices). For the ASPM, scenarios include: SB_U (updated scenario), SB_U_FD (updated scenario with only fishery-dependent indices), SB_U_FI (updated with only fishery-independent indices). Mean probabilities are shown for three different time horizons (10, 20, and 30 years) under each of six different harvest policies (expressed as a multiple of the 2000 catch). The solid horizontal line denotes 50 percent probability. Source: Cortes *et al.*, 2002.

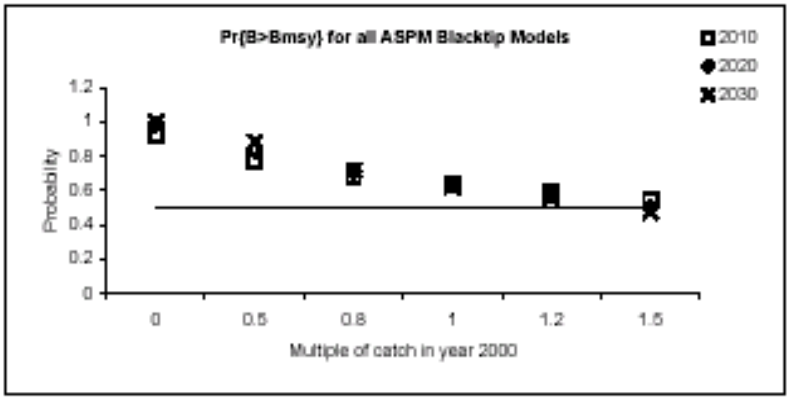


Figure 3.8 Summary Plot for Blacktip Shark of the Mean Probability That $B>B_{MSY}$ Obtained in Five Main Scenarios Using the Bayesian SPM with the SIR Algorithm and Four Main Scenarios Using the ASPM Model. The scenarios for the Bayesian SPM include: BTU (updated scenario), BTB_FD (baseline scenario with only fishery-dependent indices), BTB_FI (baseline with only fishery0independent indices), BTB (baseline scenario), and BTB_all (baseline with all available indices). For the ASPM, scenarios include: BT_U (updated scenario), BT_U_FD (updated scenario with only fishery-dependent indices), BT_U_FI (updated with only fishery-independent indices), and BT_B (baseline scenario). Mean probabilities are shown for three different time horizons (10, 20, and 30 years) under each of six different harvest policies (expressed as a multiple of the 2000 catch). The solid horizontal line denotes 50 percent probability. Source: Cortes *et al.*, 2002.

Figure 3.9 **Location of observed shark bottom longline sets, 1994-2002.** Source: Shark Bottom Longline Observer Program, 1994-2002.

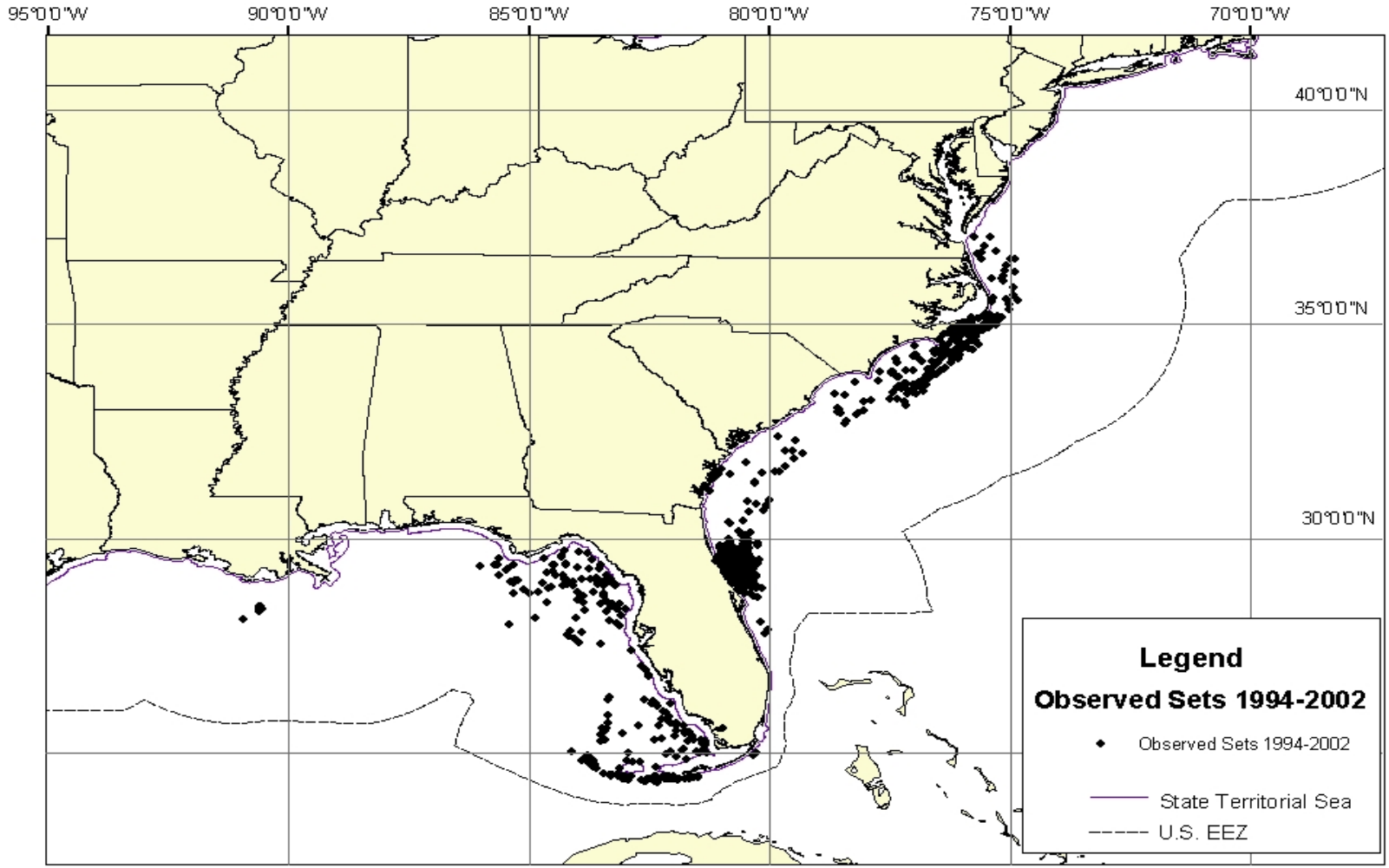


Figure 3.10 Locations of observed sea turtle bycatch by species, 1994-2002. Source: Shark Bottom Longline Observer Program, 1994-2002.

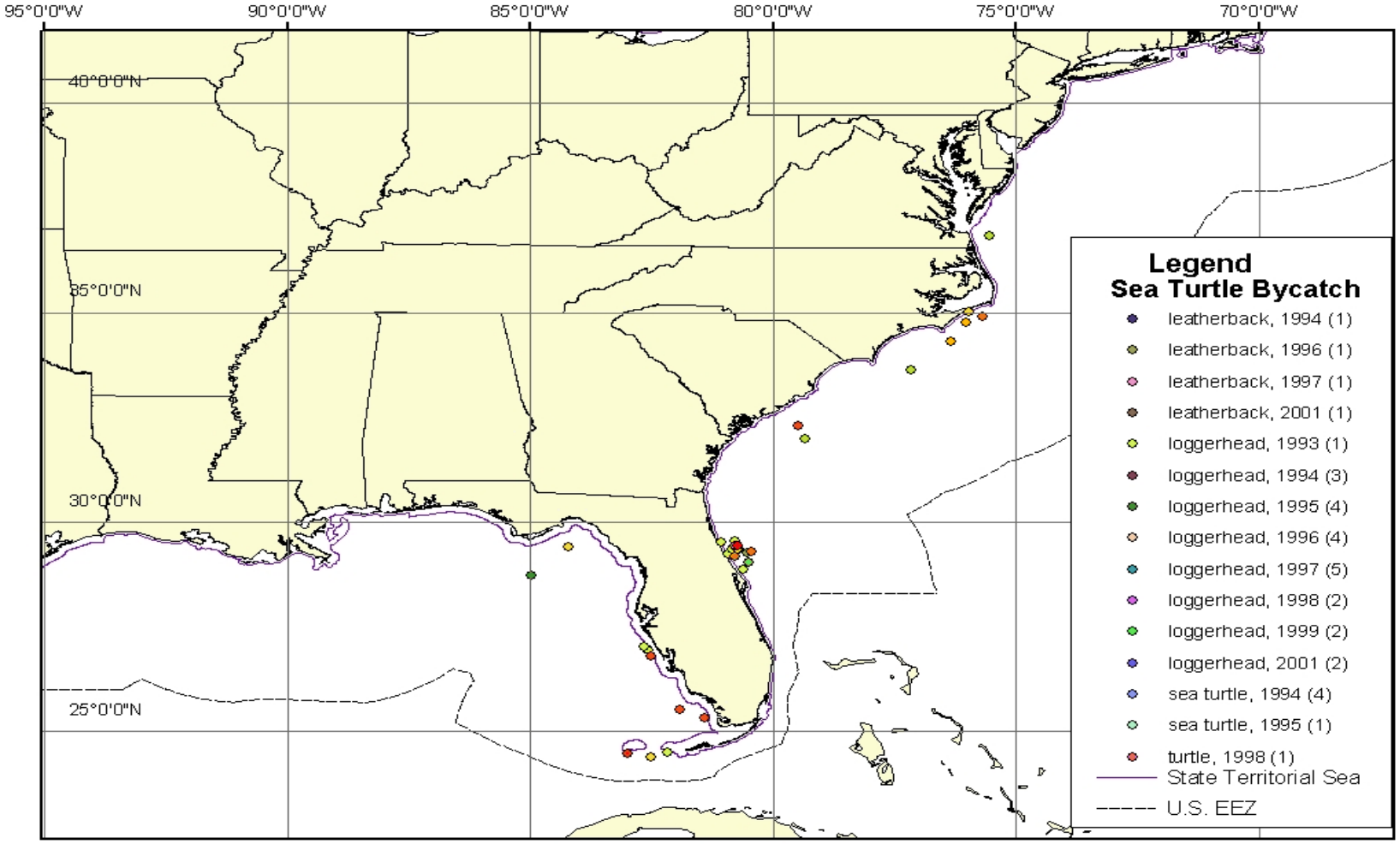
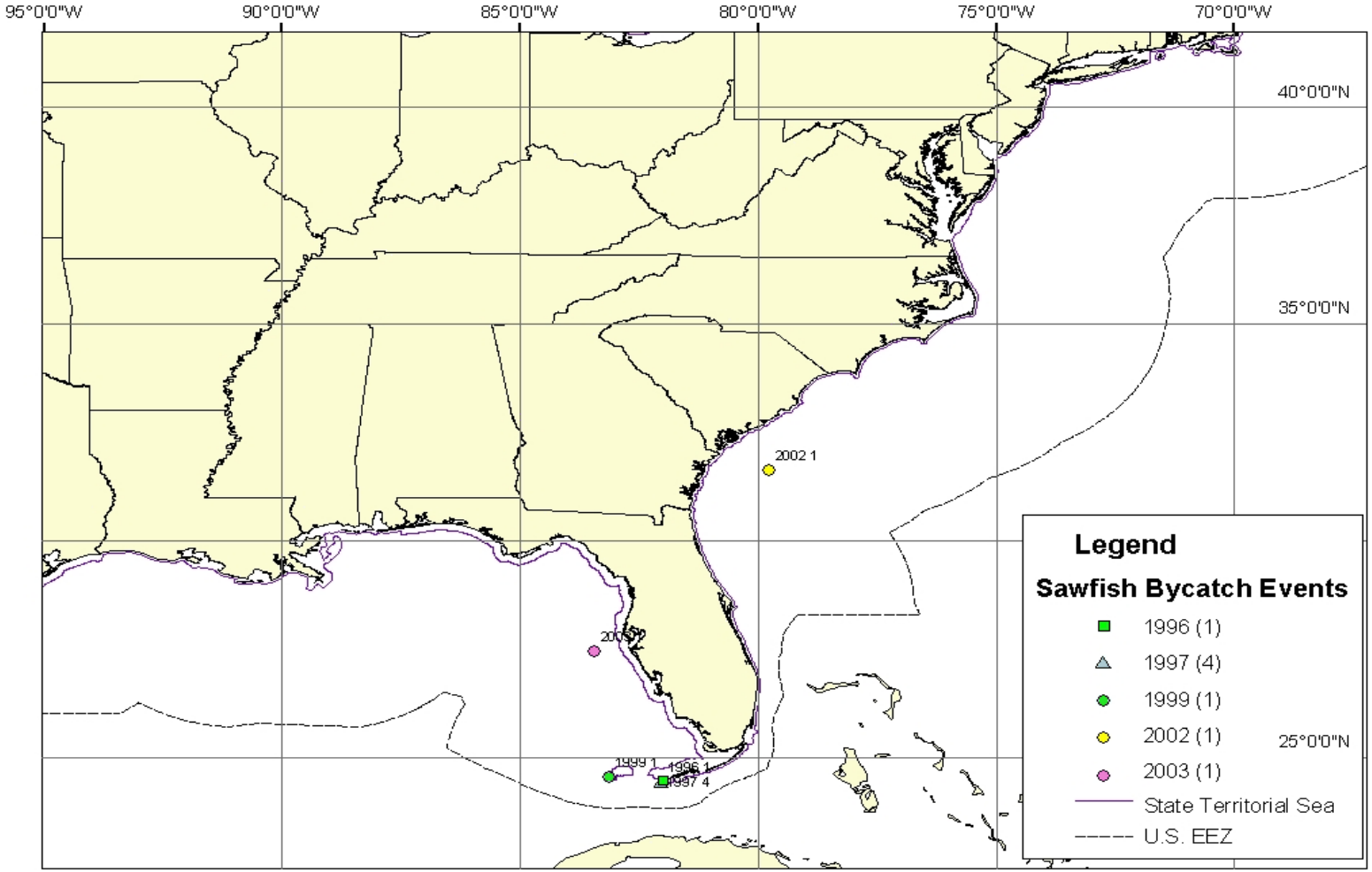


Figure 3.11 Locations of observed smalltooth sawfish bycatch, 1994-2002. Source: Shark Bottom Longline Observer Program, 1994-2002.



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4.0 ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVES CONSIDERED

All of the alternatives described in this document would apply only to fishermen on vessels that are required to have a Federal Atlantic limited access shark permit, a Federal Atlantic HMS charter/headboat permit, a Federal Atlantic HMS angling permit, or those fishermen interested in obtaining an exempted fishing or scientific research permit for sharks.

4.1 REBUILDING AND PREVENTING OVERFISHING OF ATLANTIC SHARKS

4.1.1 Rebuilding Targets and Status Determination Criteria in the HMS FMP

Under National Standard 1 (50 CFR 600.310) NOAA Fisheries is required to "prevent overfishing while achieving, on a continuing basis, the [Optimum yield (OY)] from each fishery for the U.S. fishing industry." In order to accomplish this, NOAA Fisheries must determine the maximum sustainable yield (MSY) and specify status determination criteria to allow a determination of the status of the stock. In cases where the fishery is overfished or where overfishing is occurring, NOAA Fisheries must take action to rebuild the stock (by specifying rebuilding targets) or take action to prevent overfishing. In the HMS FMP, NOAA Fisheries outlined these status determination criteria and a set of rebuilding targets. This Amendment does not change those status determination criteria or the rebuilding targets. The targets are summarized below and described fully in Chapter 3 of the HMS FMP.

The HMS FMP established the maximum fishing mortality threshold (MFMT) as F_{MSY}. F_{MSY} is defined as the fishing mortality level necessary to produce MSY on a continuing basis. When fishing mortality (F) exceeds MFMT, overfishing is occurring and remedial action must be taken. This is the current situation with the LCS complex, sandbar sharks, and finetooth sharks.

The HMS FMP established the minimum stock size threshold (MSST) as $(1\text{-}M)B_{MSY}$ when natural mortality (M) is less than 0.5. Most species of sharks have M less than 0.5. When the stock falls below MSST, the stock is overfished and remedial action must be taken to rebuild the stock. This is the current situation for the LCS complex.

Stocks are considered rebuilt when current biomass levels are equal to B_{MSY}. B_{MSY} is the level of stock abundance at which harvesting the resource can be sustained on a continual basis at the level necessary to support MSY. The current stock assessment for LCS indicates that the LCS complex as a whole is overfished. Additionally, the current LCS stock assessment indicates that sandbar and blacktip sharks have now reached or exceeded B_{MSY} and thus, are considered rebuilt.

Stock are considered healthy when F is less than or equal to 0.75 F_{MSY} and B is greater than or equal to B_{OY} (the biomass level necessary to produce OY on a continuing basis). Blacktip sharks are considered healthy.

The HMS FMP established that management measures for all HMS should have at least a 50-percent chance of reaching the target reference points used in developing rebuilding projections. This target is consistent with the technical guidelines for National Standard 1. However, as described in the HMS FMP, 50-percent is minimally acceptable for sharks. The 1997 quota rule used a 50-percent probability in order to ensure that the stock levels were maintained and did not decline further while a rebuilding plan was developed, but the HMS FMP used a 70-percent probability as a guide to ensure that the intended results of a management action are actually realized.

Compared to other HMS and other fish species, sharks are slow growing, take a long time to mature (e.g., sandbar sharks mature between 12 and 15 years), have few pups per brood, and generally reproduce every other or every three years (e.g., the sandbar shark has an average of eight to nine pups every other year). In other words, sharks have a low reproductive potential. Moreover, while there is data on certain shark species, there is not as much information on others. To ensure that all sharks in the LCS complex are taken into consideration, this Amendment re-aggregates the LCS complex; however, there is some degree of uncertainty in shark management because of the paucity of biological and/or fishing data available for some species. Additionally, a number of gear types catch sharks incidental to other target species. Many of those fisheries and gear types are managed by the Fishery Management Councils or States. Given these factors, in this Amendment as in the HMS FMP, NOAA Fisheries uses the 70-percent chance of success in order to ensure that the LCS complex rebuilds.

Thus, using these status determination criteria, NOAA Fisheries must take action to rebuild the LCS complex and prevent overfishing of the LCS complex, sandbar sharks, and finetooth sharks. The specific actions are fully described and analyzed throughout this document and below.

4.1.2 National Standard 1 and Determining the Rebuilding Time Frame

Under the National Standard 1 Guidelines, if a stock is overfished, NOAA Fisheries is required to "take remedial action by preparing an FMP, FMP amendment, or proposed regulation...to rebuild the stock or stock complex to the MSY level within an appropriate time frame" (50 CFR 600.310(e)(3)(ii)). Additionally, "in cases where a stock or stock complex is overfished, [the] action must specify a time period for rebuilding the stock or stock complex that satisfies the requirements of section 304(e)(4)(A) of the Magnuson-Stevens Act." The time frame to rebuild the stock or stock complex depends on a number of factors including:

- The status and biology of the stock or stock complex;
- Interactions between the stock or stock complex and other components of the marine ecosystem;
- The needs of the fishing communities;
- Recommendations by international organizations in which the United States participates; and

- Management measures under an international agreement in which the United States participates.

The lower limit of the specified time frame for rebuilding is determined by the status and biology of the stock and "is defined as the amount of time that would be required for rebuilding if fishing mortality were eliminated entirely" (50 CFR 600.310 (e)(4)(ii)(B)(1)).

The National Standard 1 Guidelines specify two strategies for determining the rebuilding time frame. The first strategy (50 CFR 600.310 (e)(4)(ii)(B)(2)) states that:

> "[i]f the lower limit is less than 10 years, then the specified time period for rebuilding may be adjusted upward to the extent warranted by the needs of fishing communities and recommendations by international organizations in which the United States participates, except that no such upward adjustment can result in the specified time period exceeding 10 years, unless management measures under an international agreement in which the United States participates dictate otherwise."

The second strategy (50 CFR 600.310 (e)(4)(ii)(B)(3)) specifies that:

> "[i]f the lower limit is 10 years or greater, then the specified time period for rebuilding may be adjusted upward to the extent warranted by the needs of fishing communities....except that no such upward adjustment can exceed the rebuilding period calculated in the absence of fishing mortality, plus one mean generation time or equivalent period based on the species' life-history characteristics."

4.1.3 Large Coastal Shark Rebuilding Time Frame in the HMS FMP

Based on the model projections of the 1998 LCS stock assessment, in the HMS FMP, NOAA Fisheries determined that rebuilding the LCS complex would take longer than 30 years even if no fishing were permitted. Thus, because the lower limit of the rebuilding time period was greater than 10 years, NOAA Fisheries used the second strategy (50 CFR 600.310 (e)(4)(ii)(B)(3)) for determining the rebuilding period for LCS. Because of the severity of the possible reductions and because NOAA Fisheries was trying to manage sharks on a more species-specific basis, the HMS FMP specified rebuilding plans for ridgeback LCS and non-ridgeback LCS using sandbar and blacktip sharks, respectively, as proxies.

For ridgeback LCS, NOAA Fisheries considered the generation time of sandbar sharks (19 years) and other sharks that are easily confused with sandbar sharks such as dusky sharks (27.5 years). The 1998 stock assessment projections stated that sandbar sharks would have a 71-percent probability of reaching MSY in 20 years under a zero landings policy. Given this and the generation time for sandbar sharks, NOAA Fisheries determined that the time frame for rebuilding ridgeback LCS would be 39 years (20 years to rebuild under no fishing + 19 years for a generation).

For non-ridgeback LCS, NOAA Fisheries calculated the generation time of blacktip sharks to be 9.4 years. The 1998 stock assessment projections stated that blacktip sharks would have a 69-percent probability of reaching MSY in 20 years under a zero landings policy. Given this and the generation time for blacktip sharks, NOAA Fisheries determined that the time frame for rebuilding non-ridgeback LCS would be 30 years (20 years for rebuilding under no fishing + 9.4 years for a generation).

These rebuilding time frames, even though the rebuilding plan in the HMS FMP was not fully implemented, began in 1999. Rebuilding plans were not needed for pelagic sharks or SCS at that time because these species were not overfished and were not experiencing overfishing.

4.1.4 Revised Rebuilding Time Frame for Large Coastal Shark Complex

The need to revise the time frame

In 2001, under a court-approved settlement agreement, NOAA Fisheries had the 1998 LCS stock assessment peer-reviewed. Three of the four reviewers found that the scientific conclusions and scientific management recommendations contained in the 1998 LCS stock assessment were not based on scientifically reasonable uses of the appropriate fisheries stock assessment techniques and on the best available (at the time of the 1998 LCS stock assessment) biological and fishery information relating to LCS. Because of this conclusion, NOAA Fisheries determined that the projections from the 1998 LCS stock assessment should not be used as a basis for management decisions. Accordingly, because the 1999 rebuilding time frame was based on those projections, NOAA Fisheries must revise the rebuilding time frame based on the results of the 2002 LCS stock assessment.

Under the 1999 time frame, sandbar and blacktip sharks, as the primary species in the fishery, were used as proxies for the other species. At that time, this was appropriate because the stock assessment for those species indicated that, the LCS complex, sandbar sharks, and blacktip sharks were all overfished and experiencing overfishing. The latest stock assessment indicates, however, that while the LCS complex requires a rebuilding plan, sandbar and blacktip sharks do not. Therefore, keeping sandbar and blacktip sharks as proxies for the other species is inconsistent with the results of 2002 LCS stock assessment.

Under the 1999 time frame, calculating quotas and other management measures for the complex as a whole would result in some species within the complex potentially needing one level of quota in order to rebuild within 30 years and some species potentially needing another level of quota in order to rebuild within 39 years. If NOAA Fisheries manages LCS as an aggregate (the preferred management measure A3), the split in the rebuilding time frames could lead to confusion in calculating the quotas. Revising the time frame based on the aggregate could alleviate this confusion while still allowing NOAA Fisheries the flexibility to manage the fishery by species or species group, in the future.

The revised time frame

The 2002 LCS stock assessment found that the LCS complex is overfished and experiencing overfishing. The 2002 stock assessment found that a reduction in catch of 50 percent from the 2000 catch level has, on average, a 50-percent chance of rebuilding the LCS complex to MSY in 10 years. The stock assessment also found that under a zero landings policy, 10 years would give the LCS complex, on average, a 68-percent chance of rebuilding to MSY. Thus, in order to reach the 70-percent probability of rebuilding the stock, NOAA Fisheries would need to close the LCS fishery for more than 10 years. Because the amount of time required for rebuilding under no fishing is 10 years or greater under any of the three probabilities, as discussed below, NOAA Fisheries is using the second rebuilding time frame strategy in this Amendment.

Taking into account the biology of the stocks, the results of the 2002 LCS stock assessment, the requirements of the Magnuson-Stevens Act and the National Standard Guidelines, the criteria in the HMS FMP, and the status of the fishing communities that rely on these fish, NOAA Fisheries does not believe that a 10-year rebuilding period is appropriate for the LCS complex. If the rebuilding time frame were 10 years, then in order to reach the 70-percent probability of rebuilding within the rebuilding time frame, NOAA Fisheries would have to close the commercial fishery, place a no-retention limitation on the recreational fishery, and work with all Councils and States to prevent any take of sharks in non-HMS fisheries. Therefore, under this Amendment to the HMS FMP, the rebuilding time frame for the LCS complex will be based on the second strategy under the National Standard 1 Guidelines (time to rebuild under no fishing + one mean generation). This time frame takes into account all the items listed above including the needs of the fishing communities and the status of the stock.

The 2002 LCS stock assessment estimates that, on average, there is a 68-percent chance of reaching MSY with no fishing within 10 years and a 86-percent chance of reaching MSY with no fishing within 20 years. Assuming a linear relationship, the LCS complex has a 70-percent chance of rebuilding to MSY under a zero fishing policy in approximately 11 years.

Cortes (2002) lists the generation time for 38 species of sharks including several LCS species. The species in the paper were chosen based on their wide range of demographic traits and the availability of data. The generation times for the LCS listed in this paper range from 10 years to over 20 years. Specifically, the generation times in the paper for populations in the Atlantic Ocean or Gulf of Mexico were: tiger sharks = 10.9 years; silky sharks in the northwest Gulf of Mexico = 10.6 years; silky sharks in southern Gulf of Mexico = 16.1; scalloped hammerhead = 16.7 years; lemon sharks = 16.4 years; spinner sharks = 10.4 years; dusky sharks = 26.2 years[1]; sandbar sharks = 19.8 years; bull sharks = 21.6 years; sand tiger sharks = 10.6 years[1]; and blacktip sharks = 10 years. Using the average of the 10 LCS species included in this paper,

[1] While dusky and sand tiger sharks are on the prohibited species list, the 2002 LCS stock assessment included those species that are on the prohibited species list that used to be on the LCS species list. Thus, the projections from the stock assessment include rebuilding of those species.

including the two populations of silky sharks studied in the paper, the mean generation time for the LCS complex is approximately 15.4 years. NOAA Fisheries used the average of the 10 species instead of picking one species because of the wide biological diversity of sharks and because the stock assessment did not state that there was any one species that was of particular concern.

Thus, the rebuilding time frame for the LCS complex is: 11 years (time to reach MSY under zero fishing) + 15.4 years (mean generation time of LCS species) = 26.4 years[2]. Because most of the management measures will be implemented in 2004, the LCS complex should be rebuilt in 2030. This time frame is almost the same time period projected for rebuilding non-ridgeback LCS sharks under the 1999 HMS FMP (2029) and is less than the 1999 HMS FMP rebuilding time period projected for ridgeback LCS sharks (2038).

During the public comment period, NOAA Fisheries heard that the proposed 16 years for a mean generation time seemed long and that NOAA Fisheries should use half of that time (8 years). However, given that sharks are slow growing, have a low reproductive potential compared to other fish, and that dusky sharks, one of the three shark species that is a candidate for listing under ESA, has a mean generation time of over 26 years, NOAA Fisheries feels that the full 16-year mean generation time is needed to ensure that all species in the LCS complex have a chance to rebuild while maintaining a viable commercial fishery.

Rebuilding measures in this Amendment based on time frame

The 2002 stock assessment states that, on average, reducing the catch by 50 percent gives a 61-percent chance of rebuilding the LCS complex to B_{MSY} in 20 years and a 67-percent chance of rebuilding the LCS complex in 30 years. Assuming a linear relationship, reducing the catch by 50 percent would give a 64-percent chance of rebuilding the LCS complex and preventing overfishing within the time frame outlined above. Thus, if this Amendment were only reducing the catch, reductions of greater than 50 percent would be needed to reach the guide of a 70-percent probability of rebuilding. However, NOAA Fisheries is implementing other measures, in addition to reductions in catch, that further increase the probability of rebuilding the LCS complex within the next 26 years by protecting juvenile sharks and pregnant females and minimizing mortality of those sharks that are caught and released. These measures include a time/area closure encompassing known nursery grounds (Alternative K2), gear restrictions that should reduce post-release mortality (Alternative J5), and a minimum size on recreationally-caught sharks (Alternative F2). Considering this and the other factors outlined in Chapter 2 regarding quota basis calculations, NOAA Fisheries believes that reducing the overall LCS catch by 45 percent, improving compliance with the recreational regulations, and implementing other

[2] In the draft EIS, NOAA Fisheries inadvertently missed one of the Atlantic LCS populations in Dr. Cortes' paper. This error led to a mean generation time of 16 years and a rebuilding time frame of 27 years. This error was corrected in this document.

measures such as the time/area closure will provide a 70-percent chance of rebuilding the LCS complex by 2030.

The HMS FMP requires NOAA Fisheries to conduct periodic stock assessments for species or species-groups. Thus, while this Amendment is based on the best available science at this time, NOAA Fisheries fully expects that as further information develops over the course of the rebuilding period, catch levels or other management measures will likely be changed depending on the results of future stock assessments, the subsequent likelihood of rebuilding the LCS complex by 2030, and other measures that could be taken besides reduction in catch (such as mandatory workshops - Alternative J8) that could result in reduced mortality on LCS. Based on new information, NOAA Fisheries will make appropriate adjustments to the rebuilding plan outlined in this document through rulekmakings to ensure that rebuilding occurs within the time frame established. Additionally, as more species-specific information becomes available, NOAA Fisheries will attempt to conduct species-specific assessments in order to ensure that any future management measure focuses on those species that are the most vulnerable or that need the most protection.

4.1.5 Preventing Overfishing on Sandbar Sharks

Under the National Standard 1 Guidelines, within one year of identifying a stock that is experiencing overfishing, NOAA Fisheries (in the case of HMS) must take remedial action by preparing an FMP, FMP amendment, or proposed regulations to end overfishing. In 2002, NOAA Fisheries conducted a stock assessment on LCS that showed sandbar sharks, for the first time since 1993, are not overfished ($B >= B_{MSY}$) but they are experiencing overfishing ($F > F_{MSY}$). The stock assessment states that, while reductions in catch are not needed to maintain or increase biomass levels, reductions in fishing mortality may be necessary to prevent overfishing.

Based on this Amendment, NOAA Fisheries will implement a number of measures that should reduce fishing mortality on sandbar sharks. For example, NOAA Fisheries will implement a time/area closure off of North Carolina that will protect juvenile sandbar sharks. Also, NOAA Fisheries is setting the commercial quota on the LCS aggregate. Because this quota is lower than the quota in recent years, the reduction in catch should also reduce fishing mortality on sandbar sharks. Additionally, NOAA Fisheries intends to work with enforcement and states to increase enforcement and consistency with Federal recreational bag and size limits and consider in another rulemaking requiring mandatory workshops to improve species identification and handling techniques. Babcock and Pikitch (2002) found that 84 percent of recreationally-caught sandbar sharks sampled at the dock were below the 4.5 ft size limit. Together, these management measures, if implemented and enforced, should be sufficient to end overfishing on sandbar sharks.

4.1.6 Preventing Overfishing on Finetooth Sharks

In 2002, NOAA Fisheries conducted a stock assessment on SCS that found that finetooth sharks are not overfished ($B>B_{OY}$) but are experiencing overfishing ($F>F_{MSY}$). Thus, as described above, under National Standard 1, NOAA Fisheries must take action to reduce F on finetooth sharks.

Preventing overfishing for finetooth sharks will be more difficult than preventing overfishing for sandbar sharks because the other species in the SCS complex are healthy. According to the SCS stock assessment, finetooth sharks are caught commercially almost exclusively in the South Atlantic region and mostly with gillnets (approximately 80 percent of finetooth landings) and longlines (approximately 20 percent). NOAA Fisheries is aware of approximately six vessels using gillnets to target sharks in the southeast. These vessels have 100 percent observer coverage during right whale calving season and approximately 50 percent observer coverage during the rest of the year. According to recent observer reports, these vessels do not catch as many finetooth sharks as are reported commercially. For instance, the SCS stock assessment estimates 16,658 finetooth sharks were landed commercially in 2000. According to observer reports, 1,230 finetooth sharks were observed caught during right whale calving season in 2000 (Carlson, 2000) and 168 were observed caught during non-right whale calving season in 2000 and 2001 (Carlson and Baremore, 2002). Thus, in 2000, approximately eight percent of all finetooth commercial landings ((1,230+168)/16,658) were landed by HMS fishermen directing on SCS with gillnets. The bottom longline observer program did not observe any finetooth catches in 2000 (Burgess and Morgan, 2003).

Most recreational landings of finetooth sharks occur in the Gulf of Mexico. In 2000, approximately 1,201 finetooth sharks were landed recreationally. Generally, the average weight of recreationally-caught finetooth sharks appear to be below 5 lb dw.

Thus, most of the finetooth landings appear to come from fishermen in non-HMS fisheries. In light of this and given the uncertainty stated in the stock assessment regarding the data and resulting status of finetooth sharks, NOAA Fisheries will take certain actions to identify sources of and to reduce fishing mortality on finetooth sharks. In the short term, increasing enforcement of the recreational minimum size and improving outreach to recreational fishermen should reduce fishing mortality to some extent. Additionally, reducing the SCS quota from 1997 levels based on either MSY levels for the complex or average landings of the complex should prevent the expansion of the SCS fishery. Over the next few years, NOAA Fisheries will work with states and Fishery Management Councils to identify fisheries that are landing finetooth sharks in order to reduce fishing mortality and consider requiring mandatory workshops for all fishermen. Additionally, NOAA Fisheries will continue to collect data on finetooth sharks in order to improve the data and therefore the results of future finetooth shark stock assessments.

4.2 COMMERCIAL MANAGEMENT MEASURES

4.2.1 Large Coastal Shark (LCS) Classification

As described in Chapter 2, the alternatives considered for shark classification are:

A1 Separate LCS groupings (Ridgeback/Non-ridgeback), different closure dates possible - (No Action),
A2 Separate LCS groupings (Ridgeback/Non-ridgeback), same closure date,
A3 *Aggregate LCS, one closure date - Preferred Alternative*,
A4 Species specific groupings, different closure dates possible.

Alternative A3 is the preferred alternative.

Ecological Impacts

Alternative A1 (no action) would separate the LCS complex into ridgeback and non-ridgeback shark groupings, on the basis of the mid-dorsal ridge characteristic. Under A1 it is possible to have different closure dates in the event that one group quota is filled before the other. This alternative was finalized in 1999 but not implemented until 2003 via emergency rule. Dividing the LCS complex into separate groupings was implemented on the basis that the mid-dorsal ridge provided an easy means by which fishermen, dealers and enforcement agents could identify different shark species and in order to move towards more species-specific management, as requested by fishermen and scientists. NOAA Fisheries received numerous comments on the 2003 emergency rule (68 FR 31987, May 29, 2003) as well as during scoping and public hearings for Amendment 1 that noted concerns about bycatch, the inability of fishermen/gear to target specific species or shark groups given the mixed nature of the shark fishery, continuing difficulties in identifying species and shark groups, and enforcement of two separate closure dates for LCS groupings (See Appendices 2 and 5).

While separate closures for ridgeback and non-ridgeback shark groups may allow managers to be more responsive to species management requirements within each group, partial closures of a mixed fishery could result in increased regulatory discards. To the extent that fishermen can target specific species, separate closures may not increase regulatory discards. However, to the extent that not all fishermen or enforcement officers can readily identify or target specific species, separate closures can increase regulatory discards and confusion as well as hinder rebuilding. According to observer data from 2000-2001, LCS comprise 66.2 percent of total shark catches (Burgess and Morgan, 2003). Of LCS catches, sandbar, tiger, and blacktip sharks represented 59 percent, 19 percent, and 8 percent respectively (Burgess and Morgan, 2003). Additionally, increased interactions with protected resources and associated mortality of non-target species may result if fishermen are fishing harder/longer to subsidize lost catches during a partial closure.

By comparison, alternative A2 would separate the LCS complex into ridgeback and non-ridgeback shark and establish commercial quotas for each group, but both groups would close when the first of the two quotas is filled. NOAA Fisheries currently accounts for overharvest and underharvest when setting the Federal commercial quotas. Thus, any underharvest of quota would be added to the same season of the following year. Under alternative A2, it is possible that the quota for one grouping could continue to increase over time, should underharvest in the previous season continue to occur. Under this scenario and similar to A1, fishermen would need to increase effort or fishing efficiency, particularly for one species group, in order to catch the available quota. Unless fishermen improve their species-targeting skills, this increase in effort could result in increases in bycatch of non-targeted species and/or increases in fishing mortality on LCS. It is possible that alternatives presented in Section 4.6 of this document could help to mitigate bycatch or bycatch mortality of non-target species. According to the 2002 LCS stock assessment, the LCS complex is overfished and overfishing is occurring (Cortes *et al.*, 2002).

Alternative A3 (preferred) will aggregate LCS species, and establish one commercial quota for the complex. Since only one quota exists under alternative A3 there will be only one closure date possible. NOAA Fisheries recognizes that alternative A3 offers lower resolution for quota and species-specific management, however this alternative seeks to minimize bycatch (i.e., regulatory discards) resulting from partial closures of a mixed fishery and allow fishermen the opportunity to catch the entire quota. These goals are consistent with public comment received by NOAA Fisheries during scoping and public hearings for the draft Amendment (See Appendices 2 and 5). Additionally, the number of protected resource interactions may decrease, or at least not increase, if fishermen do not have to increase effort in order to make up for lost catch during partial closures and if quotas are lower for LCS as a result of combining A3 with other preferred alternatives outlined in the quota basis section of this document. Because this alternative groups all species, this alternative will generally lead to lower overall quotas in order to protect the more vulnerable species.

Alternative A4 would establish species-specific commercial quotas. Closures would occur when the quotas for each individual species are filled. Since multiple species of shark are defined within the management unit and given that market demands for individual species differ, it is likely that multiple, differing closure dates will occur. While alternative A4 offers higher resolution for quota and species-specific management, it also increases the necessity for identification and targeting ability of shark to the species level. Accurate identification of shark species is often times difficult due to morphological similarities between species. Also, during scoping, NOAA Fisheries heard that many fishermen and dealers report species by whatever species is on top of the bucket (See Appendix 2). Additionally, this alternative may result in substantial increases of regulatory discards, especially considering that multiple closures would likely occur in a mixed fishery. Fishermen would likely need to increase effort in order to make up for lost catches during partial closures. This increase in effort may result in increased protected resource interactions and mortality on non-targeted species.

All of these alternatives would have additional ecological impacts depending upon the quota basis that is selected. Further discussion of these impacts is provided in Section 4.2.3 of this document.

Social and Economic Impacts

Alternatives A1 and A4 may result in the disruption of normal/historic fishing practices. Although A1 was established in the 1999 HMS FMP, it was not implemented due to litigation until the December 2002 emergency rule (67 FR 78990, December 27, 2002). When the rule entered into effect, concerns were raised by both fishermen and dealers during public hearings (See Appendix 2). In the event that one LCS grouping remains open while the other is closed, longer sorting times per set are likely to increase opportunity costs to fishery participants. Additionally lengthening of trips may occur in order for fishermen to compensate for lost catches during a partial closure. Increased time at sea reduces the profits fishermen gain due to increased costs for fuel, bait and ice. Safety at sea concerns are also of interest, given that fishermen must fish longer or harder to counteract for lost revenues.

Alternatives A2 and A3, by comparison, will maintain historic fishing practices (as finalized in 1999, but not under emergency rule in 2003) and food availability in the market place, given that both implement a single closure date for the season. Alternative A3, further addresses concerns from fishermen and dealers regarding inefficiencies, difficulties, and additional burden associated with having to distinguish between LCS species where group or species-specific management measures are employed. Under A2, fishermen would continue to experience inefficiencies due to the need to sort catch (i.e., mid-dorsal ridge identification between ridgeback and non-ridgeback). See Chapter 6 for additional economic information related to these alternatives.

All of these alternatives would have additional economic and social impacts depending upon which quota basis is selected. Further discussion of these impacts is provided in Section 4.2.3 of this document.

Conclusion

Alternative A3 (i.e., aggregate LCS, one closure date) is the preferred alternative because, in combination with the other preferred alternatives, it is:

1. Expected to maintain historic fishing practices (since 1999) and food availability in the market place;
2. Expected to reduce burden on fishermen for sorting;
3. Expected to decrease, or at least not increase, the number of protected resource interactions; and
4. Not expected to increase regulatory discards.

Embedded within species-based management is the necessity for accurate identification of the various species of sharks that may be commonly caught in mixed fisheries. NOAA Fisheries has

received public comment regarding the inability of fishery participants to accurately identify and effectively target individual shark species (See Appendices 2 and 5). As such, NOAA Fisheries does not believe that a species-based classification is warranted at this time. However, some comments on draft Amendment 1 noted disappointment that management appeared to be dropping the species-specific approach. NOAA Fisheries may consider implementation of species-based LCS classifications when the ability to accurately identify and effectively target shark species improves. As such, NOAA Fisheries is also considering mandatory workshops to facilitate these improvements in another rulemaking.

4.2.2 Quota Administration

As described in Chapter 2, the alternatives considered for quota administration are:

B1 Semi-annual season - (No Action),
B2 No regional quotas - (No Action),
B3 *Regional quotas - Preferred Alternative*,
B4 *Trimester season - Preferred Alternative*,
B5 Quarterly season.

Alternatives B3 and B4 are the preferred alternatives.

Ecological Impacts

Alternative B1 (no action) would implement a semi-annual season (i.e., two per year) for commercial shark fisheries. Observer data suggest that there are temporal differences in catch. For example, observed catches of LCS during 2000, 2001, and mid-2002 reflect that sandbar sharks were more commonly taken off both coasts of Florida in winter (30 percent of all species total catch) as opposed to summer (5 percent of all species total catch) (Burgess and Morgan, 2003), whereas blacktip sharks were more commonly taken in summer as opposed to winter (Burgess and Morgan, 2003). The commercial shark fishery has been managed under semi-annual seasons since 1993. Concerns about semi-annual seasons extending into shark pupping seasons were raised during scoping and public hearings on draft Amendment 1. As such, NOAA Fisheries believes that while semi-annual seasons themselves do not result in over-exploitation, the continuation of semi-annual seasons for shark fisheries may result in ecological impacts, should open seasons extend into pupping time-frames and measures are not taken to protect juvenile and reproductive female sharks.

Alternative B1 was implemented on the basis of spreading out commercial fisheries in both southern and northern areas equally throughout the year, however NOAA Fisheries has learned via public comment (See Appendices 2 and 5) that this alternative continues to prompt bycatch and pupping season concerns. For example, shark pupping seasons range from March to September in any given calendar year (See Table 4.1; NMFS, 1999). As such, a semi-annual season approach could overlap with pupping seasons in every year absent significant closures (~

½ of each period) (See Table 1.3 for a list of closure dates). Protection of juveniles and reproductive females is recommended in the 2002 LCS stock assessment (Cortes *et al.*, 2002) primarily due to late maturation schedules (sexual maturity between 5-20 years of age) for sharks (Burgess and Morgan, 2003) and potentially significant mortality on neonates (Branstetter 1990; Manire and Gruber 1993).

Alternative B2 (no action) would not implement regional quotas for commercial Atlantic shark fisheries. Under this alternative, fishermen would continue to catch LCS along the Atlantic coast and in the Gulf of Mexico throughout the open season. Regional quotas have not been implemented in the past due to data limitations. Because this alternative has been in place since 1993, continuation of this alternative would be unlikely to result in any additional ecological impacts although changing it could result in both positive and negative impacts.

Alternative B3 (preferred) will implement regional quotas for the Gulf of Mexico (Texas - West coast Florida), South Atlantic (East coast Florida - North Carolina and the Caribbean), and North Atlantic (North Carolina - Maine) commercial shark fisheries (See Tables 2.1 and 2.2). Catch data, which are broken down by region, suggests that spatial differences in fishery practices and catches warrant further consideration of this alternative at this time. Fishing effort (i.e., hook hours and soak time) in North Carolina is greater than that of Florida's west coast fisheries. For example, North Carolina fishermen fished longer (i.e., 13.6 hr/set) and set more hooks (i.e., 639 hooks/set) than did Gulf of Mexico fishermen (i.e., 12.3 hr/set; 599 hooks/set) (Burgess and Morgan, 2003). As such, fluctuations in fish availability between regions results in variable catch-per-unit-effort (CPUE) estimates. Similar to catch data, shark pupping data indicate that spatial differences exist between species utilization of various shark pupping grounds. For instance, species within the SCS complex utilize pupping grounds between South Carolina and the Gulf of Mexico, whereas some species within the LCS complex utilize only the Atlantic coast for pupping grounds. Alternative B3 in accordance with pupping season information will provide managers with flexibility to adjust regional quotas, where necessary, to reduce mortality on juveniles and reproductive female sharks.

Alternative B4 (preferred) will implement a trimester season (i.e., three per year) for commercial shark fisheries. Limited data exist regarding shark catch composition when analyzed on a trimester time scale because shark fisheries have historically operated in semi-annual seasons and have been closed during what would equate to half of the second (May - June) and entire third (September - December) trimesters under semi-annual seasons. Nonetheless, alternative B4 will provide a higher degree of resolution on which to manage seasonal fisheries and as such this option better addresses pupping and bycatch concerns, while minimizing the economic and social impacts to the fishery and its participants (see economic and social impacts as discussed below). For example, a closure of the second trimester season (May - August) would concentrate fishing effort and associated mortality during non-pupping months of the year (See Table 4.1). Unlike semi-annual or quarterly seasons, trimester seasons would aggregate the majority of shark pupping into one fishing season (i.e., second trimester). Thus, if warranted, managers could close the entire second trimester in a particular region to protect juveniles and reproductive

females. The quota that would normally be assigned to that trimester season would be split, as appropriate, amongst the other two trimesters.

Lastly, alternative B5 would implement a quarterly season for commercial shark fisheries. Limited data exist regarding shark catch composition when analyzed on a quarterly time scale because shark fisheries have historically operated in semi-annual seasons and have been closed during what would equate to the second and fourth quarters. Nonetheless, alternative B5 may provide a higher degree of resolution with which to manage seasonal fisheries and as such this option may better address/mitigate pupping and bycatch concerns, while minimizing the economic and social impacts to the fishery and its participants (see economic and social impacts as discussed below). For example, a closure of the second quarter season (April - June) would concentrate fishing effort and associated mortality during non-pupping months of the year. Quarterly seasons would, however separate the pupping season into several fishing seasons (i.e., quarters 2 and 3) as opposed to aggregating pupping into one season under preferred alternative B4.

NOAA Fisheries is unaware of any ecological impacts on protected resources associated with implementation of any of the alternatives discussed above. Few observed takes of protected resources and finfish have occurred in shark fisheries (See Chapter 3) to date. Of these observations, sea turtle takes have most commonly occurred in the first semi-annual season (January - June). Because shark fisheries have been closed during what would equate to half of the second (May - June) and entire third (September - December) trimesters under semi-annual seasons, NOAA Fisheries is unable to quantify the impacts on protected species with the preferred change in seasons. NOAA Fisheries will continue to monitor shark fishery interactions with protected resources and non-targeted finfish and will work to resolve any issues that may arise.

Social and Economic Impacts

Alternative B1 could have negative social and/or economic impacts should semi-annual seasons extend into pupping seasons. Given that LCS are overfished and overfishing is occurring, continued mortality of juvenile and reproductive females could cause the complex to decline further over time. Further declines in LCS stock status could result in additional reductions in available quota and/or other management measures, which could impact fishermen and fishing communities both economically and socially. Additionally, NOAA Fisheries has learned, via comments received during public hearings on draft Amendment 1, that a July 1st opening for the second semi-annual season makes it difficult for fishermen to establish markets with the forthcoming July 4th holiday.

Alternative B2 is unlikely to have any additional social or economic impacts because this alternative does not change quota calculation processes or fishing practices. By comparison, alternative B3 will likely enhance equity amongst regional user groups, given that access to fish available at different times of the year in different locations will occur. Because this alternative

will divide available quota based on historical landings, no significant economic impacts are anticipated. This alternative seeks to maintain historical, regional catches. See Chapter 6 for additional economic information.

Historically, markets for shark products have been closed during the late spring and late summer (See Table 1.3). As such, limited information exists on which to evaluate the social and economic affects that alternatives B4 and B5 may have on fishery participants. Under alternatives B4 and B5 fishermen and associated communities (e.g., dealers, processors, retail agents) will likely need time to adapt, given that new markets will need to be established at different times of the year. Fishery participants will need time (i.e., between two weeks and a month) to work with grocers to advertise shark products, and under the preferred alternative (i.e., B4), the time available for such advertisements may be further limited, as compared with the no action alternatives. Additionally, since fishermen will be able to land sharks at the same time as other fish, there could be fluctuations in markets for other fisheries.

Variation in open seasons could result in short-term social and economic burdens, given that fishermen will need to adjust fishing practices, including but not limited to, re-rigging gear more often to fish for shark, as opposed to other species, during what would otherwise be a closed season. Social and economic costs associated with switching gear more often may be minimized, if shark fishery participants use the same gear in other fisheries (e.g., similar gear is used to fish for shark, grouper, and tuna). Trimester seasons will minimize, compared to quarterly seasons, the costs of switching gear (i.e., only three times as opposed to four per year) and give a higher percentage of the quota to each open season than would occur under a quarterly season approach.

While it is likely that open seasons under the preferred alternative (i.e., B4) will be shorter, as compared to the no action alternatives, there will also be more open seasons (i.e., three as opposed to two) spread across the calendar year. Increasing the number of open seasons and effectively spreading open seasons out more evenly over the calendar year will, in the long-term, result in greater economic stability for fishermen and associated communities. This is primarily because the amount of "no-fishing" time between open and closed seasons will be reduced. If at a late date, NOAA Fisheries closes one trimester due to pupping concerns, the quota would be added to the remaining trimesters for that region. This occurrence would lead to longer seasons and greater market opportunities as well as reduced necessity for switching gear throughout the year. The specific economic impacts of such a closure would be analyzed at the time of consideration.

Conclusion

Alternatives B3 (i.e., regional quotas) and B4 (i.e., trimester seasons) are preferred alternatives because they will allow managers the flexibility to open and close seasons to match species requirements such as pupping season as well as ensure that historical, regional catches are maintained. Additionally, trimester seasons will give fishermen a greater chance to build markets for sharks. However, NOAA Fisheries recognizes that in the short-term these

alternatives could cause some social and economic impacts, as discussed in Chapters 6, 7, and 8. As such, NOAA Fisheries will delay implementation of trimester seasons until 2005 in order to give fishermen time to work with dealers to enhance market prices and plan out advertising strategies with grocers.

4.2.3 Quota Basis

As described in Chapter 2, the alternatives considered for quota basis are:

C1 Quota based on 1999 HMS FMP - (No Action),
C2 *Quota based on percentage of Maximum Sustainable Yield (MSY) - Preferred Alternative*,
C3 Quota based on average landings for past three years.

Alternative C2 is the preferred alternative.

Ecological Impacts

Alternative C1 would implement commercial quota levels for LCS (i.e., 620 mt dw for ridgeback LCS and 196 mt dw for non-ridgeback LCS), SCS (i.e., 359 mt dw), and pelagic sharks (e.g., 92 mt for porbeagle, 273 mt for blue, and 488 mt for other pelagic sharks). The LCS quota levels were established in the 1999 HMS FMP based on projection models in the 1998 LCS stock assessment. These LCS quotas used sandbar and blacktip sharks as proxies for ridgeback and non-ridgeback sharks, respectively. While NOAA Fisheries felt these LCS quota levels were appropriate in 1999, given the peer reviews of the 1998 LCS stock assessment and the results of the 2002 LCS stock assessment, these quota levels are no longer acceptable. The results of the 2002 LCS stock assessment indicate that blacktip sharks are fully rebuilt. Therefore a reduction of the magnitude proposed in this alternative is not necessary. Likewise, the 2002 LCS stock assessment also indicates that while overfishing is still occurring, sandbar sharks are no longer overfished and that further reductions are not necessary at this time to rebuild the biomass to optimum yield. While the 2002 stock assessment does indicate that the complex as a whole is overfished and that reductions are necessary to rebuild the complex, the 2002 LCS stock assessment also indicates that these results are related to declines in other species (i.e., dusky, hammerhead, and sand tiger sharks) within the complex.

The basis for the SCS quota, under alternative C1, was established in the 1999 HMS FMP. At that time, the quota was set at 10-percent higher than the highest commercial SCS landings in the time series available. The results of the 2002 SCS stock assessment suggests that biomass levels are at or above those which could produce MSY. This said, the HMS FMP sets $F_{target} = 0.75F_{MSY} = F_{OY}$ as the target control rule for healthy stocks. Under alternative C1, the quota would be twenty-percent lower than that of an MSY-based, healthy stock quota (See Table 2.3).

Similarly, the basis for pelagic shark quotas, under alternative C1, was established in the 1999 HMS FMP. Specifically, the porbeagle shark quota was approximately 10-percent higher than

the highest annual porbeagle landings (1990-1998). The blue shark quota was equivalent to the average weight of blue sharks discarded dead by longline fisheries targeting tunas and swordfish for the period 1987 to 1997. Since a stock assessment has not been conducted for pelagic sharks since these quotas were implemented, NOAA Fisheries has no basis for which to change these quotas at this time. Once a stock assessment is conducted, NOAA Fisheries would either implement pelagic shark quotas consistent with an ICCAT recommendation, if applicable, or set pelagic shark quotas using the same method as described herein for LCS and SCS.

By comparison, alternative C2 (preferred) would implement commercial quotas for LCS, SCS, and pelagic sharks based on MSY, as modified to produce OY. LCS quotas vary under this alternative depending upon which classification alternative is selected (See Table 2.3 of Chapter 2 for quota calculation methodologies). Specifically, if alternative C2 was combined with alternative A1 or A2, then the LCS Ridgeback quota would be 1,017 mt dw and the LCS Non-ridgeback quota would be 509 mt dw. Combination of alternative C2 with alternative A3 (preferred), will result in an LCS complex quota of 1,017 mt dw. If alternative C2 was combined with alternative A4, then the sandbar quota would be 991 mt dw, the blacktip quota would be 1,473 mt dw, and the other LCS quota would be 95 mt dw. The quota for SCS will be 454 mt dw under alternative C2. At this time, the pelagic shark quotas, which were approved in the 1999 HMS FMP, will not change.

Unlike the previous alternative, C2 incorporates a wealth of information including, but not limited to, total catch, landings, and discards. Consideration of all fisheries related mortalities and the effects on the status of the stock, as opposed to considering landings alone, will minimize uncertainty.

As noted earlier in Chapter 4, NOAA Fisheries must determine the maximum sustainable yield (MSY) as well as optimum yield (OY) and specify status determination criteria to allow a determination of the status of the stock. As such, the 1999 HMS FMP defined fishing mortality and biomass levels necessary to produce MSY and OY on a continuing basis. Given that these definitions are not subject to change in this Amendment, MSY based quotas provide a direct means for determining appropriate fishery management action. MSY and OY estimates are readily available from stock assessment outputs and can be updated annually if necessary. Because MSY can be used to set OY as a total allowable catch (TAC) level under this alternative, it is important that recreational landings and fishery related dead discards be reduced proportionately to that of commercial landings, otherwise the TAC could be exceeded. Refer to Chapter 2 and other sections in this chapter for further discussion of alternatives to achieve this goal.

Alternative C3 will implement commercial quotas for LCS, SCS, and pelagic sharks on the basis of average landings for the past three years, while taking into account dead discards and state landings after a Federal closure. LCS quotas vary under this alternative depending upon which LCS classification alternative is selected (See Table 2.3 for quota calculation methodologies). Specifically, if alternative C3 was combined with alternative A1 or A2, then the LCS Ridgeback

quota would be 794 mt dw and the LCS Non-ridgeback quota would be 931 mt dw. Combination of alternative C3 with alternative A3, would result in a LCS complex quota of 931 mt dw. If alternative C3 was combined with alternative A4, then the sandbar quota would be 635 mt dw, the blacktip quota would be 740 mt dw, and the other LCS quota would be 221 mt dw. The quota for SCS would be 300 mt dw under alternative C3. No change is proposed to the pelagic shark quotas, which were approved in the 1999 HMS FMP.

While alternative C3 incorporates the best available landings information into the process of setting annual quotas, landings data may be inaccurate due to under-reporting. This concern is especially important if fishermen view current accounting strategies (i.e., addition of any under-harvests to the same season quota in the following year) as an incentive to under-report. Alternatively, if fishermen over-report, it is possible that this alternative could lead to increased quotas regardless of the results of the stock assessment.

Under all three alternatives (i.e., C1, C2, and C3), the LCS complex would likely rebuild but on different time scales (See Section 4.1). Under alternative C1 the LCS complex would likely rebuild the fastest. Additionally, there would likely be less effort and therefore fewer interactions with protected species and non-target finfish as compared with the other alternatives. Under both alternatives C2 and C3, particularly C3, effort would be greater as compared to the no action alternative (i.e., C1) and reduced as compared to the existing effort under the current emergency rule. Considering the combination of preferred alternatives (i.e., C2 and A3), the commercial LCS quota levels will be higher for commercial fishermen as compared with the no action alternative (i.e., C1) and lower for commercial fishermen as compared with the current emergency rule (1,714 mt dw) or compared to the quotas that were in place from 1997 to 2002 (1,285 mt dw). As such, these preferred alternatives will neither result in additional interactions with protected resources and non-target finfish due to the decrease in quota, nor cause fewer interactions with protected resources due to maintained effort in the fishery, as compared with the quota and effort existing under the current emergency rule.

Under all three alternatives (i.e., C1, C2, and C3), the SCS complex would be managed for optimum yield to the commercial fishery. Given that the preferred quota level for SCS is thirty-percent higher than the highest average landings taken to date (i.e., 320 mt dw in 1997), NOAA Fisheries does not anticipate that an increase in effort would occur. As such, these alternatives would be less likely to result in any additional interactions with protected resources, but would also not reduce current level of interactions.

There are no ecological impacts associated with pelagic shark quotas under any of these alternatives, given that these quotas will not change from those implemented under the 1999 HMS FMP.

Social and Economic Impacts

In order for LCS to rebuild, reductions in catch must occur. Reducing the commercial quota will have a direct influence on the amount of catch. NOAA Fisheries recognizes that reductions in available quota would increase the likelihood of negative economic impacts to fishery participants during the rebuilding time frame (See Section 4.1). Specifically, alternatives C1, C2, and C3 will result in reductions in total revenues for directed LCS fishery participants (See Chapter 6). The preferred alternative (i.e., C2) seeks to minimize the economic impacts associated with LCS rebuilding. NOAA Fisheries anticipates that economic impacts associated with the preferred alternative will be reduced as the stock rebuilds and fewer reductions in quota are necessary to "convert" MSY to OY.

SCS fishery participants could experience both negative and positive economic impacts under these alternatives. Under alternatives C1 and C2, particularly C2, directed SCS fishery participants will experience positive economic impacts. Because quota levels for SCS will either remain the same or have the potential to increase under these alternatives, fishermen will have the opportunity to maintain current income levels or possibly increase total revenues. Therefore, it is unlikely that any negative economic impacts will be incurred. Stable or higher incomes for fishermen will reduce economic burdens in associated communities as well (i.e., economy stimulation, reduced seafood prices for consumers). By comparison, alternative C3 would reduce the available quota for SCS, thereby reducing total revenues accordingly.

There are no economic or social impacts associated with pelagic quotas under any of these alternatives, given that these quotas will not change from those implemented under the 1999 HMS FMP.

Conclusion

Alternative C2 (i.e., quota based on percentage of MSY) is the preferred alternative because, in combination with the other preferred alternatives, it will allow the LCS complex to rebuild, will promote management of sharks to produce optimum yield to the commercial fishery, will eliminate confusion about when to count discards because it sets a TAC and subsequent landings quota, will provide managers and fishermen with a comprehensive method of setting the landings quota after each stock assessment, and will minimize, to the extent practicable, economic and social impacts.

4.2.4 Commercial Minimum Size

As described in Chapter 2, the alternatives considered for commercial minimum size are:

D1 4.5 feet fork length for Ridgeback LCS - (No Action),
D2 *No minimum size - Preferred Alternative*,
D3 5 feet fork length for all LCS,

D4 5 feet fork length for Ridgeback LCS; 4.5 feet fork length for Non-ridgeback LCS,
D5 4.5 feet fork length for Atlantic Non-ridgeback LCS; 4 feet fork length for Gulf of Mexico Non-ridgeback LCS,
D6 Minimum size for overfished species *(or where overfishing is occurring)* only.

Alternative D2 is the preferred alternative.

Ecological Impacts

Alternatives D1, D3, D4, D5, and D6 present options for establishing minimum sizes for commercially caught shark species. The 2002 LCS stock assessment indicates that population growth is particularly sensitive to fishing mortality on juvenile and sub-adult sharks. As described in Chapter 2, alternatives D1, D3, D4, and D5 all propose minimum sizes designed to protect certain species by allowing those shark species to reach sexual maturity. Alternative D6 would implement this type of minimum size for all overfished species.

A minimum size of 4.5 feet fork length for ridgeback LCS was finalized, but never implemented due to a court settlement, in the 1999 HMS FMP based upon demographic analyses for sandbar sharks that indicated that juvenile and sub-adult stages or sizes were the most sensitive to fishing mortality. NOAA Fisheries felt that a minimum size would act as a type of moving time/area closure and would protect juvenile or sub-adult ridgeback LCS wherever they were located. NOAA Fisheries has new information via the 2002 LCS stock assessment which suggests that sandbar sharks are recovering despite the absence of a minimum size in the commercial fishery.

While alternatives D1, D3, D4, D5, and D6 would seek to protect and reduce fishing mortality on juvenile sharks, any conservation benefits gained under the alternatives may be offset by increases in regulatory discards and associated post-release mortality given that commercial fishermen may be unable to avoid mixed size aggregations of some shark species. For instance, while sandbar sharks tend to segregate by size, blacktip sharks and other species do not. Regulatory discards may also result in effort increases by fishermen in order to make up for lost catches, which could also result in increased interactions with protected (i.e., sea turtles and marine mammals) and non-targeted (i.e., prohibited sharks and other finfish) species. Additionally, regulatory discards are not counted against the 4,000 pound trip limit. Thus, if a fisherman should catch a set full of undersized sharks, those sharks would be discarded and the fisherman could set the gear again, possibly in another school of small sharks.

By comparison, alternative D2 (preferred) will not implement a minimum size for any commercially caught LCS. This alternative has been implemented in commercial fisheries since 1993. While D2 does not offer any additional protection for juvenile LCS, this alternative does not increase regulatory discards or effort. As mentioned earlier, any conservation benefits gained by implementing a minimum size would need to be balanced by increases in regulatory discards, post-release mortality, and effort. Furthermore, the 2002 LCS stock assessment noted that sandbar sharks are recovering and that blacktip sharks are rebuilt despite the absence of a

minimum size on these species to date. While the best available data indicate that LCS continue to be overfished and overfishing is occurring, sandbar and blacktip sharks continue to comprise the majority of the LCS landings and no further advice is offered in the 2002 LCS stock assessment about which species could benefit most from a minimum size. Additionally, with the implementation of a time/area closure (See alternative K2), juvenile LCS, particularly sandbar and dusky sharks, will have some protection.

Social and Economic Impacts

As described in the 1999 HMS FMP and noted in Chapter 6 of this document, the implementation of a minimum size on commercially caught sharks (alternatives D1, D3, D4, D5, and D6) could increase the cost of fishing because, to avoid smaller ridgeback LCS, fishermen would have to fish farther offshore which requires more fuel, groceries, and time. An alternative for fishermen who cannot fish farther out would be to set additional gear inshore. However, in order to land as much fish, the fisherman would have to set more gear (i.e., to increase effort) which would require additional bait and fuel. Thus, these alternatives could have a negative economic impact on fishermen.

Implementation of either alternative D1, D3, D4, D5, or D6, however could increase the ex-vessel price for the fish that are landed because these fish will have more meat and have larger fins. This increase in ex-vessel price might offset some of the increased fishing costs associated with implementing minimum sizes under these alternatives. National Standard 8 requires that conservation and management measures take into account the importance of fishery resources to fishing communities and, to the extent practicable, minimize adverse economic impacts on such communities. It is important to note that the lack of a minimum size does not prohibit fishermen from targeting larger sharks for which they could get a higher price in the market. Rather current market conditions have created an economic incentive to focus on larger sharks thereby providing an additional economic incentive to conserve juveniles.

Additionally, under alternatives D1, D3, D4, D5, and D6, if fishermen decide to fish farther offshore, captains and crew could be at sea for a longer period of time. This could result in increased stress on families and increased safety risk. Thus, alternatives D1, D3, D4, D5, and D6 could have negative social impacts, beyond economic, for communities that rely on the fishermen.

Under alternative D2, social and economic costs are not expected to change given that this management measure has been in place since 1993.

Conclusion

Alternative D2 (i.e., no minimum size) is the preferred alternative because, in combination with the other preferred alternatives, most notably the time/area closure offshore North Carolina, it

will minimize regulatory discards as well as minimize economic and social impacts to commercial fishermen. The preferred alternative is consistent with National Standard 8.

4.3 Recreational Management Measures

4.3.1 Recreational Retention Limits

As described in Chapter 2, the alternatives considered for recreational retention limits are:

E1 One shark per vessel per trip plus one Atlantic sharpnose shark per person per trip (No Action)

E2 Existing catch limits (E1) plus the addition of one bonnethead shark per person per trip - Preferred Alternative

E3 Existing catch limits (E1) plus the addition of one pelagic shark per vessel per trip

E4 Existing catch limits (E1) plus an allowance for vessels with HMS Angling permits participating in registered tournaments or HMS CHB permit holders on for-hire trips to retain one shark per person, up to two sharks per vessel, per trip, as well as one bonnethead shark per person per trip.

E5 Other retention limit that considers existing state recreational retention limits

E6 No retention, catch-and-release fishing for all recreational shark fisheries, inclusive of all LCS, SCS, and pelagic species.

E7 No retention limit

Ecological Impacts

As described in Chapter 3, U.S. recreational shark harvests of LCS have declined by 80 percent from the peak recorded catches in 1983 (See Table 3.18). Blacktip and sandbar sharks dominate the recreational catches of LCS by 36 and 27 percent, respectively (See Table 3.19). Recreational harvests of SCS have fluctuated between 34,900 and 189,500 fish per year since the mid 1980s, with Atlantic sharpnose comprising about 60 percent of the catch in recent years (See Tables 3.18 and 3.20). For pelagic species, recreational harvests have fluctuated from a peak of approximately 93,000 fish in 1985 to a low of about 6,200 fish in 1994. Recreational harvests of blue sharks accounted for 47 and 53 percent of the total catches of pelagic sharks in 1999 and 2000. The recreational fishing community has voiced concern about an apparent decline of shortfin mako sharks; however, until an international stock assessment is conducted in 2004, NOAA Fisheries cannot determine if an apparent decline in one area is indicative of regional distributions, migratory patterns, or an overall stock decline.

From 1991 through 2001, the Marine Recreational Fishing Statistics Survey (MRFSS) intercept survey sampled 13,056 shore- and vessel-based fishing trips which reported catching a shark listed 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 retention limits have been reduced. The percentage of

sharks released from shore-based fishing trips has remained constant (Babcock and Pikitch, 2002). Babcock and Pikitch (2002) also found that a significant fraction of trips are still harvesting more than one shark per trip and determined that if problems in the implementation of the current regulations could be resolved, mortality of sharks in the recreational fishery could be reduced significantly. Unless otherwise noted, for the purposes of the analyses below, NOAA Fisheries presumes compliance with the existing catch limits.

Alternative E1, the no action alternative, would maintain the current recreational retention limits finalized in the HMS FMP of one shark per vessel per trip, inclusive of LCS, SCS, and pelagic sharks, and the allowance for one Atlantic sharpnose shark per person per trip. While this retention limit (E1) was implemented in the HMS FMP, in part, to reduce the harvest of sandbar and blacktip sharks in recreational fisheries and, to address the problem of continued misidentification of juvenile LCS and SCS, the results of the 2002 LCS stock assessment indicate that blacktip sharks are fully rebuilt and that sandbar sharks are rebuilding. However, the 2002 LCS stock assessment indicates that the LCS complex is overfished, overfishing is occurring, and reductions are needed to rebuild the complex. These results are due to species in the complex other than sandbar and blacktip sharks.

Under alternative E1, the current trends regarding increased catch-and-release fishing by party boats would likely continue and, because all sharks are combined under one retention limit except Atlantic sharpnose sharks which are easily identified, misidentification problems should be minimized. Additionally, under this alternative, it is unlikely that LCS landings would increase and, with additional public outreach and the recent implementation of the HMS Angling category permit, increased compliance with existing catch limits and subsequent reductions in LCS landings could occur. NOAA Fisheries can use the HMS Angling category permit database to distribute educational, regulatory, and outreach materials to this known universe of anglers. A reduction is needed in order to rebuild the LCS complex within the rebuilding time-frame (See Section 4.1). The existing recreational limits implemented in the HMS FMP were intended to reduce the harvest of sandbar and blacktip sharks by 82 and 81 percent in numbers of fish, respectively. This level of reduction was not achieved because of compliance issues. Under the current rebuilding plan established in this Amendment, NOAA Fisheries estimates that an 80 to 85-percent reduction in numbers of fish, relative to recent recreational harvest levels, is needed. Assuming increased compliance, alternative E1 in combination with alternative F1 could reduce the mortality of sharks in the recreational fishery by more than 81 - 82 percent (Babcock and Pikitch, 2002). Maintaining this alternative would be unlikely to change the status of pelagic or small coastal sharks. The 2002 SCS stock assessment indicates that the current level of removals is sustainable for the SCS aggregate and the individual species, except finetooth sharks. The assessment predicted that the stock biomass of Atlantic sharpnose sharks in any given year from 1972-2000 exceeded the biomass producing MSY (Cortes, 2002), and reductions in the retention limit for Atlantic sharpnose sharks are not necessary at this time. This alternative would maintain current finetooth shark mortality levels although increased compliance with recreational minimum sizes (See Section 4.3.2) may reduce finetooth shark landings.

Alternative E1 would also maintain a combination of a per vessel and a per person retention limit, which has been identified as confusing for anglers and problematic for enforcement (especially for species that are difficult to identify), and may lead to increased landings of some species. However, Atlantic sharpnose sharks are relatively easy to identify and increased outreach efforts should reduce angler confusion and decrease any landings of non-Atlantic sharpnose sharks due to misidentification.

Alternative E2, the preferred alternative, would allow the retention of one bonnethead shark per person per trip in addition to the existing catch limits (alternative E1). Like Atlantic sharpnose sharks, bonnethead sharks are an important recreational SCS catch in some regions, are easy to identify, are not experiencing overfishing, and are not overfished. Recent estimates indicate that bonnethead sharks comprise approximately 30 percent of recreational SCS harvest (Atlantic sharpnose sharks comprise over 58 percent; Cortes and Neer, 2002). While many bonnethead sharks are likely released under the no action alternative, many are harvested legally from state waters or are harvested from Federal waters despite current Federal regulations. The combination of alternatives E2 and F2 would allow these sharks to be landed legally. While the allowance for one bonnethead per person per trip could likely result in increased mortality of bonnethead sharks, the 2002 SCS stock assessment indicates that the biomass level is above MSY and fishing mortality is below F_{OY} (Cortes, 2002). Only in 1995 was fishing mortality estimated to exceed that producing MSY (Cortes, 2002). NOAA Fisheries does not believe that this alternative would increase mortality of bonnethead sharks to the point where the stock would be experiencing overfishing or would be considered overfished. This species primarily inhabits inshore waters and is currently experiencing fishing levels near those expected under alternative E2. Impacts to LCS and other SCS would be similar to those expected under alternative E1.

Alternative E3 would allow the addition of one pelagic shark per vessel per trip to the existing catch limits (alternative E1). This limit would require anglers to identify species in the pelagic species group and would likely result in increased mortality of pelagic sharks. This limit may also increase mortality of LCS if anglers are unable to correctly identify pelagic sharks. Recreational harvest of pelagic sharks have fluctuated from a peak of approximately 93,000 fish in 1985 to a low of about 6,200 fish in 1994. At this time, because an international stock assessment is needed to account for the migratory nature of pelagic sharks, NOAA Fisheries does not have a current stock assessment for these species. ICCAT is scheduled to conduct an assessment in 2004 and has been collecting the information necessary to do this for several years. The 1993 FMP for Sharks of the Atlantic Ocean concluded that pelagic sharks were fully fished. Because NOAA Fisheries cannot determine the impacts of additional mortality on pelagic shark stocks and because this alternative could result in increased LCS mortality, this alternative is not preferred at this time. NOAA Fisheries may consider this alternative after ICCAT conducts the international stock assessment and if species identification of sharks by anglers improves. Impacts to LCS and other SCS would be similar to those expected under alternatives E1 and E2.

In addition to the existing catch limits (alternative E1), alternative E4 would allow permitted charter/headboat vessels carrying multiple paying passengers or vessels with HMS Angling

permits competing in registered tournaments to retain one shark per person, up to two sharks per vessel, per trip, as well as one bonnethead shark per person per trip. This alternative would create a retention limit similar to that in effect in the recreational swordfish fishery. It would likely result in greater mortality levels than those expected from alternatives E1, E2, and E3. This greater mortality level is not consistent with the 2002 LCS stock assessment results which indicate that the LCS complex needs a reduction in fishing mortality. Additionally, without more information regarding the status of pelagic sharks, this alternative may be detrimental to pelagic sharks. Also, although the SCS complex is estimated to be at biomass levels at or above those which could produce MSY, increased landings resulting from this alternative may increase mortality of finetooth sharks and could lead to an overfished status (Cortes, 2002). However, this alternative could be combined with other fishing controls such as increased minimum sizes, such that overall mortality is not increased; NOAA Fisheries may consider this approach in the future.

Alternative E5 would identify a retention limit that considers existing state recreational retention limits. A Federal retention limit similar to those that exist in most states could minimize confusion with Federal regulations and make enforcement less complicated. However, the requirements for recreational shark fisheries vary widely from state to state, from retention limits similar to Federal regulations to those far exceeding current Federal retention limits (Appendix 3). At this time NOAA Fisheries cannot identify a limit that would be consistent with state regulations as there is little consistency between states. Ecological impacts would vary depending on the actual limit.

Alternative E6 would implement catch-and-release fishing for all recreational shark fisheries in Federal waters, inclusive of all LCS, SCS, pelagic species, prohibited species, and deepwater/other species. Under this alternative, no sharks could be retained and all sharks subject to Federal management would have to be released in a manner that maximizes the probability of survival. Alternative E6 would result in the fastest rebuilding to MSY levels by reducing recreational fishing mortality to post-release mortality only. As no quantitative estimates for post-release mortality of sharks caught in recreational fisheries (in general or for individual species) are currently available, only qualitative impacts can be discussed at this time. However, assuming a low post-release mortality, this alternative would be expected to provide for the fastest rebuilding possible with highest probabilities that LCS stocks will increase from the 2002 levels. This alternative would be expected to meet NS 1 to prevent overfishing and rebuild overfished fisheries for LCS, and would also enhance stock status for the fully fished pelagic and rebuilt small coastal sharks.

Under alternative E7, there would be no retention limit for recreational shark fisheries in Federal waters, inclusive of all LCS, SCS, and pelagic species, and anglers would not be restricted in the number of LCS, SCS, or pelagic sharks that could be possessed or retained. This alternative would likely result in large increases in mortality of sharks in the management unit and would result in continued overfishing of LCS stocks and could lead to overfishing of SCS and pelagic sharks. It would likely result in greater mortality levels than those expected from alternatives E1,

E2, E3, E4, and E6, and does not meet NS 1 to rebuild overfished fisheries for LCS or prevent overfishing of the fully fished pelagic sharks and SCS.

Under alternatives E1 through E6, NOAA Fisheries does not anticipate any adverse impacts to finfish or protected resources because recreational fishing patterns and effort are unlikely to change. Alternatives E1 through E5 would either maintain existing catch limits or allow slightly increased shark landings because more sharks that are currently discarded may be retained, but NOAA Fisheries does not expect this increase to result in increased fishing effort. Alternative E6, which would not allow any retention of sharks, may result in increased fishing effort on other finfish as fishermen redirect on other species but may reduce shark fishing effort and therefore may reduce interactions with protected resources. Under Alternative E7, catches of finfish or protected resources may increase because recreational fishing effort may increase due to the lack of shark fishing retention limits and more shark directed trips may occur with related bycatch of finfish or protected species. However, recreational fishing gear is generally believed to have high post-release survival rates such that bycatch mortality may not increase even though bycatch rates may increase.

Under alternatives E1 through E7, NOAA Fisheries does not expect any adverse impacts to EFH because recreational fishing gear is not believed to interact with bottom structures or otherwise damage habitat.

Social and Economic Impacts

Under the no action alternative, E1, NOAA Fisheries does not anticipate any substantive change, either positive or negative, in social or economic impacts than shark fishermen currently experience. In light of the 2002 SCS stock assessment estimates, this alternative used in combination with a minimum size does not allow for full utilization of SCS stocks.

Alternative E2, the preferred alternative, would have more positive social impacts than E1 as anglers would not be constrained by the more restrictive regulations currently in place. Alternative E2 would allow the addition of one bonnethead shark per person per trip to the existing retention limits. Bonnethead sharks are easy to identify and are an important catch in some regions, but do not reach the minimum size presently in effect. Although this limit would provide an allowance for bonnethead and Atlantic sharpnose sharks, the allowances may not be available to anglers who fish outside of their ranges. This alternative would give anglers aboard headboats and charter vessels a greater opportunity to land a shark.

Fisher and Ditton (1992) found that anglers spent an average of $197 per trip and were willing to spend on average an additional $105 rather than stop fishing for sharks. Given the fact that most anglers release the fish they catch and that the catch and release fishing ethic is growing, it is unlikely that these estimates have changed substantially since 1992. Fisher and Ditton (1992) also found that 32 percent of shark anglers said that no other species would be an acceptable substitute for sharks. The additional bonnethead allowance in this alternative may slightly

increase current revenues to charterboat owners, captains, and others who rely on the recreational shark fishery.

Alternative E3 may have positive social impacts in that it could allow anglers who fish outside the range for Atlantic sharpnose sharks the opportunity to land an additional shark. This could lead to greater overall fishing satisfaction and an increased participation in directed pelagic fisheries. This alternative would require anglers to possess a greater ability to identify sharks, especially pelagic species. NOAA Fisheries is developing an identification guide to increase public education and awareness. Problems with shark identification could likely be mitigated by alternative J8 which would require fishermen to attend workshops discussing identification and current regulations. Alternative E3 could also result in positive economic impacts. The additional pelagic shark allowance in this alternative could increase tournament participation, increase current revenues to charterboat owners/captains and others who rely on the recreational shark fishery, lead to an increase in willingness to pay, and an increased angler consumer surplus.

Under alternative E4, positive social impacts could be expected to accompany the allowance for an additional shark per vessel per trip. This could lead to greater overall fishing satisfaction and an increased participation in shark fisheries. Positive economic impacts could also be expected as business and associated profits within the charter/headboat industry may increase. Tournament anglers would be able to land more than one shark per vessel for points and or weight competition. This could lead to increased tournament participation, an increase in willingness to pay, and increased angler consumer surplus. NOAA Fisheries may be able to address misidentification problems with outreach to this smaller universe of anglers.

Under alternative E5, if a limit that could minimize confusion with various state and Federal regulations could be identified, the social impacts would be generally positive. Currently, anglers appear to be unsure as to which regulations to follow depending on where they are fishing (state or Federal waters). This could lead to greater satisfaction and therefore greater willingness to pay. However, satisfaction could also decrease if the retention limit is lower than the current limit.

Alternative E6 may have substantial negative social impacts by eliminating recreational harvests of all sharks. This alternative would eliminate the opportunities for trophy and tournament anglers to bring in their catches and may significantly reduce an angler's willingness to pay if no sharks can be retained. This alternative may be perceived as "unfair" to recreational fishing interests if the commercial fishery is allowed to continue. It is important to note that this alternative would not prevent anglers from fishing and gaining the benefits of the fishing experience but it would prevent anglers from retaining any of their catch. The adverse social impacts of this alternative may be reduced to the extent that there is a growing public opinion that catch-and-release fishing is the preferable recreational fishery for sharks.

The economic impacts of alternative E6 would depend on the willingness for shark anglers to substitute other fish and release sharks caught. This is especially true as anglers would be forced

to release all sharks caught, and tournaments would be unable to harvest any trophy fish. Fisher and Ditton (1992) found that over 70 percent of the anglers surveyed said they would be just as happy releasing the fish they caught (rated as "agree" and "strongly agree"). However, it is possible that anglers may not pay to only catch and release or tag and release sharks. Fisher and Ditton (1992) found that 27 percent of the anglers surveyed fish in order to obtain fish for eating and 18 percent fish in order to obtain a trophy. Given the evidence that shark anglers do not necessarily fish in order to obtain a trophy or for consumption, it is unlikely this alternative would reduce angler consumer surplus or the willingness to pay significantly for private vessels. However, angler consumer surplus may be reduced at the tournament level, in directed pelagic shark fisheries, and in those fisheries whose participants are unwilling to substitute fishing for species other than sharks.

Under alternative E7, anglers would not be restricted in the number of LCS, SCS, or pelagic sharks that could be possessed or retained. This alternative would likely result in an increase in participation in the recreational shark fishery and have positive social and economic impacts, at least in the short-term. However, in the long-term, if LCS, SCS, and pelagic shark stocks decline, more fishing effort will be required to catch sharks, which would likely result in reduced revenues and increased costs for charterboat and headboat operations. Angler consumer surplus may also decline for shark-targeted trips.

Conclusion

Alternative E2 is preferred because, if combined with alternative F2, it will allow rebuilding of LCS shark stocks within the rebuilding time frame. In addition, alternative E2 is expected to have positive social and economic impacts by allowing increased retention of one additional bonnethead shark without increasing fishing mortality of this species beyond sustainable levels. Bonnethead sharks are not overfished and are not experiencing overfishing, and are a regionally important species in recreational fisheries. Bonnethead sharks are also an easily identified species so misidentification problems should be minimized.

4.3.2 Recreational Minimum Sizes

As described in Chapter 2, the alternatives considered for recreational minimum sizes are:

F1 4.5 feet fork length for all sharks, no size limit for Atlantic sharpnose sharks (No Action)
F2 Existing size limits (F1) plus no size limit for bonnethead sharks - Preferred Alternative
F3 5.0 feet fork length for all sharks, no size limit for Atlantic sharpnose and bonnethead sharks
F4 5.0 feet fork length for all ridgeback LCS, 4.5 feet fork length all non-ridgeback LCS, SCS, and pelagic sharks, no size limit for Atlantic sharpnose and bonnethead sharks
F5 Existing size limits (F1) plus regional non-ridgeback shark minimum sizes (4.5 feet fork length for all Atlantic non-ridgeback LCS, 4.0 feet fork length for all Gulf of Mexico non-ridgeback LCS) and no size limit for bonnethead sharks

F6 No size limit for any sharks

From 1991 through 2001, the Marine Recreational Fishing Statistics Survey (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 percentage of sharks released from shore-based fishing trips has remained constant (Babcock and Pikitch, 2002). Babcock and Pikitch (2002) found that a significant fraction of trips harvest sharks under the current minimum size limit and determined that if problems in the implementation of the current regulations could be resolved, mortality of sharks in the recreational fishery could be reduced significantly. Unless otherwise stated, for the purposes of the analyses below, NOAA Fisheries presumes compliance with the existing catch limits.

Ecological Impacts

The no action alternative, F1, would maintain the existing size limit of 4.5 feet (137 cm) fork length for all sharks except for Atlantic sharpnose sharks as finalized in the HMS FMP. The 4.5 feet fork length size limit approximates the size of first maturity for female sandbar sharks. Sminkey and Musick (1995) found that female sandbar sharks reach first maturity at approximately 140 cm fork length. Shark population studies have shown that most of the species in the LCS complex have low population growth rates, and that for those species, juvenile survival is the vital rate that most effects overall population growth rates (Cortes *et al.*, 2002). Sharks caught in recreational fisheries are thought to have low post-release mortalities and the current 4.5 feet fork length size limit should minimize fishing mortality on the stages that contribute the most to population growth by maintaining catch-and-release fishing on juvenile and subadult sharks. This alternative continues to shift recreational mortality primarily onto larger fish (some post-release mortality of undersized fish will still occur), while still allowing the recreational fishing experience and limited harvest of some sharks. However, because some species such as sandbar sharks segregate by size, this size limit would maintain fishing effort directed toward pregnant females as they enter pupping grounds in coastal bays and estuaries. The 2002 LCS stock assessment recommended protecting juveniles and reproductive females (Cortes *et al.*, 2002).

The 2002 SCS stock assessment indicated that the current level of removals is sustainable for the SCS aggregate and the individual species, except finetooth sharks. The assessment predicted that the stock biomass of Atlantic sharpnose sharks in any given year from 1972-2000 exceeded the biomass producing MSY (Cortes, 2002) and reductions for Atlantic sharpnose sharks are not necessary at this time. Under this alternative, recreational fishing for SCS is mainly catch-and-release, except for Atlantic sharpnose sharks, because some SCS like Atlantic sharpnose and bonnethead sharks do not reach 4.5 feet (137 cm fork length) at full maturity. Atlantic sharpnose and bonnethead sharks reach maximum lengths of about 110 cm total length and 150 cm total length, respectively (Compagno, 1984). Blacknose and finetooth sharks are larger species that may reach maximum sizes of 200 cm total length (Compagno, 1984). Mature individuals of

these species may reach the current minimum size on occasion. This alternative would maintain protection for finetooth sharks, which are currently experiencing overfishing.

Substantial recreational fisheries target pelagic sharks, especially shortfin mako, thresher, and blue sharks. Maintaining the current 4.5 feet fork length minimum size will have little ecological impact on pelagic sharks, because most of the pelagic sharks currently retained exceed the 4.5 feet fork length minimum size. This minimum size is smaller than the length equivalent of the 100-pound minimum size (approximately 162 cm fork length) for mako sharks that has been suggested in the past and that many tournaments often require. Therefore, this alternative is supportive of voluntary restrictions on the harvest of juvenile and subadult sharks.

Alternative F1 could result in the continued misidentification of juvenile LCS and other shark species such as Atlantic sharpnose sharks. NOAA Fisheries established a separate allowance for Atlantic sharpnose sharks in part because Atlantic sharpnose sharks were thought to be readily identifiable from other species due to the presence of white spots on the back. However, members of the public have raised concerns that species-specific identification continues to be a significant problem and that juvenile LCS are frequently misidentified, sometimes as Atlantic sharpnose sharks. NOAA Fisheries believes that, with additional education and outreach, problems with misidentification of Atlantic sharpnose sharks can be adequately addressed. NOAA Fisheries has also received public comment regarding concerns for the safety of anglers who are required to measure live sharks in order to retain them. NOAA Fisheries recommends that anglers mark areas on the outside of fishing vessel hulls (e.g., at the waterline or boot stripe) with the minimum size. If a shark is smaller than this measurement, it should be released. If a shark is larger than the measurement and not a prohibited species, it could be retained and killed before bringing it onboard.

Alternative F2, the preferred alternative, would allow the retention of bonnethead sharks with no minimum size in addition to the existing size limits (alternative F1). Bonnethead sharks are an important recreational catch in some regions, do not commonly reach the current 4.5 feet fork length minimum size, and according to the 2002 SCS stock assessment, are not experiencing overfishing and are not overfished. Between 1995 and 2000, bonnethead sharks were consistently the second-most important SCS species caught recreationally (Cortes, 2002). While many bonnethead sharks are likely released under the no action alternative, many are harvested legally from state waters or are harvested from Federal waters despite current Federal regulations. This alternative may increase mortality of bonnethead sharks relative to alternative F1 by allowing landings (because bonnethead sharks do not reach the existing minimum size, they cannot currently be landed and are subject to catch-and-release fishing only). Given that bonnethead sharks are not overfished and are not experiencing overfishing, NOAA Fisheries does not believe that this alternative would increase mortality of bonnethead sharks to the point where the stock would be considered overfished or would experience overfishing. This species primarily inhabits inshore waters and is currently experiencing fishing levels near those expected under alternative F2. Mortality reductions projected under alternatives F2 and E2 combined achieve mortality reduction levels required by the rebuilding plan in this Amendment

Alternative F3 would increase the existing size limit to 5.0 feet fork length for all sharks, except for Atlantic sharpnose sharks, and allow the retention of bonnethead sharks with no minimum size. The 5.0 feet fork length (152.4 cm) minimum size approximates the size above which all female sandbar sharks have been found to be mature. All female sandbar sharks over 149.0 cm fork length sampled by Sminkey and Musick (1995) were mature. This limit would allow all female sandbar sharks to be sexually mature before recruiting to the recreational fishery. The 2002 LCS stock assessment recommended protecting juveniles and reproductive females (Cortes *et al.*, 2002). Relative to alternative F1, this alternative would provide increased protection for other shark species such as dusky and finetooth sharks by essentially creating a catch-and-release fishery for a higher percentage of juvenile and subadult stages. Sharks caught in recreational fisheries are thought to have low post-release mortalities and the 5.0 feet fork length size limit could increase protection for many sensitive stages/sizes as recommended in the 2002 LCS stock assessment. However, relative to alternative F1, this size limit could increase fishing effort directed toward pregnant females as they enter pupping grounds in coastal bays and estuaries. According to Babcock and Pikitch (2002) the majority of sharks sampled by the MRFSS survey are below the current 4.5 feet fork length minimum size limit. Impacts to bonnethead sharks would be similar to those expected under alternative F2.

Alternative F4 would increase the existing size limit to 5.0 feet fork length for all ridgeback sharks, retain the 4.5 feet fork length size limit for all non-ridgeback sharks, maintain the no size limit for Atlantic sharpnose sharks, and allow the retention of bonnethead sharks with no minimum size. This alternative would have similar impacts as alternative F3 for ridgeback sharks and alternatives F2 and F3 for bonnethead sharks. The 4.5 feet fork length (137 cm) minimum size limit for non-ridgeback is slightly larger than the median size at which female blacktip sharks become mature in the Atlantic (126.6 cm fork length; Carlson and Baremore, 2002) so that the majority of female blacktip sharks would be sexually mature before recruiting to the recreational fishery. These limits may provide increased protection for other shark species such as dusky sharks by essentially creating a catch-and-release fishery for a higher percentage of juvenile and subadult stages. This alternative would not afford additional protection for finetooth sharks, which are currently experiencing overfishing, as do alternatives F1 and F2, because finetooth sharks are a non-ridgeback shark. This alternative would have similar impacts to alternative F3 for ridgeback pregnant females by increasing directed effort on them as they enter pupping grounds in coastal bays and estuaries. Similar to previous alternatives, alternative F4 could result in continued misidentification of juvenile LCS and other shark species as Atlantic sharpnose sharks.

Alternative F5 would, in addition to existing size limits on all ridgeback and Atlantic sharpnose sharks (alternative F1), retain the 4.5 feet fork length minimum size limit for all non-ridgeback sharks in the Atlantic region, reduce the minimum size to 4.0 feet fork length for non-ridgeback sharks in the Gulf region, and allow the retention of bonnethead sharks with no minimum size. This alternative allows for a smaller size limit for non-ridgeback sharks in the Gulf region while still allowing the majority of female blacktip sharks to be sexually mature in both the Atlantic and Gulf region before recruiting to the recreational fishery. Carlson and Baremore (2002) found

that the median sizes at which female blacktip sharks become mature in the Atlantic and Gulf regions are 126.6 cm fork length and 117.3 cm fork length, respectively. The 4.5 feet fork length (137 cm) minimum size limit for Atlantic non-ridgeback sharks is slightly larger than the median size in the Atlantic region (126.6 cm) and the 4.0 feet fork length (122 cm) minimum size limit for Gulf region non-ridgeback sharks approximates the median size in the Gulf region (117.3 cm). This alternative would have similar impacts to alternatives F1 and F2 for ridgeback and Atlantic sharpnose sharks, alternatives F1, F2, and F4 for non-ridgeback sharks in the Atlantic region, and alternatives F2, F3, and F4 for bonnethead sharks.

Under alternative F6, sharks of any size could be landed. This would allow anglers to land shark species that do not commonly reach the current minimum size limit (e.g., SCS). This alternative would likely result in large increases in mortality of sharks in the management unit and would result in continued overfishing of LCS stocks and finetooth sharks, and could lead to overfishing of SCS and pelagic sharks. It would likely result in greater mortality levels than those expected from alternatives F1, F2, F3, F4, and F5, and would not meet NS 1 to rebuild overfished fisheries for LCS or prevent overfishing of finetooth sharks or the fully fished pelagic sharks.

During the public comment period, many commenters stated that the commercial and recreational minimum sizes should be the same. NOAA Fisheries believes that a recreational minimum size limit is appropriate and will be effective at protecting juvenile sharks in the recreational fishery. Sharks caught recreationally are thought to have low post-release mortalities as compared to those captured on commercial gears. A minimum size is not being implemented in the commercial fishery because other measures, including commercial quotas, will limit overall commercial shark fishing effort and landings, and a time/area closure for directed shark bottom longline vessels will protect juvenile sharks in a known pupping and nursery area.

Under alternatives F1 through F5, NOAA Fisheries does not anticipate any adverse impacts to finfish or protected resources. Recreational fishing gear is generally believed to have high post-release survival rates such that bycatch mortality may not increase even though bycatch rates could increase. Alternatives F1 through F4 would either maintain existing catch limits or slightly decrease shark landings because increased size limits would decrease the percentage of sharks that could be retained, except for bonnethead sharks. NOAA Fisheries does not expect the allowance to land bonnethead sharks without a minimum size to result in increased fishing effort. Alternative F5, which would decrease the size limit for non-ridgeback sharks in the Gulf of Mexico, may result in slightly increased fishing effort in one region but NOAA Fisheries does not expect any increase to be large, if it occurs at all. Under Alternative F6, catches of finfish or protected resources may increase because recreational shark fishing effort may increase due to the lack of shark size limits. However, as noted above, recreational fishing gear is generally believed to have high post-release survival rates such that bycatch mortality may not increase even though bycatch rates could increase.

Under alternatives F1 through F6, NOAA Fisheries does not expect any adverse impacts to EFH because recreational fishing gear is not believed to interact with bottom structures or otherwise damage habitat.

Social and Economic Impacts

Under the no action alternative, F1, NOAA Fisheries does not anticipate any substantive change, either positive or negative, in social or economic impacts. Recreational fishermen have been operating under the present minimum size limit and allowance for Atlantic sharpnose sharks since it was finalized in the HMS FMP in 1999. The current size limit essentially maintains a catch-and-release only fishery for sharks in nearshore waters. While this size limit applies to fishing within and fish from Federal waters, it may have differentially impacted anglers who were unable to expand their fishing into deeper waters where larger fish predominate. To the extent that anglers want to retain their catch, those anglers who could not expand to offshore fishing may have experienced reductions in their harvest levels. Any reductions may have been mitigated by the allowance for the retention of Atlantic sharpnose sharks with no minimum size. This action likely had minor social impacts for offshore anglers because most of these anglers were already operating within these restrictions. Additionally, the increasing conservation ethic among anglers towards catch-and-release fishing may have mitigated any adverse social impacts of this limit. This alternative may continue to raise safety concerns for recreational fishermen who will have to determine the length of sharks relative to the minimum size.

Alternative F1 would require anglers to release most of the sharks currently caught. Babcock and Pikitch (2002) found that the fraction of management unit sharks released by party and private boats has increased as limits were reduced. Fisher and Ditton (1992) note that most anglers release the fish they catch (over 70 percent of the anglers surveyed said they would be just as happy releasing the fish they caught) and that anglers spent an average of $197 per trip and were willing to spend on average an additional $105 rather than stop fishing for sharks. Fisher and Ditton (1992) also found that 32 percent of shark anglers said that no other species would be an acceptable substitute for sharks.

While it is possible that some anglers may not pay to only catch and release or tag and release sharks, it is also possible that anglers may pay additional money for the challenge of catching a large, adult shark. This is especially true in the long-term as the stock rebuilds and large sharks become more abundant. Over 60 percent of those surveyed said they would rather catch one or two big fish than 10 smaller fish. Also, 76 percent of those surveyed said that they fish in the saltwater for the challenge (Fisher and Ditton, 1992). Fisher and Ditton (1992) state that "shark anglers are intimately involved in fishing for big fish, and for many it is probably a central life interest." Based on the above considerations, NOAA Fisheries does not believe that maintaining the current minimum size limit will affect angler consumer surplus significantly in LCS or SCS recreational fisheries. This limit is unlikely to reduce pelagic shark tournament landings as most tournaments have self-imposed species-specific minimum weight requirements which limit landings to fish exceeding this limit. In the short-term, this alternative will allow for the

continuation of current revenues to charterboat owners and captains and others who rely on the recreational shark fishery. In the long-term, as shark stocks rebuild, revenues may increase as less time would be required to catch sharks and as larger sharks become more abundant.

Alternative F2, the preferred alternative, would allow the retention of bonnethead sharks with no minimum size in addition to the existing size limits (alternative F1). NOAA Fisheries expects this alternative to have positive social and economic impacts because the current fishery regulations are more restrictive. The rationale for this alternative is that bonnethead sharks are easy to identify and are an important catch in some regions, but do not reach the minimum size presently in effect. This alternative would give anglers aboard headboats and charter vessels a greater opportunity to land a shark. Between 1995 and 2000, bonnethead sharks were consistently the second-most important small coastal shark species caught recreationally (Cortes, 2002). Allowing the retention of bonnethead sharks with no minimum size may increase willingness to pay, angler consumer surplus, and current revenues to charter/headboat owners/captains and others who rely on the recreational shark fishery.

Alternative F3 would increase the existing size limit to 5.0 feet fork length for all sharks and may have negative social and economic impacts on nearshore anglers and the supporting recreational industry. It would expand the catch-and-release fishery for sharks in nearshore waters, where juvenile and subadult sharks predominate, and may reduce recreational landings from offshore waters. While this alternative would apply to fishing within and fish from Federal waters, it may differentially impact anglers who are unable to expand their fishing into deeper waters where larger fish are more common. To the extent that anglers want to retain their catch, those anglers who cannot expand to offshore fishing may experience reductions in harvest levels. Any reductions in harvest could be mitigated by the allowances for the retention of bonnethead and Atlantic sharpnose sharks with no minimum size. This alternative would likely have minor social impacts for offshore anglers because they are currently operating under the 4.5 feet fork length minimum size and are already targeting large, adult fish. This alternative may have variable economic impacts depending on the willingness of anglers to release sharks caught and substitute other fish for sharks. It will require anglers to release most of the sharks currently caught. Fisher and Ditton (1992) note that most anglers release the fish they catch (over 70 percent of the anglers surveyed said they would be just as happy releasing the fish they caught). Given this evidence, NOAA Fisheries does not believe this minimum size would have a large adverse impact on angler consumer surplus in LCS, SCS, or pelagic shark recreational fisheries. In the short-term, this alternative could allow for the continuation of current revenues to charterboat owners, captains, and others who rely on the recreational shark fishery. In the long-term, as shark stocks rebuild, revenues may increase as less time would be required to catch sharks and as larger sharks increase in abundance. This alternative may continue safety concerns for recreational fishermen who will have to determine the length of sharks relative to the minimum size.

NOAA Fisheries expects alternative F4 to have similar social and economic impacts as alternative F3. Alternative F4 allows for the retention of non-ridgeback LCS with a 4.5 feet fork

length minimum size, while still requiring the 5.0 feet fork length minimum size for ridgeback sharks. The 4.5 feet fork length size limit for non-ridgeback sharks, combined with the allowances for the retention of bonnethead and Atlantic sharpnose sharks with no minimum size, could potentially mitigate some of the negative social and economic impacts associated with the 5.0 feet fork length size limit in alternative F3. However, many anglers may find these size limits difficult to comply with if they are unable to differentiate between ridgeback and non-ridgeback sharks. These limits may also be more difficult to enforce than one size limit for all sharks. According to Babcock and Pikitch (2002), the majority of sharks sampled by the MRFSS are below the present 4.5 feet fork length size limit.

NOAA Fisheries expects alternative F5 to have similar social and economic impacts as alternative F3. Alternative F5 allows for the retention of Atlantic region non-ridgeback LCS with a 4.5 feet fork length minimum size, allows for the retention of Gulf region non-ridgeback LCS with a 4.0 feet fork length minimum size, while still requiring the 5.0 feet fork length minimum size for all ridgeback sharks and allowing the retention of Atlantic sharpnose and bonnethead sharks with no minimum size. The smaller size limits for non-ridgeback sharks and no size limits for Atlantic sharpnose and bonnethead sharks could potentially mitigate some of the negative social and economic impacts that may be associated with the 5.0 feet fork length all shark minimum size limit in alternative F3. However, many anglers may find these size limits difficult to comply with if they are unable to differentiate between ridgeback and non-ridgeback sharks. These limits may also be more difficult to enforce than one size limit for all sharks. This alternative also requires anglers to know the region in which they are fishing. This could be confusing for anglers fishing in the Florida Keys and could create enforcement problems.

Under alternative F6, LCS, SCS, and pelagic sharks would not be subject to a minimum size for landing. This alternative would likely result in an increase in participation in the recreational shark fishery and have positive social and economic impacts, at least in the short-term. However, in the long-term, if mortality of LCS, SCS, and pelagic sharks increase, the stocks may decline. If stocks decline, more fishing effort will be required to catch sharks, which would likely result in reduced revenues and increased costs for charterboat and headboat operations. Angler consumer surplus may also decline for shark-targeted trips.

Conclusion

Alternative F2 is preferred because, if combined with alternative E2, it will allow rebuilding of LCS shark stocks within the rebuilding time frame. In addition, alternative F2 increases positive social and economic impacts by allowing retention of bonnethead sharks without a minimum size and without increasing fishing mortality beyond sustainable levels. Bonnethead sharks are not overfished and are not experiencing overfishing. Additionally, they are a regionally important species in recreational fisheries and are also an easily identified species so misidentification problems should be minimized.

4.3.3 Authorized Gears for Recreational Shark Fishing

As described in Chapter 2, the alternatives considered for authorized gears in recreational shark fisheries are:

G1 Any authorized gear (No Action)
G2 Only allow handline and rod and reel gear in the recreational shark fishery - Preferred Alternative

Ecological Impacts

The no action alternative, G1, would continue to allow any authorized gear to be used to fish for sharks recreationally. Under the no action alternative, recreational fishermen would be allowed to continue using fishing gears traditionally used in commercial fishing operations and which are thought to have higher bycatch and post-release mortality rates for sharks, finfish, and protected species than handline and rod and reel gear. NOAA Fisheries believes that this alternative could allow higher rates of bycatch and bycatch mortality to continue.

Alternative G2, the preferred alternative, would limit the allowable gears in the recreational shark fishery to handline and rod and reel gear and would promote greater consistency within recreational HMS fisheries. Presently, fishermen may use gears traditionally considered to be commercial gears to land sharks recreationally. This alternative may increase discards if fishermen are not allowed to retain sharks caught incidentally with other gears. However, this alternative may promote the use of gears with lower bycatch and bycatch mortality of sharks, finfish, and protected species, and therefore may have positive ecological impacts.

NOAA Fisheries has received public comment that alternative G2 would not allow recreational fishermen using gillnets, spearguns, bandit gear, and harpoons to retain sharks. This is correct, however, the vast majority of recreational fishermen use rod and reel or handline gear. Sharks taken recreationally in Federal waters with gears other than rod and reel and handline would be required to be released. Anglers cannot retain sharks taken with spearguns currently, thus, this alternative will not affect those fishermen. This alternative is not likely to increase discards substantially.

Under alternatives G1 and G2, no changes to impacts on EFH are expected because neither commercial or recreational shark fishing gears are believed to cause more than minimal adverse impacts, if any adverse impacts at all, to EFH.

Social and Economic Impacts

Under the no action alternative, G1, NOAA Fisheries does not anticipate any change, either positive or negative, in social or economic impacts because fishermen would not need to adjust or convert to new forms of fishing gear.

NOAA Fisheries does not expect alternative G2 to have any substantive social or economic impacts because the majority of recreational fishermen already use rod and reel and handline gear. Fishermen who are unable to hold or operate rod and reel or handline gear may apply for an exempted fishing permit (EFP) that would allow them to fish for sharks recreationally with an alternative gear. Fishermen who do not use rod and reel or handline gear generally use commercial gears and land sharks incidentally. No economic costs are expected because this alternative would restrict gears used for recreational shark fishing, and sharks retained recreationally cannot be sold. However, if this alternative results in increased discards relative to alternative G1, then negative social impacts may result as fishermen may be forced to discard sharks and increase waste.

Conclusion

Alternative G2 is preferred to promote uniformity within recreational HMS fisheries and to promote recreational fishing gears, which are thought to have lower post-release mortality rates.

4.4 DEEPWATER AND OTHER SHARKS

As described in Chapter 2, the alternatives considered for the deepwater/other species group are below. Note that alternatives described in Section 4.5 (prohibited species) also discuss deepwater and other sharks.

H1 Retain established species group (No Action)
H2 Remove species group from management unit; data collection only - Preferred Alternative

Ecological Impacts

The species in this group include the catsharks, lanternsharks, and smooth dogfish. In general, these species are slow growing compared to other sharks and are occasionally caught in deepwater trawls. At this time, there are no known fishermen who target these species.

The no action alternative, H1, would maintain the current deepwater and other species group in the management unit. This alternative would have no measurable ecological impacts because there are no known significant landings of these species and they are not subject to the permit and reporting requirements, retention limits, or quotas established in the HMS FMP. Morever, this group was added to the management unit to protect these species from being finned (see pages 3-177 and 3-178 of the HMS FMP), and the Shark Finning Prohibition Act now bans shark finning (67 FR 6194, February 11, 2002).

Alternative H2, the preferred alternative, would remove the deepwater and other species group from the management unit and require data collection only. This alternative would likely have no significant ecological impacts as there are no known significant landings of species in this

group and the Shark Finning Prohibition Act now protects these species from being finned (67 FR 6194, February 11, 2002). If directed fisheries started, NOAA Fisheries would evaluate data available at that time to see if an FMP amendment or other regulatory measures would be warranted. During the public comment period, NOAA Fisheries received comments concerned with the amount of time it may take to re-establish these species in the management unit. NOAA Fisheries believes it could re-establish the deepwater and other species group in the management unit within a short time frame. Additionally, to the extent that deepwater and other sharks are not caught by HMS fishermen, action to protect deepwater and other sharks may be needed from or in coordination with the Fishery Management Councils. NOAA Fisheries has received public comment that data collection should continue for these species until they can be assessed or until a fishery develops.

Under alternatives H1 and H2, no impacts on finfish, protected species, or EFH are expected because no changes to fishing patterns or effort would result.

Social and Economic Impacts

NOAA Fisheries does not expect alternative H1 or H2 to have significant social or economic impacts because there are no known significant landings of species in this group and no known fishermen target these species.

Conclusion

Alternative H2 is preferred because the only protection afforded under the HMS FMP, a ban on finning, is now afforded nationally under the Shark Finning Prohibition Act. Given the national protection, NOAA Fisheries believes that maintaining data collection only on these species is sufficient.

4.5 PROHIBITED SPECIES

As described in Chapter 2, the alternatives considered for prohibited species are:

I1	Retain established species group (19 species) (No Action)
I2	Return to the five species in 1997; white, sand tiger, bigeye sand tiger, whale, and basking shark
I3	Retain established prohibited species group (I1) and add finetooth shark
I4	Retain established species group (I1) and remove dusky shark
I5	Add the deepwater/other species group to the prohibited species group
I6	*Retain established prohibited species group (I1) and establish criteria for the addition and removal of species to/from the prohibited species group - Preferred Alternative*

Ecological Impacts

The no action alternative, I1, would have minor ecological impacts as it maintains the current prohibited species group with the 19 species identified in the HMS FMP. The HMS FMP prohibited the retention of these species because they were known to be vulnerable to overfishing, uncommon, or seriously depleted. NOAA Fisheries has afforded these species the maximum protection possible within its fisheries management jurisdiction. However, many species currently in the prohibited species group have high bycatch mortalities and may not survive the capture experience so that they would be discarded dead. This action may not be fully effective in that prohibited species may be improperly identified and landed in commercial and recreational fisheries. These identification problems could be mitigated with increased education and outreach efforts.

Alternative I2 would return to the 1997 prohibition on the possession of whale, basking, sand tiger, bigeye sand tiger, and white sharks within Federal waters. These five species were identified as highly susceptible to overexploitation and the prohibition on possession was a precautionary measure to ensure that directed fisheries did not develop. Compared to alternative I1, this alternative could have significant ecological impacts in that it could allow dusky and other sharks currently in the prohibited species group to be landed, which could potentially increase mortality, substantially, of dusky and other overfished/vulnerable sharks that have market value. The effects of this alternative may be mitigated by the reduction in fishing effort that may occur if these species are retained and counted against trip limits, quotas, and other management measures.

Alternative I3 would retain the established prohibited species group and add finetooth sharks. The 2002 SCS stock assessment indicated that finetooth sharks, although not overfished, are experiencing overfishing (Cortes, 2002). This alternative would have limited ecological impacts as finetooth sharks are common bycatch in non-HMS fisheries and prohibiting them will not prevent their capture. A reduction in finetooth shark landings in HMS fisheries may not significantly reduce mortality because they are only a small component of total landings. This alternative may help to reduce mortality of this species but could also increase waste and discards. Impacts to other species would be similar to alternative I1. In regard to alternative I6, finetooth sharks are not depleted and are commonly caught in HMS and non-HMS fisheries. Therefore, this species does not appear to meet the criteria selected under alternative I6, at this time.

Alternative I4 would remove the dusky shark from the current prohibited species group and would likely have significant ecological impacts. Dusky shark catch rate data indicate large population declines since the early 1970s. Dusky sharks have a high bycatch mortality, approximately 80 percent, and are usually dead when gear is retrieved. Although commercial shark fishery observer data show that dusky sharks comprise approximately one percent of total catch in recent years, this alternative could result in increased mortality of this overfished species by allowing the retention of individuals that may otherwise be released alive. However, allowing

dusky sharks to be retained and counted against trip limits and quotas could reduce overall effort in the fishery and may help to reduce waste. Impacts to other species would be similar to alternative I1. In regard to alternative I6, dusky shark data indicate that the species is still depleted and compared to other species is rarely observed caught in the bottom longline fishery (less than one percent of total catch). However, anecdotal evidence indicates more dusky sharks are being caught. NOAA Fisheries may conduct a stock assessment in the near future and will reconsider removing the dusky shark based on the results of that stock assessment.

Alternative I5 would add the species presently in the deepwater and other group to the prohibited species group (this alternative would require implementation of alternative H1). This alternative would likely have only minor ecological impacts because there are only minor landings of these species through bycatch in other non-HMS fisheries and that bycatch would likely continue regardless of a prohibition. Current regulations only protect these species against finning. However, this alternative takes a precautionary approach to managing these species. Further, prohibiting the landing of these species in HMS fisheries may limit the availability of data pertaining to them because the few deepwater sharks that are caught would need to be released. Impacts to other species would be similar to alternative I1. In regard to alternative I6, there are no data indicating stock declines at this time, and while the species are rarely caught in any fisheries, NOAA Fisheries believes there are no fisheries targeting them.

Alternative I6, the preferred alternative, would establish criteria for the addition and removal of species to/from the prohibited species group and would not likely result in significant ecological impacts, at least in the short-term because this alternative would not make any changes to the prohibited species group at this time. However, in the long-term, this alternative could allow for faster rebuilding and stock maintenance for species meeting these criteria, if bycatch mortality is not too large. For those species that may be removed from the group in the future, impacts would vary depending on fishing patterns and effort at that time. While alternative I6 lays out criteria for the inclusion and removal of species from the prohibited species list, species will be considered on a case by case basis in future rulemaking, as needed or as petitioned by the public.

As described in Chapter 2, a species could be added to the prohibited species list if at least two of the following criteria are met: (1) There is sufficient biological information to indicate the stock warrants protection, such as indications of depletion or low reproductive potential or the species is on the ESA candidate list; (2) the species is rarely encountered or observed caught in HMS fisheries; (3) the species is not commonly encountered or observed caught as bycatch in fishing operations; or (4) the species is difficult to distinguish from other prohibited species (i.e., look-alike issue). Alternatively, a species could be removed from the prohibited species list if it meets only one criterion.

Under alternatives I1 through I6, NOAA Fisheries does anticipate any adverse impacts on finfish, protected species, or EFH at this time. Alternatives I1, I3, and I5 are not expected to change fishing patterns or effort. Alternatives I2 and I4 could potentially reduce fishing effort, although this reduction would likely be minimal. While alternative I6 would establish criteria for addition

and removal of species to/from the prohibited species group, it would not make any changes to the group at this time. Accordingly, fishing patterns and effort are not expected to change. Specific impacts to finfish, protected species, or EFH would be considered in future rulemaking that applies the alternative I6 criteria.

Social and Economic Impacts

Under the no action alternative, I1, NOAA Fisheries does not anticipate any substantive change, either positive or negative, in social or economic impacts because fishermen are already operating under these restrictions.

Alternative I2 could have positive social and economic impacts for both commercial and recreational fishermen in the short-term, and negative social and economic impacts in the long-term. In the short-term, it could allow dusky sharks and other occasionally-caught sharks to be landed commercially, marketed, and utilized. This could reduce the time at sea needed to reach trip limits and may increase revenues for commercial fishermen and dealers. This alternative may increase recreational angler participation because dusky sharks used to be targeted as a large game fish in recreational fisheries. Business and associated profits within the recreational charter/headboat industry and consumer angler surplus may increase. However, in the long-term, if these overfished/vulnerable shark stocks decline, more fishing effort will be required to catch these species, and would likely result in increased costs and reduced revenues for commercial fishermen and charterboat and headboat operations. Angler consumer surplus may also decline for shark-targeted trips.

Alternative I3, would add finetooth sharks to the established prohibited species list and would likely have negative social and economic impacts in both commercial and recreational fisheries. Finetooth sharks are a common catch in both commercial and recreational fisheries and prohibiting their possession could likely result in increased costs and reduced revenues for commercial fishermen and charterboat and headboat operations, relative to alternative I1. Finetooth sharks accounted for over one-third of all commercial SCS landings in 1998 - 2000 (Cortes, 2002) and are a regionally important recreational species (Cortes and Neer, 2002).

Alternative I4 would likely have positive social and economic impacts similar to alternative I2. Due to the multispecies nature of the fishery, many fishermen find it difficult to avoid interacting with dusky sharks. This alternative could allow dusky sharks to be landed commercially, marketed, and utilized. This could reduce the time at sea needed to reach trip limits and may increase revenues for commercial fishermen, fish dealers, and processors. This alternative may increase recreational angler participation because dusky sharks used to be targeted as a large game fish in recreational fisheries. Business and associated profits within the recreational charter/headboat industry and consumer angler surplus may increase. However, in the long-term, if the overfished dusky stocks decline further, more fishing effort would be required to catch this species, and would likely result in increased costs and reduced revenues for commercial

fishermen and charterboat and headboat operations. Angler consumer surplus may also decline for shark-targeted trips.

NOAA Fisheries expects alternative I5 to have only *de minimis* (negligible) social or economic impacts as there are only minor landings of the deepwater/other species through bycatch in other fisheries.

Alternative I6, the preferred alternative, could have positive social impacts as it would clarify reasons for prohibiting species, ease the administrative burden associated with the addition and removal of species, and could allow for more rapid and adaptive management. Alternative I6 could have variable economic impacts as species are added/removed to/from the prohibited species group. Negative economic impacts could result if species that are important commercially or recreationally are added to the prohibited species group, and positive economic impacts could result if commercially valuable species or species valued by the recreational sector are removed from the prohibited species group.

Conclusion

Alternative I6 is preferred because it would clarify the reasons and criteria for adding or removing species to the prohibited species group. Until such a mechanism is finalized and fully implemented, NOAA Fisheries does not feel justified in making changes to the prohibited species list. Additionally, alternative I6 could ease the administrative burden of addition and removal of species and would allow for more rapid and adaptive management.

A petition for rulemaking should contain sufficient information for NOAA Fisheries to consider the substance of the petition. For a petition regarding changes to the prohibited species list, the petition should at a minimum:

- Indicate what species are proposed to be added to or removed from the list
- Identify which criteria warrant the addition or removal of the species
- Provide data, information, etc., relevant to those identified criteria
- State the resources necessary to develop the proposed regulations
- Explain the interest of the petitioner in the action requested
- Indicate the size of the population affected (i.e., who is affected by action)
- Indicate the public interest in the proposed regulation
- Explain the importance of the action requested to promoting established NOAA Fisheries' priorities and policies

4.6 BYCATCH REDUCTION MEASURES

Under the National Standard 9 guidelines, NOAA Fisheries is required to consider 10 factors when considering measures to minimize bycatch and bycatch mortality to the extent practicable. These factors are below. NOAA Fisheries considered all of these factors for each alternative below.

(A) Population effects for the bycatch species;
(B) Ecological effects due to changes in the bycatch of that species (effects on other species in the ecosystem);
C) Changes in the bycatch of other species of fish and the resulting population and ecosystem effects;
(D) Effects on marine mammals and birds;
(E) Changes in fishing, processing, disposal, and marketing costs;
(F) Changes in fishing practices and behavior of fishermen;
(G) Changes in research, administration, and enforcement costs and management effectiveness;
(H) Changes in the economic, social, or cultural value of fishing activities and nonconsumptive uses of fishery resources;
(I) Changes in the distribution of benefits and costs; and,
(J) Social effects.

4.6.1 Gear Restrictions

As described in Chapter 2, the alternatives considered for bycatch reduction measures are:

J1	Gillnet - net checks, Atlantic Large Whale Take Reduction Plan (ALWTRP), observers; Bottom longline - post guidelines (No Action)
J2	Existing bycatch reduction measures (J1) plus closing the shark gillnet fishery permanently/Remove gear from list of authorized gear types
J3	Existing bycatch reduction measures (J1) and allow only strikenet method in shark gillnet fishery
J4	*Existing bycatch reduction measures (J1) plus requiring VMS on shark gillnet vessels during right whale calving season and requiring VMS on directed bottom longline shark fishing vessels operating near the time/area closure off North Carolina - Preferred Alternative*
J5	*Existing bycatch reduction measures (J1) plus requiring the use of non-stainless steel corrodible hooks, the possession of release equipment on vessels with shark bottom longline gear (line cutters, dipnets, and, when approved, dehooking devices), and that bottom longline vessels move 1 nautical mile after an interaction with a protected species - Preferred Alternative*
J6	Existing bycatch reduction measures (J1) plus limiting shark bottom longline gear to a maximum of 10 miles of mainline, limiting soak time to 10 hours or less, and requiring the use of non-stainless steel corrodible circle hooks

J7 Existing bycatch reduction measures (J1) plus requiring the retention of all sharks caught in commercial shark fisheries; no discards allowed

J8 Existing bycatch reduction measures (J1) plus requiring commercial and recreational fishermen to attend workshops on present regulations, species identification, and release techniques

Ecological Impacts

The no action alternative, J1, would maintain the existing requirements on shark gillnet and bottom longline vessels. These requirements were put in place, for the most part, to reduce interactions and mortalities of protected species. Removal of these restrictions could have negative ecological impacts on protected species. This alternative would continue to provide some positive ecological impacts by maintaining measures to monitor fishery operations and reduce the mortality of protected resources. Currently, vessels participating in the shark gillnet fishery have observer, net check, and ALWTRP requirements. Bottom longline vessels are required to post handling and release guidelines.

A total of 43 sea turtles (31 loggerhead, 4 leatherback, and 8 unidentified sea turtles), two delphinids, and seven sawfish have been observed caught in the shark bottom longline fishery from 1994 to 2002 (Burgess and Morgan, 2003; G. Burgess, pers. com., 2003). Based on observer data, NOAA Fisheries estimates that a total of 2,003 loggerhead sea turtles, 269 leatherback sea turtles, and 503 unidentified sea turtles were taken in the shark bottom longline fishery from 1994 through 2002. Average annual takes are estimated to have been 222 loggerhead sea turtles, 30 leatherback sea turtles, 56 unidentified sea turtles, and 52 sawfish (NOAA, 2003b).

Over a five year period, the expected take of sea turtles from the shark bottom longline fishery would be 1,360 total loggerhead sea turtle captures with 754 mortalities; 150 total leatherback sea turtle captures with 85 mortalities; and, 30 total green, Kemp's ridley, or hawksbill turtle captures, combined, of which five mortalities for each species would be expected. Additionally, 260 smalltooth sawfish would be expected to be captured and released with no mortalities (NOAA, 2003b).

Since 1999, 21 sea turtles (1 hawksbill, 4 loggerhead, and 16 leatherback sea turtles) and 14 marine mammals (4 spotted dolphins, and 10 bottlenose dolphins) have been observed caught in the shark drift gillnet fishery (NOAA Fisheries, 2000, 2001, 2002, 2003a). In addition, one smalltooth sawfish was observed caught in a shark drift gillnet in July 2003 and was released alive (J. Carlson, pers. comm., 2003). Extrapolated observations from these data suggest serious injury and mortality of 25 bottlenose dolphin and one Atlantic spotted dolphin in the shark gillnet fishery from 1999 through 2002 (Garrison, 2003). The estimated takes of loggerhead sea turtles by year are: 1999 - none; 2000 - one mortality and 4.4 live takes; 2001 - one live take; and 2002 - 1.7 live takes. The estimated takes of leatherback sea turtles by year are: 1999 - none; 2000 - none; 2001 - 2 mortalities and 12 live takes; and 2002 - 3.4 live takes.

NOAA Fisheries estimates that, over a 5-year period, the expected take of sea turtles from the shark gillnet fishery would be 10 total loggerhead sea turtle captures with one mortality, and 22 total leatherback sea turtle captures with three mortalities. Additionally, one smalltooth sawfish would be expected to be captured and released alive during the same period (NOAA Fisheries, 2003b).

In the BiOp conducted for this rulemaking, NOAA Fisheries determined that the continued operation of the shark fisheries would not adversely affect marine mammals, and is not likely to jeopardize the continued existence of the endangered Kemp's Ridley, green, hawksbill, and leatherback sea turtles, and the threatened loggerhead sea turtle (NOAA Fisheries, 2003b).

The bycatch of non-target species and expanded take estimates of protected resources in the shark bottom longline and shark gillnet fisheries are discussed in Section 3.5. Catches and landings of target species are discussed in Section 3.3.

Alternative J2 would close the shark gillnet fishery permanently and would remove gillnet gear from the list of authorized gear types. This alternative would likely have positive ecological impacts. It may reduce bycatch and bycatch mortality of protected resources, other HMS and non-HMS species, and could reduce fishing effort in right whale critical habitat. This would support the goals of NS 9. Currently, only five vessels use gillnets to target sharks but other vessels use gillnets to target other species and catch sharks incidental to their activities. As such, any potential reductions in associated mortalities may not be large. A permanent closure of the shark gillnet fishery may also displace effort into other fisheries where bycatch and bycatch mortality may be as great or greater. The impacts to shark species would likely be positive, especially for SCS (since the shark gillnet fishery lands mostly SCS), but may be negated if other authorized gears/fisheries increase their landings respectively. However, to the extent that the fishermen who land sharks incidental to their other activities need to increase effort to offset the loss of sharks, bycatch of sharks may increase.

Alternative J3 would require that vessels operating in the shark gillnet fishery set gear using the strikenet method only. This alternative would likely result in positive ecological impacts as the shark strikenet fishery produces little bycatch (no observed protected species interactions/the majority of catch is target species). The strikenet fishery produces little bycatch because strikenet fishermen actively set their gear around aggregations of sharks and retrieve the gear quickly. This alternative could minimize protected resource interactions and the bycatch of non-target species within the shark gillnet fishery while still supporting the goals of NS 9. Alternative J3 would allow incidental shark landings from vessels participating in other gillnet fisheries, such as the mackerel fishery, to minimize discards

Alternative J3 was preferred in the draft Amendment because NOAA Fisheries believed there would be ecological benefits due to reduced bycatch of protected species and non-target finfish (e.g., red drum, tarpon, and other game fish). However, this alternative is not preferred in this

final document. Upon closer examination, NOAA Fisheries found that, in terms of actual numbers, relatively few sea turtles have been captured in the shark gillnet fisheries compared to other fisheries. This has been further substantiated by recent studies performed by NOAA's Southeast Fisheries Science Center indicating that interactions with protected species in the shark gillnet fishery are a rare event (Garrison, 2003). In the October 29, 2003 BiOp, NOAA Fisheries estimated that the expected take of sea turtles and sawfish in the shark gillnet fishery over a five-year period would be 10 total loggerhead sea turtle captures with one mortality, 22 total leatherback sea turtle captures with three mortalities, and one smalltooth sawfish released alive (NOAA Fisheries, 2003b). In addition, some fishermen who use shark drift gillnet gear claim to have modified their gear in efforts to reduce interactions with protected resources. One commenter reported that he has modified his nets to float higher in the water column and use less weight, in an attempt to allow any entangled sea turtles to reach the surface and better survive. Another commenter reported that he has switched to nets with a smaller mesh size and claims to have increased his Atlantic sharpnose shark catch and decreased his interactions with protected resources.

Some commenters expressed concern regarding the ecological impacts of shark gillnets on non-target species including, red drum, tarpon, and other game fish. As discussed in Section 3.5, observer data indicate that the shark gillnet fishery does not catch large numbers of these species. In regard to red drum in particular, 28 fish were observed caught in 2002, of which 50 percent were released alive. One commenter stated that while targeting SCS with driftnet gear, one of the biggest discard species is king mackerel. The net fishermen have petitioned the South Atlantic Fishery Management Council to allow more of these fish to be retained, thereby reducing regulatory discards. Many commenters stated that NOAA Fisheries should consider gear modifications to reduce bycatch of protected resources and non-target species.

With regards to impacts on sharks, some commenters indicated that Atlantic sharpnose and blacktip sharks make up the majority of the drift gillnet landings and that these species are not overfished and overfishing is not occurring according to the latest stock assessments

NOAA Fisheries believes that gear modifications or other measures may be effective to reduce protected resource interactions and bycatch and bycatch mortality of non-target species while allowing the shark gillnet fishery to continue. NOAA Fisheries may consider gear modification or other options for this fishery in a future rulemaking and encourages fishermen to submit comments regarding suitable gillnet gear modification options.

Alternative J4, a preferred alternative, would require VMS on shark gillnet vessels during right whale calving season and would require VMS on directed bottom longline shark fishing vessels near the selected time/area closure or any future closures. This alternative is consistent with the rationale for requiring VMS on pelagic longline vessels (i.e., enforcement of time/area closures). If used in conjunction with closed areas, alternative J4 could enhance rebuilding to MSY levels for LCS. The ecological cost of not enforcing a time/area closure effectively is further depletion of fully or overfished stocks with longer times to rebuilding.

Alternative J5, a preferred alternative, would require the use of non-stainless steel corrodible hooks aboard shark bottom longline fishing vessels, require the possession of release equipment (line cutters, dipnets, and, when approved, dehooking devices) on vessels with shark bottom longline gear, and require bottom longline vessels to move one nautical mile after an interaction with a protected species. Both corrodible hooks and release equipment may reduce post-release mortality of protected species, sharks, and finfish, however, impacts are not quantified at this time. Release equipment is inexpensive and relatively simple to use and the pelagic longline fishery has similar release equipment requirements. The requirement to move one nautical mile after an interaction with protected species such as a marine mammal, sea turtle, or sawfish would reduce the probability of another interaction with a protected species because these species often aggregate in clusters. By requiring vessels to move after an interaction, the vessel would increase the likelihood of avoiding additional animals in a cluster when setting subsequent gear. This alternative would likely have positive ecological impacts and would support the goals of NS 9. The positive ecological impacts of this alternative could be enhanced by providing educational workshops where, in addition to other topics, NOAA Fisheries could demonstrate release techniques and ensure that fishermen were trained in the proper use of release equipment.

Alternative J6 would cap the allowable length of each shark bottom longline gear in the water to 10 miles, establish a 10 hour maximum soak time, and require that all shark bottom longlines be rigged with non-stainless steel corrodible circle hooks in order to limit effort and decrease mortality and waste. This alternative would likely have positive ecological impacts and would support the goals of NS 9. Periodically, fishermen are forced to cease gear haul-back operations, leave the remainder of their longline gear and catch in the water, and return to port for offloading because they have reached the 4,000 lb trip limit or for other reasons. By capping the allowable length of shark bottom longline gear, this alternative may reduce the chances of one set catching more than the 4,000 lb trip limit and could reduce the mortality of species remaining attached to the gear. The Commercial Shark Fishery Observer Program (CSFOP) observed nine trips from 1994 - 2002 that reached the 4,000 lb trip limit with one set. Of those nine trips, three could only be partially retrieved due to reaching the trip limit. The mainlines of these sets were 12.0, 6.0, and 13.3 miles long, with an average of 10.4 miles. (G. Burgess, pers. comm., 2003).

Alternative J6 would also establish a 10 hour maximum soak time. Shorter soak times could allow incidental catch and bycatch to be released sooner and with less injury, which could lead to increased survivability of protected and non-target species. However, reductions in soak time could cause fishermen to increase the number of sets fished per trip, or the number of hooks fished per set, and may result in increased effort and unsafe conditions. In a recent analysis conducted by the Virginia Institute of Marine Science, researchers found that soak time influenced hooking mortality of dusky sharks. The researchers found that hooking mortality for dusky sharks was 85 percent for soak times greater than 20 hours, 79 percent for soak times greater than 15 hours, and 57 percent for soak times less than 15 hours. Dusky sharks were found to have the lowest hooking mortality (five percent) on sets with soak times less than 10 hours (Romine *et al.*, 2001). According to observer data (GSAFDF, 1997), average shark bottom longline sets generally last between 10.1 and 14.9 hours, with some areas having a much smaller

average. Burgess and Morgan (2003) report average shark bottom longline soak times for 2000 - 2002 as 9.0 hours in the Florida East Coast region, 12.3 in the Florida Gulf Coast region, and 13.6 hours in the Carolina region.

Alternative J6 would also require that all shark bottom longlines be rigged with non-stainless steel corrodible circle hooks. The use or possession of straight shank ("J") hooks, or any variation of stainless steel hook, would be prohibited on shark bottom longline vessels. Circle hooks generally lodge in the corner of the mouth rather than in the throat or gut. Sharks and finfish that are not retained are more likely to be released with less injury. Protected species would also likely benefit from reduced injuries, as circle hooks are less likely to hook in the throat or gut. Although no specific research on circle hook use in shark bottom longline fisheries is available, circle hooks have been found to significantly reduce the rate of hook ingestion by loggerhead turtles and reduce the associated post-hooking mortality (Watson, *et al.*, 2003).

Alternative J7 would require all sharks caught in commercial shark fisheries to be retained and landed. This alternative could have both positive and negative ecological impacts. It could virtually eliminate the bycatch of sharks in the commercial shark fishery and reduce the fishing effort needed to reach trip limits and fill quotas, thus reducing potential interactions with protected species. However, it could increase mortality of juvenile sharks, prohibited species, and other sharks normally not retained. Fishermen may also high-grade and discard less marketable species to avoid reaching the trip limit, increasing waste.

Alternative J8, would require both commercial and recreational fishermen to attend educational workshops and would likely result in positive ecological impacts. This alternative could: (1) reduce bycatch mortality by demonstrating handling and release techniques for finfish, sea turtles, and marine mammals; (2) improve shark (and possibly other) species identification; (3) improve compliance with current regulations; and (4) improve the accuracy of reported data. This alternative would likely benefit overfished stocks of HMS by increasing post-release survival of all species discarded. During the public comment period, commenters stated that the development of educational programs could improve shark species identification which may improve compliance and rebuilding efforts. The commenters also claimed that the proper use of release equipment, taught in a controlled environment, may reduce bycatch mortality and should be available to both commercial and recreational fishermen. Further, one commenter stated that educational workshop training should be a prerequisite for obtaining an HMS Angling category permit.

Alternative J1 would likely have no impacts on EFH because it would not change fishing patterns or effort. Alternatives J2 and J3 may have positive impacts on EFH by eliminating and substantially restricting, respectively, fishing effort. However, neither shark drift gillnets nor shark strikenets are believed to have adverse impacts on EFH so that any positive impacts would likely be small. Alternatives J4, J5, and J8 are largely administrative in nature and would not change fishing patterns or effort, and subsequently would not impact EFH. Alternatives J6 and J7 would likely reduce fishing effort and may have positive impacts on EFH. Alternative J6 may

have measurable positive impacts to EFH because it would limit the amount of bottom longline allowed per set. However, shark bottom longline gear is not believed to adversely affect EFH so positive impacts may not be large.

Social and Economic Impacts

Under the no action alternative, J1, NOAA Fisheries does not anticipate any substantive change, either positive or negative, in social impacts, or any significant change in ex-vessel prices or economic benefits, primarily because this alternative does not change current fishing practices.

All of the alternatives listed above (J1-J8) could have minimal economic benefits if consumers perceive shark fishing vessels as conservation minded or if LCS stocks improve.

Alternative J2 would likely result in significant negative social and economic impacts for the five vessels actively fishing in the shark gillnet fishery or those vessels that land sharks incidental to their other activities but, overall, would not directly affect the vast majority of the entire shark fishing fleet. It would likely cause economic dislocation of affected individuals or small entities, and may put many of them out of business. This alternative would eliminate the need for observer coverage in the shark gillnet fishery and eliminate the associated administrative burden on NOAA Fisheries.

Alternative J3 would likely result in significant negative social and economic impacts for the five vessels actively fishing in the shark gillnet fishery but, overall, would not directly affect the vast majority of the entire shark fishing fleet. It may result in large decreases in revenues for fishermen who traditionally fished in the drift gillnet fishery and place financial burdens on those fishermen who may need to purchase a second smaller vessel and outfit it for strikenet fishing. NOAA Fisheries estimates that the smaller vessel could cost between $2,000 and $14,000 to purchase. The use of a second vessel for strikenet fishing may also increase associated operating costs. Additionally, several fishermen that currently strikenet fish also use a spotter plane to locate schools of sharks, which may further increase operating costs for fishermen that would be required to strikenet under this alternative. For those fishermen that currently strikenet fish, this alternative would have less of an impact but may still increase costs if they drift gillnet fished part of the time. Recently, some strikenet vessels have begun striking behind other vessels such as trawl vessels (e.g. shrimp vessels) without a second vessel (Carlson and Baremore, 2002c). This negates the need for a spotter plane and could reduce the variable costs substantially. Their efforts are moderately successful and could reduce the costs of fishing in a strikenet method substantially. Alternative J3 would allow for a reduction in the current observer coverage levels in gillnet fisheries outside right whale calving season. This could reduce the costs associated with observer coverage and the administrative burden on NOAA Fisheries.

During the public comment period, NOAA Fisheries received comments stating that the shark gillnet fishermen generally target Atlantic sharpnose sharks from April 1 through November 15 with drift gillnet gear. The commenters claim that strikenet gear has not been effective at

catching Atlantic sharpnose sharks and they feel that drift gillnet gear is the only effective method of targeting this resource. The commenters wrote that strikenet gear cannot be used to target SCS or LCS during the summer months because these species do not aggregate during those months. Comment was received from fishermen currently active in the shark gillnet fishery stating that if they were not allowed to use drift gillnet gear, their businesses would no longer be viable and that even allowing strikenet gear would put vessels currently using strikenet gear out of business because they could only fish in the winter for LCS.

NOAA Fisheries has also received comments about possible enforcement difficulties associated with allowing strikenets only, stemming from the subtleties of gear deployment. Further comment was received from a state agency supporting the prohibition of shark gillnets in Federal waters to complement similar prohibitions in state waters, thereby minimizing drains on state law enforcement resources.

The intent of this alternative was to allow the commercial shark gillnet fishery to continue while minimizing interactions with protected resources as well as reducing bycatch of non-target species. Through public comment it has been brought to the attention of NOAA Fisheries that allowing the use of strikenets only would not accomplish this objective. Therefore, the final regulations will permit the use of drift gillnets with possible gear modifications or other measures being implemented through a future rulemaking, based upon further study.

Alternative J4, a preferred alternative, would require VMS on shark gillnet vessels during right whale calving season and would require VMS on directed bottom longline shark fishing vessels operating near the time/area closure off of North Carolina. This alternative may result in significant negative economic impacts on small entities but will have minor economic impacts on the fishery as a whole because it would only be required for a few select vessels participating in the shark fishery.

The costs of a VMS unit may be considered burdensome by fishing vessel owners, particularly by those vessels operating at the margin. However, the economic impacts of the VMS program would be necessary to implement the preferred time/area closure effectively. If implemented in conjunction with alternative K2, this alternative could result in five shark gillnet vessels and approximately seven directed bottom longline shark vessels (see analysis in Appendix 4) having to install VMS units at an initial average cost of approximately $1,300 - $3,250 ($1,000 - $2,500 per unit and $300 - $750 installation fee), an average annual maintenance cost of approximately $500/year, and approximately $1.44/day for position reports. NOAA Fisheries believes that requiring VMS for only that sub-population of the shark fishing fleet that fishes in the vicinity of the time/area closures is appropriate because the intent of the measure is to monitor vessel activity to ensure that time/area closures are effective. If other time/area closures are implemented, additional vessels would likely be affected. In an attempt to provide vessel owners with some flexibility and help minimize costs, NOAA Fisheries has type-approved four VMS units from two manufacturers for use in the pelagic longline fisheries. No VMS units have been type-approved specifically for use in the Atlantic shark fisheries as of this date. Based on a range

of VMS units commercially available, NOAA Fisheries expects any VMS unit type-approved for Atlantic shark fisheries to be similar or identical to those type-approved for the pelagic longline fisheries.

VMS has several social and economic benefits, namely that it provides a secure communication system and an emergency beacon and position report (immediate global positioning system distress signal), if needed. VMS would benefit fishermen, and safety of human life at sea, by increasing communication with markets, family members, vessel owners, and the Coast Guard. VMS can show that vessels are not operating in closed areas, may allow vessels to transit closed areas without special gear stowage procedures, and allows for the collection of real-time data. Fishermen may also be eligible for benefits for cooperating with the NOAA Weather Service via their VMS. In addition, VMS could allow confidential real-time logbook reporting if a personal computer is linked to the system which could decrease the paperwork burden on fishermen, observers, and NOAA Fisheries. VMS may increase revenues by allowing less burdensome regulations and more fishing time (up to the time of a closure instead of being in port by the closure).

VMS offers an administrative benefit to NOAA Fisheries as well. The VMS would allow managers to coordinate for observer sampling and coverage in order to achieve coverage goals. It may reduce the need for observer coverage and lessen associated administrative costs, including enforcement costs. Also, with VMS, NOAA Fisheries can identify trips that have started without the required observer and can seek further enforcement of observer regulations.

Alternative J5, a preferred alternative, is designed to reduce bycatch mortality and would likely have only minor social and economic impacts. In addition to existing bycatch reduction measures (alternative J1), vessels with longline gear onboard would be required to possess and use only non-stainless steel corrodible hooks and to possess release equipment (line cutters, dipnets, and, when approved, dehooking devices). Line cutters, dipnets, and dehooking devices are relatively simple to use, but may require training to use effectively. The purchase of release equipment would likely only be a minor expense to most fishermen. The design specifications from the Hawaii pelagic longline fishery, from which the pelagic longline dipnet and line clipper standards were taken, were estimated to cost approximately $250.00 for both devices (65 FR 16346, March 28, 2000). While hook removal devices are commercially available from several vendors, NOAA Fisheries has not implemented specifications like those for line clippers and dipnets and would delay the effective date of this requirement until such time as specifications are developed. Hook removal devices range in price depending on the application, but could cost between $6.00 and $210.00. Fishery participants have largely supported the use of hook removal devices in some applications in HMS fisheries. There are currently similar release equipment requirements in the pelagic longline fishery. Although many shark fishermen may already use non-stainless steel corrodible hooks, this may increase the financial burden on fishermen who will have to purchase new hooks. The requirement to move one nautical mile after an interaction with a protected species could increase fuel costs due to increased time transiting to another fishing area and increase the time needed to fish if alternate fishing grounds are not as productive

for target species. However, because few protected species have been observed caught, NOAA Fisheries does not believe that this requirement would affect more than a few trips for all vessels combined, each year.

NOAA Fisheries has received comment that the use of dehooking devices and disentanglement gear may not only save fishermen money by retrieving hooks, but it may also increase efficiency by reducing the time and effort spent re-rigging gear and removing hooks and line from target and non-target species. One commenter also stated that the use of dehooking and disentanglement gear may speed up fishing operations.

Enforcement of alternative J5 could be challenging. Dockside inspections would identify the presence or absence of release equipment and corrodible hooks, but would not address whether or not they were actually used or whether or not a vessel moved after an interaction with a prohibited species. This alternative could have high administrative costs due to enforcement efforts that would be necessary as well as management efforts to define allowable hooks and dehooking device(s). One commenter noted that NOAA Fisheries could require vessel operators to display certificates documenting their attendance at a workshop indicating to enforcement that they were trained in the proper use of the release equipment.

Alternative J6 would cap the allowable length of shark bottom longline gear to 10 miles, establish a 10 hour maximum soak time, and require that all shark bottom longlines be rigged with non-stainless steel corrodible circle hooks. This alternative could be challenging to enforce and would likely result in minimal negative social and economic impacts. Limits on soak time and length of bottom longline gear could also pose safety concerns. In bad weather, fishermen may not be able to safely retrieve fishing gear within the 10 hour limit. The 10 mile gear restriction and the 10 hour soak time limit may cause fishermen to increase the number of sets fished per trip or the number of hooks fished per set and could result in increased effort. Many shark fishermen may already use non-stainless steel circle hooks, but those who do not would incur the costs of replacing hooks and re-rigging gear.

Under alternative J7, fishermen would be required to retain all sharks caught. This alternative could result in minimal negative social and economic impacts. If no discards were allowed, trip limits and quotas could be reached more quickly and may result in derby fishing conditions. Derby conditions may result in depressed ex-vessel prices, reduced revenues, market gluts, and concerns for the safety of fishermen at sea. Additionally, revenues may also decline if lower market value species were required to be retained instead of allowing continued fishing for higher market value species.

Under alternative J8, commercial and recreational fishermen would be required to attend workshops discussing shark (and possibly other) species identification, marine mammal, sawfish, and sea turtle release techniques, and current regulations. This alternative would likely result in positive social impacts. NOAA Fisheries would conduct the educational workshops, the only costs incurred by fishermen would be related to travel and time to attend the workshops. To

minimize costs to fishermen, NOAA Fisheries could offer workshops at several locations near recreational and commercial shark fishing ports. NOAA Fisheries would also try to hold workshops during non-fishing seasons to minimize lost fishing time. The administrative costs for workshops is high, but may be exceeded by the benefits associated with the possible impacts from increased education. Before implementation, NOAA Fisheries would attempt to identify ways to minimize costs such as video conferencing or internet based training.

While comments during scoping indicated that workshops would be more beneficial if fishermen attended on a voluntary basis instead of as the result of a requirement, comments received on the draft Amendment indicated some preference for mandatory workshops. The commenters claimed that educational workshops could be beneficial to both recreational and commercial fishermen. One commenter stated that the educational workshops could serve as a forum where fishermen could learn about current research, regulations, and share information about their fishery that could be transferred to other fisheries (e.g., recreational to commercial). The commenters indicated that this atmosphere could give the attendees a feeling of stewardship of the environment and their fishery, and that this could lead to better working relationships with NOAA Fisheries.

While it appears that mandatory workshops would be beneficial, because over 20,000 permit holders would be involved, NOAA Fisheries realizes that there are implementation and operational issues that need to be addressed. NOAA Fisheries is currently investigating the following issues, including but not limited to: (1) types of penalties for not attending a workshop (e.g., loss of permit); (2) implementation concerns (e.g., test specifics, access to online media, course certificates); (3) specifically who would be required to attend workshops (e.g., permit holders, vessel operators, crew members); and (4) the fact that the recreational community did not submit comments regarding the workshops. NOAA Fisheries believes that alternative J8 may have been overlooked by the recreational community because it was analyzed in the bycatch section.

Based on these issues, and the fact that NOAA Fisheries would need to delay the implementation of this measure in order to receive Paperwork Reduction Act (PRA) approval, address any implementation difficulties, and receive a full range of public comment, NOAA Fisheries intends to move forward with this measure in a future rulemaking in order to assure that all aspects of the alternative are fully analyzed. In the interim, NOAA Fisheries will attempt to make voluntary workshops available to the public.

Conclusion

Alternative J4 is preferred because, with the implementation of time/area closures, it could allow vessels to transit closed areas without special gear stowage procedures, it would allow for the collection of real-time data, it could enhance rebuilding to maximum sustainable yield levels for LCS, and may also allow more finely defined closure areas. Alternative J5 is preferred because it would reduce post release mortality of protected species, sharks, and finfish by reducing the

amount of time a hook remains embedded in an animal, and would reduce the probability of multiple interactions with protected species.

4.6.2 Time/Area Closures

As described in Chapter 2, the alternatives considered for time/area closures are:

K1 No time/area closures - (No Action)
K2 *Time/area closure for sandbar and dusky shark nursery and pupping areas off of North Carolina during the winter fishery - Preferred Alternative*
K3 Time/area closure for all shark nursery and pupping areas during pupping season based on EFH identifications for neonate and juvenile sharks

The preferred alternative is Alternative K2.

Ecological Impacts

Under alternative K1 (no action), NOAA Fisheries would not implement any time/area closures to protect sharks. This alternative has been in effect since the 1993 FMP. The 1999 HMS FMP did not implement any time/area closures because most shark nursery and pupping areas are within state waters; the State of North Carolina had recently closed state waters which, at the time, was estimated to be sufficient to reduce juvenile sandbar and dusky shark mortality; and the commercial minimum size finalized in the HMS FMP was intended to further reduce the incidental catch of juvenile sharks by acting as a type of moving time/area closure. Based on new information, NOAA Fisheries is analyzing time/area closures in different areas which include Federal waters as discussed below for Alternatives K2 through K3.

Alternative K1 would take no additional action to reduce the bycatch of juvenile sharks or pregnant females in pupping areas during the pupping season, and in combination with alternative D2, would continue to have a negative effect on these vulnerable life stages. Under this alternative bycatch issues would have to be addressed through other measures and neonates and juveniles of all species could continue to be caught. This alternative could have a negative ecological impact by allowing the continued harvest and discard of juvenile and neonate sharks and prohibited species such as the dusky shark. The 2002 LCS stock assessment indicated that the LCS complex continues to be overfished, and recommended protecting juvenile and pregnant females. Data from the shark observer program indicate that there are high catch rates of juvenile sharks and dusky sharks in the shark bottom longline fishery. This alternative would do nothing to reduce the catch of these species.

Alternative K1 could have a negative impact on the bycatch of other fish species by allowing for continued fishing during shark pupping season in areas that may have high numbers of neonate and juvenile sharks and prohibited species. This alternative is not expected to have any additional negative impacts on marine mammals and seabirds. Since bottom longline gear is set

on the bottom, there are few interactions involving marine mammals or seabirds (See Section 3.5).

Alternative K2 would close an area from Oregon Inlet, North Carolina at 35°41' North offshore to 74°51' West, then following the 60 fathom contour to 35°30' North and 74°46' W and continuing along the 60 fathom contour south to 33°51' North and 76°24' West to all directed shark LAPs with bottom longline gear on board from January through July (Figures 2.2 and 4.1). The closure encompasses approximately 4,490 nm^2.

This action would protect an area where neonate and juvenile dusky and sandbar sharks are most abundant and would have a positive ecological impact by reducing discards and preventing bycatch of prohibited species. The area has been identified as EFH for both sandbar and dusky sharks and as a Habitat Area of Particular Concern (HAPC) for sandbar sharks due to important nursery and pupping grounds in areas adjacent to Hatteras and Ocracoke Islands and offshore of those islands (Chapter 10). Other areas identified as HAPC for similar reasons such as the mouth of Great Bay, NJ, lower and middle Delaware Bay, and lower Chesapeake Bay, MD, were not included in the time/area closure because they are predominantly in state waters and fishing effort is low in those areas. The HAPC off North Carolina is one of only four areas identified as HAPC, and is the only area that extends significantly into Federal waters. The HAPC in Chesapeake Bay has a slight overlap with Federal waters near the mouth of the Bay. Both alone and in combination with other management actions such as seasonal quotas, trip limits, gear restrictions, and a recreational minimum size, this action will have a positive ecological impact by increasing survival of neonate and juvenile dusky and sandbar sharks and helping to rebuild stocks.

For dusky sharks, a prohibited species, the ecological impact of a time/area closure would be positive. This species is highly susceptible and vulnerable to overfishing and is currently a candidate for listing under the ESA. Female dusky sharks do not reach sexual maturity until age 17 years (~300 cm or 10 feet total length), and male dusky sharks mature at 290 cm (~9.5 feet). Additionally, dusky sharks caught on longlines are seldom released alive. Of the observed catch of dusky sharks, only 18.8 percent were alive when brought to the vessel.

Like the dusky shark, the sandbar shark is a slow growing species that reaches sexual maturity at 15 to 16 years. Both sexes reach maturity at about 147 cm or approximately five feet total length. The 2002 LCS Stock Assessment indicated that sandbar sharks are still experiencing overfishing, and recommended reducing juvenile mortality. The time/area closure would have a positive impact on both neonate and juvenile life stages. A high percentage of neonates and juveniles were observed caught in the time/area closure whereas very low percentages of juveniles and no neonates were observed caught outside the time/area closure. Without the time/area closure the potential for continued harvest of large numbers of these vulnerable life stages would remain high.

In the draft Amendment, NOAA Fisheries proposed closing approximately 31,487 nm^2 from Virginia to South Carolina to all shark bottom longline fishing from January through July. Based on public comments, NOAA Fisheries re-examined the data and refined the area. Analyses and data presented below indicate the expected impacts of the revised area and, where appropriate, comparisons between the original and revised areas are provided. The seaward boundary of the revised area follows the 60 to 80 fathom contour, and was selected to include all observed catches of dusky sharks and sandbar sharks. No dusky or sandbar sharks were observed caught east of approximately 50 fathoms. Since large numbers of sharks appear to be caught in a line along the 50 fathom contour, a buffer of approximately two miles was included thus extending the boundary to 60 to 80 fathoms (See Figure 4.1). The northern boundary was selected to include the Habitat Area of Particular Concern (HAPC) for sandbar sharks off Cape Hatteras and because areas north of Cape Hatteras have historically had low catches of both dusky and sandbar sharks. The southern boundary was selected based on low numbers of dusky sharks that have been observed caught there in recent years, and because the proportion of juvenile and neonate sandbar sharks is much lower there than in the time/area closure.

In assessing the ecological impacts of the revised time/area closure, NOAA Fisheries analyzed two different time series of data from the Commercial Shark Fishery Observer Program for dusky sharks. The first time series was from 1994-2002, and the second was from 2001-2002. A Geographic Information System (GIS) program was used to plot all observed catches of dusky, sandbar, and LCS, and spatial analyses were performed to determine the number of each species (and life stage) observed caught in the time/area closure in comparison to the rest of the Atlantic. NOAA Fisheries conducted a separate analysis of the shorter time period after receiving public comments that the catch of dusky sharks has declined since they were prohibited (65 FR 38440, June 21, 2000), and that fishermen are no longer targeting them. No trips were observed in the time/area closure in 2000 due to lack of observer program funding, and the data for 2001-2002 had to be aggregated due to the low number of observed trips and confidentiality issues. The data were analyzed with and without redistribution of effort for both the shorter and longer time periods.

For sandbar sharks, only the longer time period was analyzed with and without redistribution of effort. NOAA Fisheries did not feel it was appropriate to look at the shorter time frame for sandbar sharks because they are not prohibited. Results for both species and the LCS complex are provided below and summarized in Tables 4.1 to 4.13 and in Figures 4.2 to 4.7. Since the preferred alternative is to close the area from January through July, the numbers and percentages of sharks provided in the text are for those months only, unless noted otherwise. Data for all months are provided in Tables 4.2 to 4.13.

For the redistribution of effort analyses, only data from the Atlantic were used and results are given for the Atlantic only since displaced fishing vessels off North Carolina are more likely to remain in the Atlantic than to move to the Gulf of Mexico. In addition, catches of dusky sharks in the Gulf of Mexico have historically been low; since 1994 only 29 dusky sharks or 2 percent of all observed catch of dusky sharks was from the Gulf of Mexico. The redistribution of effort

analysis assumes that all effort currently in the time/area closure will be redistributed to open areas of the Atlantic. While some fishermen will continue fishing in open areas of the Atlantic, others may choose to leave the fishery as a result of the closure, and thus the actual percentage reduction resulting from the time/area closure will likely fall between the results of the redistribution and no redistribution of effort estimates. Figures comparing catches of dusky and sandbar sharks in the time/area closure with all observed catches in the Atlantic and Gulf of Mexico are provided (Figures 4.2 to 4.4).

Time/Area analysis with no redistribution of effort

The effectiveness of the time/area closure along the mid-Atlantic coast was evaluated by determining the percent reduction in total U.S. Atlantic shark bottom longline catch of dusky, sandbar, and LCS for each month. Data from the longer time series (1994-2002) indicated that of the 1,392 dusky sharks observed caught in the Atlantic from 1994-2002, 1,099 (79 percent) were caught in the time/area closure from January through July (See Table 4.3). Of these, 1,016 (92 percent) were neonates or juveniles. Only 292 (21 percent) of all other dusky sharks were caught outside of the time/area closure (See Figure 4.2). Thus, without redistribution of effort, the total catch of dusky sharks from January through July would be reduced by 79 percent (See Tables 4.2 and 4.3).[3]

For the shorter time period, fewer dusky sharks were caught (68 from 2001-2002), but the percentage of total observed catch of dusky sharks remained high in comparison to the rest of the Atlantic and Gulf (62 percent). Thus, based on the shorter time frame, and without redistribution of effort, the catch of dusky sharks would be reduced by 62 percent (See Figure 4.3).

The number of dusky sharks observed caught and the CPUE have declined in recent years (See Table 4.5). Observed catches of dusky sharks peaked in 1998 at 298, and reached a low of 68 in 2001-2002. Although the overall number of dusky sharks observed caught in recent years has declined, the actual number caught based on expanded take estimates is much higher (See Table 4.6). The estimates of expanded takes reported in the table are similar to landings estimates for 2000-2001 from Cortes and Neer (2002) which are also shown in the table.

Of the 12,445 sandbar sharks observed caught in the Atlantic from 1994-2002, 6,755 (54 percent) were caught in the time/area closure from January through July (See Table 4.7). Of these, 4,149 (61 percent) were neonates or juveniles. When compared to the rest of the Atlantic and Gulf of Mexico, 2,647 (24 percent) of adults, 4,118 of 5,055 (81 percent) of juveniles, and 31 of 31 (100 percent) of neonate sandbar sharks were caught inside the time/area closure (See Figure 4.5). Of the sandbar sharks observed caught outside of the time/area closure, 76 percent were adults, 19 percent were juveniles and 0 percent were neonates (See Figure 4.4).

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[3]The overall number of observed dusky sharks reported in the draft Amendment was higher due to inadvertent inclusion of catches of dusky sharks in state waters. A total of 117 dusky sharks were observed caught in state waters from 1994-2002, and are not included in the present analyses.

Of the 23,814 LCS observed caught in the Atlantic from January through July 1994-2003, 10,070 (42 percent) were caught in the time/area closure (See Table 4.8). The majority of those catches occurred in January, March, and July (See Figure 4.5).

As discussed below, a potential ecological consequence of the closure may be the redistribution of fishing effort to areas adjacent to, or seaward of the closure.

Time/Area analysis with redistribution of effort

The ecological effects of redistribution of fishing effort were evaluated by determining the percent reduction in total observed Atlantic shark bottom longline catch of dusky and sandbar shark, and LCS inside and outside of the time/area closure. The method used to calculate percent changes in catch rates of dusky sharks with redistribution of effort is discussed below. The results for dusky and sandbar sharks are summarized in Tables 4.9 to 4.11 and for LCS in Tables 4.12 and 4.13. Redistribution of effort was analyzed for both the longer (1994-2002) and shorter (2001-2002) time periods.

The first step was to determine the monthly catch and effort (number of hooks) in the time/area closure and the Atlantic Ocean based on observer data in the shark bottom longline fishery. The next step was to determine the number of dusky sharks caught in the remaining open areas (E of Table), calculated by subtracting the number caught in the closed area from the entire Atlantic Ocean (B-D), excluding the Gulf of Mexico. The next step was to determine the catch-per-unit-effort (CPUE) for dusky sharks in the remaining open area. This was accomplished by dividing the number of dusky sharks caught in the open area (E) by the number of hooks fished in the open area (calculated by subtracting the number of hooks in the closed area from those Atlantic-wide; A-C). The open-area CPUE was then multiplied by the number of hooks that were used in the closed area to determine the number of additional fish that would be caught in the open fishing areas by the displaced effort (C*F), which was then added to the existing open area catch (E+G) to give a new open area total catch (I). The estimated total catch (I) was then subtracted from the original total number caught in the time/area closure (B-H) to estimate the change in number of dusky sharks that would be caught as a result of the relocated effort. Columns J and K show the cumulative number of dusky sharks avoided by the time/area closure, and the percent reduction in overall dusky shark catch as a result of the closure, respectively.

The redistribution of effort analysis indicates that despite an increase in fishing effort outside the time/area closure, the overall catch of dusky sharks would be reduced by the time/area closure. Based on the longer time period, 1,036 (74 percent) fewer dusky sharks would have been caught with the time/area closure in effect (See Table 4.9). Based on the shorter time period, 64 (55 percent) fewer dusky sharks would have been caught (See Table 4.10).

This same procedure was performed on observer data for sandbar sharks and the LCS complex. Based on observer data from 1994-2003, the catch of sandbar sharks is predicted to be reduced by 46 percent (See Table 4.11), and LCS by 28 percent (See Table 4.12). Numerically, 6,406

fewer sandbar sharks and 6,712 fewer LCS would have been observed caught during the period 1994-2003 with the time/area closure in effect. Based on the shorter time period, LCS catch would have decreased by three percent outside of the time/area closure (See Table 4.13).

Although the redistribution of effort analysis indicates that overall catch of LCS will decrease as a result of the closure, there will most likely be an increase in fishing effort outside of the closure which may result in higher catches of adult sandbar as well as other LCS in those areas, and a decline in the number of dusky sharks and juvenile sandbars being caught. The number of prohibited species caught outside of the closure is low compared to the number of prohibited species currently being caught inside the closure (See Table 4.14). Thus, prohibited species such as the sand tiger, night, and bignose sharks could potentially benefit from the closure as well.

Comparison of the original vs. the revised time/area closure

NOAA Fisheries decided to revise the time/area closure after receiving public comments that the original time/area closure did not accurately reflect declining trends in dusky shark catches and that the closure would have severe economic consequences resulting in many fishermen going out of business. NOAA Fisheries re-analyzed the data and revised the boundary as described above. NOAA Fisheries also analyzed the catches in the original time/area closure versus the revised time/area closure to determine whether the revised closure would have the intended effect of reducing dusky shark bycatch and the catch of neonate and juvenile sandbar sharks. The following data are provided to demonstrate that the revised time/area closure will still be effective in reducing the catch of dusky sharks and neonate and juvenile sandbar sharks, while allowing fishermen to continue fishing in open areas off North Carolina from January through July.

From 1994-2002, 1,103 of 1,232 (90 percent) of dusky sharks caught in the original time/area closure were also caught within the boundary of the revised time/area closure. For neonate dusky sharks, 324 of 340 (95 percent) were also caught in the revised time/area closure, 692 of 793 or 87 percent of juveniles, and 87 of 99 (88 percent) of adults were also caught in the revised time/area closure (See Table 4.15 and Figure 4.7).

For sandbar sharks, 6,796 of 8,722 (78 percent) caught in the original time/area closure were also caught in the revised time area closure. For neonate sandbar sharks, 31 of 31 (100 percent) were caught in the revised time/areas closure, 4,118 of 4,321 (95 percent) of juveniles, and 2647 of 4,370 (61 percent) of adults were caught in the revise time/area closure (See Table 4.15 and Figure 4.8). The data indicate that open areas north and south of the revised time/area closure have much lower percentages of juveniles and much higher percentages of adult sandbar sharks.

Although not very high, there is some bycatch of other species such as stingrays and teleosts associated with the bottom longline fishery. Alternative K2 would result in a decrease in bycatch of other species which would have a positive impact on their populations and the ecosystem as a whole. Although the number of marine mammals, sea turtles, and seabirds caught incidentally in

the bottom longline fishery is not high, the likelihood of an encounter would be reduced by the time/area closure (See Section 3.5). This alternative is expected to have a positive effect on protected species such as sea turtles, marine mammals and seabirds.

Alternative K3 would implement the largest time/area closure(s) of all the alternatives in this document, and could result in a large reduction in the catch of neonate and juvenile sharks. It would provide less protection for juvenile sharks and pregnant females than a year-round closure in those areas identified as EFH but would still enhance rebuilding. This alternative could have a positive ecological impact on shark populations by enhancing survival of neonate, juvenile, and pregnant sharks. Although many of the areas identified as EFH are in state waters, some are located in Federal waters, and the extent of the time/area closure(s) would be considerable. This alternative could also have a positive impact on the bycatch of other fish species by closing large areas of the coast to bottom longlining during the spring pupping season. The bycatch of fish species commonly associated with the bottom longline fishery would be reduced.

Alternative K3 could also have a positive effect on marine mammals, sawfish, and seabirds. Although interactions with marine mammals, sawfish, and seabirds are rare in the shark bottom longline fishery, the possibility of an accidental encounter would be reduced if portions of the coast were closed to fishing for several months.

Social and Economic Impact

Since Alternative K1 would not impact the way fishing activities have been conducted in the past, this alternative is not expected to cause short-term social or economic impacts. There could be long-term economic impacts if the LCS stock does not rebuild and NOAA Fisheries implements measures to conserve or enhance EFH for rebuilding purposes.

Alternative K2 could have a negative social and economic impact, particularly for those fishermen in states bordering the time/area closure. The original time/area closure would have closed a significantly larger area (31,487 nm^2) to all commercial bottom longline fishing. NOAA Fisheries re-examined the data as a result of public comments that indicated the original closure was overly large and would have had severe economic impacts. NOAA Fisheries believes that the revised closure, while significantly smaller than the original area proposed (4,490 nm^2), will still be effective in reducing the overall mortality of dusky and juvenile sandbar sharks, and will also provide an opportunity for fishermen to continue fishing in North Carolina waters north and south of the closure. As a result, NOAA Fisheries believes that some of the economic impacts of the proposed closure will be mitigated.

Data from the shark observer program indicates that 99 percent of sandbar sharks caught within the closure, including juveniles, are landed and less than one percent are tagged or released as bycatch. This indicates that fishermen are selling the carcasses and deriving economic benefit, even from juvenile sharks. Fishermen could potentially benefit from catching fewer, larger sharks outside the time/area closure which would have more meat and larger fins and could

command a higher price. Disposal of shark carcasses would be expected to decrease with the reduction in bycatch. However, by requiring fishermen to travel farther to fish, the cost of fuel, food and labor may increase. These increased costs may also result in higher marketing costs. The reduction in shark landings could also affect dealers, especially those who are supplied by the vessels which have historically fished in the time/area closure.

The seaward boundary of the time/area closure is approximately 20 miles from shore its closest point off Cape Hatteras, and approximately 90 miles offshore at its farthest point off Cape Fear. Based on the number of hooks observed in the Atlantic from 1994-2003, 22 percent of the fishing effort was located in the time/area closure during the months of January through July. This indicates a substantial percentage of fishermen who targeted fish in the time/area closure.

Analysis of data from the shark observer program indicates that few if any sharks have been observed caught by bottom longline vessels seaward of the time/area closure, but that sharks have been caught north and south of the time/area closure. Data from tagging studies indicates that there may be large numbers of sharks north of the time/area closure however, fishing effort has historically been low in this area. Thus, fishermen will likely choose to travel north or south, not farther offshore, to avoid the closure. Fishermen have traditionally targeted areas closest to shore near Cape Hatteras where shark concentrations are highest, and the closure would require them to adjust their fishing practices accordingly. Traveling farther from a homeport may also increase safety risk.

This alternative could impact social, economic, or cultural values of the fishing communities. North Carolina has a total of 23 directed shark fishing permits, or 9 percent of the total number of directed shark fishing permits (256 issued in 2003). In 2002, there were five directed shark fishing permits issued to vessels in Virginia, 7 in South Carolina, and 23 in North Carolina. Of these, only 8 vessels with a homeport located in North Carolina reported landings in 2001. All of these vessels and their owners, and potentially others from adjacent states who have traditionally targeted sharks in the winter fishery off of Cape Hatteras, could be impacted by the closure (See Chapter 6.9). By contrast, there are two directed shark permits in Georgia and 55 on the East coast of Florida for a combined total of 23 percent of all directed permits. Fishermen would have several alternatives: (1) leave the fishery; (2) relocate to a different homeport during the period of the closure from January to July; (3) permanently move to a new home port; or, (4) continue to fish from their current homeport with the imposed burden of further travel and increased costs.

The time/area closure does not affect incidental shark permit holders because they are having minimal or no impact on shark catches in the time/area closure. As of October 2003, a total of 37 incidental shark permits had been issued to vessels in North Carolina, Virginia, and South Carolina, and none of these vessels reported shark landings in 2001 or 2002. All of these vessels have multiple permits, and a majority (25) did not have a swordfish permit, indicating that they were targeting species such as king mackerel, Spanish mackerel, or had charter vessel permits for snapper grouper or coastal migratory pelagic species such as king and Spanish mackerel. The predominant gear types being used by these vessels are rod and reel (including downriggers),

bandit gear, and/or handline gear. Based on the landings data, the species being targeted, and the gear types being used, NOAA Fisheries does not believe it would be appropriate to exclude these vessels from the time/area closure. Doing so would create additional negative economic impact that is not warranted. NOAA Fisheries may include these gear types in the future if information becomes available to indicate that they are having a negative impact on the rebuilding of LCS as a result of fishing in the time/area closure.

Fishing communities, suppliers, and dealers in the region might also be impacted by lower landings resulting in declining sales. Two fishing-dependent communities, Hatteras and Wanchese, will be directly affected by the closure (See Chapter 9). Since sharks are a relatively small component of all fish catches for these communities and the commercial fleet already fishes in areas other than the closed area, the social and cultural impacts on commercial fishermen in general, their families and communities may be mitigated to some degree. The recreational fishery and charter/headboats catch sharks as an incidental species in troll fishing, and since they are not affected by the closure, there are unlikely to be any social and cultural impacts on this fishery.

Fishermen have commented on, and observer data supports the fact that most dusky sharks are dead when caught which results in unnecessary waste when discarding carcasses. Since current regulations prohibit retention of dusky sharks there is not likely to be a major economic impact as a result of decrease in dusky shark landings. However, there may be an economic impact as a result of the reduction in catch of other LCS, particularly sandbar sharks, which are also caught in large numbers in the time/area closure.

The alternative could have an impact on enforcement costs and management effectiveness. Implementation of a Vessel Monitoring System (VMS, Alternative J4) should address potential enforcement issues involving the time/area closure. In order to effectively manage the time/area closure, a reliable enforcement system will need to be established. Costs associated with the implementation of VMS in the bottom longline fishery are discussed in a separate section (See Section 4.6.1).

Alternative K3 would result in a time/area closure for all shark nursery and pupping areas during pupping season based on EFH identifications for neonate and juvenile sharks. Due to the areas that would be closed to fishing, alternative K3 would be expected to have greater negative social and economic impacts than alternative K1 or K2. Many areas that fishermen have traditionally relied upon would be closed during peak fishing periods. This would require fishermen to travel further to fish and would increase costs associated with the fishery.

Although alternative K3 would reduce the catch of bottom longline caught neonate and juvenile sharks during the spring pupping season, it would also have a considerable negative economic impact on fishermen by closing large sections of coastal waters to shark fishing. Fishermen would be directly impacted by a reduction in catch and income from areas that they have traditionally relied upon. Since most pupping and nursery areas are nearshore, fishing practices

and behavior of fishermen would also be affected by requiring fishermen to travel further offshore. Due to greater distances traveled, fishermen would spend more time at sea, and associated costs of food, fuel, and labor could increase. This could cause some fishermen to go out of business, move to new areas, or alter fishing patterns in other ways. This alternative could result in a change in the distribution of benefits and costs, with the financial costs of operating in the fishery increasing and benefits decreasing.

Conclusion

Alternative K2 is the preferred alternative because it significantly reduces the bycatch of dusky sharks and the catch of neonate and juvenile sandbar sharks and is expected to help rebuild overfished LCS consistent with the LCS stock assessment recommendations and National Standard 9 of the Magnuson-Stevens Act. Certain management measures have been implemented for the LCS complex as a whole, such as counting dead discards and state landings after Federal closures against Federal quotas, trip limits, and prohibiting possession of certain shark species including dusky sharks. However, the time/area closure is a specific measure to reduce fishing impacts in a known shark nursery and pupping area. The action would reduce the landings, bycatch, and discards of neonate and juvenile dusky and sandbar sharks, as well as other prohibited species. Although the closure could have substantial economic impacts on fishermen in states adjacent to the area, overall economic impacts may be mitigated by fishermen traveling outside of the closed area to fish.

The time/area closure is one of the few areas in the Atlantic and Gulf of Mexico where large numbers of juvenile sharks of more than one species are caught in EFH and HAPC areas in Federal waters. Additionally, given the limited degree of nursery and pupping areas in Federal waters, this action is necessary to reduce the level of fishing mortality on these vulnerable life stages. Many Atlantic and Gulf of Mexico states have recently implemented or are considering implementing more restrictive shark harvest regulations, including fishery closures. NOAA Fisheries intends to keep working with the Atlantic and Gulf states to implement sharks harvest regulations that will meet conservation objectives.

Based on public comments that NOAA Fisheries should consider a clear exit strategy for the time/area closure, NOAA Fisheries will be reviewing the status of both dusky and sandbar sharks, the two species most affected by the time/area closure, in the near future. Based on the status of those stock assessments, NOAA Fisheries may consider revising the size and scope of the closure, the duration of the closure, and potentially elimination of the closure.

4.7 ESSENTIAL FISH HABITAT

As described in Chapter 2, the alternatives considered for identification of Essential Fish Habitat are:

L1 Maintain current EFH identified areas (No Action)
L2 Identify EFH for the fishery management unit (FMU) based on the entire geographic range of the species
L3 Existing EFH and, as appropriate, identify EFH for the FMU for each species and life stages as those habitats necessary for spawning, breeding, feeding, or growth to maturity
L4 *Existing EFH and, as appropriate, increase or decrease the EFH areas identified for individual species in the FMU based on special needs* **-** *Preferred Alternative*

The preferred alternatives is L4.

Ecological Impacts

There are no direct ecological impacts associated with the designation of EFH. However, depending on the alternative selected, and the actions taken by NOAA Fisheries to improve the conservation and enhancement of EFH, the range of positive ecological impacts may vary. The geographic size and location of EFH could influence the number of Federal agency actions that may adversely affect EFH and hence trigger the consultation process. For example, alternative L2 would result in a larger EFH area than either alternative L3 or L4, and as a result a greater number of Federal Actions might require consultation under L2 than L3 or L4. The resulting actions taken to minimize impacts based on the conservation recommendations provided in Chapter 10 could have important ecological consequences on EFH. Similarly, if NOAA Fisheries were to take actions to conserve or enhance EFH based on alternative L2, the ecological impact would be greater, in a positive sense, than it would be under alternative L3 or L4.

Alternative L1, the no action alternative, would maintain the current EFH identified areas. This is the alternative the fishery has been operating under since the 1999 HMS FMP. Since the 1999 HMS FMP, several shark species have had a change in stock status. For instance, the stock assessment for sandbar sharks indicated that the stock was overfished in 1998 but not overfished in 2002. Similarly the stock assessment for blacktip shark indicated that the stock was overfished in 1998 and rebuilt in 2002. The change in status of these species and the availability of new information justifies a review and update of areas currently identified as EFH. The geographic scope of EFH identified under this alternative would be less than either alternative L2 or L3 and potentially similar to L4. As discussed below, alternative L4 would not change the current EFH area unless new information indicated that a change was necessary. Thus, the positive ecological impacts associated with this alternative would be less than alternative L2 and L3, and potentially similar to L4, depending upon geographic scope of EFH identified under alternative L4 and potential future actions taken by NOAA Fisheries to conserve and enhance EFH.

Alternative L2 would identify EFH for the fishery management unit (FMU) based on the entire geographic range of the species. This alternative would implement the most precautionary approach to identifying EFH, and if future management measures were based on EFH identifications, would result in the largest area to be considered. This alternative would not be as effective as alternatives L3 and L4 because information is available to narrow the geographic extent of EFH. Information from fishery dependent and independent datasets such as research and tagging studies, the shark observer program, and expert opinion are available with which to refine the areas identified as EFH, and which represent a subset of the geographic range of the species. However, this alternative could potentially result in the largest positive ecological impacts because the area encompassed is greater than any other area. Under this alternative a large portion of the EEZ could be identified as EFH.

Alternative L3 would identify EFH for each species and life stage as those habitats necessary for spawning, feeding, breeding, or growth to maturity, based on new information made available since the 1999 HMS FMP. If no new information is available, then the existing EFH areas (Alternative L1) would be retained. This alternative would include 100 percent of the species' observed distribution, as opposed to alternative L2 which represents 100 percent of the entire geographic range. Thus, this alternative represents an area reduced in size from alternative L2. The basis for this alternative is to evaluate each species and life stage individually to ultimately comprise the EFH identification for the fishery. This alternative would identify a subset of the entire geographic range of the species which encompasses those habitats considered most important to spawning, breeding, feeding and growth to maturity. This would result in a higher degree of confidence that the area is EFH and does not include marginal habitat. From a management perspective, a narrowing of EFH as described above, could result in a higher level of protection and a greater ability to enhance and conserve EFH.

Alternative L4 would begin with 100 percent of the observed distribution in alternative L3 and increase or decrease the geographic scope of EFH for each species in the FMU based on the specific needs of the species. If no new information is available, the existing EFH identifications would be maintained. Under this alternative, flexibility would be provided to increase or decrease the geographic extent of EFH based on the status of the stock. Since overfished resources are considered to be at greater risk, the percentage of habitat identified as EFH would be greater than that of fully fished or not overfished species. For species that are not overfished, the EFH area could be refined to those areas considered essential and not beyond. In some cases, this alternative could result in the same identifications as alternative L3. NOAA Fisheries believes that a more refined approach to identifying EFH would afford greater protection because conservation measures could be better tailored to meet the needs of particular species.

The method used to identify EFH under alternative L4 is described in detail in Chapter 10. In summary, the observed distribution points for each species and life stage were plotted on a 10 by 10 minute grid covering the Atlantic and Gulf of Mexico and analyzed using a Geographic Information System. The number of observations per grid was used as a guide to identify

potential EFH, and the resulting percentages of observed distribution points included in EFH under alternative L4 are provided in Table 10.1. The percentages indicate that this alternative resulted in an average of 77 percent of all species' observed distributions being identified as EFH. For all species, the percentage of observed distribution included in EFH was highest for neonate and juvenile life stages and lowest for adults. This is believed to be the result of neonate and juvenile shark tendency to aggregate in coastal pupping and nursery areas, whereas adults are more widely dispersed in coastal and offshore areas. Although there are no direct ecological impacts resulting from this alternative, the methodology used here to identify EFH could be important in providing the basis for future management actions taken to conserve and enhance EFH.

Alternative L4 is preferred because it provides an objective way of identifying EFH, and because it allows for the expansion or contraction of EFH for a vulnerable life stage or species based on the status of a particular species or life stage. For example, for overfished species, 90 percent of the range of distribution could hypothetically be identified as EFH, and for a species that is not overfished, 75 percent of the range of distribution might be identified as EFH. Using a similar approach, the frequency of occurrence of a particular species or life stage in a particular habitat type could be established to further refine and narrow the range of EFH and possibly form the basis for identifying Habitat Areas of Particular Concern (HAPCs). Even though assigning percentages or frequency of occurrence to a given species' distribution provides an objective way of identifying EFH, depending upon the frequency of distribution selected, important habitat could be excluded, or marginal habitat could be included. The former could have a negative impact on the species if management actions were taken to conserve EFH, and the latter could potentially have a slightly positive but no negative impact.

Alternative L4 would likely result in smaller EFH areas than either alternatives L2 or L3. However, as described in more detail in Chapter 10, the areas identified as EFH under this alternative are still quite large and are based upon the best scientific information available and expert opinion. All of the alternatives would have a positive ecological impact once management actions are taken to conserve, enhance, and minimize fishing and non-fishing impacts on EFH.

Social and Economic Impacts

There are no direct social or economic impacts associated with the alternatives for identifying EFH. Similar to the discussion above on ecological impacts, there may be social and/or economic impacts that result from management actions (i.e. time/area closures) taken to conserve, enhance, or mitigate fishing impacts on EFH. Depending on the geographic scope of the area identified as EFH, the potential management measures could have social and economic impacts to a greater or lesser degree. For example, the number of Federal actions that may adversely affect EFH and thus trigger consultation and/or conservation recommendations would likely be greater if larger areas were identified as EFH. Conversely, by refining the scope of EFH, management measures could be tailored to specific areas and would result in less negative

economic impact, or potentially positive economic impacts depending on the outcome of the action. The nature and degree of economic and/or social impacts would not be known until specific management actions are proposed and analyzed.

Conclusion

Alternative L4 is the preferred alternative because it provides the full range of options that NOAA Fisheries believes are necessary to thoroughly and accurately identify EFH. Under this alternative, the existing EFH identifications would remain in effect until NOAA Fisheries completes the five year review in 2004 of EFH for all HMS not covered under this FMP Amendment. Alternative L4 provides NOAA Fisheries with the flexibility to update and refine EFH identified in the 1999 HMS FMP based on the latest scientific information. NOAA Fisheries does not believe that this alternative will have negative ecological, economic, or social impacts. These actions would help identify EFH areas for managed species and thus lead to measures that may reduce impacts to EFH, particularly for neonate and juvenile life stages, but also prohibited species.

4.8 EXEMPTED FISHING PERMITS (EFP) ADMINISTRATION

As described in Chapter 2, the alternatives considered for EFP administration are:

M1 Maintain combined permitting system for scientific research and display - (No Action),
M2 *Develop separate display permitting system, apart from research - Preferred Alternative.*

Alternative M2 is the preferred alternative.

Ecological Impacts

Alternatives M1 and M2 propose different EFP administration systems. Alternative M1 would maintain a combined permitting system for scientific research and educational/public display. This alternative has been in place since 1999. By comparison, alternative M2 will require creation and implementation of a separate display permitting system, which will operate apart from exempted fishing activities focusing on scientific research. Under both alternatives, the quota of 60 mt ww for the purpose of public display and exempted fishing activities would remain. NOAA Fisheries will continue to examine the appropriate nature of this quota over time.

Since neither of these alternatives are anticipated to result in a change in fishing practices or fishing effort, there are no anticipated ecological impacts associated with implementation.

Social and Economic Impacts

No social or economic impacts are anticipated to result from implementation of either of the alternatives listed above as these options deal primarily with the administration system under which the activities will be permitted.

Conclusion

Alternative M2 (i.e., develop separate display permitting system, apart from research) is the preferred alternative because administration of public display permits will be streamlined. Implementation of this alternative will not result in any ecological, economic, or social impacts.

4.9 IMPACTS ON ESSENTIAL FISH HABITAT

The Magnuson-Stevens Act requires that NOAA Fisheries evaluate the potential adverse effects of fishing activities on EFH and must include management measures that minimize adverse effects to the extent practicable. At this time, there is no evidence that physical effects caused by fishing under this FMP are adversely affecting shark EFH to the extent that detrimental effects can be identified on the habitat or the fisheries. Most of the preferred alternatives, such as shark classification (aggregating LCS and having one closure date), quota administration (establishing regional quotas and trimester seasons), quota basis, and recreational management measures will have no direct impact on EFH. The time/area closure will reduce fishing mortality on the prohibited dusky shark and juvenile sandbar sharks, but is not expected to have a direct impact on EFH. Further discussion of EFH is provided in Chapter 10.

4.10 IMPACTS ON PROTECTED SPECIES

Management measures selected in Amendment 1 are not expected to have an adverse impact on protected species. Protected resources of greatest concern in the shark fishery are endangered right whales and sea turtles. Several management actions are being taken to minimize impacts and reduce the bycatch of these species. For example, non stainless steel corrodible hooks are selected for the directed shark bottom longline fishery which will minimize impacts to protected species such as sea turtles if they are accidentally hooked. De-hooking equipment designed to safely release incidentally caught sea turtles is also being selected. Finally, although the time/area closure should reduce the bycatch of prohibited species such as the dusky shark, it may have the added benefit of reducing potential encounters with protected species as well. A requirement to have VMS on directed shark bottom longline vessels should aid NOAA enforcement of the time/area closure.

4.10.1 Conclusions of the October 2003 Biological Opinion

A new Biological Opinion for Atlantic shark fisheries was prepared in October of 2003 in response to the proposed measures in Amendment 1 (NOAA Fisheries, 2003). It concluded that

the continued operation of the shark fisheries as amended by the actions in Amendment 1 would not adversely affect marine mammals. However, other protected resources, specifically sea turtles and smalltooth sawfish, may be affected by the selected actions in Amendment 1, although the actions are not likely to appreciably reduce either the survival or recovery of loggerhead, Kemp's ridley, green, hawksbill or leatherback sea turtles in the wild by reducing their reproduction, numbers, or distribution (NOAA Fisheries, 2003). These species are found throughout all or a portion of the action area, defined as the U.S. Atlantic, Gulf of Mexico, and Caribbean EEZ. Sea turtles and smalltooth sawfish have been documented as taken incidentally in one or more components of the Atlantic shark fishery. Background information on the range-wide status of these species can be found in a number of published documents, including: recovery plans for loggerhead sea turtle (NMFS and USFWS, 1991a), Kemp's ridley sea turtle (USFWS and NMFS, 1992), green sea turtle (NMFS and USFWS, 1991b) and leatherback sea turtle (NMFS and USFWS, 1992); sea turtle status reviews and biological reports (NMFS and USFWS, 1995; Marine Turtle Expert Working Group (TEWG), 1998 & 2000; NMFS, 2001a), and the smalltooth sawfish status review (available online at http://www.nmfs.noaa.gov/prot_res/PR3/status_reviews.html).

The species of sea turtles that are expected to be affected by the selected alternatives in Amendment 1 are all highly migratory. NOAA Fisheries believes that no individual members of any of the species are likely to be year-round residents of the action area. Individual animals will make migrations into nearshore waters as well as other areas of the North Atlantic Ocean, Gulf of Mexico, and the Caribbean Sea. Therefore, the range-wide status of the affected species of sea turtles most accurately reflects the species' status within the action area.

Smalltooth sawfish are not highly migratory species, although some large, mature individuals may engage in seasonal north/south movements. The U.S. Distinct Population Segment (DPS) of smalltooth sawfish is confined to only a small portion of the action area, mainly waters off Florida and possibly occasionally off Georgia. Only large, mature individuals are known to occur in the action area. Information is not available regarding how much time smalltooth sawfish of different sizes spend at different depths. Generally smaller (younger) animals are restricted to shallower waters, whereas large animals are believed to roam over a larger depth range. The smalltooth sawfish may only be present in the U.S. EEZ intermittently, spending the rest of their time in shallower waters. Based on this information, the range-wide status of smalltooth sawfish most accurately reflects the species' status within the action area.

Sea turtles can be captured as a result of the use of bottom longlines, gillnets and rod and reel/handline fishing gear. Captured turtles can be released alive uninjured or can be killed as a result of the interaction. Some turtles that are released alive from bottom longline gear may die later as a result of the ingestion of a hook, endangerment in the gear, or the trailing of gear that was not cut away prior to release. There are detailed descriptions of how these gears affect sea turtles including a detailed discussion on post release mortality of sea turtles in the June 19, 2001, Opinion on the Reinitiation of Consultation on the Atlantic Highly Migratory Species Fishery Management Plan and its Associated Fisheries (NMFS, 2001b).

Smalltooth sawfish can also be captured as a result of the use of bottom longlines, gillnets and rod and reel/handline. The October 2003 Biological Opinion for Atlantic shark fisheries represents the first federal fishery to undergo formal consultation for this species (NOAA Fisheries, 2003).

4.10.2 Protected Species Takes in the Shark Bottom Longline Fishery

In the bottom longline fishery a total of 43 sea turtles were observed caught from 1994 through 2002 based on 862 observed sets (Figures 3.9 and 3.10) (Burgess and Morgan, 2003; NOAA Fisheries, 2003). Of the 43 sea turtles observed, 31 were loggerhead sea turtles of which 17 were released alive. Another nine loggerheads were released in an unknown condition and five were released dead. Based on extrapolation of observer data and reported effort from the logbook data, it was estimated that a total of 2,003 loggerhead sea turtles were taken in the shark bottom longline fishery from 1994 through 2002 (NOAA Fisheries, 2003). An additional 503 unidentified sea turtles were estimated to have been taken. On average, 222 loggerhead sea turtles and 56 unidentified sea turtles were taken annually during this time period in the shark bottom longline fishery.

The estimated takes in the 2003 BiOp do not discriminate between live and dead releases. However, of the observed takes, 23 percent were lethal. Based on this information it is estimated that 51 loggerhead turtles (222 x 0.23) will be killed as a result of an interaction with a bottom longline. The highest estimate of post release mortality is 42 percent (NMFS, 2001b). This is for turtles that ingested a hook (the percent mortality is lower depending on how the animal was hooked). Being conservative and assuming that all animals ingest the hook, 42 percent of the animals released alive will die as a result of their interaction with the longline. This means that another 72 loggerhead sea turtles (222-51=171, then 171 x 0.42) will be killed. Therefore, it is estimated that 123 loggerheads (72 + 51) will be killed per year (NOAA Fisheries, 2003).

Four of the 43 observed sea turtles taken in the bottom longline fishery were leatherback sea turtles; three of these were released in an unknown condition and one was released dead. Based on these observations, it was estimated that 269 leatherback sea turtles were taken in the shark bottom longline fishery during 1994 through 2002 (NOAA Fisheries, 2003). On average, 30 leatherback sea turtles each year were taken by the shark bottom longline fishery during 1994 through 2002. These take estimates do not discriminate between live and dead releases. Of the observed leatherback takes, 25 percent were lethal. Applying the observed leatherback mortality rate of 25 percent to the total leatherback takes and an additional 42 percent for post-release mortality to the remaining, results in a total of 17 leatherbacks killed per year. The leatherback mortality is very conservative because it is known that leatherbacks rarely ingest or bite hooks, but are usually foul hooked on their flippers or carapaces, reducing the likelihood of post-hooking release mortality. However, leatherback-specific data for this fishery are not available and therefore the most conservative estimate is used.

Smalltooth sawfish have also been observed caught (seven known interactions, six released alive, one released in unknown condition) in shark bottom longline fisheries from 1994 through 2002 (See Figure 3.11) (Morgan pers. comm., 2003). Based on extrapolation of these observations, expanded sawfish take estimates for 1994 through 2002 were developed for the shark bottom longline fishery (NOAA Fisheries, 2003). A total of 466 sawfish were estimated to have been taken in this fishery during 1994-2002, resulting in an average of 52 per year. Additionally, it is important to note that all of the sawfish takes observed, except for one, were released alive. Under current observer coverage, an observed interaction with a sawfish is a rare event. The observer data, in combination with anecdotal information collected in databases, indicate that lethal takes may be extremely rare, but more data is needed to confirm such a finding. The estimates of lethal and non-lethal takes would be greatly improved with more observer coverage. NOAA Fisheries presently has no data to indicate that lethal takes occur. Based on this information NOAA Fisheries expects no smalltooth sawfish will be killed as a result of the measures selected in Amendment 1 over the next five years.

4.10.3 Protected Species Takes in the Shark Gillnet Fishery

In the shark gillnet fishery, loggerhead sea turtles are rarely caught. During the 1999 right whale calving season no loggerhead sea turtles were caught in this fishery (Carlson and Lee, 1999). No loggerhead sea turtles were observed caught with strikenets during the 2000-2002 right whale calving seasons (Carlson, 2000; Carlson and Baremore, 2001; Carlson and Baremore, 2002a). However, three loggerhead sea turtles have been observed caught with drift gillnets during right whale calving season, one each year from 2000 to 2002 (See Table 3.39) (Carlson, 2000; Carlson and Baremore, 2001; Carlson and Baremore, 2002a; Garrison, 2003).

During the 2000 and 2001 non-right whale calving seasons, no loggerhead sea turtles were observed caught in gillnets fished in a strikenet method while one loggerhead sea turtle was observed caught and released alive in gillnets fished in a driftnet method (See Table 3.39) (Carlson and Baremore, 2001). No loggerhead sea turtles were caught outside of the right whale calving season in 2002 (Carlson and Baremore, 2002b).

Expanded take estimates for sea turtles were developed for the shark drift gillnet fishery. Estimates were based on the analysis of observer data from the NOAA Fisheries' Southeast Fisheries Science Center. Observer data gathered from 1999-2002 were used to estimate takes in the drift gillnet fishery. Prior to 1999, observer coverage was limited and inconsistent, but since 1999, a much higher degree of observer coverage has occurred, including very high coverage in the southern Florida area during the right whale calving season (November 15 - March 30) when sea turtle takes are known to be much more likely. The estimated takes of loggerhead sea turtles by year, were as follows: 1999 - none; 2000 - one mortality and 4.4 live takes; 2001 - one live take; and 2002 - 1.7 live takes (NOAA Fisheries, 2003).

Because of the high degree of variability in takes which is associated with variability in water temperatures, sea turtle abundances, and other factors that cannot be predicted, a 5-year estimated

take was utilized for the incidental take statement (ITS) instead of a 1-year average estimated take. Over a 5-year period the expected take of loggerhead sea turtles from the drift gillnet fishery would be 10 total captures of which one would be expected to be killed (NOAA Fisheries, 2003).

In the shark gillnet fishery, leatherback sea turtles are sporadically caught. During the 1999 right whale calving season, two leatherback sea turtles were caught in this fishery, and both were released alive (Carlson and Lee, 1999). No leatherback sea turtles were observed caught with strikenets during the 2000 - 2002 right whale calving seasons (Carlson, 2000; Carlson and Baremore, 2001; Carlson and Baremore, 2002a). Leatherback sea turtles have also been observed caught with gillnets including fourteen in 2001 and two in 2002 (See Table 3.39) (Carlson, 2000; Carlson and Baremore, 2001; Carlson and Baremore, 2002a; Garrison, 2003). NOAA Fisheries temporarily closed the shark gillnet fishery (strikenetting was allowed) from March 9 to April 9, 2001, due to the increased number of leatherback interactions that year (66 FR 15045, March 15, 2001).

During the 2000 and 2001 non-right whale calving seasons, no leatherback sea turtles were observed caught in gillnets fished in strikenet or driftnet methods (Carlson and Baremore, 2001). No leatherback sea turtles were caught outside of the right whale calving season in 2002 (Carlson and Baremore, 2002b).

The estimated takes of leatherback sea turtles by year were as follows: 1999 - none; 2000 - none; 2001- two mortalities and 12 live takes; and 2002 - 3.4 live takes (NOAA Fisheries, 2003). Because of the high degree of variability in takes which is associated with variability in water temperatures, sea turtle abundances, and other factors that cannot be predicted, a 5-year estimated take was utilized for the incidental take statement (ITS) instead of a 1-year average estimated take. Over a 5-year period the expected take of leatherback sea turtles from the drift gillnet fishery would be 22 total captures of which three would be expected to be killed (NOAA Fisheries, 2003).

To date there has been only one observed catch of a smalltooth sawfish in shark gillnet fisheries. The sawfish was taken on June 25, 2003 in a gillnet set off of southeast Florida and it was released alive (Carlson pers. comm., 2003). The set was characteristic of a typical drift gillnet set, with gear extending 30 to 40 feet deep in 50 to 60 feet of water. Prior to this event it was speculated that the depth at which drift gillnets are set above the sea floor may preclude smalltooth sawfish from being caught. Although sometimes described as a lethargic demersal species, smalltooth sawfish feed mostly on schooling fish, thus they would occur higher in the water column during feeding activity. In fact, smalltooth sawfish and Atlantic sharks may be attracted to the same schools of fish, potentially making smalltooth sawfish quite vulnerable if present in the area fished. The previous absence of smalltooth sawfish incidental capture records is more likely attributed to the relatively low effort in this fishery and the rarity of smalltooth sawfish, especially in Federal waters. These factors may result in little overlap of the species with the gear.

The recently observed smalltooth sawfish was cut from the net and released alive with no visible injuries. This indicates that smalltooth sawfish can be removed safely if entangled gear is sacrificed.

As discussed in the proposed action, gillnets are also used to "strikenet". When strike gillnetting fishers target and encircle specific schools of sharks after visually detecting them (usually by spotter pilot). Given the large and or distinct morphology of smalltooth sawfish, this species would likely be detected visually, as well as distinguished from shark species, thus avoided. This fishing method has been shown to also reduce potential encounters by limiting the time that gear is in the water. Strike gillnet sets are typically only one to two hours in contrast to six to 10 hours for each drift gillnet set. Endangered and threatened species, or protected marine mammals for that matter, have never been observed taken in strikenet sets.

Given the high rate of observer coverage in the shark gillnet fishery, NOAA Fisheries believes that smalltooth sawfish takes in this fishery are very rare. The fact that there were no smalltooth sawfish caught during the year 2001, when 100 percent of the fishing effort was observed, indicates that smalltooth sawfish takes (observed or total) most likely do not occur on annual basis. Based on this information, NOAA Fisheries believes that one incidental capture of a sawfish (released alive) over the next five years, will occur as a result of the use of gillnets in this fishery (NOAA Fisheries, 2003).

4.10.4 Protected Species Taken in Rod and Reel/Handline Fisheries

Sea Turtles

Recreational fishermen targeting sharks generally use bait and hook. Sea turtles are known to take baited hooks. NOAA Fisheries has no data specifically showing that sea turtles are taken by recreational anglers fishing for sharks. Most recorded sea turtle captures by recreational fishermen occur off fishing piers where sea turtles are known to frequent due to lighting and the concentration of bait. There were no sea turtles caught during the June Gulf Coast Shark Census held each year between 1991 and 1999 (operating out of Sarasota) which happens offshore and not on fishing piers. The selected measures in Amendment 1 pertain to recreational shark fishing in Federal waters. Based on the information above NOAA Fisheries believes that the chances of a recreational shark fishermen catching a sea turtle in Federal waters is discountable (NOAA Fisheries, 2003).

Smalltooth Sawfish

Smalltooth sawfish are known to be occasionally hooked with rod and reel and/or handline during recreational fishing. These captures occur most frequently in state waters 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. These interviews indicate that the

majority of anglers do not try to catch any particular kind of fish. Target species of the minority group that did try to catch a particular type, however, included snook, spotted sea trout, red drum, and tarpon. Thus the vast majority of incidental smalltooth sawfish captures are not from shark fishing.

The only indication that smalltooth sawfish may be occasionally hooked by a fishermen targeting sharks stems from the June Gulf Coast Shark Census between 1991 and 1999. Five smalltooth sawfish were captured and released in 20,000 line hours of recreational fishing effort. The captures, however, were all from either inside the barrier islands or just offshore from barrier islands, along the southwest Florida coast between Cape Romano and Saint Petersburg; thus all within state waters.

Given the overall scarcity of smalltooth sawfish encounters in state waters where this species is believed to occur in greater abundance and density, the chances of a smalltooth sawfish being encountered during recreational fishing in Federal waters are extremely rare. The MRFSS database has no records of smalltooth sawfish captured in Federal waters, let alone one during fishing targeting sharks. Therefore, NOAA Fisheries believes that the chances of a recreational shark fisherman catching a smalltooth sawfish in Federal waters are discountable (NOAA Fisheries, 2003).

4.10.5 Effects of the Selected Measures

The selected alternative to reduce the LCS commercial quota from 1997-2002 levels, resulting in a 45 percent reduction, is expected to reduce fishing effort for the shark bottom longline fishery. Effort reductions are not expected in the shark gillnet fishery because it primarily targets SCS and drift gillnet fishing will not be eliminated under Amendment 1. The 2003 Biological Opinion for the Atlantic shark fishery found that the reduction in bottom longline effort may result in a reduction of the number of sea turtle interactions (NOAA Fisheries, 2003). NOAA Fisheries has no way of quantifying the effect on sea turtles at this time. Any such effort reductions will only reduce smalltooth sawfish interactions if effort reductions occur in the southern fishing areas where smalltooth sawfish are known to occur.

NOAA Fisheries has also selected alternatives to implement a time/area closure off of North Carolina and require vessel monitoring systems on gillnet and bottom longline vessels. Although the time/area closure is expected in part to reduce the bycatch of prohibited species such as the dusky shark, the 2003 BiOp found it may have the added benefit of reducing potential sea turtle interactions (NOAA Fisheries, 2003). This benefit depends however, on how much effort reduction actually results from this action. Most bottom longline fishermen tend to fish close to their home port, so if redistribution of effort does occur, the effort is expected to redistribute to areas adjacent to or seaward of the closure. Sea turtle interactions may occur in these areas as well, thus reduced sea turtle interactions may not be realized if effort is merely redistributed. The time/area closure occurs north of where smalltooth sawfish occur, thus will provide no benefit to smalltooth sawfish. Conversely, should effort redistribute to the southern fishing grounds,

smalltooth sawfish interactions could potentially increase as a result of the time area closure. Based on the expected area of any effort redistribution, however, NOAA Fisheries believes the time/area closure will have no smalltooth sawfish impacts (NOAA Fisheries, 2003).

The requirement to have VMS on directed shark gillnet and bottom longline vessels will aid in enforcement of the time/area closure. Additionally, this measure could lead to improvements in effort data in this area which is used in estimating takes of protected species. Any such improvements however, would only potentially benefit sea turtles, as again this would be in areas outside the range of smalltooth sawfish.

NOAA Fisheries is not reducing the recreational bag limit but is working towards increasing compliance with existing regulations. NOAA Fisheries is also restricting the authorized gear in the recreational fishery to handline and rod and reel. Post-release mortality of these gear types is lower than that of traditional commercial gears such as bottom longline or gillnet. Since these gears are presently not used in recreational fishing, little benefit to sea turtles and smalltooth sawfish is expected.

Some of the regulations in Amendment 1 were specifically designed to reduce, to the extent practicable, bycatch and bycatch mortality of sea turtles and marine mammals. These alternatives include; requiring the use of corrodible hooks, de-hooking devices (once a de-hooking device is approved), dipnets, and line cutters on bottom longline vessels (similar to the requirements for pelagic longline vessels); and requiring bottom longline vessels to move 1 nmi after an interaction with a protected species (also similar to the requirement for pelagic longliners). The 2003 BiOp found these measures are expected to have a positive impact on protected species (NOAA Fisheries, 2003). Additionally, the 2003 BiOp concluded that non-stainless steel corrodible hooks for the directed shark bottom longline fishery will minimize impacts to sea turtles and smalltooth sawfish if they are accidentally hooked. De-hooking equipment should also safely release incidentally caught sea turtles.

4.10.6 Cumulative Effects

Cumulative effects are the effects of future state, local, or private activities that are reasonably certain to occur within the action area and were considered in the 2003 BiOp (NOAA Fisheries, 2003). Federal actions that are unrelated to the proposed action were not considered in the 2003 BiOp because they require separate consultation pursuant to Section 7 of the ESA.

The 2003 BiOp found that within the action area, major future changes are not anticipated in the ongoing human activities described in the environmental baseline (NOAA Fisheries, 2003). The present, major human uses of the action area–commercial and recreational fishing (that affect sea turtles and smalltooth sawfish) and recreational beach use and boating (that affect sea turtles)–are expected to continue at the present levels of intensity in the near future.

Beachfront development, lighting, and beach erosion control are ongoing activities along the Atlantic and Gulf coasts. 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, as conservation awareness spreads, more and more coastal cities and counties are adopting more stringent measures to protect hatchling sea turtles from the disorienting effects of beach lighting.

State-regulated commercial and recreational fishing activities in Atlantic Ocean and Gulf of Mexico waters currently result in the incidental take of threatened and endangered species. It is expected that states will continue to license/permit large vessel and thrill-craft operations which do not fall under the purview of a Federal agency, and issue regulations that will affect fishery activities. Any increase in recreational vessel activity to include fishing in inshore and offshore waters of the Gulf of Mexico and Atlantic Ocean will likely increase the number of turtles and sawfish taken by injury or mortality in vessel collisions (in the case of turtles). Recreational hook-and-line fisheries have been known to lethally take sea turtles and smalltooth sawfish (when intentional, otherwise non lethal). Future cooperation between NOAA Fisheries and the states on these issues should help decrease take of sea turtles and sawfish caused by recreational activities. NOAA Fisheries will continue to work with coastal states to develop and refine ESA Section 6 agreements and Section 10 permits to enhance programs to quantify and mitigate these takes.

4.10.7 Conclusion of the 2003 HMS Biological Opinion

Sea Turtles

With the exception of the northern nesting population of loggerheads, nesting for loggerheads, Kemp's ridley, green, and leatherback sea turtles have been increasing or remaining stable in the southeastern United States and Rancho Nuevo, Mexico (in the case of Kemp's ridleys). These population increases have occurred despite the take levels associated with the shark fisheries. The 2003 BiOp found that Amendment 1 is not expected to significantly change this fishery's effects on sea turtles (it most likely will decrease the number of lethal takes to an as of yet undetermined level) (NOAA Fisheries, 2003). Based on information presented in the Environmental Baseline section of the 2003 BiOp and the analysis in the December 2, 2002, BiOp on the shrimp fishery (for which the entire HMS fishery was part of the baseline), the increase in TED opening sizes associated with the final TED rule, published in the *Federal Register* on February 21, 2003 (68 FR 8456), is expected to allow the northern nesting population of loggerheads, as well as the other turtle populations, to increase. Therefore, the 2003 BiOp found that the effects of the actions are not likely to appreciably reduce either the survival or recovery of loggerhead, Kemp's ridley, green, hawksbill or leatherback sea turtles in the wild by reducing their reproduction, numbers, or distribution (NOAA Fisheries, 2003). In particular, the 2003 BiOp determined that the activities associated with the selected actions, when added to ongoing activities affecting these species in the action area and the cumulative effects (See

Section 4.10.6), to affect sea turtles in a way that reduces the number of animals born in a particular year (i.e., a specific age-class), the reproductive success of adult sea turtles, or the number of young sea turtles that annually recruit into the adult breeding population. Based on these facts, the 2003 BiOp concluded that the selected actions are not likely to jeopardize the continued existence of the endangered Kemp's ridley, green, hawksbill, and leatherback sea turtles, and the threatened loggerhead sea turtle (NOAA Fisheries, 2003). Critical habitat has not been designated for these species in the action area; therefore, none will be affected.

Smalltooth sawfish

The 2003 BiOp found that although Atlantic shark fisheries would result in the temporary disturbance of behavior and short term injury (in the case of bottom longline hooking) of smalltooth sawfish, based on available information, the activities are not expected to affect the reproduction of the individuals that are caught, nor result in mortality (NOAA Fisheries, 2003). Based on this information, Atlantic shark fisheries would not affect reproduction, numbers, or distribution of wild populations of smalltooth sawfish. Therefore the selected actions will not reduce the smalltooth sawfish populations' likelihood of surviving and recovering in the wild. Thus, the 2003 BiOp concludes that the selected actions in Amendment 1 are not likely to jeopardize the continued existence of smalltooth sawfish (NOAA Fisheries, 2003).

4.10.8 Incidental Take Statement

Anticipated Amount or Extent of Incidental Take

Based on observer data, observed and self-reported effort data, and the distribution and density of sea turtles in the action area, NOAA Fisheries anticipates that the continued prosecution of the Atlantic shark fisheries under the HMS FMP, including implementation of Amendment 1 may result in take (NOAA Fisheries, 2003). Currently available information on the relationship between sea turtles and sawfish and the Atlantic shark fishery indicates that injury and/or death of sea turtles and smalltooth sawfish is likely to occur. Therefore, pursuant to section 7(b)(4) of the ESA, the 2003 BiOp anticipates an actual 5-year total incidental take for the Atlantic shark fishery of:

- 172 leatherback turtles, of which 88 will be lethal.
- 1370 (1120 + 250 of the expected 280 unidentified, which are most likely loggerhead turtles) loggerhead turtles of which 755 will be lethal.
- 30 total in any combination of hawksbill, green, and Kemp's ridley (remaining 30 of the expected 280 unidentified), with 5 lethal takes per species.
- 261 smalltooth sawfish, of which no lethal takes are expected.

The above take estimates were further broken down by gear type. These limits represent the number of total estimated takes, based on observed takes extrapolated across total effort levels for this fishery. Each gear type must be considered independently, and if the actual calculated

incidental captures or mortalities exceed the amount estimated below for a gear type, the 2003 BiOp specifies that formal consultation for that gear type must be re-initiated immediately (NOAA Fisheries, 2003). The take estimates by gear type are as follows:

Bottom Longline Gear

Species	Total Takes (5-year)	Mortalities (5-year)
Loggerhead sea turtle	1360	754
Leatherback sea turtle	150	85
Other sea turtle species (green, Kemp's ridley, or hawksbill)	30 (combined for all species)	5 (5 per species)
Smalltooth sawfish	260	0

Drift Gillnet Gear

Species	Total Takes (5-year)	Mortalities (5-year)
loggerhead sea turtle	10	1
leatherback sea turtle	22	3
smalltooth sawfish	1	0

4.11 ENVIRONMENTAL JUSTICE CONCERNS

Executive Order 12898 requires agencies to identify and address disproportionately high and adverse environmental effects of its regulations on the activities of minority and low-income populations. In particular, the environmental effects of the regulations should not have a disproportionate effect on minority and low-income communities. The communities of Dulac, LA, and Fort Pierce, FL, have significant populations of Native Americans and Black-Americans respectively. These two communities also have significant populations of low-income residents. None of the preferred alternatives for proposed management measures are expected to have a disproportionate impact on these minority populations and low-income populations.

The time/area closure off the coast of North Carolina has the potential to have adverse economic and social impacts, however NOAA Fisheries does not anticipate that these effects will fall disproportionately on minority or low-income populations. The time/area closure is designed in part to reduce the bycatch of a prohibited species, the sale and marketing of which is already prohibited under current regulations. However, substantial numbers of sandbar shark are caught in the time/area closure, and the reduction in income from this fishery may have a negative economic impact. This and other management measures are designed to rebuild the LCS complex and prevent other species of sharks from becoming overfished. NOAA Fisheries believes that this will provide long-term economic stability for the fishery and communities that are dependent upon the fishery.

4.12 COASTAL ZONE MANAGEMENT CONCERNS

The Coastal Zone Management Act (CZMA, 1972, reauthorized 1996) requires that Federal actions be consistent to the extent practicable, with the enforceable policies of all state coastal zone management programs. NOAA Fisheries has determined that the list of current preferred alternatives which seek to rebuild the LCS complex, prevent overfishing of the LCS complex, and prevent overfishing of other species of sharks will be implemented in a manner consistent to the maximum extent practicable with the enforceable policies of the coastal states in the Atlantic, Gulf of Mexico, and Caribbean that have Federally approved coastal zone management programs. NOAA Fisheries asked for states' concurrence with this determination during the proposed rule stage. As of October 31, 10 states had replied affirmatively regarding the consistency determination. NOAA Fisheries presumes that the remaining states that have not yet responded also concur with the determination. One state, Georgia, replied that allowing the use of gillnets, including the strikenet method, is not consistent with the State's CZMA program.

The State of Georgia objects to the consistency determination due to the continuing operation of the shark gillnet fishery in Federal waters impacting resources shared by adjacent state waters. NOAA Fisheries shares the State of Georgia's concern regarding the impact of the shark gillnet fishery on sea turtles, marine mammals, and sport fish. However, data currently available indicate relatively low rates of bycatch and bycatch mortality of protected species and other finfish in this fishery (See Section 3.5). The incidental capture of endangered species in the shark gillnet fishery is regulated under the ESA and the October 29, 2003, BiOp did not conclude that continuation of the shark gillnet fishery would jeopardize any endangered or threatened resources and issued a new incidental take statement for the fishery. Therefore, NOAA Fisheries is not prohibiting the use of this gear at this time. This finding is consistent with National Standard 2 which requires that management measures be based on the best scientific information available including the BiOp. In this document, NOAA Fisheries is preferring a measure that will require all shark gillnet vessels to install and activate a VMS during right whale calving season, and is making a commitment to examine in a future rulemaking, gear modifications or other alternatives that will reduce bycatch and bycatch mortality in this fishery. NOAA Fisheries will also work with existing take reduction teams and relevant Fishery Management Councils to examine methods of reducing bycatch. Thus, NOAA Fisheries finds that the final regulations implemented in the FMP Amendment are consistent with Georgia's Coastal Zone Management Program to the maximum extent practicable.

The State of Georgia objects to the consistency determination due to the continuing operation of the shark gillnet fishery in Federal waters impacting resources shared by adjacent state waters. Specifically, the State of Georgia raises a concern regarding the impact of the shark gillnet fishery on sea turtles, marine mammals, and sport fish. NOAA Fisheries acknowledges the concern raised; however, under the Magnuson-Stevens Fishery Conservation and Management Act's (16 U.S.C. § 1801 et seq.) (Magnuson-Stevens Act) National Standards, the Agency must, among other things, implement conservation and management measures to prevent overfishing

while achieving, on a continuing basis, the optimum yield from each fishery; base its actions upon the best scientific information available; manage stocks throughout their range to the extent practicable; minimize adverse economic impacts on fishing communities to the extent practicable; and minimize bycatch and bycatch mortality to the extent practicable. 16 U.S.C. §§ 1851(a)(1), (2), (3), (8), and (9).

At this time, there is not sufficient information to support a closure, pursuant to the Magnuson-Stevens Act, of the shark gillnet fishery in Federal waters adjacent to Georgia. Gillnets are the commercial gear that are used to target small coastal sharks (SCS), a complex that is not, according to the latest SCS stock assessment, overfished. See Section 3.2.2. Based on the best scientific information available, this Amendment would manage the fishery for optimum yield by preferring a quota level that would increase the SCS commercial quota from the level in the 1999 HMS FMP. See Section 4.2.3. Given that a quota increase is warranted under the stock assessment, closing the shark gillnet fishery in Federal waters off Georgia would not facilitate achieving, on a continuing basis, the optimum yield from the fishery and managing the stocks through their range.

With regard to bycatch, this Amendment minimizes bycatch and bycatch mortality to the extent practicable. Incidental capture of threatened and endangered species is regulated under the ESA. As discussed in Section 4.10, according to an October 29, 2003, BiOp prepared pursuant to the ESA, there are relatively low rates of bycatch and bycatch mortality in the shark gillnet fishery. The BiOp concludes that continuation of the shark gillnet fishery would not jeopardize any endangered or threatened resources and issued a new incidental take statement for the fishery. Thus, NOAA Fisheries is not prohibiting the use of gillnet gear at this time.

While this Amendment does not prohibit the use of gillnet gear, it does consider permanent closure of the shark gillnet fishery (alternative J2) and allowing only the strikenet method in the shark gillnet fishery (alternative J3) in its discussion of bycatch alternatives. See Section 4.6.1. Alternative J2, in particular, would make this Amendment fully consistent with Georgia's CZMA program, as it would result in removal of gillnets as an authorized gear in the Federal shark fishery. However, NOAA Fisheries is not preferring alternatives J2 and J3 at this time, due to the significant, negative social and economic impacts on the five vessels actively fishing in the shark gillnet fishery. Rather, NOAA Fisheries is preferring a measure that will require all shark gillnet vessels to install and activate a VMS during right whale calving season, and, in future rulemaking, will examine additional gear modifications or other alternatives to reduce bycatch and bycatch mortality in this fishery. NOAA Fisheries will also work with existing take reduction teams and Fishery Management Councils to examine methods of reducing bycatch. Thus, NOAA Fisheries finds that this FMP Amendment is consistent to the maximum extent practicable with Georgia's CZMA program.

4.13 CUMULATIVE IMPACTS

Cumulative impact is the impact on the environment, which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR § 1508.7). A cumulative impact includes the total effect on a natural resource, ecosystem, or human community due to past, present, and future activities or actions of Federal, non-Federal, public, and private entities. Cumulative impacts may also include the effects of natural processes and events, depending on the specific resource in question. Cumulative impacts include the total of all impacts to a particular resource that have occurred, are occurring, and will likely occur as a result of any action or influence, including the direct and reasonably foreseeable indirect impacts of a Federal activity. The goal of this section is to describe the cumulative ecological, economic and social impacts of past, present and reasonably foreseeable future actions with regard to the Atlantic shark fishery.

Past, Present, and Reasonably Foreseeable Actions

One of the primary goals of the 1993 Shark FMP and the 1999 HMS FMP was to establish management measures intended to reduce overfishing, rebuild U.S. Atlantic shark populations, and to prevent overfishing of fully fished stocks. Alternatives to rebuild and manage the Atlantic shark fisheries included, among other things, quotas for LCS, SCS, and pelagic sharks, a public display and scientific quota, retention and size limits, a prohibition on shark finning, overharvest and underharvest adjustment authority, and permitting and reporting requirements, including a limited access system. The limited access system was intended to prevent overcapitalization and reduce latent effort in the fishery. The 1999 HMS FMP also established ridgeback and non-ridgeback LCS categories and a commercial minimum size requirement for ridgeback LCS, as well as retention and size limits for recreational shark fishermen (See Chapter 1). Due in part to litigation, certain management measures for LCS and SCS were suspended, including commercial quotas, the commercial minimum size, and some accounting methods.

Since the HMS FMP, NOAA Fisheries has finalized two supplemental environmental impact statements where final actions were designed to reduce impacts on both target and non-target species. The first one, published in June 2000, analyzed management measures, particularly time/area closures, to reduce bycatch, bycatch mortality, and incidental catch in the pelagic longline fishery. The final actions were expected to have negative direct, indirect, and cumulative economic and social impacts for pelagic longline fishermen and were expected to have positive ecological impacts regarding reduction in bycatch and bycatch mortality. This rulemaking was expected to have little impact on directed shark fishermen but could impact fishermen who catch and land sharks incidentally.

The second supplemental environmental impact statement, published in July 2002, analyzed the management measures contained in a June 14, 2001, Biological Opinion addressing sea turtle bycatch and bycatch mortality in HMS fisheries. Certain measures in that rulemaking, such as

the closure of the Northeast Distant Area (NED) to pelagic longline vessels, are expected to have negative direct, indirect, and cumulative economic and social impacts on pelagic longline fishermen. These effects however, have been mitigated in the short-term because vessels are able participate in an experimental fishery in the NED. The rulemaking also implemented measures in the shark gillnet fishery. The management measures for the shark gillnet fishery (required net checks for sea turtles and other marine mammals at least every two hours and ceasing of fishing and notification to NOAA Fisheries if a whale is taken) are anticipated to have little to no adverse impacts on shark fishermen and are expected to have some positive impact in regard to possible reductions in sea turtle mortality.

As discussed in Chapter 1 of this document, the LCS and SCS quotas and certain measures from the 1999 final rule were never implemented due to litigation. Several emergency rules were implemented as interim measures pending completion of this FMP Amendment. Moreover, the 2002 stock assessments for LCS and SCS indicated that, under past and present management measures, some shark stocks continue to be overfished but are rebuilding (e.g., the sandbar shark), some shark stocks are fully rebuilt (e.g., the blacktip shark), and some shark stocks remain healthy (e.g., the Atlantic sharpnose shark). The emergency measures were put into place to maintain biomass levels until a rebuilding plan was implemented. In all, the final actions of the emergency rules, both individually and in combination with each other, were designed to prevent overfishing and facilitate rebuilding of the stocks without adverse economic or social impacts pending an amendment to the HMS FMP.

Other actions that were taken subsequent to the 1999 HMS FMP include making the shark observer program mandatory in 2002, and mandatory cost earnings reporting, a new requirement for shark recreational anglers to obtain the HMS Angling category permit, and new regulations on shark exempted fishing permits in 2003. Further actions NOAA Fisheries may consider in the future include bycatch reduction measures, commercial trip limits, allocation between directed, incidental, and recreational permit holders, season openings and closings, limited access streamlining, recreational reporting, and pelagic shark quotas and adjustments based on assessments. NOAA Fisheries may address some or all of these issues in a forthcoming rulemaking.

While the 2002 SCS stock assessment does indicate that overfishing is occurring on finetooth sharks, the biomass of the stock is still above the level at which it would be overfished. The selected alternatives described in this FMP Amendment are intended to address this and other issues. Several of the most significant measures are listed below:

(1) Aggregate LCS into one complex with one closure date to reduce bycatch and reduce dead discards;
(2) Establish a trimester season to address temporal differences in fishing practices, fish availability, and pupping seasons;
(3) Establish commercial shark quotas based on a percentage of MSY;
(4) No minimum size requirement for commercially harvested sharks;

(5) Maintain existing recreational shark catch limits of one shark per vessel per trip and one Atlantic sharpnose shark per person per trip, with addition of one bonnethead shark per person per trip; and,
(6) Establish a time/area closure for dusky and sandbar shark pupping and nursery areas.

Cumulative Ecological Impacts

The HMS FMP concluded that the cumulative long-term impacts of management measures implemented in the FMP would be to rebuild overfished fisheries; minimize bycatch and bycatch mortality, to the extent practicable; identify and protect essential fish habitat; and minimize adverse impacts of fisheries regulations on fishing communities, to the extent practicable.

Although past management actions may have had some negative economic and social impacts, these actions have promoted the long-term sustainability and continued economic viability of the shark fishery. The two dominant species, blacktip and sandbar, are no longer overfished. Blacktip sharks are now listed as rebuilt, and sandbar sharks are no longer overfished, although overfishing is still occurring. Finetooth sharks are experiencing overfishing, but are not yet at a point where they are overfished.

Annual harvest of Atlantic sharks peaked at approximately 8,000 mt dw in the late 1980s. The 1993 Shark FMP established a quota of 2,463 mt dw for LCS for 1993 and 2,570 mt dw for LCS for 1994. The quota of 2,570 mt dw was reduced by 50 percent to 1,285 mt dw in 1997, and further reduced to 816 mt dw in the 1999 HMS FMP (See Chapter 1, Table 1.2). The 1999 quotas were never implemented due to litigation, and the 1997 quotas remained in effect until the temporary emergency rule increased the quotas in 2001. More recently (1997-2001), annual harvests of Atlantic sharks have averaged approximately 2,300 mt dw due to overharvests in Federal landings and landings in state waters after Federal closures. The overall trend has been a reduction in the quotas established for Atlantic sharks, with a concomitant decline in harvest, which has lead to positive impacts for Atlantic sharks by reducing overfishing and allowing two key species to be rebuilt (blacktip) or no longer overfished (sandbar). Blacktip and sandbar sharks combined account for approximately 64 percent of the observed catch, and an even larger percentage of landings. The quotas selected in this final Amendment reduce the LCS quota by 268 mt dw from 1,285 mt dw to 1,017 mt dw, which should rebuild LCS populations within the rebuilding time frame and prevent overfishing.

For non-target species, which include a wide variety of finfish species, rays, invertebrates, and protected species such as sea turtles, the cumulative impact of reducing overall fishing effort has been positive. Measures that have been taken to reduce the bycatch of protected species in HMS Fisheries include implementation of the NED closed area to pelagic longlining, a requirement to post handling and release guidelines for incidentally captured sea turtles on vessels, and in this final Amendment, requiring the use of non-stainless steel corrodible hooks, line cutters, dipnets, and dehooking devices to mitigate impacts on incidentally caught sea turtles. Measures have also been taken to reduce interactions with endangered right whales during the calving season by

requiring 100 percent observer coverage. Additionally, new regulations on shrimp turtle excluder devices should reduce shark bycatch in shrimp fisheries and have a positive ecological impact.

Since the EFH provisions were added to the Magnuson-Stevens Act in 1996, action has been taken to identify and protect shark EFH. Additional research delineating important shark nursery and pupping areas has been undertaken and this information has contributed to the time/area closure for dusky and sandbar shark nursery habitat in EFH and HAPC areas in this FMP Amendment (See Section 4.6.2). The management measure to require VMS on shark bottom longline fishing vessels will further assist NOAA Fisheries in enforcement of the time/area closure, and protection of these vulnerable life stages of sharks. Several time/area closures have been implemented as part of HMS fisheries to reduce discards, protect other HMS species such as juvenile swordfish, and to reduce bycatch of protected species. Currently, approximately 3 million square miles of ocean are closed to HMS fishing at various times of the year. Cumulatively, these actions have had a positive ecological impact on HMS fisheries as a whole as well as on non-target species.

Actions NOAA Fisheries may consider in the future include commercial trip limits, bycatch reduction measures, allocation between directed, incidental, and recreational permit holders, season openings and closings, limited access streamlining, recreational reporting, and pelagic shark quotas and adjustments based on assessments. These measures, if considered, would be designed to address specific needs of the fishery, and as such, would be intended to have positive ecological impacts. Presently, there are no known third party planned actions that may affect target species.

In summary, the past, present, and reasonably foreseeable future actions have had a positive ecological impact by reducing fishing pressure and allowing stocks to rebuild.

Cumulative Economic and Social Impacts

The cumulative economic and social impact of actions taken since the 1993 Shark FMP, the 1999 HMS FMP, and the current HMS FMP Amendment has been to reduce the number of participants and overall latent effort in the shark fishery. By reducing the number of permitted vessels in the fishery, the overall quotas, implementing trip limits, expanding the list of prohibited species, and a variety of other commercial and recreational management measures, the fishery has had to deal with regulatory impacts and adapt to economic changes.

Since 1993, there has been a substantial decline in the number of vessels fishing for Atlantic sharks. With the implementation of the FMP in 1993, both the number of vessels and fishing effort were reduced. The limited access permit system for directed and incidental shark fishing in 1999 further reduced the number of vessels to 878. The number of directed and incidental shark permits has continued to decline and numbered 627 as of October 2002. Of these, only 251 have directed shark permits. Recent analysis indicates that of the 251 vessels, only 85 reported

landings in 2001 (See Chapter 6). As of March 1, 2003, anglers fishing for any HMS are required to have an HMS angling permit. This permit and the HMS Charter headboat permit allow fishermen to catch HMS recreationally and are not species specific. As of May 2003, approximately 9,372 recreational fishermen had been issued an Atlantic HMS Angling permit and 2,412 charter/headboat permits had been issued (See Chapter 6).

As a result of management actions, vessels that used to fish for sharks may have moved to other fisheries, may have gone out of business, or experienced other adverse economic impacts. Approximately 98 percent of these vessels hold permits in other fisheries because the short seasons require them to fish in other fisheries. Average ex-vessel prices for shark have remained fairly constant, and have not increased enough to offset potential declines in landings. The average ex-vessel price of LCS across all regions was approximately $0.91 per lb dw in 2001 (See Chapter 6). Some of the selected alternatives in this Amendment, while not directly reducing the number of participants in the fishery further, may have negative economic impacts by further reducing LCS commercial quotas, and in particular, establishing a time/area closure for dusky and sandbar shark pupping and nursery areas off the coast of North Carolina. Other actions, such as raising the SCS commercial quotas, are expected to have a positive economic impact.

Many of the economic impacts experienced by the fishery are not solely the result of Federal actions. Many coastal states have implemented, or are in the process of implementing, shark regulations. Several states have begun to develop regulations consistent with federal regulations. In 1999, the Mid-Atlantic Fishery Management Council passed a motion encouraging all the states from Maine to Texas to close their state waters to all directed fishing for large coastal sharks in order to protect pupping and nursery areas. The New England Fishery Management Council supported the Mid-Atlantic Council's recommendation and requested that NOAA Fisheries do everything possible to facilitate the closing (NMFS, 1999). While no Atlantic states have closed state waters entirely to shark fishing, many require closures to go into effect with the Federal closure, and other state regulations such as trip and size limits and landing requirements have been implemented to curtail fishing effort.

With regard to trip limits, NOAA Fisheries has received comments that fishermen would like to see a higher trip limit for incidental landings during a directed fishery closure to prevent regulatory discards. With regard to allocation, there currently is no quota for the recreational shark fishery which caught 142,000 LCS in 2001, compared to 99,000 LCS landed in the commercial fishery. The recreational LCS catch declined from a high of 426,000 in 1986 to 142,000 LCS (NOAA Fisheries, 2003). With the recreational sector catching such a large number of sharks, there is a need to examine whether quotas in the recreational fishery are warranted. As described above, allocation between directed, incidental, and recreational permit holders is one of several options NOAA Fisheries may consider in the future. In terms of commercial quota allocation, the directed and incidental shark fisheries are currently operating under a single quota, and this approach may need to be re-examined also. Finally, season openings and closings are crucial for both economic and ecological reasons. Economically, the

timing of openings and closings can impact the marketing and sale of product. Fishermen have commented that there are times of the year when consumer demand for sharks is greater and prices consequently higher. A change in the opening date for the fishery may thus improve profit margins. Ecologically, shark populations could potentially benefit from a reduction in fishing effort during vulnerable developmental stages.

The overriding goal of shark management has been to provide a sustainable harvest that will provide the greatest economic benefit to the largest number of individuals. The management strategy for sharks has been consistent with the National Plan of Action (NPOA) for the conservation and management of sharks. The NPOA requires NOAA Fisheries to undertake extensive data collection, analysis, and management measures in order to ensure long-term sustainability of U.S. shark fisheries.

4.14 COMPARISON OF THE ALTERNATIVES

The ecological, social, and economic impacts compared in Table 4.16 are for the foreseeable short-term future. However, NOAA Fisheries expects that many of the short-term, negative social and economic impacts associated with the alternatives could translate into positive long-term social and economic impacts as shark stocks continue to rebuild. Table 4.16 represents a summary of impacts associated with each of the alternatives, however, there are competing impacts associated with many of the alternatives listed. As such, please reference the individual alternatives as analyzed in chapters 4, 6, 7, 8 and 9.

Table 4.1 Summary of Shark Pupping Seasons for Some Species. Source: NMFS, 1999.

		Month of the Year											
		1	2	3	4	5	6	7	8	9	10	11	12
Ridgeback	Sandbar			**Florida - New Jersey**									
Non ridgebacks	Blacktip					**Georgia - Florida**							
	Spinner						**Gulf of Mexico**						
	Bull					**Florida and Gulf of Mexico**							
	Lemon					**Florida**							
	Scalloped hammer head						**South Carolina and Gulf of Mexico**						
SCS	Atlantic sharpnose				**South Carolina and Gulf of Mexico**								
	Finetooth				**South Carolina and Gulf of Mexico**								
	Blacknose				**South Carolina and Gulf of Mexico**								
	Bonnethead								**Florida and Gulf of Mexico**				
Prohibited	Dusky				**South Carolina through Maryland**								

Table 4.2 Percent Change in Catch of Dusky, Sandbar, and LCS Complex in the Revised Time/Area Closure under Different Scenarios With and Without Redistribution of Effort 1994-2002.

	Without redistribution of effort from 1994-2002		With redistribution of effort based on data from 1994-2002		With redistribution of effort based on data from 2001-2002	
	Original	Revised	Original	Revised	Original	Revised
Dusky shark	-85%	-79%	-79%	-74%	-60%	-55%
Sandbar shark	-66%	-51%	-48%	-46%	Not available	
LCS	-58%	-42%	-27%	-28%	+30%	-3%

Table 4.3 Example of Temporal Variations in Effectiveness of Closing Revised Area on Dusky Shark Catches. Source: shark observer program data from 1994 through 2002. * Indicates months that the fishery has always been closed.

Month (1994-2003)	Number of dusky sharks observed caught inside the time/area closure	Number of dusky sharks observed caught outside the time/area closure	Percentage reduction in dusky sharks caught if time/area is closed
January	340	52	87%
February	162	70	70%
March	339	28	92%
April	103	18	85%
May	15	1	94%
June*	0	0	0%
July	140	54	72%
August	1	3	25%
September	0	52	0%
October	0	13	0%
November*	0	1	0%
December*	0	0	0%
Total	**1,100**	**292**	
Total (Jan-July)	**1,099**	**223**	**79%**[++]

[++] calculated by dividing the number of dusky sharks caught from Jan-July by the total number of dusky sharks caught during the entire fishing year [1,099/(1100+292)=79%].

Table 4.4 Example of Temporal Variations in Effectiveness of Closing Revised Area on Dusky Shark Catches. Source: shark observer program data from 2001-2002. * Indicates months that the fishery has always been closed.

Month (1994-2003)	Number of dusky sharks observed caught inside the time/area closure	Number of dusky sharks observed caught outside the time/area closure	Percentage reduction in dusky sharks caught if time/area is closed
January	30	4	88%
February	2	1	67%
March	29	1	97%
April	1	0	100%
May	0	0	0%
June*	0	0	0%
July	5	8	38%
August	1	2	33%
September	0	24	0%
October	0	0	0%
November*	0	0	0%
December*	0	0	0%
Total	**68**	**40**	
Total (Jan-July)	**67**	**14**	**62%**[++]

[++] calculated by dividing the number of dusky sharks caught from Jan-July by the total number of dusky sharks caught during the entire fishing year [67/(68+40)=62%].

Table 4.5 Catch and CPUE Estimates for Dusky Sharks Based on Data from the Shark Observer Program in the Time/Area Closure by Year.

Year	Number of dusky sharks observed caught inside the time/area closure	Number of hooks observed inside the time/area closure	CPUE in time/area closure
1994	5	4,522	0.00111
1995	211	18,646	0.01132
1996	158	14,137	0.01118
1997	110	16,543	0.00665
1998	298	20,820	0.01431
1999	250	12,357	0.02023
2000	0	0	-
2001-2002	68	15,439	0.00440
Total	**1,100**	**102,464**	

Table 4.6 Expanded Take Estimates for Dusky Sharks Based on Data from the Shark Observer Program for the Commercial Shark Bottom Longline Fishery by Year.

Year	Number of dusky sharks observed caught in Atlantic and Gulf of Mexico	Expanded take estimate for commercial fishery	Commercial landings estimate from Cortes and Neer (2002)[+]	Recreational landings estimate
1994	66	4,567	--	--
1995	387	19,250	--	--
1996	208	14,417	--	--
1997	138	11,246	--	--
1998	306	18,707	--	--
1999	286	18,667	--	5,570
2000-2002*	115	6,063	5,755	8,100
Total	**1,506**	**92,917**		

*Data for these years had to be aggregated due to low observer coverage and confidentiality issues.
[+] Data are for 2001-2002 only, and do not include 2000

Table 4.7 Example of Temporal Variations in Effectiveness of Closing Area on Sandbar Shark Catches. Source: shark observer program data from 1994 through 2003.* Indicates months that the fishery has always been closed.

Month (1994-2003)	Number of sandbar sharks observed caught inside the time/area closure	Number of sandbar sharks observed caught outside the time/area closure	Percentage reduction in sandbar sharks caught if time/area is closed
January	2,239	1,670	57%
February	632	969	39%
March	2,156	534	80%
April	427	12	97%
May	61	56	52%
June*	0	0	0%
July	1,240	1,440	46%
August	28	316	8%
September	13	558	2%
October	0	94	0%
November*	0	0	0%
December*	9	0	0%
Total	**6,805**	**5,649**	
Total (Jan-July)	**6,755**	**4,681**	**54%**[++]

[++]calculated by dividing the number of sandbar sharks caught from Jan-July by the total number of sandbar sharks caught during the entire fishing year [6,755/(6,805+5,649)=54%].

Table 4.8 Example of Temporal Variations in Effectiveness of Closing Area on LCS Complex. Source: shark observer program data from 1994 through 2003. Data includes sandbar and dusky sharks. * Indicates months that the fishery has always been closed.

Month (1994-2003)	Number of large coastal sharks observed caught inside the time/area closure	Number of large coastal sharks observed caught outside of time/area closure	Percentage reduction in large coastal sharks caught if time/area closed
January	2,778	3,483	44%
February	893	2,140	29%
March	2,958	1,996	60%
April	1,157	546	68%
May	88	215	29%
June*	0	0	0%
July	2,101	3,067	41%
August	68	1,010	6%
September	27	1,153	2%
October	0	134	0%
November*	0	0	0%
December*	0	0	0%
Total	**10,070**	**13,744**	
Total (Jan-July)	**9,975**	**11,447**	**42%**[++]

[++] calculated by dividing the number of LCS caught from Jan-July by the total number of LCS caught during the entire fishing year [9,975/(10,070+13,744)=42%].

Table 4.9 Redistribution of Fishing Effort for Dusky Sharks in the Revised Time/Area Closure Alternative for Years 1994-2003. Source: shark observer program data from 1994 through 2003. * Indicates months in which fishery has always been closed.

	A	B	C	D	E	F	G	H	I	J	K
Month (1994-2003)	Number of hooks in Atlantic	Number of dusky sharks caught in Atlantic	Number of hooks in time/area closure	Number of dusky sharks caught in time/area closure	Number of dusky sharks caught in open Atlantic (B-D)	Dusky shark CPUE in Atlantic (E/(A-C))	Number of additional dusky sharks caught in open Atlantic by displaced effort (C*F)	Dusky shark catch from open Atlantic with displaced fishing effort (E+G)	Number of dusky sharks avoided by area closure (B-H)	Cumulative catch avoided by month (sum of I)	Percent of total dusky discards avoided by closure (J/14.0)
Jan	122,245	392	24,935	340	52	5.34e-04	13	65	327	327	23.33
Feb	53,071	232	11,502	162	70	1.68e-03	19	89	143	470	10.19
Mar	100,332	367	24,853	339	28	3.71e-04	9	37	330	799	23.56
Apr	27,135	121	4,846	103	18	8.08e-04	4	22	99	898	7.08
May	15,599	16	967	15	1	6.83e-05	0	1	15	913	1.07
June*	1,163	1	0	0	1	0.00e+00	0	1	0	913	0.00
July	134,301	194	32,727	140	54	5.32e-04	17	71	123	1,036	8.76
Aug	35,975	4	1,245	1	3	8.64e-05	0	3	1	1,037	0.06
Sept	37,963	52	1,642	0	52	0.001432	2	54	-2	1,035	-0.17
Oct	6,448	13	0	0	13	0.002016	0	13	0	1,035	0.00
Nov*	0	1	0	0	1	0	0	1	0	1,035	0.00
Dec*	3,149	9	0	9	0	0	0	0	9	1,044	0.64
Total	**537,381**	**1,402**	**102,717**	**1,109**	**293**	**0**	**66**	**359**	**1,043**	**10,542**	
Total Jan-July	**453,846**	**1,323**	**99,830**	**1,099**	**224**	**0**	**63**	**287**	**1,036**		

Percent reduction in catch calculated by dividing the number of sharks avoided caught from Jan-July (J8) by the total number of sharks caught during the entire fishing year (B14).

Table 4.10 Redistribution of Fishing Effort for Dusky Sharks in the Time/Area Closure Alternative for Years 2001-2002. A total of 216 dusky shark were observed caught from 2000-2003 in the shark bottom longline fishery. Source: shark observer program data from 1994 through 2003. * Indicates months in which fishery has always been closed.

	A	B	C	D	E	F	G	H	I	J	K
Month (1994-2003)	Number of hooks in Atlantic	Number of dusky sharks caught in Atlantic	Number of hooks in time/area closure	Number of dusky sharks caught in time/area closure	Number of dusky sharks caught in open Atlantic (B-D)	Dusky shark CPUE in Atlantic (E/(A-C))	Number of additional dusky sharks caught in open Atlantic by displaced effort (C*F)	Dusky shark catch from open Atlantic with displaced fishing effort (E+G)	Number of dusky sharks avoided by area closure (B-H)	Cumulati ve catch avoided by month (sum of I)	Percent of total dusky discards avoided by closure (J/1.17)
Jan	30,968	38	3,940	30	8	2.96e-04	1	9	29	29	24.64
Feb	20,266	3	1,560	2	1	5.35e-05	0	1	2	31	1.64
Mar	54,713	32	4,482	29	3	5.97e-05	0	3	29	60	24.56
Apr	14,693	2	0	1	1	6.81e-05	0	1	1	61	0.85
May	0	0	0	0	0	0.00e+00	0	0	0	61	0.00
June*	153	0	0	0	0	0.00e+00	0	0	0	61	0.00
July	31,862	15	5,095	5	10	3.74e-04	2	12	3	64	2.65
Aug	24,471	3	897	1	2	8.48e-05	0	2	1	65	0.79
Sept	793	24	0	0	24	0	0	24	0	65	0.00
Oct	0	0	0	0	0	0	0	0	0	65	0.00
Nov*	0	0	0	0	0	0	0	0	0	65	0.00
Dec*	2,369	0	0	0	0	0	0	0	0	65	0.00
Total	**180288**	**117**	**15974**	**68**	**49**	**9.36e-04**	**3**	**52**	**65**	**689**	
Total Jan-July	**152655**	**90**	**15077**	**67**	**23**	**8.51e-04**	**3**	**26**	**64**		

Percent reduction in catch calculated by dividing the number of sharks avoided caught from Jan-July (J8) by the total number of sharks caught during the entire fishing year (B14).

Table 4.11 Redistribution of Fishing Effort for Sandbar Sharks in the Revised Time/Area Closure Alternative for Years 1994-2003. Source: shark observer program data from 1994 through 2003. * Indicates months in which fishery has always been closed.

	A	B	C	D	E	F	G	H	I	J	K
Month (1994-2003)	Number of hooks in Atlantic	Number of sandbar sharks caught in Atlantic	Number of hooks in time/area closure	Number of sandbar sharks caught in time/area closure	Number of sandbar sharks caught in open Atlantic (B-D)	Sandbar shark CPUE in Atlantic (E/(A-C))	Number of additional sandbar sharks caught in open Atlantic by displaced effort (C*F)	Sandbar shark catch from open Atlantic with displaced fishing effort (E+G)	Number of sandbar sharks avoided by area closure (B-H)	Cumulative catch avoided by month (sum of I)	Percent of total sandbar discards avoided by closure (J/124.45)
Jan	122,245	3,909	24,935	2,239	1,670	1.72e-02	428	2098	1811	1811	14.55
Feb	53,071	1,601	11,502	632	969	2.33e-02	268	1237	364	2175	2.92
Mar	100,332	2,690	24,853	2,156	215	2.85e-03	71	286	2404	4579	19.32
Apr	27,135	439	4,846	427	12	5.38e-04	3	15	424	5004	3.41
May	15,599	117	967	61	56	0.00e+00	0	56	61	5065	0.49
June*	1,163	0	0	0	0	0.00e+00	0	0	0	5065	0.00
July	134,301	2,680	32,727	1,240	1,012	9.96e-03	326	1338	1342	6406	10.78
Aug	35,975	344	1,245	28	183	5.27e-03	7	190	154	6561	1.24
Sept	37,963	571	1,642	13	31	8.54e-04	1	32	539	7100	4.33
Oct	6,448	94	0	0	0	0	0	0	94	7194	0.76
Nov*	0	0	0	0	0	0	0	0	0	7194	0.00
Dec*	3,149	0	0	0	0	0	0	0	0	7194	0.00
Total	**537,381**	**12,445**	**102,717**	**6,796**	**4,148**	**0**	**1,103**	**5,251**	**7,194**	**65,345**	
Total Jan-July	**453,846**	**11,436**	**99,830**	**6,755**	**3,934**	**0**	**1,096**	**5,030**	**6,406**		

Percent reduction in catch calculated by dividing the number of sharks avoided caught from Jan-July (J8) by the total number of sharks caught during the entire fishing year (B14).

Table 4.12 Redistribution of Fishing Effort for LCS in the Time/Area Closure Alternative for Years 1994-2003. Source: shark observer program data from 1994 through 2003. * Indicates months in which fishery has always been closed.

	A	B	C	D	E	F	G	H	I	J	K
Month (1994-2003)	Number of hooks in Atlantic	Number of LCS caught in Atlantic	Number of hooks in time/area closure	Number of LCS caught in time/area closure	Number of LCS caught in open Atlantic (B-D)	LCS CPUE in Atlantic (E/(A-C))	Number of additional LCS caught in open Atlantic by displaced effort (C*F)	LCS catch from open Atlantic with displaced fishing effort (E+G)	Number of LCS avoided by area closure (B-H)	Cumulative catch avoided by month (sum of I)	Percent of total LCS reduced by closure (J/238.14)
Jan	122,245	6,261	24,935	2,778	3,483	3.58e-02	892	4375	1886	1886	7.92
Feb	53,071	3,033	11,502	893	2,140	5.15e-02	592	2732	301	2186	1.26
Mar	100,332	4,954	24,853	2,958	1,996	2.64e-02	657	2653	2301	4487	9.66
Apr	27,135	1,703	4,846	1,157	546	2.45e-02	119	665	1038	5525	4.36
May	15,599	303	967	88	215	1.47e-02	14	229	74	5599	0.31
June*	1,163	0	0	0	0	0.00e+00	0	0	0	5599	0.00
July	134,301	5,168	32,727	2,101	3,067	3.02e-02	988	4055	1113	6712	4.67
Aug	35,975	1,078	1,245	68	1,010	2.91e-02	36	1046	32	6744	0.13
Sept	37,963	1,180	1,642	27	1,153	3.17e-02	52	1205	-25	6719	-0.11
Oct	6,448	134	0	0	134	0	0	134	0	6719	0.00
Nov*	0	0	0	0	0	0	0	0	0	6719	0.00
Dec*	3,149	0	0	0	0	0	0	0	0	6719	0.00
Total	**537,381**	**23,814**	**102,717**	**10,070**	**13,744**	**2.44e-01**	**3,351**	**17,095**	**6,719**		
Total Jan-July	**453,846**	**21,422**	**99,830**	**9,975**	**11,447**	**1.83e-01**	**3,263**	**14,710**	**6,712**		

Percent reduction in catch calculated by dividing the number of sharks avoided caught from Jan-July (J8) by the total number of sharks caught during the entire fishing year (B14).

Table 4.13 Redistribution of Fishing Effort for LCS in the Time/Area Closure Alternative for Years 2001-2002. Source: shark observer program data from 1994 through 2003. * Indicates months in which fishery has always been closed.

	A	B	C	D	E	F	G	H	I	J	K
Month (1994-2003)	Number of hooks in Atlantic	Number of LCS caught in Atlantic	Number of hooks in time/area closure	Number of LCS caught in time/area closure	Number of LCS caught in open Atlantic (B-D)	LCS CPUE in Atlantic (E/(A-C))	Number of additional LCS caught in open Atlantic by displaced effort (C*F)	LCS catch from open Atlantic with displaced fishing effort (E+G)	Number of LCS avoided by area closure (B-H)	Cumulative catch avoided by month (sum of I)	Percent of total LCS reduced by closure (J/6.03)
Jan	30,968	163	3,940	23	140	5.18e-03	20	160	3	3	0.43
Feb	20,266	91	1,560	7	84	4.49e-03	7	91	0	3	0.00
Mar	54,713	89	4,482	21	68	1.35e-03	6	74	15	18	2.48
Apr	14,693	29	0	0	29	1.97e-03	0	29	0	18	0.00
May	0	6	0	0	6	0.00e+00	0	6	0	18	0.00
June*	153	0	0	0	0	0.00e+00	0	0	0	18	0.00
July	31,862	128	5,095	23	105	3.92e-03	20	125	3	21	0.50
Aug	24,471	81	897	4	77	3.27e-03	3	80	1	22	0.18
Sept	793	16	0	0	16	2.02e-02	0	16	0	22	0.00
Oct	0	0	0	0	0	0	0	0	0	22	0.00
Nov*	0	0	0	0	0	0	0	0	0	22	0.00
Dec*	2,369	0	0	0	0	0	0	0	0	22	0.00
Total	**180,288**	**603**	**15,974**	**78**	**525**	**4.04e-02**	**56**	**581**	**22**		
Total Jan-July	**152,655**	**506**	**15,077**	**74**	**432**	**1.69e-02**	**53**	**485**	**21**		

Percent reduction in catch calculated by dividing the number of sharks avoided caught from Jan-July (J8) by the total number of sharks caught during the entire fishing year (B14).

Table 4.14 List of LCS Species Caught Inside and Outside the Original Time/Area Closure. Source: shark observer program data from 1994 through 2003. The numbers presented below were based on the original time/area closure. Data were not available to provide estimates for the revised closure.

	Inside Closed Area		Outside Closed Area	
	Total	Percent of Category	Total	Percent of Category
Sandbar	11,828	0.72	3,840	0.42
Tiger	1,856	0.11	2,652	0.29
Dusky	1,489	0.09	161	0.02
Scalloped Hammerhead	307	0.02	216	0.02
Blacktip	374	0.02	1,589	0.17
Sand tiger	355	0.02	26	0.00
Silky	47	0.00	161	0.02
Bull	46	0.00	66	0.01
Great Hammerhead	36	0.00	92	0.01
Night	30	0.00	1	0.00
Spinner	34	0.00	102	0.01
Bignose	26	0.00	3	0.00
Lemon	11	0.00	29	0.00
Nurse	7	0.00	279	0.03
Caribbean reef	3	0.00	1	0.00
Smooth Hammerhead	1	0.00	6	0.00
White	1	0.00	13	0.00
TOTAL	16,451	1.00	9,237	1.00

Table 4.15 Comparison of the Number and Percentage of Dusky and Sandbar Sharks Caught in the Original vs. the Revised Time/Area Closure.

Species	Life Stage	Number in Revised Time/Area	Number in Original Time/Area	Percent in Revised Time/Area
Dusky	Neonate	324	340	95%
	Juvenile	692	793	87%
	Adult	87	99	88%
	Total	1,103	1,232	90%
Sandbar	Neonate	31	31	100%
	Juvenile	4,118	4,321	95%
	Adult	2,647	4,370	61%
	Total	6,796	8,722	78%

Table 4.16 Comparison of the Alternatives Considered. + denotes positive impact; - denotes negative impacts; 0 denotes no impact.

ALTERNATIVE		ECOLOGICAL IMPACTS	SOCIAL IMPACTS	ECONOMIC IMPACTS
Commercial Management Measures				
Shark Classification				
Alternative A1 (No Action)	Separate LCS groupings (Ridgeback/Non-ridgeback), different closure dates possible	(-)	(-)	(-)
Alternative A2	Separate LCS groupings (Ridgeback/Non-ridgeback), same closure date	(-)	(-)	(-)
Alternative A3 (Preferred)	*Aggregate LCS, one closure date*	(+)	(+)	(-)
Alternative A4	Species specific groupings, different closure dates possible	(- -)	(-)	(-)
Quota Administration				
Alternative B1 (No Action)	Semi-annual season	(-)	(-)	(-)
Alternative B2 (No Action)	No regional quotas	(0)	(0)	(0)
Alternative B3 (Preferred)	*Regional quotas*	(0)	(+)	(0)
Alternative B4 (Preferred)	*Trimester season*	(+)	(-)	(-)
Alternative B5	Quarterly season	(+)	(-)	(-)
Quota Basis				
Alternative C1 (No Action)	Quota Basis from 1999 HMS FMP	(+)	(-)	(-)

Alternative C2 Combined with A3 (Preferred)	*LCS complex quota based upon percentage of Maximum Sustainable Yield (MSY)*	(+)	(-)	(-)
Alternative C2 Combined with A1/A2	LCS group quota based upon percentage of MSY	(-)	(+)	(+/-)
Alternative C2 Combined with A4	LCS species-specific quota based upon percentage of MSY	(-)	(+)	(+/-)
Alternative C3 Combined with A3	LCS complex quota based upon average landings for past three years	(+)	(-)	(-)
Alternative C3 Combined with A1/A2	LCS group quota based upon average landings for past three years	(-)	(+)	(+/-)
Alternative C3 Combined with A4	LCS species-specific quota based upon average landings for past three years	(-)	(+)	(+/-)
Minimum Size				
Alternative D1 (No Action)	4.5 ft for Ridgeback LCS	(-)	(-)	(-)
Alternative D2 (Preferred)	*No minimum size*	(0)	(0)	(0)
Alternative D3	5 ft for all LCS	(-)	(-)	(-)
Alternative D4	5 ft for Ridgeback; 4.5 ft for Non-ridgeback LCS	(-)	(-)	(-)
Alternative D5	4.5 ft for Atlantic Non-ridgeback; 4 ft for Gulf of Mexico Non-ridgeback LCS	(-)	(-)	(-)
Alternative D6	Minimum size for overfished species (or where overfishing is occurring) only	(-)	(-)	(-)

Recreational Management Measures

Retention limits				
Alternative E1 (No action)	One shark per vessel per trip plus one Atlantic sharpnose shark per person per trip	(+)	(0)	(0)
Alternative E2 *(Preferred)*	*Existing catch limits (E1) plus the addition of one bonnethead shark per person per trip*	(+)	(+)	(+)
Alternative E3	Existing catch limits (E1) plus the addition of one pelagic shark per vessel per trip	(-)	(+)	(+)
Alternative E4	Existing catch limits (E1) plus an allowance for vessels with HMS Angling permits participating in registered tournaments or HMS CHB permit holders on for hire trips to retain one shark per person, up to two sharks per vessel per trip as well as one bonnethead shark per person per trip	(- -)	(+)	(+)
Alternative E5	Other retention limit that considers existing state recreational retention limits	variable	variable	variable
Alternative E6	No retention, catch-and-release fishing for all recreational shark fisheries, inclusive of all LCS, SCS, and pelagic species.	(+ + +)	(- - -)	(- -)
Alternative E7	No retention limit	(- - -)	(+ +)	(+)
Minimum Size				

Alternative F1 (No Action)	4.5 ft FL for all sharks, no size limit for Atlantic sharpnose sharks	(+)	(0)	(0)
Alternative F2 *(Preferred)*	*Existing size limits (F1) plus a no size limit for bonnethead sharks*	(+)	(+)	(+)
Alternative F3	5.0 ft FL for all sharks, no size limit for Atlantic sharpnose and bonnethead sharks	(+ +)	(-)	(-)
Alternative F4	5.0 ft FL for all ridgeback sharks, 4.5 ft FL all non-ridgeback LCS, SCS, and pelagic sharks, no size limit for Atlantic sharpnose and bonnethead sharks	(+ +)	(-)	(-)
Alternative F5	4.5 ft FL for all sharks except no size limit for Atlantic sharpnose and bonnethead sharks and regional non-ridgeback LCS minimum sizes (4.5 ft FL all Atlantic non-ridgeback LCS, 4.0 ft FL for all Gulf of Mexico non-ridgeback LCS)	(+)	(-)	(-)
Alternative F6	No size limit for any sharks	(- -)	(+ +)	(+)
Authorized Gear				
Alternative G1 (No Action)	Any authorized gear	(-)	(0)	(0)
Alternative G2 *(Preferred)*	*Only allow handline, rod and reel, and bandit gear in the recreational shark fishery*	(+)	(0)	(0)

Deepwater and other sharks

Alternative H1 (No Action)	Retain established species group	(0)	(0)	(0)
Alternative H2 (Preferred)	*Remove species group from management unit; data collection only*	(0)	(0)	(0)

Prohibited Species

Alternative I1 (No Action)	Retain established species group (19 species)	(+)	(0)	(0)
Alternative I2	Return to the five species in 1997; white, sand tiger, bigeye sand tiger, whale, and basking sharks	(- - -)	(+)	(+)
Alternative I3	Retain established prohibited species group (I1) and add finetooth shark	(+)	(-)	(-)
Alternative I4	Retain established species group (I1) and remove dusky shark	(- - -)	(+)	(+)
Alternative I5	Retain established species group (I1) and add the deepwater/other species	(+)	(0)	(0)

Alternative I6 (Preferred)	*Existing regulations and, as appropriate, retain established prohibited species group (I1) and establish criteria for the addition and removal of species to/from the prohibited species group*	(+)	(+)	variable

Bycatch Reduction Measures

Gear Restrictions - Gillnet and Bottom Longline Gear Only				
Alternative J1 (No action)	Gillnet - net checks, LWTRT, observers; Bottom longline - post guidelines	(+)	(0)	(0)
Alternative J2	Existing bycatch reduction measures (J1) plus closing the shark gillnet fishery permanently/Remove gear from list of authorized gear types	(+)	(-)	(-)
Alternative J3	Existing bycatch reduction measures (J1) and allow only strikenet method in shark gillnet fishery	(+)	(-)	(-)
Alternative J4 (Preferred)	*Existing bycatch reduction measures (J1) plus requiring VMS on shark gillnet vessels during right whale calving season and requiring VMS on directed bottom longline shark fishing vessels operating near the time/area closure off North Carolina*	(+)	(+)	(-)

Alternative J5 (Preferred)	*Existing bycatch reduction measures (J1) plus requiring the use of non-stainless steel corrodible hooks, the possession of release equipment on vessels with shark bottom longline gear (line cutters, dipnets, and, when approved, dehooking devices), and that bottom longline vessels move 1 nautical mile after an interaction with a protected species*	(+ +)	(-)	(-)
Alternative J6	Existing bycatch reduction measures (J1) plus limiting shark bottom longline gear to a maximum of 10 miles of mainline, for each gear in the water, limiting soak time to 10 hours or less, and requiring the use of non-stainless steel corrodible circle hooks	(+ +)	(-)	(-)
Alternative J7	Existing bycatch reduction measures (J1) plus requiring the retention of all sharks caught in commercial shark fisheries; no discards allowed	variable	(-)	(-)
Alternative J8	Existing bycatch reduction measures (J1) plus requiring commercial and recreational fishermen to attend workshops on present regulations, species identification, and release techniques.	(+)	(+)	(-)

Time/Area Closures				
Alternative K1 (No Action)	No time/area closures	(-)	(0)	(0)
Alternative K2 (Preferred)	*Time/area closure for sandbar and dusky shark nursery and pupping areas off of North Carolina during the winter fishery*	(+ +)	(-)	(-)
Alternative K3	Time/area closure for all shark nursery and pupping areas during pupping season based on EFH identifications for neonate and juvenile sharks	(+ + +)	(--)	(--)

Essential Fish Habitat

Alternative L1 (No Action)	Maintain current EFH identified areas	(0)	(0)	(0)
Alternative L2	Identify EFH for the fishery management unit (FMU) based on the entire geographic range of the species	(+ +)	(0)	(0)
Alternative L3	Existing identification and, as appropriate, identify EFH for the FMU for each species and life stages as those habitats necessary for spawning, breeding, feeding, or growth to maturity	(+)	(0)	(0)

Alternative L4 (Preferred)	*Existing EFH and, as appropriate, increase or decrease the EFH areas identified for individual species in the FMU based on special needs*	(+)	(0)	(0)

Exempted Fishing Permits

Alternative M1 (No Action)	Maintain combined permitting system for scientific research and display	(0)	(0)	(0)
Alternative M2 (Preferred)	*Develop separate display permitting system for sharks, apart from research or exempted fishing permits*	(0)	(0)	(0)

Figure 4.1 Close-up view of the time/area closure off North Carolina showing bathymetry and coordinates.

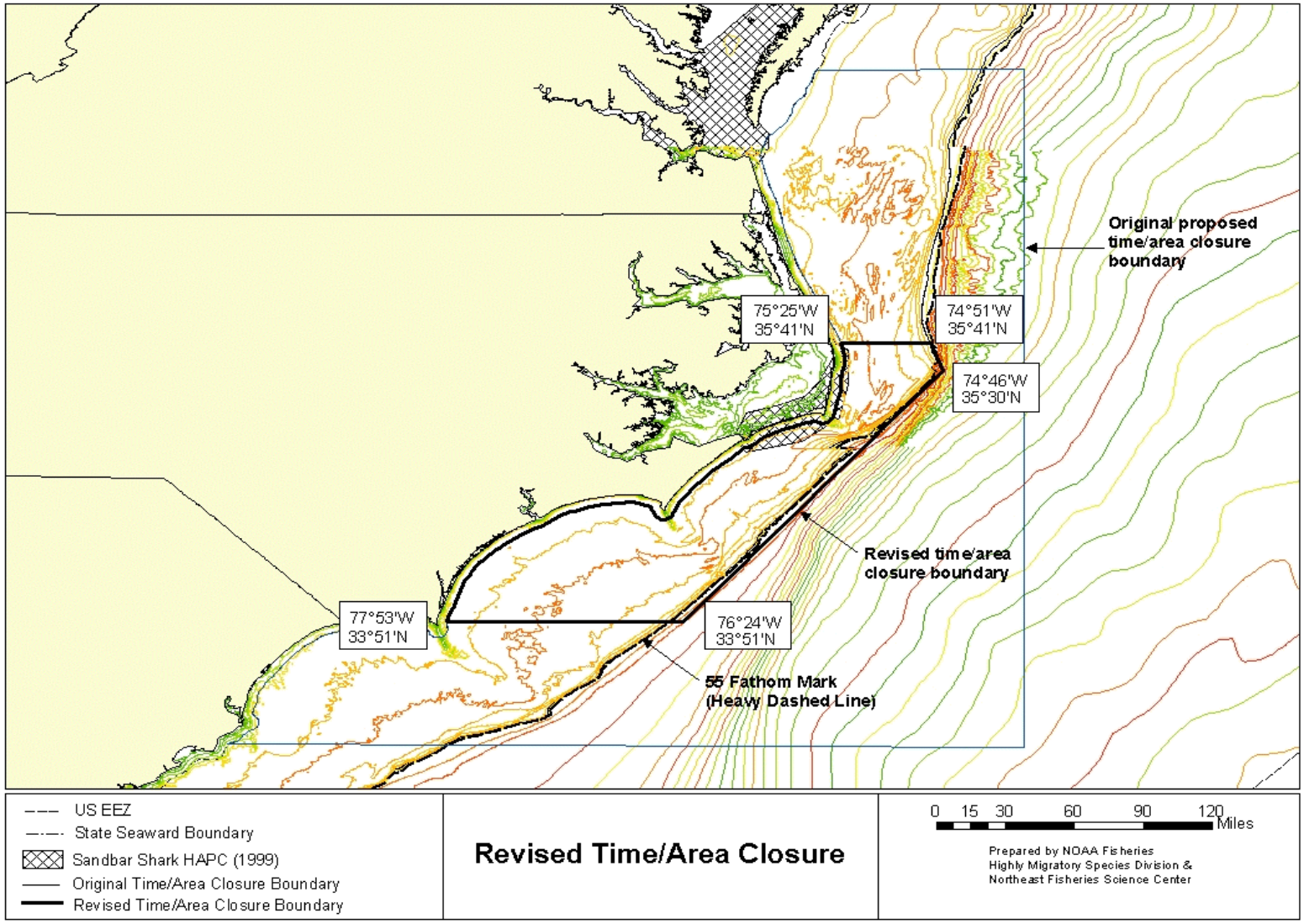


Figure 4.2 Map of the time/area closure showing observed catches of dusky sharks in the revised and original time/area closure vs. all observed dusky sharks caught in the Atlantic and Gulf of Mexico from 1994-2002.

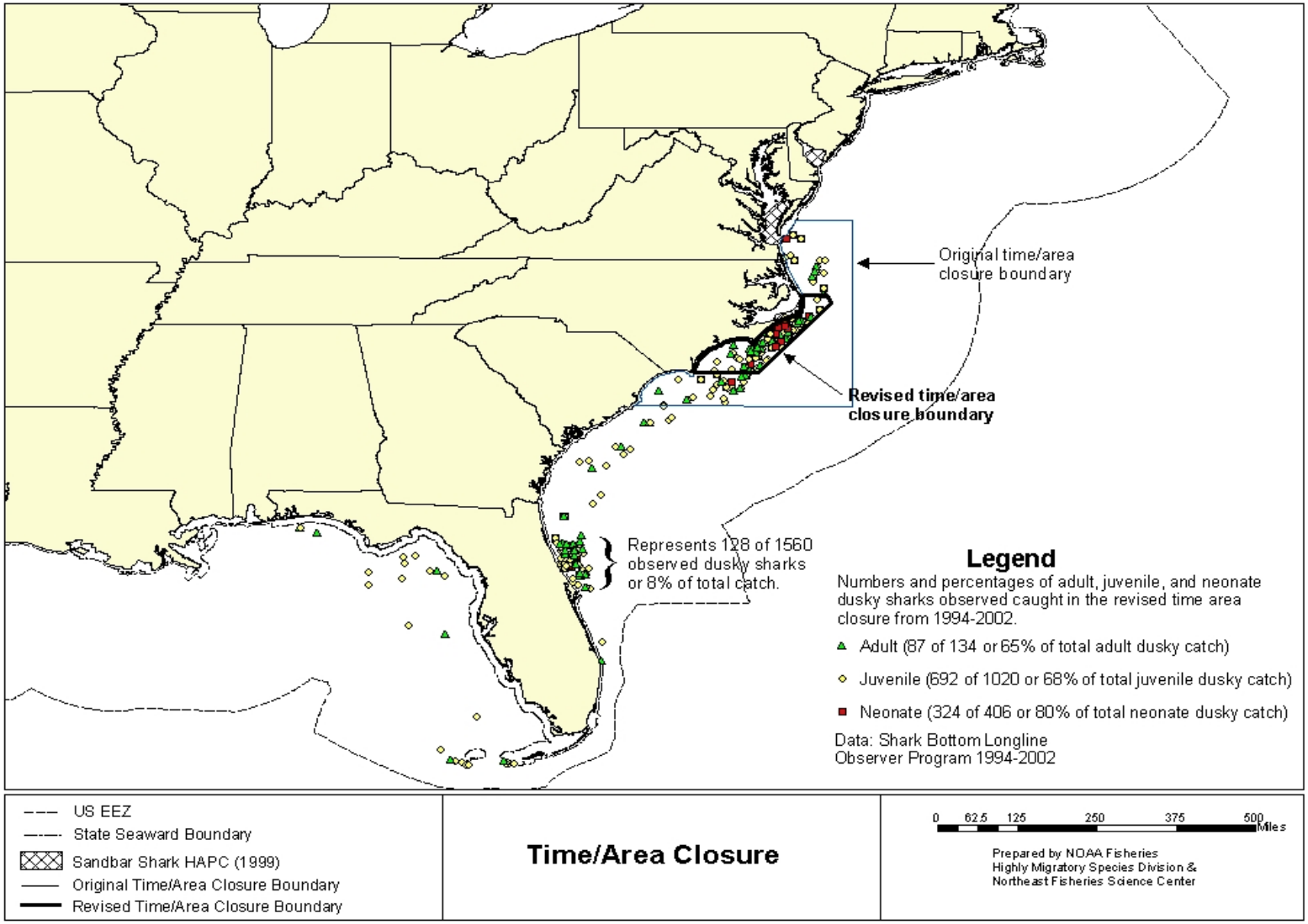


Figure 4.3 **Map of the time/area closure showing observed catches of dusky sharks in the revised and original time/area closure vs. all observed dusky sharks caught in the Atlantic and Gulf of Mexico from 2001-2002.**

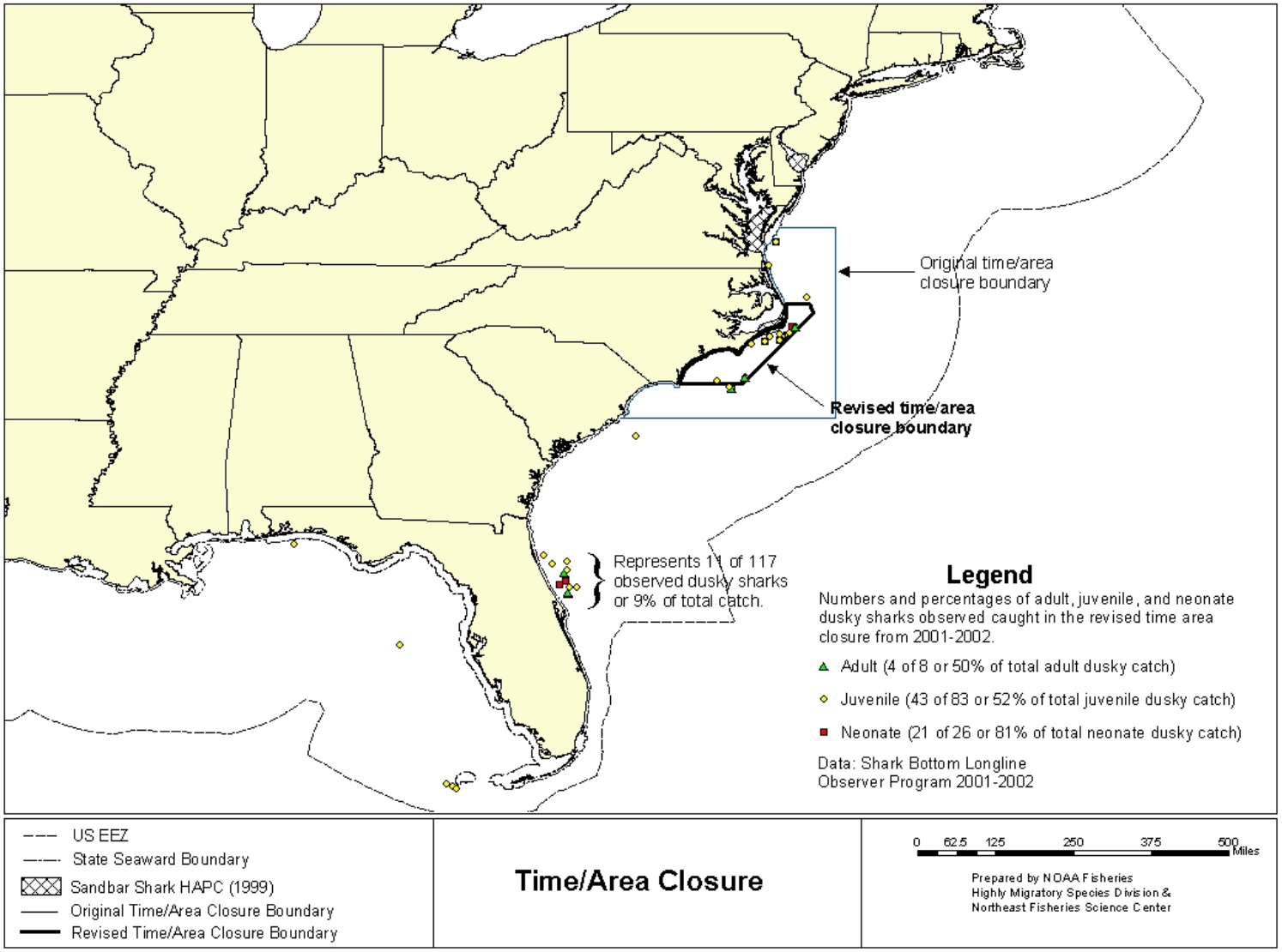


Figure 4.4 Map of the time/area closure showing observed catches of sandbar sharks in the revised and original time/area closure vs. all observed sandbar sharks caught in the Atlantic and Gulf of Mexico from 1994-2002.

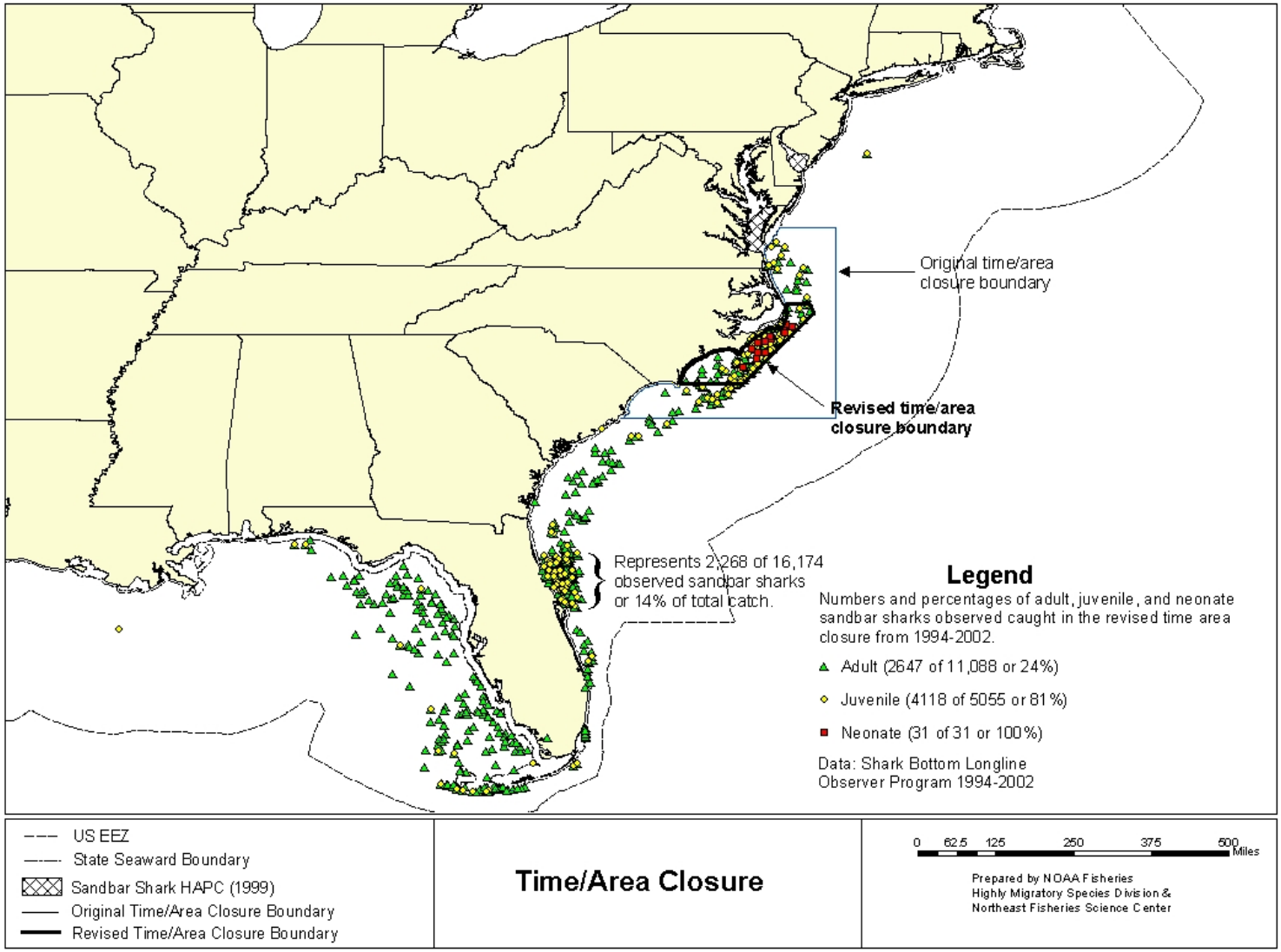


Figure 4.5 Map of the time/area closure showing observed catches of LCS in the revised and original time/area closure vs. all observed LCS caught in the Atlantic and Gulf of Mexico from 1994-2003.

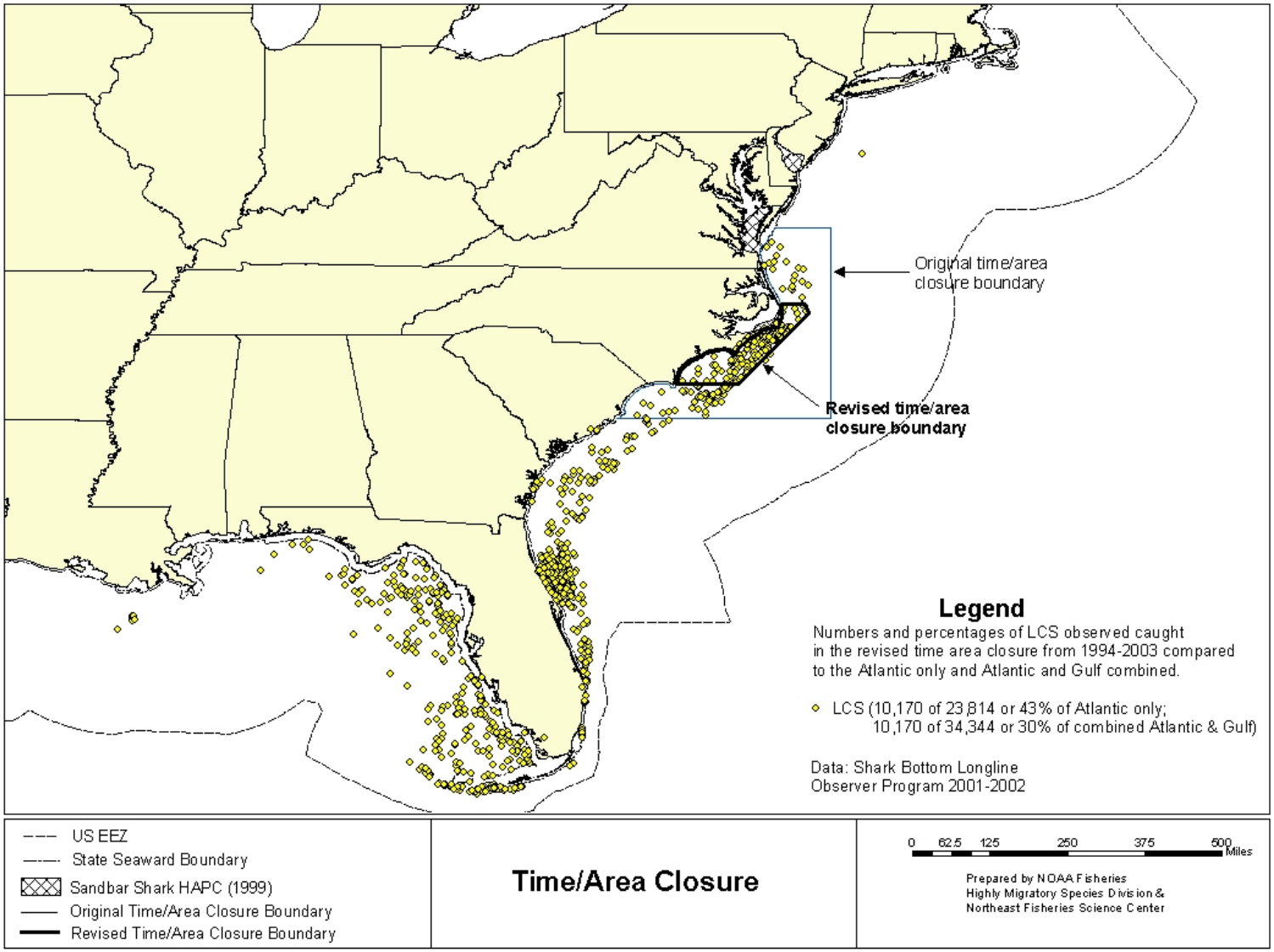


Figure 4.6 Comparison of the original vs. revised time/area closure showing all observed catches of dusky sharks by life stage in the two areas.

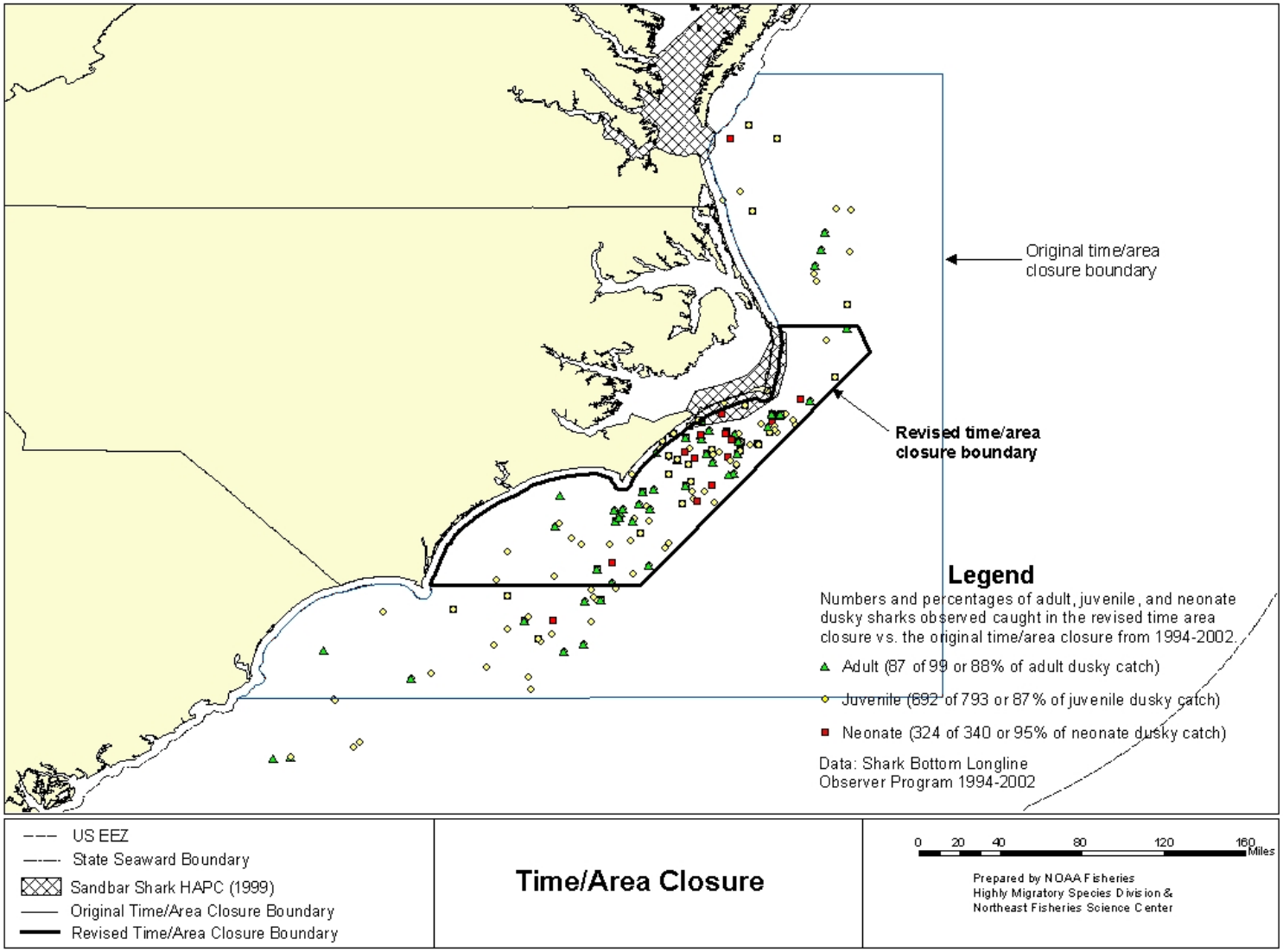
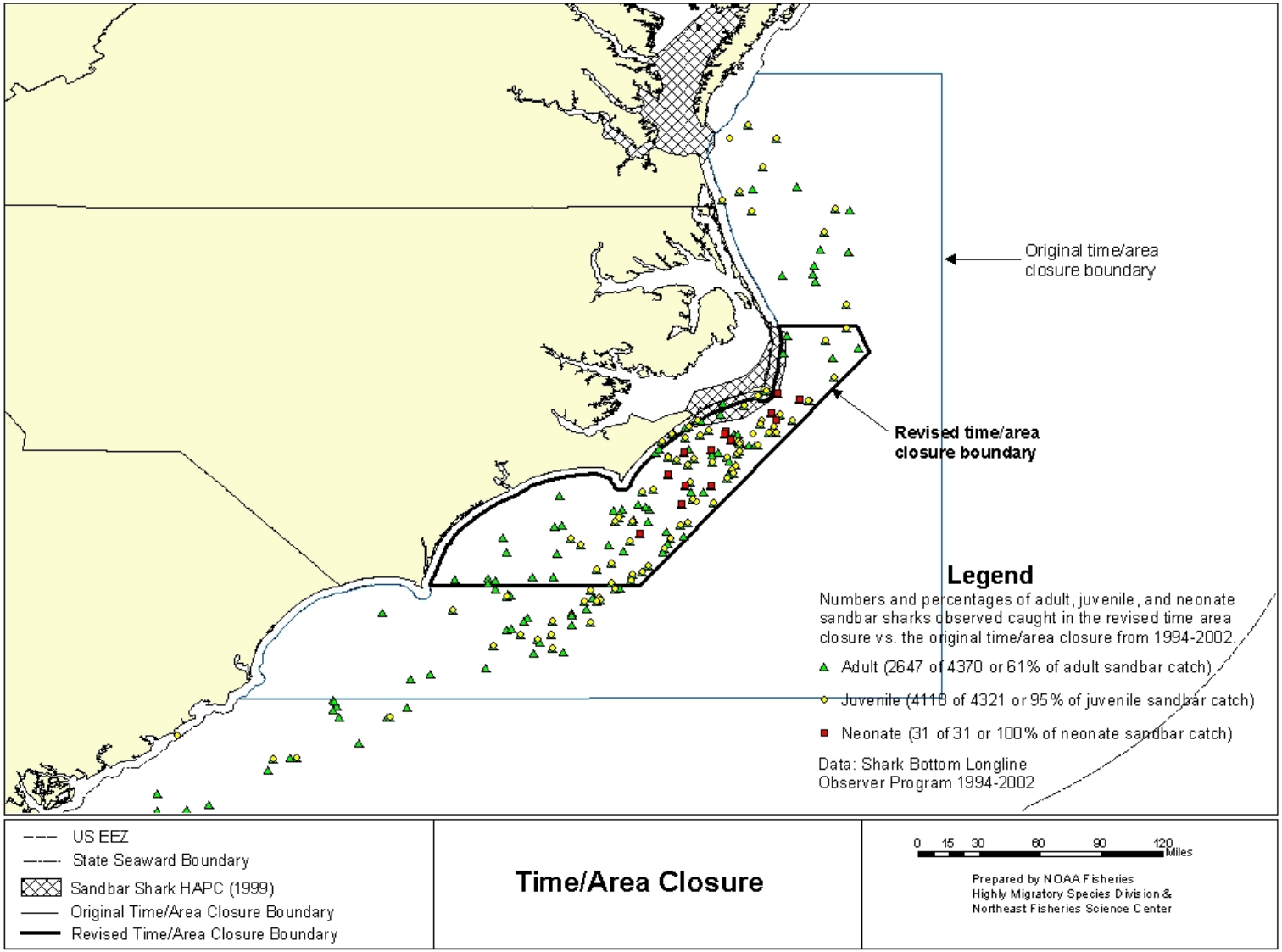


Figure 4.7 Comparison of the original vs. revised time/area closure showing all observed catches of sandbar sharks by life stage in the two areas.



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5.0 MITIGATION AND UNAVOIDABLE ADVERSE IMPACTS

In the draft Amendment, NOAA Fisheries identified a preferred alternative to allow vessels in the gillnet fishery to use the strikenet method only, due to expected large ecological benefits. However, public comment indicated that the social and economic impacts would be severe and NOAA Fisheries did not select alternative J3 as a preferred alternative in this final Amendment.

Several of the selected alternatives could also have adverse social and/or economic impacts. These alternatives include the resulting commercial LCS quota level (combination of alternatives A3 and C2), establishing trimester seasons (alternative B4), maintaining the current prohibited species group and establishing criteria for addition/removals to/from the list (alternative I6), requiring VMS on shark gillnet vessels during right whale calving season and on directed bottom longline vessels during time and area closures (alternative J4), requiring release equipment onboard and moving one nautical mile after a protected species interaction (alternative J5), and establishing a time/area closure in the mid-Atlantic region (alternative K2). Most of these alternatives only affect commercial fishermen, however, the alternative regarding the prohibited species group (alternative I6) could affect recreational fishermen as well.

The alternative to require commercial and recreational fishermen to attend workshops in regard to regulations, species identification, and release techniques (alternative J8) is not selected at this time. However, NOAA Fisheries intends to consider such mandatory workshops to increase outreach and compliance with regulations in future rulemaking. NOAA Fisheries will develop regulatory and other materials in the interim.

5.1 MITIGATION MEASURES

NOAA Fisheries is not selecting alternative J3, allowing only the strikenet method fishing in the shark gillnet fishery, and has revised alternative K2, the time/area closure in mid-Atlantic region to protect neonate and juvenile dusky and sandbar sharks, in part, to mitigate the social or economic impacts.

Alternative J3, allowing only the strikenet method fishing in the shark gillnet fishery, is not selected in this document because of public comment that it would force the entire shark gillnet fishery out of business. The measure was intended to reduce bycatch of marine mammals, sea turtles, and finfish by extending current requirements for strikenet fishing, which has little bycatch on non-shark species, from during the winter in right whale critical habitat to year-round in all areas. However, strikenet fishing requires shark species to school or form large aggregations in order to be effective and NOAA Fisheries received public comment that LCS do not school in the summer and that the SCS do not school. Thus, gillnet fishermen would not be able to fish effectively for LCS outside of the winter or for SCS, and would likely go out of business. As it was not NOAA Fisheries intent to close the fishery, this final Amendment does not select alternative J3. The selected alternatives (J4 and J5) maintain current requirements and allow drift gillnet fishing outside of right whale critical habitat during the winter. These

alternatives would provide positive ecological impacts with regard to bycatch by requiring VMS on gillnet vessels during right whale calving season and on directed bottom longline shark fishing vessels operating near the time/area closure off North Carolina as well as requiring the use of non-stainless steel corrodible hooks, the possession of release equipment on vessels with shark bottom longline gear (line cutters, dipnets, and, when approved, dehooking devices), and that bottom longline vessels move one nautical mile after an interaction with a protected species. Reducing bycatch and bycatch mortality is a priority, and NOAA Fisheries intends to consider other measures such as gear modifications or handling techniques in future rulemaking.

Alternative K2, the time/area closure in mid-Atlantic region, was reduced in size by 26,997 square nautical miles in response to public comment that the closure preferred in the draft Amendment was overly restrictive, does not accurately reflect recent trends in dusky shark catches, and that a closure could be more focused along depth contour lines. For dusky sharks, 90 percent of sharks caught in the original time/area closure were also caught within the revised time/area closure. Approximately 95 percent of neonates, 87 percent of juveniles, and 88 percent of adult dusky sharks were caught in the revised time/area closure. For sandbar sharks, 78 percent of sharks caught in the original time/area closure were also caught in the revised time area closure. Approximately 100 percent of neonates, 95 percent of juveniles, and 61 percent of adult sandbar sharks were caught in the revised time/area closure.

While the preferred alternative in the draft Amendment encompassed a larger area and a greater percentage of observed neonate and juvenile dusky and sandbar sharks, the area also would have closed all of North Carolina waters as well as areas of Virginia and South Carolina. The selected alternative still provides effective protection for neonate and juvenile dusky and sandbar sharks while also providing fishing opportunities in North Carolina both north and south of the closed area. Nevertheless, some fishermen may go out of business, particularly North Carolina fishermen. The time/area closure, even though revised and reduced in this document, would directly affect the estimated 13 active North Carolina fishermen and would require them to either change fishing areas or stop fishing during the closure. Additionally, those vessel owners who continue in the fishery near the closed area, would need to install VMS (alternative J4). While VMS has a large initial cost and smaller, continuing maintenance costs, it would also allow fishermen to transit the closed area and allow them to stay with their current dealer and with their family. Thus, over time, VMS, which is an effective enforcement tool, could help mitigate some of the adverse impacts associated with the closure. Finally, delaying the effective date of the time/area closure to January 2005 should also mitigate the negative impacts by providing time to adjust to these requirements.

Alternatives A3/C2 could also have significant adverse economic impacts in the short-term, particularly on small entities, and could cause some vessel owners to go out of business. While alternatives A3 and C2, in combination, result in a lower LCS commercial quota than in recent years, the alternatives themselves do not necessarily require the quota to be lower. In fact, the same alternatives, result in a quota for SCS that is higher than recent landings. Based on these two alternatives, the LCS commercial quota could increase over time as the LCS stocks rebuild,

depending on the results of any future stock assessments. Additionally, under alternative C2, the quota level is considered a landings quota. In other words, dead discards would not be taken off the quota (they were already considered in calculating the quota level). State landings after a Federal closure would still be taken off the quota. Additionally, if fishermen reduce discards and/or if recreational landings decrease as a result of increased compliance, then the proportion of MSY available to commercial fishermen could increase, resulting in increased quota levels.

As described in Chapters 4, 6, 7, and 8, the adverse impacts of some of the selected alternatives would be minor and may help mitigate the impacts of other selected alternatives while also meeting the objectives of this Amendment and the Magnuson-Stevens Act. NOAA Fisheries attempted to mitigate the economic and social impacts as much as possible in designing the alternatives. For example, as reflected in Appendix 4, NOAA Fisheries analyzed whether the VMS requirement would be required fleet-wide or could be narrowly tailored. Appendix 4 indicates that VMS is not needed on all directed shark fishermen with bottom longline gear onboard. The selected alternative does not consider putting VMS on all directed shark fishermen, thus, the negative economic impact of VMS is reduced for the fishery as a whole. Additionally, delaying the effective date of the VMS requirement for directed shark bottom longline vessels to January 2005 and for shark gillnet vessels to November 15, 2004, should also mitigate the impacts by providing time to adjust to these requirements (purchase and install equipment, etc.).

Establishing trimester seasons (alternative B4) could have short-term social and economic impacts because of the change in fishing practices and the need to build markets during times when the fishery had traditionally been closed. However, over time, because the openings of the fishery would be spread farther throughout the year, trimester seasons should have positive economic and social impacts. NOAA Fisheries is delaying the effective date of the trimester seasons to January 2005 to mitigate any impacts by providing time to adjust. Alternative I6, maintaining the current prohibited list and establishing criteria for additions/removals, would impose no immediate impacts but could have adverse impacts if additional species not currently included on the list are added in the future. Conversely, alternative I6 could have positive impacts if certain species are removed from the list. This would allow fishermen to target a greater range of shark species. Alternative J5 requires fishermen to buy and use release equipment such as dipnets, line cutters, and dehooking devices. The total cost of the equipment should be minimal and would be a one-time cost. Moving after a marine mammal interaction could increase the cost of a trip; however, few marine mammals have been observed or reported caught with bottom longline.

Most of the shark fishermen are likely to continue to derive their income predominantly from commercial fishing activities. Because the majority of shark fishermen hold permits in other fisheries and fish in other fisheries at least part of the year, fishermen who are adversely affected may increase participation in other fisheries in which they already participate and some fishermen might shift to participate in recreational fisheries by converting to charterboat operations. However, some vessel owners, particularly bottom longline fishermen in the mid-

Atlantic region, might choose to exit all commercial fisheries. If they do, they would be able to sell their shark limited access permits to other interested fishermen (predominantly those fishermen in other geographic areas). Since other fisheries use bottom longline gear as well, fishermen choosing to exit commercial fisheries may also be able sell their vessels and their gear.

Finally, NOAA Fisheries is producing a *Guide to Sharks, Tunas, and Billfish of the U.S. Atlantic and Gulf of Mexico* that is intended to increase accurate species-specific identification of HMS caught in recreational and commercial fisheries. The guide was developed for use in the field and is a working reference offering at-a-glance physical descriptions, habitat and distribution information, and diagnostic and field photographs, including side-by-side comparisons of many similar species. The guide should be available winter 2003.

5.2 UNAVOIDABLE ADVERSE IMPACTS

As described above, the selected alternatives may have adverse ecological, economic, and/or social impacts. The reasons for selecting those alternatives are outlined in the previous sections of this document. The selected alternatives, including those with adverse impacts, are necessary to rebuild LCS within the rebuilding time frame, consistent with the Magnuson-Stevens Act, and minimize impacts on juvenile sharks, marine mammals, and sea turtles, consistent with the 2002 stock assessments, the Magnuson-Stevens Act, ESA, and MMPA. In considering the alternatives, NOAA Fisheries selected alternatives that would minimize the adverse impacts while maximizing the positive impacts. Thus, any resulting adverse impacts are unavoidable.

5.3 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The selected alternatives would not result in any irreversible and irretrievable commitment of resources. There may be some adverse ecological impacts because alternative J3 was not selected, thus the selected alternatives J4 and J5 would maintain current bycatch levels. However, alternatives J4 and J5 would have positive impacts by reducing bycatch mortality. Moreover, alternative K2 would reduce bycatch and bycatch mortality of fish, sea turtles, and marine mammals. The selected alternatives would aid in rebuilding LCS populations within the rebuilding time frame and prevent overfishing.

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No references cited.

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No references cited.

References for Section 5.2
No references cited.

References for Section 5.3
No references cited.

6.0 ECONOMIC EVALUATION

This section assesses the economic impacts of the alternatives presented in this document. Additional economic and social considerations and information are discussed in Chapters 4, 7 and 8 of this document and Chapter 5 of the annual SAFE report.

6.1 NUMBER OF FISHING AND DEALER PERMIT HOLDERS

6.1.1 Number of commercial permit holders and dealers

As of October 2002, approximately 376 fishermen had been issued an incidental commercial shark limited access permit and 251 had been issued a directed commercial shark limited access permit (See Table 6.1). In September 2003, there were approximately 351 incidental permit holders and 256 directed permit holders. The addresses of these permit holders range from Texas through Maine with over half (57 percent) of the directed permit holders and 39 percent of the incidental permit holders located in Florida. Most directed permit holders use bottom longline to target sharks. The number of directed permit holders reporting shark landings in logbooks is generally less than 100 in any given year. There were eighty five directed permit holders reporting shark landings in logbooks during 2001. Because of the limited number of permits, the relatively short season lengths, and the relatively little profit available from shark fishing, it is unlikely that the number of active directed shark permit holders would increase substantially.

The number of directed permit holders that use gillnet gear to fish for sharks has been less than 11 vessels in recent years (See Table 6.2). These fishermen fish off the east coast of Florida and Georgia. Because of gear restrictions, the relatively short LCS season, the small profit margin, and the observer coverage requirements for these vessels, it is unlikely that the number of vessels in the gillnet fishery would increase substantially.

Also, as of October 2002, there were 267 dealers permitted to buy sharks (NOAA Fisheries, 2003). Dealer addresses also range from Texas through Maine with 38 percent located in Florida. NOAA Fisheries believes that all permit holders and related businesses (e.g. bait shops, tackle shops, processors, exporters) - all of which are considered small entities - could experience a range of economic impacts because of the preferred alternatives described in this document. These impacts are described in Chapter 4 of this document. Additional economic information is provided in this chapter.

6.1.2 Number of recreational permit holders

As of March 1, 2003 (67 FR 77434), anglers fishing for any HMS are required to have an HMS angling permit. This permit and the HMS charterheadboat permit allow fishermen to catch HMS recreationally and are not species specific. As of September 30, 2003, approximately 18,249 recreational fishermen had been issued an Atlantic HMS angling permit and 4,041 charter/headboat permits had been issued (Table 6.1). These permit numbers have increased

substantially. The addresses of these permit holders range from Texas through Maine and also include addresses in some land-locked states as well.

6.2 GROSS REVENUES OF SHARK FISHERMEN

Of all Atlantic HMS, sharks bring in the lowest total gross revenues (~$2.9 million total in 2001) (See Table 6.3). Directed and incidental permit holders earned $2.7 million and $0.2 million, respectively, of the total gross revenues for shark fishermen during 2001. If the total gross revenues are averaged across the approximately 85 active directed shark permit holders, then the average annual gross revenues per directed shark fisherman is just over $32,800 (ranging from a minimum of $75 to a maximum of $181,215). Incidental shark fishermen had average gross revenues from sharks of just over $5,900 (ranging from a minimum of $75.16 to a maximum of $118,995). The majority of incidental permit holder's gross revenue is expected to come from other fisheries. The total average gross revenues from all shark permit holders will vary depending upon participation in other fisheries.

Average ex-vessel prices of LCS meat across all regions was approximately $0.91 per lb dw in 2001. Pelagic sharks brought in the largest ex-vessel price at $1.11 per lb dw and SCS brought in the lowest ex-vessel price of $0.79 per lb dw during this same time period. Average ex-vessel prices for shark fins was approximately $19.67 per lb in 2001. These prices resulted in gross revenues in 2001 of $1,341,510 for LCS, $66,485 for pelagic sharks, $36,339 for SCS, and $1,554,011 for shark fins (See Table 6.3).

6.3 VARIABLE COSTS, NET REVENUES, AND WILLINGNESS TO PAY

6.3.1 Costs and net revenues of commercial shark fishermen

Little economic data are available on the costs of bottom longline fishing. NOAA Fisheries began selecting 20 percent of all active directed commercial shark fishermen to report cost earnings information in 2003. The collection of this information (OMB No. 0648-0371, expiration June 30, 2005) will greatly improve shark management.

NOAA Fisheries believes that the variable costs for commercial shark fishermen using bottom longline gear are similar to the fishing costs for pelagic longline. There are some costs which may be lower for bottom longline gear. For instance, shark fishermen should not need lightsticks (used to catch swordfish) and often set less gear than pelagic longline fishermen. McHugh and Murray (1997) found that a seven day trip had an average profit (owner's share of catch minus all expenses) of $1,589. Vessels between 40 and 49 feet had an average profit of $1,975 for a seven day trip.

At this time, NOAA Fisheries also has limited information available regarding variable costs of shark gillnet fishing. NOAA Fisheries expects that the fishing costs per trip are less than those of a pelagic longline fishing trip because the trips are usually shorter (an average of 18 hours per

trip), vessels do not fish far offshore (within 30 nautical miles from port), and the gear does not need hooks, bait, or light sticks. Other costs, such as net repair, may be incurred.

Shark gillnet vessels that fish in a strikenet method probably incur higher costs per trip than those vessels that fish in a drift gillnet method. This is because strikenetting usually requires the use of a small vessel (used to run the net around the school of sharks) and a spotter plane (used to spot schools of fish). While the cost per trip is higher than the traditional drift gillnet method, bycatch in this method is extremely low, catch rates of the target species is high, and vessels can complete a set in less time (one hour versus nine hours). NOAA Fisheries estimates that the smaller vessel could cost between $2,000 and $14,000 to buy. Because these second vessels have specific requirements to be sturdy enough to hold the gillnet and move quickly around the school of sharks, it is likely that vessel owners would need to re-fit any used vessel bought for this purpose. Additionally, a second vessel means additional fuel and maintenance costs. Spotter planes in other fisheries are paid based on the percentage of the proceeds from the trip, generally 10 to 25 percent of gross revenues. Thus, given the average gross revenues per trip, converting from drift gillnet fishing to strikenet fishing could be prohibitive if the vessel needs both a second vessel and a spotterplane.

Recently some strikenet vessels have begun striking behind other vessels such as trawl vessels (e.g., shrimp vessels). This negates the need for a spotter plane and could reduce the variable costs substantially. Additionally, some of the smaller drift gillnet vessels have begun to use shorter nets to strike fish without a second vessel (Carlson and Baremore, 2002). Their efforts are moderately successful and could reduce the costs of the fishing in a strikenet method substantially by reducing the amount of net that needs to be repaired and the amount of additional gear needed.

6.3.2 Willingness to pay for Atlantic shark

There are little additional data or new reports regarding willingness to pay to fish for Atlantic sharks caught recreationally.

The most recent data NOAA Fisheries has comes from a 1994 survey of anglers in New England and the Mid-Atlantic (Hicks *et al.*, 1999). The data collected were used to estimate expenditures and economic value of the various groups of recreational fisheries in this area. One category of fishing, called "Big Game" consisted primarily of HMS, including sharks, billfish, and tunas. Although this study is not an exhaustive picture of the entire HMS recreational fishery, the results provide considerable insight into the absolute and relative values of the recreational fisheries for HMS.

Overall average willingness to pay (WTP) for a one-day fishing trip ranged from a low of less than a dollar in New Hampshire to a high of $42 in Virginia. The study found that aggregate WTP (average WTP times the number of trips) ranged from $18,000 in New Hampshire to nearly $1 million in Virginia. Using model results, it was possible to estimate the WTP for a one fish

increase in the expected catch rate across all sites in the choice set. The highest average value was attributed to big game fish, ranging from $5 to $7 per trip (about $5.40 on average), in addition to the value of the trip. The marginal value of an increase in catch per trip was highest for big game fish, and lowest for bottom fish. Thus, increasing the recreational bag limit would have minor impacts, if any, on angler WTP. Additionally, Fisher and Ditton (1992) found that anglers were willing to pay an additional $105 per trip rather than stop fishing for sharks.

The 1994 survey results also indicated that boat fees were responsible for the greatest percentage of expenditures. Roughly 70 percent and 53 percent of total expenditures went for private/rental boats and charter/party boats, respectively. Travel expenses were the smallest portion of expenditures, although travel costs for those fishing on party/charter vessels were about twice as high as for those fishing on private/rental boats ($28 *vs*. $16).

In 1998, a survey was completed of a number of charterboats (96 of an estimated 430) and party boats (21 out of 23) throughout Alabama, Mississippi, Louisiana, and Texas (Sutton *et al.*, 1999). The study found that party boat operators did not frequently target sharks. Specifically, the study indicates that 65 percent of party boat operators reported targeting sharks at least once and that shark trips represented 5 percent of the total effort by party boat operators (Sutton *et al.*, 1999).

The increase in angling permit holders from 13,263 in October 2002 to over 18,000 in October 2003 indicates an increased willingness to pay for HMS permits and gear in order to have the chance to catch HMS recreationally.

6.4 EXPECTED ECONOMIC IMPACTS OF THE COMMERCIAL MANAGEMENT MEASURES

Economic analyses for commercial management measures were performed utilizing a SAS computer program for combining and sorting logbook and permit data. Specifically, NOAA Fisheries combined data from the following 1) 2001 pelagic longline logbooks, 2) 2001 snapper-grouper logbooks, 3) 2001 Northeast multispecies logbooks, and 4) shark permit database. The output information from SAS provided NOAA Fisheries with the number/weight of sharks landed by permit holder. Microsoft Excel was used to convert numbers of fish to pounds, where appropriate, and then the data were combined with 2001 ex-vessel price data (i.e., average ex-vessel prices) for LCS, SCS, and pelagic sharks as well as shark fins to calculate total, minimum, maximum, and average gross revenues (i.e., for both the fishery as well as small entities) by management category, permit type, season, and permit holder. The 2001 gross revenues as described above, were used as a baseline for comparison of economic impacts expected to result from implementation of commercial management alternatives considered.

6.4.1 Expected economic impacts of the LCS classification

NOAA Fisheries considered four separate LCS classification alternatives (See Chapter 2). Under alternatives A1 (separate groups, different closures) and A4 (species specific groups, closure for most vulnerable species), the time required to haul back each set is likely to increase, in the event

that one LCS grouping remains open while the other is closed. This could result in additional costs to fishermen including variable and opportunity costs. Additionally, lengthening of trips may occur in order for fishermen to compensate for lost catches during a partial closure.

Under alternative A2 (separate groups, same closure), fishermen would continue to experience inefficiencies in terms of additional time required to sort catch. This could result also in the lengthening of trips to make up for these inefficiencies. Increased time at sea, which is possible under alternatives A1, A2, and A4, reduces the profits fishermen gain due to increased costs for fuel, bait, and ice.

By comparison, alternative A3 (aggregate, one closure) could result in fewer economic impacts on a trip level. However, because alternative A3 does not allow for increases in quotas on a species level, the overall quotas for the complex could be lower (See Table 2.3). Thus, alternative A3 could have impacts on revenues.

6.4.2 Expected economic impacts of the quota administration

NOAA Fisheries considered five separate quota administration alternatives. Alternative B1 (semi-annual season) could result in economic impacts if semi-annual seasons continue to extend into pupping seasons, which overtime could result in further decline of LCS stocks and economic stability of the fishery. Alternative B2 (no regional quotas) is not anticipated to change fishing costs since fishermen will continue to catch fish until the quota is taken.

While alternative B3 (regional quotas) has not been implemented previously, NOAA Fisheries does not anticipate any significant economic impact given that this alternative will simply establish a quota on the basis of historical landings by region. Concern was noted during public hearings on draft Amendment 1 that estimates of landings on which the regional quotas will be based may be underestimated and may result in additional vessels being forced out of the fishery. NOAA Fisheries combined information from two separate databases containing regional landings information as reported by dealers and states to NOAA Fisheries. NOAA Fisheries believes that the landings reported by dealers and states represents the best available information pertaining to regional data. Given that alternative B3 seeks to maintain historical landings via utilization of regional quotas, as opposed to reducing landings, NOAA Fisheries does not expect this alternative to change previous fishing practices or result in any significant economic impact. Additionally, over time, this alternative may allow NOAA Fisheries the flexibility to manage quotas to each region's maximum economic advantage.

Alternatives B4 (trimester season) and B5 (quarterly season) could result in economic impacts given that markets have not yet been developed for the late spring and late fall, during which commercial seasons have historically been closed. Alternatives B4 and B5 may take time for fishermen and associated communities (e.g., dealers, processors, retail agents) to adapt to, given that new markets will need to be established at different times of the year. Fishery participants will need time (i.e., between two weeks and a month) to work with grocers to advertise shark

products and under the preferred alternative (i.e. B4) the time available for such advertisements may be further limited, as compared with the no action alternative. Additionally, since fishermen may be able to land sharks at the same time as other fish, there could be fluctuations in markets for other fisheries. Spreading open seasons out more evenly over the calendar year could, in the long-term, result in greater economic stability for fishermen and associated communities because the amount of time between open and closed seasons would be reduced. In order to reduce the economic impacts associated with the preferred alternative (i.e., B4), NOAA Fisheries will implement a delay in effectiveness to give fishery participants an opportunity to work with dealers and grocers to enhance markets and advertise in advance of season openings. Additionally, comments received by NOAA Fisheries during the public comment period on draft Amendment 1 suggested that variation in open seasons could result in short-term social and economic burdens, given that fishermen will need to adjust fishing practices, including but not limited to, re-rigging gear more often to fish for shark, as opposed to other species, during what would otherwise be a closed season. Social and economic costs associated with switching gear more often may be minimized, if shark fishery participants use the same gear in other fisheries (e.g. similar gear is used to fish for shark, grouper, and tuna). Trimester seasons are preferred to quarterly seasons because trimesters will minimize the costs of switching gear (i.e., only three times as opposed to four per year) and give a higher percentage of the quota to each open season than would occur under a quarterly season approach.

6.4.3 Expected economic impacts of the quota basis

Overall, NOAA Fisheries considered three separate quota basis alternatives for sharks. However, when considered in combination with the LCS classification alternatives (A1-A5) as described in section 6.4.1 above and in Chapter 2, NOAA Fisheries considered a total of seven separate quota basis alternatives for LCS. No changes are proposed for Pelagic sharks quotas at this time, but NOAA Fisheries may consider revisions, if appropriate, following the next stock assessment.

6.4.3.1 LCS quota basis

Fishermen have been fishing under the LCS quota of 1,285 mt dw, since 1997 except for 2003. When the 1997 quota level went into effect, many shark fishermen left the fishery or made the decision to fish for sharks on a part-time basis. In 2003, NOAA Fisheries increased the LCS quota temporarily to a total of 1,714 mt dw under an emergency rule. However, the emergency rule was meant as an interim measure pending completion of this amendment. As such, the baseline for comparison of economic impacts in this document is the 1997 quota for the LCS complex (1,285 mt dw).

Given this baseline for economic comparison (i.e., 1997 quota for LCS complex ~1,285 mt dw), alternatives considering groupings or species-specific quotas are summed to derive quantitative estimates of economic impacts (See Table 6.4). As such, the group findings are based on the assumption that LCS ridgeback quota plus LCS non-ridgeback quota equal that of the complex. The species-specific findings are based on the assumption that the sandbar quota, plus the

blacktip quota, plus the other LCS quota equal that of the complex. It is notable that the economic impacts of the sum may not equal the economic impacts of the individual parts, if considered separately because some species are worth more than others.

The vast majority of comments received by NOAA Fisheries during the public comment period on draft Amendment 1 were in support of the MSY quota basis (i.e., alternative C2). However, commenters expressed concern about the adoption of a 40-percent reduction versus a 50-percent reduction in catch as recommended in the 2002 stock assessment. NOAA Fisheries indicated in the DEIS that the percent reduction came from the recommended reduction in the 2002 LCS stock assessment, which was reduced slightly for consideration of the following factors: (1) while the stock assessment did say that the LCS complex should be reduced by 50 percent, it also said that the reductions should be on species other than sandbar and blacktip; (2) observer data indicates that sandbar and blacktip sharks comprise approximately 67 percent of the LCS catch, indicating that a quota reduction would mostly apply to those species; (3) the peer reviews indicated that the complex assessment may not be as accurate as individual species because of biological differences between species; (4) CPUE data for silky, tiger, and scalloped hammerhead do not indicate decline; and (5) the other preferred measures such as the time/area closure will reduce mortality and/or dead discards. After considering these factors along side of public comment received, NOAA Fisheries feels that a revised percent reduction (i.e., 45%) in addition to the other preferred alternatives is reasonable and will rebuild the LCS complex. This change in percent reduction will result in an additional economic impact of $202,687 in total gross revenues of the fishery as a whole and $1,689 in average revenues for small entities, from what was originally estimated in the DEIS. These amounts are included in the economic analysis described below.

Alternative C1 (1999 HMS FMP quota) does not allow for changes to the quota and based upon the 2002 stock assessment would establish a quota that is too low to promote achievement of optimum yield (i.e., greatest overall benefit to the Nation). Whereas, alternatives C2 (MSY based quota) and C3 (landings based quota) would promote both achievement of rebuilding targets and optimum yield goals and objectives. Neither alternative C2 or C3 should have significant economic impacts on the fishery as a whole, but the resulting quota when combined with the other preferred alternatives could have a significant impact on small entities.

Economic analyses indicate that the LCS quota was worth $2,895,521 in 2001 under the baseline for comparison (i.e., 1,285 mt dw). Both of the alternatives considered for LCS complex quotas, C2 (MSY based quota) and C3 (landings based quota), would decrease available quota (See Table 2.3). When compared with the baseline, alternative C2 (i.e. MSY complex quota) results in a 21-percent reduction in total gross revenues for the fishery as a whole (See Table 6.4). Whereas, alternative C3 (i.e., landings complex quota) would result in a 28-percent reduction in total gross revenues for the fishery as a whole. Of the three alternatives considered for LCS group quotas, alternative C1 (HMS FMP based quota) would decrease available quota, while C2 and C3 would increase the available quota (See Table 2.3). When compared with the baseline, alternatives C1, C2, and C3 for LCS group quotas result in a 24-percent reduction, 14-percent

increase, and 21-percent increase in total gross revenues for the fishery as a whole, respectively (See Table 6.4). Of the two additional alternatives for LCS species-specific quotas, C2 and C3, both would increase the available quota (See Table 2.3). When compared with the baseline, alternative C2 (i.e. MSY species-specific quota) results in a 33-percent increase in total gross revenues for the fishery as a whole (See Table 6.4). Whereas, alternative C3 (i.e., landings species-specific quota) results in a 16-percent increase in total gross revenues as a whole.

Any decrease in the LCS quota will also lead to shorter seasons. This in turn could lead to lower ex-vessel prices because of market gluts and the difficulty in finding buyers for fish that are only available for a short period of time each year. Thus, these alternatives would likely force additional fishermen out of the fishery and could lead to an incidental only fishery.

By comparison, any increase in the quota could lead to longer seasons. This in turn could lead to higher ex-vessel prices because fishermen would be able to bring LCS to the dock over time, eliminating market gluts, and because fishermen could make arrangements with dealers in advance. However, increases in quota may also result in long-term economic impacts, if LCS stocks do not rebuild and continue to decline over time.

6.4.3.2 SCS quota basis

NOAA Fisheries considered three different SCS quota alternatives (See Table 6.5). Fishermen have been fishing under an SCS quota of 1,760 mt dw, since 1997, except for in 2003 when an emergency rule was in place as an interim measure pending a plan amendment. Commercial fishermen have historically caught a small portion of this quota. For example, the highest landings on record by fishermen was in 2001, where 326 mt dw was accounted for in the commercial fishery. Economic analyses indicate that the SCS quota was worth $36,339 in 2001 under the baseline for comparison (i.e., 1,760 mt dw).

Alternatives C1 (HMS FMP based quota - 359 mt dw) and C2 (MSY based quota - 454 mt dw) propose quota levels that are greater than the total of all reported landings in any year since management began, including the most recent emergency rule and associated extensions. When compared with the baseline, alternative C1 results in no change to ex-vessel prices or economic benefits (See Table 6.5). Whereas, alternative C2 results in an 10-percent increase in total gross revenues for the fishery as a whole.

Alternative C3 (landings based quota - 300 mt dw) could have some minor negative impacts on the fishery as well as fishermen because it is a slight decrease from 2001 landings. When compared to the baseline, alternative C3 results in a 17-percent decrease in total gross revenues for the fishery as a whole (See Table 6.5). This decrease could cause a fishery closure as a result of the quota being exceeded. However, because alternative C3 is the average of recent landings, this alternative should not have significant economic impacts.

6.4.3.3 Pelagic shark quota basis

NOAA Fisheries is not proposing any change to pelagic shark quotas which were adopted under the 1999 HMS FMP. As such, NOAA Fisheries does not anticipate a change in ex-vessel prices or economic benefits as a result of maintaining these quotas.

6.4.4 Expected economic impacts of the minimum size

NOAA Fisheries considered six different minimum size alternatives, five of which provided options for establishing a minimum size in the commercial fishery (i.e., D1- 4.5 feet fork length ridgeback LCS, D3 - 5 feet fork length LCS, D4 - 5 feet fork length ridgeback LCS/4.5 feet fork length non-ridgeback LCS, D5 - 4.5 feet fork length for Atlantic non-ridgeback LCS/4 feet fork length Gulf of Mexico non-ridgeback LCS, and D6 - minimum on overfished species) and one which did not (i.e., D2 - no minimum size). As described in the HMS FMP, implementation of a minimum size could increase fishing costs because fishermen would either have to fish farther offshore to avoid fish smaller than the minimum size or set additional gear in order to catch more fish that meet the minimum size requirement. As such, additional fuel, bait, groceries, and possibly additional gear could be required. However, implementation of a minimum size could also increase ex-vessel price slightly because fishermen would be landing fish that have more meat and that have larger fins. Under alternative D2, NOAA Fisheries does not expect any changes in fishing costs or ex-vessel prices. Given that there has been no minimum size in the commercial fishery to date, there are no economic impacts associated with implementation of alternative D2.

6.4.5 Expected economic impacts of preferred commercial alternatives combined

The preferred alternatives (A3, B3, B4, C2, and D2), when combined, will result in economic impacts to the fishery as a whole, some of which may be significant for small entities/vessel owners. This is especially true of preferred alternatives A3 and C2, which will result in a decrease in available LCS quota. However, all of these alternatives, when compared to the other alternatives described above, mitigate undesirable or greater economic impacts associated with continued overfishing, shortened seasons, and economic instability of fishery participants and associated fishing communities in the long-term. The combination of these preferred alternatives is necessary for LCS to rebuild and SCS to achieve optimum yield.

6.5 Expected Economic Impacts of the Recreational Management Measures

6.5.1 Expected economic impacts of the recreational retention limits

NOAA Fisheries considered seven separate recreational retention limit alternatives (See Chapter 2). Alternative E1, the no action alternative (one shark per vessel per trip plus one Atlantic sharpnose shark per person per trip), is not anticipated to change fishing costs or ex-vessel prices, given that this is the retention limit under which recreational fishermen have been fishing.

As described in Chapter 4, implementation of retention limits under alternatives E2 (existing catch limits (E1) plus one bonnethead shark per person per trip), E3 (existing catch limits (E1) plus the addition of one pelagic shark per vessel per trip), and E4 (existing catch limits (E1) plus an allowance for vessels with HMS angling permits participating in registered tournaments/CHB permit holders on for hire trips, as well as one bonnethead per person per trip) could result in positive economic benefits as increases in retention limits may increase tournament participation and business profits within the charter/headboat industry for sharks. Economic studies described in Chapter 4, indicate that the addition of one shark would only increase WTP by $7. Alternative E5 (other state based retention limit) could result in variable economic costs depending upon what the retention limit is and where anglers are fishing. For example, the economic impacts associated with alternative E5 could be negative if the retention limit is less than the current limit or positive if the retention limit is more than the current limit. By comparison, alternative E6, which would eliminate all retention of sharks, would likely result in negative economic impacts depending upon the willingness for shark anglers to substitute other fish and release sharks that are caught as a result of recreational fishing activity.

Alternative E7 (no retention limit) would likely result in positive economic benefits in the short-term due to increases in recreational fishery participation; however, in the long-term, as discussed in Chapter 4 this alternative may also result in negative impacts should shark stocks decline.

6.5.2 Expected economic impacts of the recreational minimum sizes

As described in Chapter 4, NOAA Fisheries does not expect any changes in fishing costs or ex-vessel prices under the no action alternative, F1 (4.5 feet fork length for all sharks, no size limit for Atlantic sharpnose sharks), because fishermen have been operating under the present minimum size limits since 1999. By comparison, alternative F2 (existing size limits (F1) plus no size limit for bonnethead sharks) could increase recreational willingness to pay, angler consumer surplus, and current revenues to charter/headboat owners/captains and others who would benefit from a retention allowance for bonnethead sharks.

Alternatives F3 (5.0 feet fork length for all sharks, no size limit for Atlantic sharpnose or bonnethead sharks), F4 (5.0 feet fork length for all ridgeback LCS, 4.5 feet fork length all non-ridgeback LCS, SCS, and pelagic sharks, no size limit for Atlantic sharpnose or bonnethead sharks) and F5 (existing size limits (F1) plus regional non-ridgeback shark size limits, and no size limit for bonnethead sharks) would require that anglers release most of the sharks currently caught in the recreational fishery, which could result in variable negative economic impacts in the short-term. However, these impacts would likely be mitigated by the rebuilding of shark stocks over time.

Under alternative F6, no minimum size, there may be an increase in participation in the recreational fishery, thereby resulting in positive economic impacts. However, in the long-term, alternative F6 may contribute to stock declines, which could result in increased fishing costs and reduced revenues.

6.5.3 Expected economic impacts of the authorized gears for recreational shark fishing

NOAA Fisheries does not anticipate a change in ex-vessel prices or economic benefits as a result of maintaining G1 (any authorized gear) or implementing G2 (only allow handline and rod and reel). No economic costs are anticipated because these alternatives address gear restrictions for recreational shark fishing in federal waters, where sharks retained cannot be sold.

6.5.4 Expected economic impacts of preferred recreational alternatives combined

The preferred alternatives (E2, F2, and G2), when combined, will result in economic benefits to the recreational fishery as a whole. This is especially true of preferred alternatives E2 and F2, which will result in increased angler consumer surplus, an increase in willingness to pay and increased revenues to charter/headboat owners/captains and others who rely on the recreational fishery.

6.6 Expected Economic Impacts of the Deepwater and Other Shark Alternatives

NOAA Fisheries does not expect alternatives H1 (retain established species group) or H2 (remove species group from management unit; data collection only) to result in changes to ex-vessel prices or economic benefits because there are no known significant landings of species in this group and The Shark Finning Prohibition Act now bans finning.

6.7 Expected Economic Impacts of the Prohibited Species Alternatives

NOAA Fisheries does not anticipate a change in ex-vessel prices or economic benefits as a result of implementing alternative I1 (retain established species group), because fishermen are already operating under these restrictions. Similarly, implementation of alternative I5 (add deepwater/other species group to prohibited species group) would not result in any substantive economic benefits because there are only minor landings of the deepwater/other species through bycatch in other fisheries.

In general, adding a species to the prohibited species list would have negative economic impacts. Not only would fishermen have to discard the fish but if fishermen are unable to avoid the prohibited species, then fishermen would have to spend time removing fish from the gear. In the long-term, fishermen might gain benefits if the species is removed from the list. As described in Section 4.5, alternatives I2 (return to the five species in 1997), I3 (retain established prohibited species group and add finetooth), and I4 (retain established species group and remove dusky)

could have negative long-term economic impacts. While alternatives I2 and I4 could allow dusky sharks and other occasionally caught sharks to be landed commercially and recreationally, thereby increasing short-term revenues to the fishery, should these species decline, more fishing effort would be required to catch these sharks and this would likely result in increased costs and reduced revenues for commercial fishermen and charter/headboat operations.

Additionally, if dusky or other species are listed under ESA, the whole fishery could be affected and potentially closed. Alternative I3 would likely result in increased costs and reduced revenues for commercial fishermen and charter/headboat operations. Finetooth sharks accounted for over one-third of all commercial SCS landings in 1998-2000 (Cortes, 2002). As such, SCS fisheries could experience as much as a 33-percent reduction in total revenues should landings composition in the SCS fishery remain the same under alternative I3.

By comparison, alternative I6 (retain established prohibited species group and establish criteria for addition and removal of species) could have positive and negative economic impacts, depending upon which species are added/removed to/from the prohibited species group. For instance, if a commercially or recreationally valuable species is added, then a negative economic impact may be incurred in that this species would no longer be available to commercial or recreational fisheries, with the exception of catch and release in the recreational fishery. Alternatively, if a commercially or recreationally valuable species is removed, then a positive economic impact may be incurred in that this species would no longer be prohibited from retention.

6.8 EXPECTED ECONOMIC IMPACTS OF THE BYCATCH REDUCTION MEASURES

6.8.1 Expected economic impacts of the gear restrictions

NOAA Fisheries does not anticipate a significant change in ex-vessel prices or economic benefits as a result of implementing alternative J1 (gillnet net checks, LWTRP, observers/bottom longline post guidelines), primarily because this alternative does not change current fishing practices. Alternative J2 (existing bycatch measures plus closing shark gillnet fishery permanently) would result in significant negative economic impacts for the six vessels actively fishing in the shark gillnet fishery, but minimal economic impacts on the fishery as a whole.

As described in Chapter 4, alternative J3, which would not close the fishery but require use of striknet fishing, could have significant impacts on those vessels not currently strikenetting (ranging between 2 and 4 vessels out of 5). It may result in large decreases in revenues for fishermen who traditionally fished in the drift gillnet fishery and place financial burdens on those fishermen who may need to purchase a second smaller vessel and outfit it for strikenet fishing. NOAA Fisheries estimates that the smaller vessel could cost between $2,000 and $14,000 to purchase. The use of a second vessel for strikenet fishing may also increase associated operating costs. Additionally, several fishermen that currently strikenet fish also use a spotter plane to locate schools of sharks, which may further increase operating costs for fishermen that would be

required to strikenet under this alternative. For those fishermen that currently strikenet fish, this alternative would have less of an impact but may still increase costs if they drift gillnet fished part of the time. Recently, some strikenet vessels have begun striking behind other vessels such as trawl vessels (e.g., shrimp vessels). This negates the need for a spotter plane and could reduce the variable costs substantially. Additionally, some of the smaller drift gillnet vessels have begun to use shorter nets to strike fish without a second vessel (Carlson and Baremore, 2002). Their efforts are moderately successful and could reduce the costs of fishing in a strikenet method substantially. Alternative J3 would allow for a reduction in the current observer coverage levels in gillnet fisheries outside right whale calving season. This could reduce the costs associated with observer coverage and the administrative burden on NOAA Fisheries.

NOAA Fisheries received numerous comments regarding alternative J3 including comments stating that the shark gillnet fishermen generally target Atlantic sharpnose sharks from April 1 through November 15 with drift gillnet gear. The commenters claim that strikenet gear has not been effective at catching Atlantic sharpnose sharks and they feel that drift gillnet gear is the only effective method of targeting this resource. The commenters wrote that strikenet gear cannot be used to target SCS during the summer months because these species do not aggregate during those months. Comment was received from fishermen currently active in the shark gillnet fishery stating that if they were not allowed to use drift gillnet gear, their businesses would no longer be viable. NOAA Fisheries also received comments from a state agency supporting the prohibition of shark gillnets in Federal waters to complement similar prohibitions in state waters, thereby minimizing drains on state law enforcement resources.

The intent of alternative J3 was to allow the commercial shark gillnet fishery to continue and minimize economic impacts, while minimizing interactions with protected resources as well as reducing bycatch of non-target species. Through public comment it has been brought to the attention of NOAA Fisheries that allowing the use of strikenets only would not accomplish this objective. Therefore, the final regulations will permit the use of drift gillnets with possible gear modifications or other measures being implemented through future rulemaking, based upon further study and economic analysis.

Alternative J4 will require vessels to install VMS units, which will result in negative economic impacts in the short-term. However, in the long-term, alternative J4 could result in increased revenues by allowing less burdensome regulations and more fishing time. Under the time/area closure in alternative K2, alternative J4 would result in approximately five gillnet shark fishing vessels and approximately seven directed category bottom longline shark fishing vessels[1] having to install VMS units. Specifically, the costs associated with implementing a VMS program in the Atlantic shark gillnet fishery include an initial average cost per vessel of approximately $2,275

[1]Fourteen bottom longline vessels fished (i.e., on average during 2000 and 2001) in the area near the time/area closure. Seven of these vessels should already have VMS because they are associated with swordfish permits. As such, NOAA Fisheries estimates that the remaining seven vessels will need to purchase VMS units as selected in this amendment. See Appendix 4 for further explanation.

(not including postage costs for returning certification statement), an average annual maintenance cost of approximately $500/year, and approximately $197.28/year for communications during the right whale calving season. Costs associated with implementing a VMS program in the directed shark bottom longline fishery include an initial average cost per vessel of approximately $2,275 (not including postage costs for returning certification statement), an average annual maintenance cost of approximately $500/year, and approximately $305.28/year for communications during the proposed 212 day shark bottom longline time/area closure. Economic analyses of the impacts associated with this VMS requirement indicate that only five percent of the fleet would be affected and that this will result in a eight-percent reduction in total gross revenues for the fishery as a whole and a 26-percent reduction in total gross revenues for the 12 vessels directly affected by this proposed requirement during the first year of implementation. For every year thereafter, economic analyses indicate that annual costs will result in a seven-percent reduction in total gross revenues for the fishery as a whole and a seven-percent reduction in total gross revenues for the 12 vessels directly affected by this proposed requirement. In an attempt to provide vessel owners with flexibility and help minimize costs, NOAA Fisheries has type-approved four VMS units from two manufacturers for use in the pelagic longline fisheries. No VMS units have been type-approved specifically for use in the Atlantic shark fisheries as of this date. Based on the range of VMS units commercially available, NOAA Fisheries expects any VMS unit type-approved for Atlantic shark fisheries to be similar or identical to those type-approved for the pelagic longline fisheries. Additionally, VMS could allow shark vessels to transit closed areas because the signature would indicate whether of not the vessel is fishing. While this is not true for strikenet vessels, the VMS requirement could reduce the need for observer coverage, which would result in short-term economic benefits. Additionally, delayed implementation of the VMS requirement will allow time for type approval and time for vessels to obtain the VMS units and adjust to the new requirements, which will minimize the overall economic impact.

As described in Chapter 4, alternative J5 (existing bycatch reduction measures plus requirement of the use of non-stainless steel corrodible hooks, release equipment, and requirement for bottom longline vessel to move one nautical mile after interaction with a marine mammal or sea turtle) will likely result in increased economic impacts to fishermen, primarily because of increased costs associated with the requirement to reset gear as well as fuel, time and labor costs. The costs associated with purchasing release equipment are minimal. NOAA Fisheries has received comment that these requirements may increase fishing efficiency and result in decreased costs for fishermen. For example, dehooking and disentanglement gear may speed up fishing operations by reducing costs associated with purchasing and replacing lost gear. Additionally, NOAA Fisheries believes that most fishing vessels will move at least one nautical mile during the course of normal operations, so the cost of fuel may be mitigated. Alternatives J6 (existing bycatch reduction measures plus gear limitations for bottom longline vessels) and J7 (existing bycatch measures plus requiring retention of all sharks) would likely result in minimal negative economic impacts. Specifically, alternative J6 could result in increased costs for replacing hooks and re-rigging gear, whereby alternative J7 may result in derby fishing conditions where revenues and market values for shark products may decline. Alternative J8 (existing bycatch reduction measures plus requirement for mandatory workshops) will likely result in minimal economic

impacts to fishermen, as the costs incurred will be those associated with travel and time to attend workshops discussing shark species identification, marine mammal and sea turtle release techniques, and current regulations. Economic costs associated with alternative J8 may be mitigated if stock status improves as a result of more accuracy in identification and increasing fishing efficiency with the use of release equipment and techniques. Furthermore, economic impacts associated with alternative J8 could be further reduced if workshops are held near commercial and recreational ports of interest, during the closed season for shark fishing, and if workshops are conducted by utilizing video-conferencing or internet training options. Additionally, if these workshops are mandatory, then economic costs associated with consequences (e.g. loss of permit, etc.) of not completing such training may also be incurred. Alternative J9 is analyzed under alternative A2.

All of the alternatives listed above (i.e., J1-J9) could have minimal economic benefits if consumers perceive shark fishing vessels as conservation minded or if LCS stocks improve and consumers are willing to pay more for domestic shark meat.

6.9 EXPECTED ECONOMIC IMPACTS OF THE TIME/AREA CLOSURES

NOAA Fisheries does not anticipate a change in ex-vessel prices or economic benefits as a result of implementing alternative K1 (no time/area closure), primarily because this alternative does not change current fishing practices. In the long-term, if this alternative prevents the rebuilding of stocks, then this alternative could have economic impacts. By comparison, alternatives K2 (revised time/area closure for sandbar and dusky sharks off North Carolina) and K3 (time/area closure for all shark nursery and pupping grounds) could all have a negative economic impact on shark fishery participants by closing large sections of coastal waters to shark bottom longline fishing.

Original economic analyses in the DEIS indicated that alternative K2 could have a direct economic impact on a total of 34 vessels (out of 251 total directed permits issued in 2002 ~ 14%) with directed shark permits, of which only 13 vessels with home ports located in South Carolina, North Carolina, and Virginia reported shark landings during 2001. These vessels reported gross revenues totaling $351,600 during that year. Revised economic analyses, which were conducted as a result of public comment and associated revisions to the time/area closure indicate that K2 could have a direct economic impact on a total of 23 vessels (out of 256 total directed permits issued in 2003 ~ 9%) with directed shark permits. Furthermore, revised economic analyses indicate that only 8 vessels with home ports located in North Carolina reported shark landings during 2001. This revised analysis indicates that alternative K2, in a worst case scenario, will result in a 15-percent reduction in total gross revenues for the fishery as a whole and in a three-percent reduction of revenues for the small entities directly affected by the proposed closure. As such, the revised time/area closure mitigates the economic impacts by $17,956 in total gross revenues for the small entities directly affected by the closure as compared with the original preferred alternative. Additionally, fishermen could relocate and fish in another location outside of the time/area closure to mitigate some of these economic impacts.

Because alternative K3 proposes a much larger closed area that would affect all directed permit holders for both the Atlantic and the Gulf of Mexico, the economic impacts associated with this alternative are assumed to be much greater than that of alternative K2, especially in terms of significance to small entities and the fishery as a whole. Fishermen would be directly impacted by a reduction in catch and income from areas that they have traditionally relied upon. Fishing practices and behavior of fishermen would also be affected by requiring fishermen to travel further offshore. Due to greater distances traveled, fishermen would spend more time at sea, and associated costs of food, fuel, and labor could increase. This could cause some fishermen to go out of business, move to new areas, or alter fishing patterns in other ways. This alternative could result in a change in the distribution of benefits and costs, with the financial costs of operating in the fishery increasing and benefits decreasing.

While implementation of either K2 or K3 will have significant impacts for fishermen/small entities directly affected, the LCS quotas would still be taken and fishermen who currently fish in areas outside of the closure could get economic benefits associated with less competition for available quota.

6.10 Expected Economic Impacts of Preferred Bycatch Reduction, Time/area, and Commercial Management Measures Combined

The preferred alternatives (A3, B3, B4, C2, D2, J4, J5, and K2), when combined, will result in economic impacts to the fishery as a whole, some of which would be significant for small entities/vessel owners. This is especially true of preferred alternatives A3 and C2, J4, as well as K2, which will likely result in decreased economic revenues and increased economic costs via decreasing available LCS quota, requiring VMS, and implementing a revised time/area closure for dusky and sandbar sharks. However, all of these alternatives, when compared to the other alternatives described above, mitigate undesirable, or greater economic impacts associated with continued overfishing, shortened seasons, bycatch of vulnerable species, and economic instability of fishery participants and associated fishing communities in the long-term. Moreover, in response to public comment, NOAA Fisheries considered ways in which to minimize economic impacts of the preferred alternatives. The combination of these preferred alternatives is necessary for LCS to rebuild and SCS to achieve optimum yield.

6.11 Expected Economic Impacts of the EFH

NOAA Fisheries does not anticipate a change in ex-vessel prices or economic benefits as a result of implementing any of the alternatives for identifying EFH. The identification of EFH does not generally result in any management measures.

6.12 EXPECTED ECONOMIC IMPACTS OF THE EFP ADMINISTRATION

Since both alternative M1 (maintain combined permitting system) and M2 (separate permitting systems for display and research) deal with EFP administration, NOAA Fisheries does not anticipate a change in ex-vessel prices or economic benefits as a result of implementing either alternative.

Table 6.1 **Number of Atlantic Shark Permit Holders**. The actual number of permit holders are subject to changes and can vary from year to year based on participation rates.

Permit Type	Number of Permits Issued	
	October 2002	September 2003
Shark Directed Limited Access Permits	251	256
Shark Incidental Limited Access Permits	376	351
Atlantic HMS Angling Category*	9,372**	18,249
Atlantic HMS Charter/headboat	4,041	4,041
Total	14,040	22,897

* Contains all HMS permits, not shark specific.
**As of May 2003.

Table 6.2 **Number of Operating Shark Gillnet Vessels.** Source: Trent *et al*., 1997; Carlson and Lee, 1999; Carlson and Baremore, 2001; Carlson, pers comm.

Year	Number of vessels	Year	Number of vessels
1990	11	1997	unknown
1991	unknown	1998	unknown
1992	unknown	1999	4
1993	5	2000	6
1994	6	2001	6
1995	11	2002	5
1996	unknown	2003	Data not available

Table 6.3 Estimates of the Total Ex-vessel Value Gross Revenues of Atlantic Shark Fisheries as Presented in the 2003 SAFE Report. Note: Average ex-vessel prices are the average of averages and may have some weighting errors. Prices are for calendar year 2001. Sources: NOAA Fisheries, 2003.

Species	2001		
	Ex-Vessel Price ($/lb dw)	Weight (lb dw)	Fishery Value ($)
LCS	$0.91	1,474,186.7	$1,341,509.90
Pelagic Sharks	$1.11	59,896.1	$66,484.67
SCS	$0.79	45,999.0	$36,339.21
Shark Fins (weight = 5% of all sharks landed)	$19.67	79,004.1	$1,554,010.65
Total	--	--	$2,998,344.43

Table 6.4 **Economic Impacts of LCS Quota Alternatives Considered**. Sources: 2001 pelagic longline, snapper grouper, and Northeast multispecies logbook data; 2001 Shark permit data; 2001 ex-vessel prices for Atlantic sharks as reported in NOAA Fisheries, 2003.

Alternative	Baseline (1285 mt dw)	Alt C1	Alternative C2				Alternative C3		
			A3 Complex		A1/A2 Group	A4 Species	A3 Complex	A1/A2 Group	A4 Species
			Proposed in DEIS	Selected in this document					
Percent Change in Total Gross Revenues versus Baseline	--	- 24%	-14%	-21%	14%	33%	-28%	21%	16%
Total Gross Revenues for Fishery (minimum - maximum)	$2,895,521	$2,200,595 ($ 2.88 - $65,972)	$2,490,148 ($3.26 - $74,653)	$2,287,461 ($2.99 - $68,577)	$3,358,804 ($4.39 - $100,695)	$4,343,280 ($5.68 - $130,209)	$2,084,775 ($2.73 - $62,500)	$3,648,356 ($4.77 - $109,376)	$3,445,669 ($4.51 - $103,299
Average Revenues for Fishermen (minimum - maximum)	$24,129	$18,338 ($26.83 - $132,883)	$20,751 ($30.36 - $150,368)	$19,062 ($27.89 - $138,129)	$27,990 ($40.96 - $202,822)	$36,194 ($52.96 - $262,270)	$17,373 ($25.42 - $125,890)	$30,403 ($44.49 - $220,307)	$28,714 ($42.02 - $208,068)

Table 6.5 **Economic Impacts of SCS Quota Alternatives Considered**. Sources: 2001 pelagic longline, snapper grouper, and Northeast multispecies logbook data; 2001 Shark permit data; 2001 ex-vessel prices for Atlantic sharks as reported in NOAA Fisheries, 2003.

Alternative	Baseline (1760 mt dw)	Alt C1	Alternative C2	Alternative C3
			Selected in this document	
Percent Change in Total Gross Revenues versus Baseline	--	--	10%	- 17%
Total Gross Revenues for Fishery (minimum - maximum)	$36,339	$36,339 ($0.00 -$4,738)	$40,336 ($0.00 - $5,260)	$30,161 ($0.00 - $3,933)
Average Revenues for Fishermen (minimum - maximum)	$303	$303 ($0.00 - $6,369)	$336 ($0.00 - $7,070)	$251 ($0.00 - $5,286)

References for Section 6.0
No references cited.

References for Section 6.1
No references cited.

References for Section 6.2

NOAA Fisheries. 2003. Stock assessment and fishery evaluation (SAFE) report for Atlantic highly migratory species. 264 pp.

References for Section 6.3

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References for Section 6.4
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References for Section 6.5
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No references cited.

References for Section 6.7

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References for Section 6.8

Carlson, J.K. and I. Baremore. 2002. The directed shark gillnet fishery: non-right whale season, 2000 and 2001. NOAA NMFS, Southeast Fisheries Science Center, Panama City, FL. Sustainable Fisheries Division Contribution PCB-01/02-002. 8 pp.

References for Section 6.9

No references cited.

References for Section 6.10

No references cited.

References for Section 6.11

No references cited.

References for Section 6.12

No references cited.

7.0 REGULATORY IMPACT REVIEW

The Regulatory Impact Review (RIR) is conducted to comply with Executive Order 12866 (E.O. 12866) and provides analyses of the economic benefits and costs of each alternative to the nation and the fishery as a whole. Certain elements required in an RIR are also required as part of an environmental impact statement (EIS). Thus, this section should be considered only part of the RIR, the rest of the RIR can be found throughout this document.

7.1 DESCRIPTION OF THE MANAGEMENT OBJECTIVES

Please see Chapter 1 for a description of the management objectives associated with this Amendment.

7.2 DESCRIPTION OF THE FISHERY

Please see Chapter 3 for a description of the fisheries that could be affected by this Amendment.

7.3 STATEMENT OF THE PROBLEM

Please see Chapter 1 for a description of the problem and need for this Amendment.

7.4 DESCRIPTION OF EACH ALTERNATIVE

Please see Chapter 2 for a summary of each alternative and Chapter 4 for a complete description of each alternative and its expected ecological, social, and economic impacts. Chapters 6 and 8 provides additional information related to the alternatives.

7.5 ECONOMIC ANALYSIS OF EXPECTED EFFECTS OF EACH ALTERNATIVE RELATIVE TO THE BASELINE

NOAA Fisheries does not believe that the national net benefits and costs would change significantly in the long-term as a result of implementation of the preferred alternatives. The total amount of sharks landed and available for consumption are not expected to change substantially in the short-term as a result of this action. In the long-term, as LCS are rebuilt to sustainable levels, the total amount of sharks may increase.

The 1997 quotas of 1,285 mt dw for LCS and 1,760 mt dw for SCS were used as baselines for comparison and economic impact analyses on commercial quota alternatives. Fishermen have been fishing under these quotas since 1997. While the 2003 emergency rule did increase the LCS quota slightly from the 1997 LCS baseline (i.e., 1,285 mt dw without state landings; 1,600 mt dw with state and Federal landings combined) to 1,714 mt dw (i.e., 1,714 mt dw with state and Federal landings combined), the action was temporary and intended to serve as an interim management measure until the completion of this Amendment. Under the preferred alternatives

the commercial LCS and SCS quotas decrease (See Tables 6.4 and 6.5). The recreational bag limits increase under the preferred alternatives outlined in Chapters 2 and 4. Table 7.1 indicates the possible net economic benefits and costs of each alternative.

7.6 CONCLUSION

Under E.O. 12866, a regulation is a "significant regulatory action" if it is likely to: 1) have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or tribal governments or communities; 2) create a serious inconsistency or otherwise interfere with an action taken or planned by another agency; 3) materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights, and obligation of recipients thereof; or 4) raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order. The preferred alternatives described in this document do not meet the above criteria. Therefore, under E.O. 12866, the preferred alternatives described in this document have been determined to be not significant for the purposes of E.O. 12866. A summary of the expected net economic benefits and costs of each alternative, which are based on supporting text in Chapters 4 and 6, can be found in Table 7.1.

Table 7.1 Summary of the net benefits and costs for each alternative

Alternative	Net Economic Benefits	Net Economic Costs
LCS Classification		
A1	None	Minimal - sorting requirement could lengthen trips
A2	None	Minimal - sorting requirement could lengthen trips
A3 -Preferred Alternative	Minimal - no sorting needed, except for prohibited species	Minimal - if quotas for complex reduce quota, then decreases in revenue may occur
A4	Minimal - if quotas on individual species increase quota, then increases in revenues may occur	Minimal - sorting requirements could lengthen trips
Commercial Quota Administration		
B1	None	Minimal
B2	None	None

Alternative	Net Economic Benefits	Net Economic Costs
B3 - Preferred Alternative	Minimal	None
B4 - Preferred Alternative	Minimal	Minimal
B5	Minimal	Minimal
Commercial Quota Basis		
C1	• Could be benefit if LCS stocks rebuild	• 24% reduction in LCS quota (See Table 6.4)
C2 (plus A3) - Preferred Alternative	• 10% increase in SCS quota (See Table 6.5) • For LCS (rebuilding all species) a benefit could occur in long-term	• 21% reduction in LCS quota (See Table 6.4)
C2 (plus A1/A2)	• 14% increase in LCS quota (See Table 6.4) • 10% increase in SCS quota (See Table 6.5)	• Could be cost if LCS stocks do not rebuild in the long-term
C2 (plus A4)	• 33% increase in LCS quota (See Table 6.4) • 10% increase in SCS quota (See Table 6.5)	• Could be cost if LCS stocks do not rebuild in the long-term
C3 (plus A3)	None	• 28% reduction in LCS quota (See Table 6.4) • 17% reduction in SCS quota (See Table 6.5)
C3 (plus A1/A2)	• 21% increase in LCS quota (See Table 6.4)	• 17% reduction in SCS quota (See Table 6.5) • Could be cost if LCS stocks do not rebuild in the long-term
C3 (plus A4)	• 16% increase in LCS quota (See Table 6.4)	• 17% reduction in SCS quota (See Table 6.5) • Could be cost if LCS stocks do not rebuild in the long-term

Alternative	Net Economic Benefits	Net Economic Costs
Commercial Minimum Size		
D1	Minimal	Minimal
D2 - Preferred Alternative	None	None
D3	Minimal	Minimal
D4	Minimal	Minimal
D5	Minimal	Minimal
D6	Minimal	Minimal
Recreational Retention Limits		
E1	None	None
E2 - Preferred Alternative	Minimal	None
E3	Minimal	None
E4	Minimal	None
E5	Minimal, if the retention limit is more than the current limit.	Minimal, if the retention limit is less than the current limit.
E6	None	Moderate
E7	In the short-term, increases in participation possible. In the long-term, none.	In the short-term, none. In the long-term, fishery could be overfished.
Recreational Minimum Size		
F1	None	None
F2 - Preferred Alternative	Minimal	None
F3	In the short-term, none. In the long-term, economic revenues could increase as sharks rebuild.	In the short-term, WTP could decrease if fishermen couldn't land sharks. In the long-term, none.

Alternative	Net Economic Benefits	Net Economic Costs
F4	In the short-term, none. In the long-term, economic revenues could increase as sharks rebuild.	In the short-term, WTP could decrease if fishermen couldn't land sharks. In the long-term, none.
F5	In the short-term, none. In the long-term, economic revenues could increase as sharks rebuild.	In the short-term, WTP could decrease if fishermen couldn't land sharks. In the long-term, none.
F6	In the short-term, increases in participation possible. In the long-term, none.	In the short-term, none. In the long-term, costs to fish could increase and fish may be hard to catch if stocks decline
Authorized Gears for Recreational Fishing		
G1	None	None
G2 - Preferred Alternative	None	None
Deepwater and Other Sharks		
H1	None	None
H2 - Preferred Alternative	None	None
Prohibited Species		
I1	None	None
I2	In the short-term, fishermen could land additional species and spend less time sorting catch in a haulback. In the long-term, none (should stocks decline).	In the short-term, none. In the long-term, should stocks decline additional management measures might be considered that would decrease revenues.
I3	None	Could result in additional sorting and one third fewer revenues in SCS fishery.
I4	In the short-term, minimal. In the long-term, none (should stocks decline).	In the short-term, none. In the long-term, dusky sharks might be listed under ESA. This could have significant impact on small entities.

Alternative	Net Economic Benefits	Net Economic Costs
I5	None	None
I6 - Preferred Alternative	Minimal	Minimal
Bycatch Reduction Measures		
J1	Could be minimal if consumers perceive shark fishing vessels as conservation minded or if LCS stock improve.	None
J2/J9	Could be minimal if consumers perceive shark fishing vessels as conservation minded or if LCS stock improve.	Minimal for the fishery as a whole, but significant for 6 vessel owners/small entities.
J3	Could be minimal if consumers perceive shark fishing vessels as conservation minded or if LCS stock improve.	Minimal for the fishery as a whole, but significant for 6 vessel owners/small entities.
J4 - Preferred Alternative	In the short-term, none. In the long-term minimal, if consumers perceive shark fishing vessels as conservation minded or if LCS stock improve.	In the short-term, significant for small entities. In the long-term, minimal.
J5 - Preferred Alternative	Could be minimal if consumers perceive shark fishing vessels as conservation minded or if LCS stock improve.	Minimal
J6	Could be minimal if consumers perceive shark fishing vessels as conservation minded or if LCS stock improve.	Minimal
J7	Could be minimal if consumers perceive shark fishing vessels as conservation minded or if LCS stock improve.	Minimal

Alternative	Net Economic Benefits	Net Economic Costs
J8	Could be minimal if consumers perceive shark fishing vessels as conservation minded or if LCS stock improve.	Minimal
Time and Area Closures		
K1	None	None
K2 - Preferred Alternative	Minimal, with improvements in dusky and sandbar stock status.	In short-term, significant economic impact for small entities/vessels directly involved. In the long-term, economic impacts on small entities may be reduced with relocation to fish in areas outside the proposed time/area closure as well as improvements in dusky and sandbar status. Minimal impacts are anticipated for vessels fishing away from closure and for the whole fishery because quota will continue to be caught.
K3	Minimal, with improvements in shark stock status.	In short-term, significant economic impact for small entities/vessels directly involved. In the long-term, economic impacts on small entities may be reduced with improvements in shark status. Minimal impacts are anticipated for vessels fishing away from closure and for the whole fishery because quota will continue to be caught.
EFH		
L1	None	None
L2	None	None
L3	None	None
L4	None	None

Alternative	Net Economic Benefits	Net Economic Costs
EFP		
M1	None	None
M2 - Preferred Alternative	None	None

References for Section 7.0
No references cited.

References for Section 7.1
No references cited.

References for Section 7.2
No references cited.

References for Section 7.3
No references cited.

References for Section 7.4
No references cited.

References for Section 7.5
No references cited.

References for Section 7.6
No references cited.

8.0 FINAL REGULATORY FLEXIBILITY ANALYSIS (FRFA)

The Final Regulatory Flexibility Analysis (FRFA) is conducted to comply with the Regulatory Flexibility Act and provides analyses of the economic benefits and costs of the preferred alternatives on small entities. Certain elements required in an FRFA are also required as part of an environmental impact statement (EIS). Thus, this section should be considered only part of the FRFA; the rest of the FRFA can be found throughout this document.

8.1 STATEMENT OF THE NEED FOR AND OBJECTIVES OF THIS FINAL RULE

Please see Chapter 1 for a description of the need for and objectives of the final rule.

8.2 A SUMMARY OF THE SIGNIFICANT ISSUES RAISED BY THE PUBLIC COMMENTS IN RESPONSE TO THE INITIAL REGULATORY FLEXIBILITY ANALYSIS, A SUMMARY OF THE ASSESSMENT OF THE AGENCY OF SUCH ISSUES, AND A STATEMENT OF ANY CHANGES MADE IN THE RULE AS A RESULT OF SUCH COMMENTS

NOAA Fisheries received many comments on the proposed rule and draft Amendment 1 during the comment period. These and NOAA Fisheries' responses are summarized in Appendix 5 of this document and will be included in the final rule. NOAA Fisheries did not receive any comments specific to the Initial Regulatory Flexibility Analysis (IRFA), but did receive a limited number of comments related to economic issues and concerns. Most of the economic comments pertained to proposed commercial quota reductions, implementation of trimester seasons and regional quotas, gillnet restrictions, VMS requirements, and the time/area closure. These comments are responded to with the other comments in Appendix 5 and the economic concerns are summarized here.

Of the economic comments received by NOAA Fisheries, most noted anticipation of substantial economic impacts associated with implementation of commercial quota reductions, VMS requirements, and the time/area closure. Specifically, comments noted that commercial quota reductions, VMS requirements, and the time/area closure offshore North Carolina would put fishermen out of business and create less economic stability amongst industry participants. Economic comments pertaining to implementation of trimester seasons and regional quotas identified similar concerns, noted disruptions in existing markets, and stated that the combination of regional quotas and trimester seasons would lead to insufficient income. Additionally, NOAA Fisheries received comments noting that gillnet restrictions, which would allow strikenet method only, would not allow the commercial shark gillnet fishery to continue while minimizing interactions, as it was originally intended. Specifically, comments suggest that Atlantic sharpnose, the species comprising the vast majority of SCS landings, can only be caught using gillnet gear and that SCS do not aggregate like other shark species.

NOAA Fisheries is aware, and stated in the economic analyses and Initial Regulatory Flexibility Analyses (IRFA) for the proposed rule, that reductions in commercial quotas, implementation of

trimesters, regional quotas, VMS requirements, and the time/area closure would likely result in economic impacts to the fishery as a whole, some of which may be significant for small entities/vessel owners. However, all of these alternatives, when compared to the other alternatives considered, mitigate undesirable or greater economic impacts associated with continued overfishing, shortened seasons, bycatch of vulnerable species, and economic instability of fishery participants and associated fishing communities in the long-term. The combination of these preferred alternatives is necessary for LCS to rebuild and SCS to achieve optimum yield, consistent with the objectives of this rule, the Magnuson-Stevens Act, and other domestic laws.

In order to mitigate some of the costs associated with implementation of reduced commercial quotas, trimesters, regional quotas, VMS requirements, and the time/area closure, NOAA Fisheries will delay effectiveness of trimester seasons, VMS requirements, and the time/area closure in order to give fishermen time to (1) purchase VMS units, (2) work with dealers to enhance market prices and plan out advertising strategies with grocers, and (3) prepare and plan for the closure. Furthermore, NOAA Fisheries was able to reduce the size of the time/area closure, as originally proposed in the DEIS. The revised time/area closure, which is anticipated to affect only eight vessels as opposed to 13, mitigates the economic impacts to small entities directly affected by the revised closure by $17,956 in total gross revenues as compared with the original preferred alternative. Specifics on changes to the alternatives and the expected economic impacts can be found in Chapters 2, 4, 6, and 7.

Finally, NOAA Fisheries proposed allowances for strikenet method only in the shark gillnet fishery in order to allow the commercial shark gillnet fishery to continue while minimizing interactions with protected resources as well as reducing bycatch of non-target species. Through public comment it has been brought to the attention of NOAA Fisheries that allowing the use of strikenets only would not accomplish this objective. Therefore, the final regulations will permit the use of drift gillnets with possible gear modifications or other measures being implemented in a future rulemaking, based upon further study. Specifics on changes to the alternatives and the expected economic impacts can be found in Chapters 2, 4, 6, and 7.

8.3 DESCRIPTION AND ESTIMATE OF THE NUMBER OF SMALL ENTITIES TO WHICH THE PROPOSED RULE WILL APPLY

NOAA Fisheries considers all permit holders to be small entities. A description of the fisheries affected can be found in Chapter 3 of this document.

In October 2002, there were approximately 251 directed shark permit holders and 376 incidental shark permit holders for a total of 627 permit holders who were authorized to fish for sharks. As of September 2003, there were approximately 256 directed permit holders and 351 incidental permit holders for a total of 607 permit holders who are authorized to fish for sharks and could be affected by the preferred alternatives outlined in the final rule. Only about 20 percent of all permit holders are actually active in the fishery. Currently, 120 vessels (i.e., number of vessels

that reported landings of shark during 2001) would be affected by changes (i.e., increases/decreases) in shark quotas.

Original economic analyses of the proposed time/area closure in the DEIS indicated that alternative K2 could have a direct economic impact on a total of 34 vessels (out of 251 total directed permits issued in 2002 ~ 14%) with directed shark permits. Revised economic analyses, which were conducted as a result of public comment and associated revisions to the time/area closure indicate that K2 would have a direct economic impact on a total of 23 vessels (out of 256 total directed permits issued in 2003 ~ 9%) with directed shark permits. Additionally, while there are 256 directed shark permit holders as of September 2003, only eight vessels with home ports in North Carolina reported shark landings during 2001.

NOAA Fisheries knows of fewer than 11 shark fishermen who have used drift gillnet gear at some point in the past and only five in recent years. These five vessels would have been affected by the shark gillnet gear requirements of the proposed rule, however NOAA Fisheries has decided not to implement the preferred alternative J3 at this time.

The recreational requirements proposed in this rulemaking could affect all recreational HMS permit holders including HMS angling category permit holders (~18,249 as of September 2003) and HMS charter/headboat permit holders (~ 4,041 as of September 2003). While there are a number of permit holders in these categories, these permit holders can target any HMS; few actually target sharks.

Other sectors of HMS fisheries such as dealers, processors, bait houses, and gear manufacturers might be affected by the proposed regulations, particularly the shift to trimester seasons for commercial fisheries, reduction in commercial LCS quota/increase in commercial SCS quota, and time/area closure off North Carolina during the winter commercial fishery. However, the final rule does not apply directly to them. Rather it applies only to permit holders and fishermen. As such, economic impacts on these other sectors are discussed in Chapter 4, 6, and 7.

8.4 Description of the Projected Reporting, Record-keeping, and Other Compliance Requirements of the Final Rule, Including an Estimate of the Classes of Small Entities Which Will Be Subject to the Requirements and the Type of Professional Skills Necessary for Preparation of the Report or Record

Some of the preferred alternatives in this document may result in additional reporting, record-keeping, and compliance requirements. Alternative J4 would require Atlantic shark fishermen operating near the time area closure to install and activate a VMS unit. The preferred alternative

would result in approximately five gillnet shark fishing vessels and approximately seven[1] directed category bottom longline shark fishing vessels having to install VMS units. The costs associated with implementing a VMS program in the Atlantic shark gillnet fishery include an initial average cost per vessel of approximately $2,275 (not including postage costs for returning certification statement), an average annual maintenance cost of approximately $500/year, and approximately $197.28/year for communications during the right whale calving season. Costs associated with implementing a VMS program in the directed shark bottom longline fishery include an initial average cost per vessel of approximately $2,275 (not including postage costs for returning certification statement), an average annual maintenance cost of approximately $500/year, and approximately $305.28/year for communications during the proposed 212 day shark bottom longline time/area closure. The position reports generated by the VMS units are automatic so no time burden is imposed on the vessel operator.

The use and submission of a checklist will be required only for the initial installation or when the hardware or communications service provider changes. NOAA Fisheries estimates a time burden of five minutes for completing the VMS installation and activation checklist.

NOAA Fisheries expects alternative J4 to increase costs but it should not increase the needed skill level required for HMS fisheries.

Preferred alternatives (E2-existing limit plus one bonnethead, G2-recreational authorized gear, K2-time/area closure, J5-bycatch gear requirements, and M2-separate display permits) may change the way and areas in which fishermen can fish and set their gear, may require the possession and use of specific equipment, may limit the gears authorized for use in recreational shark fisheries, and may increase the skill level needed to participate in HMS fisheries. Alternative E2 could result in positive economic benefits as increase in retention limits may increase tournament participation and business profits within the charter/headboat industry for sharks. NOAA Fisheries does not expect alternative G2 to have any substantive economic impacts because this alternative addresses gear restrictions for recreational shark fishing in federal waters, where sharks retained cannot be sold. Alternative K2 would implement a time/area closure and could have significant economic impacts, particularly for those fishermen in states bordering the closure (i.e., North Carolina). However, for vessels not directly affected by the closure there might be a few economic benefits, and NOAA Fisheries anticipates long-term benefits to the fishery as a whole when the LCS complex rebuilds. Alternative J5 would likely only have minor economic impacts (e.g., the purchase of stainless-steel hooks and release equipment, and increased fuel costs associated with the requirement to move one mile after an interaction with a marine mammal or sea turtle). Although the release equipment required under proposed alternative J5 is relatively simple to use, limited training may be required to use them effectively. No economic impacts are anticipated to result from the implementation of alternative

[1]Fourteen bottom longline vessels fished (i.e., on average during 2000 and 2001) in the area near the time/area closure. Seven of these vessels should already have VMS because they are associated with swordfish permits. NOAA Fisheries estimates that the remaining seven vessels will need to purchase VMS units as selected in this Amendment. See Appendix 4 for further explanation.

M2, because this alternative does not change application processes or add new requirements to existing regulations.

The other preferred alternatives, which are outlined in Chapter 2, will change quota but would not likely change reporting or compliance in the fishery.

8.5 Description of the Steps the Agency Has Taken to Minimize the Significant Economic Impact on Small Entities Consistent with the Stated Objectives of Applicable Statues, Including a Statement of the Factual, Policy, and Legal Reasons for Selecting the Alternative Adopted in the Final Rule and the Reason That Each One of the Other Significant Alternatives to the Rule Considered by the Agency Which Affect Small Entities Was Rejected

In the Initial Regulatory Flexibility Analyses for the proposed rule, NOAA Fisheries described alternatives to the proposed rule which accomplish the stated objectives and which minimize any significant economic impacts. These impacts are discussed below and in Chapters 4 and 6 of this document. Additionally, the Reg Flex Act (5 U.S.C. § 603 (c) (1)-(4)) lists four types of alternatives which should be discussed. These categories of alternatives (all of which assume the proposed action could impact small entities differently than large entities) are:

1. Establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities
2. Clarification, consolidation, or simplification of compliance and reporting requirements under the rule for such small entities
3. Use of performance rather than design standards
4. Exemptions from coverage of the rule for small entities

As noted earlier, NOAA Fisheries considers all permit holders to be small entities. In order to meet the objectives of this final rule and address the management concerns at hand, NOAA Fisheries cannot exempt small entities or change the reporting requirements for small entities. Among other things, this final rule would set quotas for the fishing season, retention limits for the recreational fishery, and gear restrictions, all of which would not be as effective with differing compliance and reporting requirements. Thus, there are no alternatives discussed which fall under the first and fourth categories described above. Alternatives under the second category are discussed below, and performance standards are addressed in the context of rebuilding targets, which were considered and subsequently approved in a previous fishery management plan.

As described below, NOAA Fisheries considered a number of alternatives that could minimize the economic impact of the preferred alternatives, particularly those pertaining to LCS commercial quota reductions, revised time/area closures, VMS requirements, and use of corrodible hooks and release equipment aboard bottom longline vessels. Analyses relating to the

economic impacts of each specific alternative considered can be found in Chapter 6, and are not repeated here. In cases where NOAA Fisheries knows that alternatives are likely to aversely affect fishermen and there are no other alternatives that would achieve the objectives of the rule, NOAA Fisheries is delaying implementation to give fishermen the opportunity to adjust and obtain any equipment they may need.

8.5.1 Commercial Management Measures

The preferred alternatives for commercial management measures (i.e., A3-LCS complex classification, B3-regional quotas, B4-trimester seasons, C2-MSY based quotas, and D2-no minimum size) were designed to minimize economic impacts incurred on fishermen, while simultaneously enhancing equity amongst users groups, allowing healthy stocks to be managed at optimum yield, and allowing overfished stocks to rebuild. Specifically, alternative A3 may, compared to the other alternatives considered, increase profits individual fishermen gain by reducing costs associated with the lengthening of trips (i.e., fuel, bait, and ice) due to sorting inefficiencies realized under the other alternatives. The consolidation of LCS into one aggregate group under alternative A3 also simplifies compliance and reporting requirements under the proposed rule for small entities.

While alternative A1 in consideration with C2 could result in larger quotas, it was rejected because it could also increase confusion for fishery participants who are complying with the regulations and, inconsistent with the Magnuson-Stevens Act, may result in delays for LCS to rebuild. Implementation of alternative B3 is not anticipated to result in any changes to economic benefits or costs, but is anticipated to enhance equity amongst user regions. Alternative B4 seeks to spread open seasons out more evenly over the calendar year and could, in the long-term, result in greater economic stability for fishermen and associated communities because the amount of time between open and closed seasons would likely be reduced. Thus alternatives B3 and B4 could help minimize any economic impacts caused by other preferred management measures.

NOAA Fisheries considered a wide range of quotas that resulted from the combination of classification and quota basis alternatives. These alternatives resulted in the possibility of seven different commercial quotas for LCS and three different commercial quotas for SCS. Each quota alternative carefully considered the results of the 2002 stock assessments for LCS and SCS. The preferred quota alternatives (i.e., A3 and C2) will implement commercial quota levels of 1,017 mt dw for the LCS aggregate and 454 mt dw for the SCS aggregate, which will result in a 21-percent reduction in LCS quota and a 10-percent increase in SCS quota, respectively.

As mentioned in Chapter 4, while other quota alternatives, for example C2 or C3 (in combination with A1/A2/A4) propose increased quotas for LCS, they were rejected because they are likely to result in rebuilding delays for the LCS stock, which is inconsistent with the Magnuson-Stevens Act. Moreover, economic impacts could be incurred in the fishery over the long-term should LCS stocks continue to decline. The inclusion of fishing mortality and biomass targets in the

HMS FMP adequately address the need for performance standards in assessing the effectiveness of proposed quota management measures.

NOAA Fisheries is also proposing no minimum size (i.e., alternative D2), which helps to minimize economic impacts on the commercial shark fishery. Other alternatives considered, which would have imposed varying minimum sizes, were rejected because they would have had greater economic impacts on fishery participants and associated communities. Given that the commercial fishery has been operating under these conditions since 1999, NOAA Fisheries does not anticipate any significant changes in economic benefits or costs as a result of maintaining this management measure.

8.5.2 Recreational Management Measures

Similar to that of the preferred alternatives for commercial quotas, the preferred alternatives for recreational retention (i.e., E2-existing limits plus one bonnethead) and minimum size limits (i.e., F2-existing size limits plus no minimum size for bonnethead) were designed to minimize the economic impacts on recreational fishermen, while simultaneously allowing healthy stocks to be managed at optimum yield and overfished stocks to rebuild. Specifically, alternative E2 would allow additional retention of one bonnethead per person per trip. Since this retention would otherwise be prohibited, this alternative may increase revenues to charter/headboats and other small entities who rely on the recreational shark fishery for income. Even though E3 or E4 might further minimize economic impacts, these and other recreational retention limits were rejected because they do not meet fishery management plan goals and objectives. Alternative F2, combined with the other recreational preferred alternatives, takes into account the fact that bonnethead sharks do not reach the minimum size currently in place. As such, alternative F2 simplifies compliance for small entities with the proposed retention limits for bonnethead sharks. Alternative F2 is anticipated to increase the willingness to pay, angler consumer surplus, and current revenues to charter/headboat captains and other small entities who rely on the recreational shark fishery for income. Other recreational size limit alternatives were rejected because of economic and stock status concerns, which are further described in Chapters 2, 4, and 6 of this document.

Additionally under alternative G2, NOAA Fisheries is proposing that authorized gear be limited to handline, rod and reel, and bandit gear in the recreational fishery. This alternative addresses the need for NOAA Fisheries to clarify which gear types are authorized specifically for recreational fishing activities. Most recreational HMS fishermen already use handline as well as rod and reel in the fishery. As such, there are no anticipated economic costs or benefits associated with implementation of preferred alternative G2.

Thus NOAA Fisheries does not expect the preferred recreational management measures (i.e., E2, F2, or G2) to have a significant economic impact on a substantial number of small entities.

8.5.3 Deepwater, Other and Prohibited Shark

Alternative H2, which removes the deepwater and other sharks from the management unit and specifies these species for data collection purposes only, seeks to simplify compliance and reporting requirements under the proposed rule for small entities. As such, no economic costs are anticipated with implementation of preferred alternative H2.

Alternative I6, which retains 19 prohibited species and establishes a criteria for the addition/removal of other species to/from the prohibited species group, also simplifies compliance and reporting requirements under the proposed rule for small entities. Given the possibility that recreationally or commercially valuable species may either be added/removed from the prohibited species group, it is possible that economic impacts/benefits would be experienced by small entities. While removing or adding sharks to the prohibited list could have economic impacts, maintaining status quo while establishing a process to add or remove, should not have economic impacts on a substantial numbers of small entities. Other alternative considered, such as I2 and I4, which would reduce the number of species on the prohibited species list, could have more positive economic impacts. However, these alternatives were rejected because they could delay rebuilding of LCS, inconsistent with Magnuson-Stevens Act, and could result in long-term negative economic impacts if stocks decline further.

8.5.4 Bycatch Reduction Measures

The preferred alternatives for bycatch reduction (i.e., J4 and J5) were designed to minimize the economic impacts on fishermen, while simultaneously promoting bycatch reduction of protected species in shark fisheries.

Specifically, alternative J4 would require some vessels to install VMS units, which would result in economic impacts to small entities in the short-term. However, in the long-term, alternative J4 could result in increased revenues by preventing more burdensome regulations and allowing more fishing time. Additionally, bottom longline vessels would be able to traverse closed area, while gillnet vessels may require less observer coverage under J4. The proposed regulations to implement the VMS program in Atlantic shark fisheries would require approximately five gillnet shark fishing vessels and approximately seven directed category bottom longline shark fishing vessels to install VMS units. Requiring VMS for only a portion of the shark fishing fleet, minimizes the economic impact on the remainder of the fleet. Specifically, the costs associated with implementing a VMS program in the Atlantic shark gillnet fishery include an initial average cost per vessel of approximately $2,275 (not including postage costs for returning certification statement), an average annual maintenance cost of approximately $500/year, and approximately $197.28/year for communications during the right whale calving season. Costs associated with implementing a VMS program in the directed shark bottom longline fishery include an initial average cost per vessel of approximately $2,275 (not including postage costs for returning certification statement), an average annual maintenance cost of approximately $500/year, and approximately $305.28/year for communications during the proposed 212 day shark bottom longline time/area closure. Economic analyses of the impacts associated with VMS requirements on small entities indicate that the average gross revenue by permit holder, during the first year of

implementation, will be reduced by nine percent. For every year thereafter, economic analyses on small entities indicate that the average gross revenue by permit holder will be reduced by two percent. In an attempt to provide vessel owners with flexibility and help minimize costs, NOAA Fisheries has type-approved four VMS units from two manufacturers for use in the pelagic longline fisheries. No VMS units have been type-approved specifically for use in the Atlantic shark fisheries as of this date. Based on the range of VMS units commercially available, NOAA Fisheries expects any VMS unit type-approved for Atlantic shark fisheries to be similar or identical to those type-approved for the pelagic longline fisheries. Once this type-approval is completed it is likely that this alternative will result in simplification of compliance and reporting requirements under the proposed rule for such small entities. VMS would only be needed if there is a time/area closure in order to ensure adequate compliance with the closure. Because of the need to ensure adequate enforcement of the closed areas, the VMS requirement is the most effective method to accomplish this objective. Although requiring VMS will result in additional economic costs to small entities, NOAA Fisheries considered this to be the most useful tool to ensure compliance. No other alternatives are available at this time that would be as effective in terms of enhancing enforcement of the closed areas.

The preferred alternative J5 would likely result in minor economic impacts to small entities, primarily because the cost associated with purchasing release equipment is minimal and is a one time cost. Although many shark fishermen may already use non-stainless steel corrodible hooks, this may increase the financial burden on fishermen who will have to purchase new hooks. The requirement to move one nautical mile after an interaction with a marine mammal or sea turtle would likely increase fuel costs due to increased time transiting to another fishing area and increased time needed to fish if alternate fishing grounds are not as productive for target species. However, because few marine mammals or sea turtles have been observed caught, NOAA Fisheries does not believe that this requirement would affect more than a few trips for all vessels combined, each year.

8.5.5 Time/Area Closures

NOAA Fisheries is proposing a revised time and area closure for sandbar and dusky shark nursery and pupping areas offshore North Carolina during the winter fishery under preferred alternative K2. This alternative is designed to reduce bycatch of neonates and juvenile sandbar sharks and dusky sharks by 92 percent and 61 percent, respectively. This alternative is likely to have significant impacts on 23 small entities/vessel owners by closing large sections of coastal waters to shark fishing.

Original analyses pointed toward a total of only 13 vessels with home ports located in South Carolina, North Carolina, and Virginia as having reported shark landings during 2001. These vessels reported gross revenues totaling $351,600 during that year. Revised economic analyses indicate that only 8 vessels with home ports located in North Carolina reported shark landings during 2001. This revised analysis indicates that alternative K2 will result in a 15-percent reduction in total gross revenues for the fishery as a whole and in a three-percent reduction of

revenues for the small entities directly affected by the proposed closure. As such, the revised time/area closure mitigates the economic impacts by $17,956 in total gross revenues for the small entities directly affected by the closure as compared with the original preferred alternative.

Fishermen would be directly impacted by a reduction in catch and income from areas that they have traditionally relied upon. Fishing practices and behavior of fishermen would also be affected by requiring fishermen to travel further offshore. Due to greater distances traveled, fishermen would spend more time at sea, and associated costs of food, fuel, and labor could increase. This could cause some fishermen to go out of business, move to new areas, or alter fishing patterns in other ways. This alternative could result in a change in the distribution of benefits and costs, with the financial costs of operating in the fishery increasing and benefits decreasing. However, the preferred alternative may result, once LCS rebuild, in slight benefits for fishery participants that are not directly affected by the closure and it minimizes the economic impacts compared to the other time/area closure alternative (i.e., K3) which considers a closure for all shark nursery and pupping areas during pupping season. Simplification of the regulations, similar to that of K1, would compromise the ecological effectiveness of the proposed time/area closure in terms of bycatch reduction (See Chapter 4). Additionally, it is not likely that formulating performance standards would help reduce bycatch of sandbar or dusky sharks in this fishery.

8.5.6 Essential Fish Habitat

None of the alternatives considered would affect small entities in any way that would complicate compliance and reporting requirements for EFH or result in significant economic impacts for small entities.

8.5.7 Exempted Fishing Permits

None of the alternatives considered are expected to affect small entities in any way that would complicate compliance and reporting requirements for EFPs or result in significant economic impacts for small entities.

8.5.8 Summary of Vessel Buyback Programs

Reducing fishing capacity is one overcapitalization alternative that could provide some economic relief. Commonly known as buyback, this alternative pays harvesters in fisheries with too much fishing capacity either (a) to surrender their fishing permits for that fishery or (b) both to surrender all their fishing permits and withdrawn their fishing vessels from all fishing (by scrapping or by title restriction). A buyback's statutory authority is section 312(b)-(e) of the Magnuson-Stevens Act. The buyback's intent is to decrease excess harvesting capacity, increase the economic efficiency of the remaining harvesting capacity, and facilitate the conservation and management of fishery resources.

There have been a number of buyback programs that have been implemented or are in the initial stages of implementation (See Table 8.1). Buyback programs funded entirely or in part by the Federal government have reduced the number of permitted fishing vessels in New England, Texas, and Washington. Beginning in 1976 and continuing to the present, programs financed partly or entirely by the Federal government have awarded cash compensation to people surrendering salmon fishing licenses in the Pacific Northwest. More recently, federal funds have been used to purchase licensed vessels in the New England groundfish fishery, and contributed to the fishing license buyback program in the Texas Bay and bait shrimp fisheries. Responding to interest in expanding these programs and the arguments of those who believe that industry should both play a more central role in designing buyback programs and pay for profitable programs, the Sustainable Fisheries Act amended the Magnuson-Stevens Act to create new buyback program options. New fishing vessel reduction programs authorized by Section 312 of the Sustainable Fisheries Act can draw on both Federal and industry funding, these programs operate under federal guidelines and assistance, and they will use loans from the federal treasury.

Payments for reducing fishing capacity can be fixed, based on market values or production histories, determined by reverse auctions, or a combination of these. Buyback costs can be funded by Federal appropriations, Federal loans repayable by post-buyback harvesters, contributions from other public or private entities, or a combination of these. Title XI of the Merchant Marine Act, 1936, as amended, is the authority under which NOAA Fisheries' Fisheries Finance Program makes loans for financing buyback costs.

On May 18, 2000, NOAA Fisheries implemented an interim final rule for implementing a section 312 buyback (65 FR 31444). Although NOAA Fisheries has not yet conducted a buyback solely under the section 312 authority, NOAA Fisheries has conducted one buyback partially under the section 312 authority and several buybacks under other authorities.

NOAA Fisheries recently conducted a $90 million buyback in the Bering Sea pollock fishery. Although separately authorized by the American Fisheries Act, the pollock buyback involved a loan under Title XI that will be repaid by fees collected under section 312. The pollock buyback's cost was financed by a $15 million Federal appropriation and a $75 million buyback loan from the Fisheries Finance Program. Post-buyback pollock harvesters will repay the loan over the next 30 years by a fee of 0.6 cents for each pound of inshore pollock they land. Shoreside processors will deduct the fee from ex-vessel proceeds otherwise payable to the harvesters, and forward fee revenues to NOAA Fisheries for application to the loan. This buyback involved fixed payments and vessel scrapping as well as the revocation of all fishing permits the vessels possessed.

Except for several additional requirements, buyback loans entirely under the authority of section 312 work the same way as the pollock buyback loan. The additional requirements are that the repayment fees equal some portion (not to exceed five percent) of the ex-vessel value of post-buyback landings and that industry referenda authorize the fees before buyback loans occur. Under Title XI alone, however, 20 years is the maximum maturity for buyback loans. Buyback

loans are statutory loans. Buyback loans involve no promissory notes, mortgages, or other conventional loan documentation. Post-buyback landing fees are the exclusive source of repaying, and security for, buyback loans. Fee payment and collection are mandatory. Beyond these fees, however, no one has any other liability for loan repayment.

Before enactment of the section 312 and Title XI buyback authorities, NOAA Fisheries conducted a major buyback in the Northeast multispecies fishery. Under the authority of the Interjurisdictional Fisheries Act and funded entirely by Federal appropriations, this buyback involved vessel scrappings as well as permit revocations. For $22.5 million, this buyback scrapped 68 vessels. The buyback also revoked 475 fishing permits.

The multispecies buyback involved a reverse auction. Each bidder specified the price (buyback payment) for which the bidder was willing to withdraw fishing capacity and the average value over a 3-year period of all multispecies production for the vessel and permit involved. The price, stated as a percentage of the production, was the factor by which this buyback ranked bids for acceptance. The bids accepted were those whose buyback prices were the lowest percentage of the production values.

In connection with the Northeast multispecies buyback, NOAA Fisheries also made $20 million in general Title XI loans available for refinancing existing debts on vessels remaining in the fishery after the buyback. By providing longer repayment terms and lower interest rates, these Title XI refinancing loans decreased the debt service burdens of post-buyback vessels.

Other buybacks preceding the section 312 authority have involved inshore fishing permits in the Washington state salmon fishery and the Texas state shrimp fishery. Also conducted under the Interjurisdictional Fisheries Act, 75 percent of these buyback costs were funded by Federal appropriations. The other 25-percent was funded by non-Federal sources.

Recently, NOAA Fisheries provided funds via an Saltonstall-Kennedy Grant to the Gulf and South Atlantic Fisheries Foundation, Inc. Money from this grant will be used to study and develop a plan for a buyout program in the commercial shark fishery. NOAA Fisheries looks forward to seeing the results of this study.

8.5.9 Other Options for Economic Relief

Besides buyback programs, there may be other options for economic relief. NOAA Fisheries has worked with a number of other agencies/departments to explore programs that are available to fishermen and other businesses affected by fishery management measures. These programs are described below.

1. The Small Business Administration (SBA) is a source of guarantees for loans from local banks. The 7(a) Loan Guaranty Program is one of SBA's primary lending programs. It provides loans to small businesses unable to secure financing on reasonable terms

through normal lending channels. The program operates through private-sector lenders that provide loans which are, in turn, guaranteed by the SBA--the Agency has no funds for direct lending or grants. Most lenders are familiar with SBA loan programs so interested applicants should contact their local lender for further information and assistance in the SBA loan application process. Information on SBA loan programs, as well as the management counseling and training services offered by the Agency, is also available from the local SBA office. Interested parties can learn more about this program by visiting the SBA website: http://www.sba.gov/financing/fr7aloan.html.

2. The Economic Development Administration (EDA) was created to create new jobs and retain existing jobs in economically stressed communities. Through a series of grant programs, the EDA helps distressed communities develop strategies to improve their own economic situation through a multifaceted cooperative effort. Most of the EDA activity affecting the fishing industry has been funded through the EDA's Public Works Program and the EDA's Economic Adjustment Program. The Public Works Program has funded port and harbor improvements. The Economic Adjustment Program helps communities adjust to serious changes in their economic situation, and proceeds from this program are generally used for organization, business development, revolving loan funds, infrastructure, and market research. Interested parties can learn more about these programs, including eligibility requirements and contact information, by visiting the EDA website: http://www.doc.gov/eda/html/prgtitle.htm.

3. The Farm Credit System (FCS) is a nationwide financial cooperative that lends money and provides financial services to agriculture and rural America. Congress created the FCS in 1916 to provide American agriculture with a dependable source of credit. The FCS makes loans and leases at competitive rates with flexible terms to fit the needs of farmers, ranchers, commercial fisherman, agribusinesses and country home owners. As of January 1997, the FCS was comprised of 225 banks and associations that include the following: 6 Farm Credit Banks, which make direct, long-term loans through 60 Federal Land Bank Associations and provide loan funds to 65 Production Credit Associations; 56 Agricultural Credit Associations; and 31 Federal Land Credit Associations. Long-term loans to the fishing industry are made for a variety of purposes, including real estate for aquaculture operations, processing and marketing facilities, and capital equipment. In addition, short-term FCS loans can be used to buy production equipment such as fuel or bait while longer-term loans may be used for gear expenditures, the purchase of new vessels, and the reconditioning of older vessels. Interested parties can locate a FCS lender by visiting the following website: http://www.fcredit.com/locate.htm.

4. The U.S. Department of Labor's Economic Dislocation and Worker Adjustment Assistance Act provides funds to States and local substate grantees so they can help dislocated workers find and qualify for new jobs. It is part of a comprehensive approach to aiding workers who have lost their jobs that also includes provisions of the Worker Adjustment and Retraining Notification Act and the Trade Adjustment Assistance

program. Workers who have lost their jobs and are unlikely to return to their previous industries or occupations are eligible for the program. This includes workers who lose their jobs because of plant closures or mass layoffs; long-term unemployed persons with limited job opportunities in their fields; and farmers, ranchers and other self-employed persons who become unemployed due to general economic conditions. Services include retraining services, readjustment services, and needs-related payments. Interested parties can obtain more information about services available and contact information by visiting the following website: http://www.doleta.gov/programs/factsht/edwaa.htm.

5. The Fishing Vessel Obligation Guarantee Program (FOG) was established by the Federal Ship Financing Act of 1972. With the passage of the Sustainable Fisheries Act, the FOG program was renamed the Fisheries Finance Program (FFP) and was authorized to finance buyback programs and the purchase of Individual Transferable Quota shares by small-scale fishermen and crew members. The FFP is a direct federal loan program. Regulations implementing the new authority for financing industry-funded vessel buybacks have not been finalized, but the program is expected to require an interested fishery to develop and submit a business plan for the buyback to NOAA Fisheries for review and approval. The plan will have to include an economic analysis describing the benefits to remaining vessels. If the plan is approved by NOAA Fisheries, participants in the fishery must vote whether to implement the plan. If a plan is approved by the fishery's participants, the FFP will borrow money from the U.S. Treasury Department to buyback vessels of permits. The vessel owners or permit holders remaining in the fishery will repay the Treasury loan through a levy of up to five percent of the ex-vessel value of the fishery's landings.

Table 8.1 Completed NOAA Fisheries Vessel Buyback Programs. Sources: Grable, pers. comm. 2003; Gorrel, pers. comm. 2003.

BUYBACK NAME [1]	NUMBER VESSELS	NUMBER PERMITS	BUYBACK COST FUNDING (MILLIONS OF $)			
			GRANTEE COST	PRODUCER COST (LOAN) [3]	FEDERAL COST	TOTAL COST
NE Multispecies	11	67	-	-	2	2
Washington Salmon	-	296	-	-	4	4
NE Multispecies	68	475	-	-	22.5	22.5
Texas Inshore Shrimp	-	310	-	-	1.4	1.4
Washington Salmon	-	142	-	-	5.2	5.2
Washington Salmon	-	391	1.2	-	3.5	4.7
Alaska Pollock (BSAI) [2]	9	17	-	75	15	90
NE Multispecies	-	245	-	-	10	10
West Coast Groundfish [4]	92	240	-	35.8	10	45.8
Total Done [5]	180	2,183	1.2	110.8	73.6	185.6

[1] All but two of the buybacks above were disaster assistance, in which the Agency merely included buyback because of its desire to accomplish a conservation objective as well as a disaster assistance objective. Of those above, only BSAI pollock and West Coast groundfish are pure buyback.
[2] The 9 vessels involved in this buyback were very large factory trawler/processors (250-300 foot range).
[3] We disburse buyback loan proceeds as buyback payments, and post-buyback harvesters repay the loans by landing fees which apply to all post buyback landings.
[4] The buyback removes Federal groundfish trawl permits (other than those from vessels harvesting whiting and processing it at sea) and Dungeness crab and pink shrimp permit issued by Washington, Oregon, or California and held by the owner of the Federal groundfish trawl permit. Bidding under this buyback is complete, but the buyback's loan repayment fee referendum is ongoing (voting closed on 10/29/03). If a simple majority of voters approve the fee, we will complete the buyback; otherwise, the bidders' reduction contract will be of no further force and effect. Nevertheless, this table counts this buyback in the "done" total in the assumption that the referendum will succeed.
[5] Not included in this table is an upcoming $100 million buyback in Alaska's BSAI crab fishery, 100% of which a buyback loan will finance. We should publish the final regulations for this buyback during late October or early November of this year, with buyback bidding commencing about 30 days thereafter. Once bidding is completed, this buyback's conclusion will then also be contingent upon a referendum about the landing fee required to repay the $100 million buyback loan. Several other, minor, ongoing permit buybacks, in the form of disaster assistance, are also not included in the above table.

References for Section 8.0
No references cited.

References for Section 8.1
No references cited.

References for Section 8.2
No references cited.

References for Section 8.3
No references cited.

References for Section 8.4
No references cited.

References for Section 8.5
No references cited.

References for Section 8.6
No references cited.

References for Section 8.7
No references cited.

9.0 COMMUNITY PROFILES OF ATLANTIC AND GULF COAST SHARK FISHERIES

9.1 INTRODUCTION

The Magnuson-Stevens Act requires all fishery management plans (FMPs) to include a fishery impact statement which shall assess, specify and describe the likely effects of the measures on fishermen and fishing communities (§303(a)(9)). When establishing a limited access system for the fishery one of the factors that must be taken into account is the cultural and social framework relevant to the fishery and any affected fishing communities (§303(b)(6)).

Similarly, the National Environmental Policy Act (NEPA) requires federal agencies to consider the interactions of natural and human environments by using "a systematic, interdisciplinary approach which will ensure the integrated use of the natural and social sciences ... in planning and decision-making" (NEPA §102(2)(a)). Federal agencies should address the aesthetic, historic, cultural, economic, social, or health effects which may be direct, indirect, or cumulative. Consideration of the social impacts associated with fishery management measures is a growing concern as fisheries experience variable participation and/or declines in stocks.

Social impacts are the consequences to human populations that follow from some type of public or private action. Those consequences may include changes in "the ways in which people live, work or play, relate to one another, organize to meet their needs and generally cope as members of a society ... " (Interorganizational Committee on Guidelines and Principles for Social Impact Assessment, 1994:1). In addition, cultural impacts may involve changes in the values and beliefs that affect the way that people identify themselves within their occupation, their communities, and society in general. Social impact analyses help determine the consequences of policy action in advance by comparing the status quo with the projected impacts. Public hearings, scoping meetings, and Advisory Panel meetings provide input from those concerned with the impacts of a proposed management action.

The Magnuson-Stevens Act outlines a set of National Standards (NS) that apply to all fishery management plans and the implementation of regulations. Specifically, NS 8 notes that:

> "Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to: (1) provide for the sustained participation of such communities; and, (2) to the extent practicable, minimize adverse economic impacts on such communities." (§301(a)(8))

"Sustained participation" is defined to mean continued access to the fishery within the constraints of the condition of the resource (50 CFR §600.345(b)(4)). It should be clearly noted that NS 8 "does not constitute a basis for allocation of resources to a specific fishing community nor for

providing preferential treatment based on residence in a fishing community" (50 CFR §600.345(b)(2). The Magnuson-Stevens Act further defines a "fishing community" as:

> " ... a community that is substantially dependent upon or substantially engaged in the harvest or processing of fishery resources to meet social and economic needs, and includes fishing vessel owners, operators, crew, and fish processors that are based in such communities." (§3(16))

While geographic location is an important component of a fishing community, management measures often have the most identifiable impacts on fishing fleets that use specific gear types. In addition, since the species (sharks) in this FMP are highly migratory, fisheries and the people involved may shift among geographic locations to follow the fish. The geographic concentrations of shark fisheries can vary from year to year as the behavior of these migratory fish is somewhat unpredictable. Thus, the relationship between these fleets and geographic fishing communities is not always a direct one; however, it is an important variable for understanding social and cultural impacts. Therefore, the definition of community takes into account both geographic factors and the use of a specific gear type in domestic shark fisheries.

NOAA Fisheries (1994, 2001) guidelines for social impact assessments specify that the following elements are required in the development of FMPs and FMP amendments:

- information on distributional impacts, non-quantifiable considerations such as expectations and perceptions of the alternative actions, and the potential impacts of the alternatives on both small economic entities and broader communities;
- descriptions of the ethnic character, family structure, and community organization of affected communities;
- descriptions of the demographic characteristics of the fisheries;
- descriptions of important organizations and businesses associated with the fisheries; and,
- identification of possible mitigating measures to reduce negative impacts of management actions on communities.

This chapter contains some of the requirements of a social impact assessment. The other requirements are contained in other sections of the document including Chapters 4, 6, and 7.

9.2 METHODOLOGY

For the principal states involved in the fishery, NOAA Fisheries compiled a profile of basic sociological information. From the 255 communities identified as involved in the 2001 commercial fishery, NOAA Fisheries focused on specific towns based on shark landings data, the size of the shark fishing fleet, the relationship between the geographic communities and the fishing fleets, and the existence of other community studies. While the recreational fishery is an important component in the overall shark fishery, participation and landings are not documented in a manner which permits community identification. Only the recreational fishery found in the commercial fishing communities selected has been profiled to provide an oversight of the fishery

because of this lack of community-based data for the sport fishery. The information in this document incorporates by reference the study by Douglas Wilson et al (1998) of the HMS fishery and incorporated in the 1999 HMS FMP and the work of McCay and Cieri (2000) for the Mid-Atlantic Fishery Management Council, "The Fishing Ports of the Mid-Atlantic".

9.3 OVERVIEW OF THE SHARK FISHERY

The shark fisheries of the Atlantic and Gulf coasts, excluding the fishery for dogfish, extend from Maine to Texas, and include Puerto Rico and the U.S. Virgin Islands. The geographic extent of the commercial fishery is large, but in 2001 it was concentrated in the waters off three states; Florida (51.8 percent of landings by weight), Louisiana (16.9 percent) and North Carolina (16.5 percent) (Table 9.1). Four states, Virginia, New Jersey, South Carolina and Mississippi, jointly contributed a further 12.8 percent of the 2001 commercial landings by weight. The remaining fourteen states contributed 1.9 percent of the landings, with none of the individual states reporting commercial landings of more than 30,000 pounds and most much less.

The fishery is notable for the degree of flexibility of the commercial fishing fleet. Of the 582 vessels in the 2001 fleet, 235 (40 percent) held directed fishery permits. The remaining 60 percent of the fleet held incidental catch permits and did not target the shark stocks as part of their seasonal round of fisheries. The incidental catch permits allowed the retention and sale of sharks taken in the course of fishing for other species. Vessels which engaged in the directed fishery for sharks did so on a seasonal basis, depending on area and the length of the fishing season, and fished for other species at other times of the year.

The mobility of the vessels is also noteworthy. Many of the New England and North Carolina vessels were reported to fish as far south as Florida, and Texas vessels fished across the Gulf of Mexico east to Florida. Other commercial vessels had transferred to Florida and were based in Floridian ports year-round. Of these vessels, two Californian communities were the homes of permit owners, one community in Indiana was home to another, and several permits were issued to residents of New York communities adjacent to the St. Lawrence River. In the case of some vessels with incidental permits, it was reported by fishermen that the vessels were sport-fishing or charter vessels and the permits were held so that the fish could be sold to defray the costs of the trip (in 2003, 4 charter vessels also held commercial incidental-take licenses). Due to the results of mobility analyses for VMS (Appendix 4), NOAA Fisheries feels that the most mobile vessel were probably the vessels using pelagic longline, not bottom longline.

The dealers are also highly mobile. Table 9.1 shows the number of dealers who handled shark in each state in 2001. Many of the dealers are licensed to trade in two or more states, and thus the actual number of buyers is estimated to be significantly less than the 247 dealer licenses would suggest. For example, one of the dealers buying sharks in Virginia is based in New York and also buys sharks in Maryland, Delaware, New Jersey, Rhode Island and Massachusetts. Other buyers take incidental catches from vessels they normally service, and may trade as little as 20 pounds of shark in one year.

The recreational fishery for sharks is also diverse and is growing as restrictions on catches of other highly migratory species are imposed. The recreational 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. Since the 1960s however, there has been increasing interest in catching sharks using light tackle. Because of the light tackle and the danger of boating a shark, catch and release is the practice of most recreational fishermen. The only species usually retained for personal consumption are mako, thresher, and black-tip sharks. Many charter boat operators are promoting light tackle fishing for sharks as a way of building catches for their clients and business for themselves. In 2001 HMS permit requirements were changed from tuna-only to permits required for all HMS species. An indication of the interest in the billfish and shark fisheries is that the number of charter boats with HMS permits increased by one-third between 2000 and 2002 (See Table 9.1a).

While there are a cadre of recreational fishermen who target sharks from private boats and beaches, they are a small number compared to those who catch shark as incidental to their fishing. This is particularly true in the tuna and billfish fisheries in which trolling gear is used, often with live bait. The MRFSS survey does not show species-specific data on recreationally-caught shark and treats all HMS taken in the sport fishery as rare event species.

Information Used in this Assessment

As indicated earlier, the commercial fishery involves some 255 communities. This number is based on places for which commercial landings data is available, places in which licensed shark dealers operate, and places declared on commercial shark fishing permit application forms as the address of the permit holder. From this list of 255 communities, 9 are profiled in this study as being representative of the fishery. They were selected on the basis of involvement with both the commercial and recreational shark fisheries.

To ensure continuity with the 1999 HMS FMP assessment, if a community was selected in 1998, and was described as having a shark fishery, it was selected for this assessment as well. Because of their relatively minimal involvement in the commercial shark fisheries, this study does not include places in Maine, New Hampshire, Massachusetts, New York, Delaware, Maryland, Virginia, South Carolina, Georgia, Alabama, Mississippi, and Texas. One port each in Massachusetts, New Jersey and Florida (New Bedford, Brielle and Islamorada, respectively) which was in the 1998 study has been dropped from this assessment because the reported landings of sharks were insignificant relative to their participation in other HMS fisheries. One community in Florida, Fort Pierce, has been added to the communities profiled because of its relatively high shark landings. Ports selected for detailed study are Barnegat Light, Wanchese, Hatteras, Pompano Beach, Fort Pierce, Madeira Beach, Panama City, Dulac and Venice. For comparative purposes, demographic profiles of states and communities highlighted in the report by Wilson *et al.* (1998) include both 1990 and 2000 Bureau of the Census data.

The Southeast Fisheries Science Center does not report fisheries data by port of landing. For this reason, communities involved in the fisheries from North Carolinas to Texas are identified by the commercial permit data. Other corroborating data has been developed from use of secondary data and from published reports. Information, for communities and states, that was displayed in the 1999 HMS FMP is reproduced in this study for comparative purposes. Unlike the 1998 study used in the1999 HMS FMP, it has not been possible to undertake field research for this assessment.

There are no data available for the numbers of recreational fishermen and their shark landings by community, and thus it is not possible to precisely identify places associated with the recreational fishery. In this assessment, reports of charter fishing operations, fishing tournaments, and related activities have been used to identify the scope of recreational shark fishing for each of the communities described.

9.4 SHARK FISHERY PROFILES BY STATE

9.4.1 Maine

Demographic Profile of State of Maine (source: U.S. Census, 2000)

Population:	1,274,923	100%
Education:		
High school graduates (25 years or older)	742,605	85.4%
Employment:		
Labor force (16 years and over)	659,360	51.7%
Unemployed	31,165	3.1%
Employment in some industry sectors:		
Retail	84,412	13.5%
Manufacturing	88,885	14.2%
Education, health & social services	144,918	23.2%
Arts, recreation, lodging & food services	44,606	7.1%
Farming, fishing, forestry & mining	16,087	2.6%

Field and Stream (2002) has noted that the largest of the mako and blue sharks are found in the Gulf of Maine. Maine has seven commercial vessels with shark fishing permits. Three of these permits are for the directed shark fishery. The State also has seven licensed dealers handling sharks. Maine communities involved with the commercial shark fishery are Cape Elizabeth, Harpswell and Portland (Cumberland County); Southwest Harbor and Winter Harbor (Hancock County); Owls Head and Rockland (Knox County); and Kittery, Milbridge, and Old Orchard Beach (York County). Because of the small numbers of fishermen and dealers/processors in the state, community profiles were not developed.

The small scale of the shark commercial fishery off Maine (See Table 9.2) belies the fact that some of the vessels fish in the shark fisheries in southern waters and make landings in Florida and other states. The incidental nature of shark catches off Maine for the commercial fishery is also true for the recreational fishery; sharks are often taken during tuna fishing trips. There is however a small group of anglers who fish with light tackle for blue shark, mako and porbeagle in the Gulf of Maine. In 2001, an estimated 308,100 sportfishermen made 932,000 fishing trips in marine waters off Maine. Of these anglers, 54 percent were from out of state. The American Sportfishing Association (ASA) estimated that all saltwater recreational fishing in Maine in 2001 generated some $67.8 million in direct and indirect retail sales. Employment in marine recreational fishing services was estimated to be 1,287 jobs (ASA, 2002). An indication of recreational interest in shark fishing is that charter boat operators advertise shark fishing trips from York Harbor, Sheepscot, Casco Bay, Saco Bay, Bath, Damariscotta, and Old Orchard Beach. Some 42 charter/headboats in Maine held HMS permits in 2003. These Maine charter operations are seasonal, typically from Memorial Day to Labor Day, and some of the operators advertise that they move to Florida, or the Caribbean, to run charters during the Florida season from November to May.

9.4.2 New Hampshire

Demographic Profile of New Hampshire (source: U.S. Census, 2000		
Population:	1,235,786	100%
Education:		
High school graduates (25 years or older)	720,233	87.4%
Employment:		
Labor force (16 years and over)	677,190	70.5%
Unemployed	25,500	2.7%
Employment in some industry sectors:		
Retail	89,089	13.7%
Manufacturing	117,673	18.1%
Education, health & social services	130,390	20.0%
Arts, recreation, lodging & food services	45,001	6.9%
Farming, fishing, forestry and mining	5,837	0.9%

New Hampshire's commercial shark fishery is very small and largely incidental to the take of other species (See Table 9.3). The local fishery involves three vessels, one of which has a directed-take permit, and two dealers. The communities involved with the fishery are Hampton Falls, Portsmouth and Rye (Rockingham County), and Dover (Strafford County). Because of the small size of the fishery, community profiles were not developed for New Hampshire ports.

The recreational fishery for sharks in New Hampshire waters is largely incidental, on a very small scale, and similar to that of Maine. Occasionally caught close to shore, most makos are taken in

water reaching depths over 20 fathoms. In 2001, 155,000 anglers made 360,000 fishing trips to the marine waters off New Hampshire. Of these saltwater anglers 48 percent were visitors from out-of-state. It is estimated that these saltwater anglers generated some $59.3 million in direct and indirect retail sales related to their fishing in New Hampshire in 2001. The marine recreational fishing services sector provided some 1,103 jobs in the state in 2001 (ASA, 2002). There are 42 charter boat operators in Portsmouth, Rye, New Castle, Dover, Seabrook and Hampton who held HMS permits in 2003. Many of these charter boats advertise shark fishing trips offshore from June through September, with the best fishing in June and July. Target species for these trips are mako, blue, thresher and porbeagle sharks.

9.4.3 Massachusetts

Demographic profile of Massachusetts (source: U.S. Census 1990, 2000)*

	1990	2000
Population:	6,016,425	6,349, 097
Education:		
High school graduates (25 years or older)	80.0%	84.8%
Employment:		
Labor force (16 years and over)	67.8%	60.4%
Percent of civilian workforce unemployed:	6.7%	3.0%
Main sources of employment:		
Retail	16.0%	11.0%
Manufacturing durable goods	12.0%	12.8%
Health, education and social services	21.2%	23.7%
Arts, recreation, lodging & food services	5.1%	6.8%
Farming, forestry, and fisheries	1.0%	0.4%

* Profiles of States and communities highlighted in Wilson *et al.* (1998) show both 1990 and 2000 Census data for comparative purposes.

Commercial fisheries in Massachusetts are diverse, and range from small-scale inshore small-boat fisheries for lobster and clams, to off-shore scallops, groundfish dragging, and longline fishing for HMS species. In 2001, New Bedford ranked 9th in the United States for the weight of fish landed, and 1st for value with ex-vessel sales bringing in $150,500,000.

In 2001, the Massachusetts commercial landings of sharks occurred in Chatham, Gloucester, New Bedford, Harwich Port, Plymouth, and Scituate. Licensed dealers were active in 15 locations in the Commonwealth. There were 14 vessels with incidental take permits and 6 vessels with directed-take permits for shark in 2001. The landings of shark in 2001 (See Table 9.4) were 27 percent of those in 1996 by weight and 43 percent of the 1996 landings by ex-vessel value.

Marine recreational fishing in Massachusetts attracted an estimated 750,000 anglers in 2001 (NOAA Fisheries, 2002) who made 4,524,000 fishing trips. Some 279,000 (37 percent) of the anglers were from out of state. Direct and indirect retail sales generated by marine recreational fishermen in Masschusetts in 2001 were estimated to be some $320.7 million. The marine recreational fishing industry generated some 5,423 jobs in the Commonwealth in 2001 (ASA, 2002). Shark fishing, largely catch and release using light tackle, takes place in offshore waters. Recreational vessels often travel 50-100 miles out to their fishing grounds and most shark trips are 10-12 hours in duration, with some longer overnight, and two- or three-day trips. There are 332 charter boats/headboats with HMS permits in Massachusetts in 2003. Sharks are usually taken incidental to bluefin tuna fishing, but a number of charter boat operators advertise shark fishing trips. South and east of Cape Cod, the mako, blue and porbeagle sharks of the Gulf of Maine are joined by thresher, dusky, and tiger sharks.

Shark fishing tournaments are promoted, and participated in, by some charter boat operators. Examples of these tournaments include Boston Big Game and Monster Shark Tournaments (Oak Bluffs); Nantucket Angler's Club (Nantucket); Fisherman Outfitter's Cutty Hunk Shootout (Cutty Hunk); and Giant Bluefin Tournament (Hyannis). Charter boat operations which advertise fishing trips for shark are based in Newburyport, Rockport, Gloucester, Boston, Quincy, Chatham, Harwich Port, South Yarmouth, Hyannis, Mashpee, East Falmouth, Oak Bluffs, Edgartown, Vineyard Haven, Menemsha, Mattapoisett, Fairhaven, New Bedford, and Westport Point.

9.4.4 Rhode Island

Demographic Profile of Rhode Island (source: U.S. Census, 2000)

Population:	1,048,319	
Education:		
High school graduates (25 years or older)	541,487	78.0%
Employment:		
Labor force (16 years and over)	534,353	64.6%
Unemployed	29,859	3.6%
Employment by industry:		
Retail	60,426	12.1%
Manufacturing	82,260	16.4%
Education, health & social services	115,236	23.0%
Arts, recreation, lodging & food services	43,230	8.6%
Farming, fishing, forestry, & mining	2,396	0.5%

The commercial shark fisheries are incidental to other longline fisheries in Rhode Island. There were 12 vessels fishing for sharks in 2001, of which 11 held incidental-take permits. Dealers licensed to handle shark operated in thirteen locations in the state, but the total commercial landings in the state were only 11,787 pounds in 2001 (See Table 9.5). Communities involved

with the commercial fishery included Warwick, Little Compton, Newport, Tiverton, Block Island, Narragansett, Peace Dale, Point Judith, South Kingstown, Wakefield and West Kingstown. (Dealers operated in Little Compton, Newport, Tiverton, Point Judith, and South Kingstown.) Because of the small-scale of the shark fishery in the communities listed, no community profiles have been developed.

The recreational fishery for sharks is, like that in the other New England states, largely incidental to the recreational offshore bluefin tuna fishery. In 2001, some 397,000 anglers took 1,496,000 saltwater fishing trips for all species of fish. Of these marine anglers, some 65% were from out-of-state. Retail sales generated by marine anglers in Rhode Island in 2001 are estimated to total $86.2 million and 1,382 jobs were generated in the marine recreational fishing industry (ASA, 2002). Recreational shark fishing from Rhode Island is seasonal between late June and October, with a peak in late August. There are a variety of species available with the most common being mako sharks of 60-100 pounds. After mako, thresher, blue, dusky and sandbar sharks are the most common species caught by anglers. Light tackle is the gear preferred for shark fishing by the charter operators and most private boat fishermen, and catch and release is normal in the fishery.

In 2003, Rhode Island was home state to 93 charter/headboats with HMS permits. Charter operators offering shark fishing trips are based in Block Island, Point Judith, Little Compton, Warwick, West Greenwich, Newport and Westerly. Charter trips for sharks are usually to the deep waters south of Rhode Island and the eastern tip of Long Island, last at least 10 hours and, in August, are often overnight trips. On the ten-hour trips five anglers are usually carried, and the charter fee is of the order of $800. This fee is similar to those charged in the other New England states. Fees for participation in a five-day fishing tournament are of the order of $4,500 for a fully rigged and provisioned boat with skipper and mate (the angler is responsible for the payment of the tournament fees, which can be in excess of $5,000 per angler).

9.4.5 Connecticut

Demographic Profile of Connecticut (source: U.S. Census, 2000)		
Population:	3,405,565	
Education:		
High school graduates (25 years or older)	1,927,961	84.0%
Employment:		
Labor force (16 years and over)	1,765,319	66.6%
Unemployed	92,668	3.2%
Employment by industry:		
Retail	185,633	11.2%
Manufacturing	246,607	14.8%
Education, health & social services	366,568	22.0%
Arts, recreation, lodging & food services	111,424	6.7%
Farming, fishing, forestry, & mining	7,445	0.4%

Connecticut's involvement in the commercial shark fishery is slight. The reported landings are small (See Table 9.6) and only one dealer in the state is licensed to handle shark. One vessel has an incidental catch permit. The communities involved in the commercial shark fishery are New London and Old Lyme. Because of the minimal involvement in the fishery, no community profiles were developed.

Recreational shark fishing is conducted throughout Long Island Sound, but primarily from the eastern ports in the state from which offshore waters can be easily reached. There are 61 charter/headboats in Connecticut which hold HMS permits. Charter boats advertising shark fishing trips operate from Milford, New London, Norwalk, Old Lyme, Saybrook, Stonington and Westport. The recreational fishery is principally a catch and release fishery using light tackle.

9.4.6 New York

Demographic Profile of New York State (source: U.S. Census, 2000)		
Population:	18,976,457	
Education:		
High school graduates (25 years or older)	9,916,212	79.1%
Employment:		
Labor force (16 years and over)	9,046,805	61.1%
Unemployed	640,108	4.3%
Employment by industry:		
Retail	877,430	10.5%
Manufacturing	839,425	10.0%
Education, health & social services	2,039,182	24.3%
Arts, recreation, lodging & food services	611,280	7.3%
Farming, fishing, forestry, & mining	54,372	0.6%

The dollar value of the commercial shark fisheries of New York is approximately 1/1000th of all commercial fishery landings in New York (See Table 9.7). There are 19 vessels with permits in the shark fishery, of which 7 vessels have directed-take permits. Of these vessels at least five also participate in the shark fisheries off New Jersey and Florida. Dealers holding shark licenses operate in 37 locations in New York state. The communities involved in the commercial and recreational fisheries for shark include Freeport, Lawrence, Ammagansett, Brightwaters, East Hampton, East Quogue, Greenport, Hampton Bays, Islip, Montauk, Oakdale, Brooklyn, Riverhead, Seaford, Port Jefferson, Babylon, Hauppauge, Staten Island, Southold, and Wantagh. Since the commercial and recreational shark fisheries are only a very small and geographically dispersed sector of New York's fisheries, individual community profiles have not been developed.

Saltwater recreational fishermen are estimated to number some 514,000 in New York State, of whom 29,000 (6 percent) are visitors from out-of-state. In 2001, these anglers made some

4,624,000 fishing trips. The ASA estimated that, in 2001, saltwater angling generated some $389.3 million in New York state in retail sales and some 5,122 jobs in the marine recreational fishing industry. While there is no information on recreational shark catches, shark fishing by anglers appears to be largely catch and release, using light tackle, incidental to tuna and billfish fishing offshore. In New York state there are 319 charter/headboats with HMS permits in 2003. A number of charter boat operators advertise shark fishing as part of their offerings. For example of the 31 charter boats operating out of Montauk, 21 advertise shark fishing either as an occasional exciting catch or offering shark fishing trips offshore. Montauk is positioned well for offshore trips as it lies only 20-40 miles from the edge of deep water and Gulf Stream eddies. Connecticut and Rhode Island boats on the other hand have to travel at least 60-100 miles to reach the prime fishing waters for tunas and sharks. Another 20 charter boats at ports on Long Island advertise shark fishing opportunities. Principal among these ports are Seaford and Hampton Bays, with 4 vessels each.

9.4.7 New Jersey

Demographic Profile of New Jersey (source: U.S. Census, 1990 and 2000)

	1990	2000
Population:	7,730,188	8,414,350
Education:		
High school graduates (25 years or older)	76.9%	82.1%
Employment:		
Labor force (16 years and over)	64.2%	64.1%
Unemployed	5.7%	5.8%
Employment by industry:		
Retail	5.0%	11.3%
Manufacturing	17.0%	12.0%
Education, health & social services	19.1%	19.8%
Arts, recreation, lodging & food services	6.5%	6.9%
Farming, fishing, forestry, & mining	1.0%	0.3%

In the five-year period, 1996-2001, New Jersey's commercial shark landings fell by approximately 56 percent from 520,000 pounds (260 mt). The landed value of shark taken in the commercial fishery fell by 50.4 percent or almost $200,000. Table 9.8 documents that commercial landings reported during 2001. In 2001, 62 vessels had commercial fishing permits, of which 35 were incidental catch permits, and dealers with shark permits operating in 23 locations in New Jersey ports.

New Jersey communities involved with the commercial fishery include Egg Harbor City (Atlantic County); Englewood (Bergen County); Medford (Burlington County); Cape May, Cape May Courthouse, Ocean City, Sea Isle City, Seaville and Wildwood (Cape May County); Jersey City

(Hudson County); Brielle, Manasquan, and Shark River (Monmouth County); Brick, Forked River, Barnegat Light, Manahawkin, Point Pleasant, Ship Bottom, Tom's River, Town Bank, Tuckerton, Wareton, and West Creek (Ocean County), and Pompton Plains (Passaic County). Of these communities, Cape May and Barnegat Light had the greatest involvement in the fishery, with 7.7 percent and 86.1 percent of commercial landings of shark respectively in 2001. Three dealers and 9 vessels with incidental-take permits operate in Cape May in 2003. In 2003, 10 dealers, 8 vessels with incidental-take permits, and 15 vessels (55 percent) with directed-harvest permits operate from Barnegat Light.

Marine recreational fishing attracted 1,306,000 participants in New Jersey in 2001. They made 7,484,000 saltwater fishing trips during the year. Of these anglers, 543,000 (42 percent) were from out-of-state, and 42,000 from non-coastal counties in New Jersey. The ASA estimated that saltwater angling-related retail sales in New Jersey were some $448.7 million in 2001. The marine recreational fishing industry provided some 7,762 jobs in New Jersey in 2001 (ASA, 2002).

The recreational fishery for sharks is primarily incidental to fishing for tuna and billfish. Some 385 New Jersey charter/headboats hold HMS permits in 2003. Of these party and charter boats some advertise shark trips using light tackle during the summer and early fall (July-October). These trips go offshore between 25 and 60 miles to the heads of the canyons, and thus are full-day or overnight trips. Mako, thresher, blue and dusky sharks are the species most frequently mentioned in charter boat advertisements, often with a note that the mako and thresher sharks are the only ones that "are good for the table."

Communities which have charter boats or tournaments advertising shark as part of their target-catch or "prized" species include Cap May, Point Pleasant, Barnegat Light, Waretown, Sea Bright, Long Branch, Belmar, Brielle, Atlantic City, Margate City, Somers Point, Ocean City, Sea Isle City and Avalon. There is no information available to identify communities involved in the private-boat recreational fishery for sharks.

9.4.7.1 Barnegat Light

Demographic Profile of Barnegat Light (source: U.S. Census, 1990 & 2000)	1990	2000
Population:	681	764
Education:		
High school graduates (25 years or older)	84.9%	92.1%
Employment:		
Labor force (16 years and over)	51.0%	46.9%
Unemployed	1.0%	2.7%
Employment by Occupation		
Managerial/professional	32.0%	40.8%
Technical/administrative	31.0%	36.3%
Precision production, craft & repair	14.0%	11.3%

Barnegat Light has grown and changed in the decade between the 1990 and 2000 Censuses. The changes are reflected in two demographic dimensions. The first is a shift to higher education/higher qualification occupations and the second is a continued shift to an older, retired population. The change in age structure also signifies a change in the workforce and the source of household earnings. In 2000, there were 371 households with an average size of 2.06 persons/household. Of these households, 233 (62.8 percent) received income in the form of earnings, while 202 households (54.4 percent) received income from Social Security. Retirement income was received by 130 households (35.0 percent). For households receiving income from earnings, the average income was $63,373 in 1999[1]. The average Barnegat Light household with retirement income received $22,168 (plus appropriate Social Security payments). In comparison with New Jersey as a whole, employment earnings were less than the state average, while retirement income was above the state average. However, the median household income in Barnegat Light ($52,361) in 1999 was some $2,800 lower than the state-wide median household income.

Barnegat Light is a vacation and retirement destination. Of the 1,207 housing units available in 2000, 64.3 percent (781 units) were vacation homes, and 371 homes were occupied year-round. Some 55 homes were unoccupied at the time of the 2000 census. About one-quarter of the resident population had lived in Barnegat Light for less than five years in 2000, and most of the new

[1] Income and earnings data reported in the decennial Censuses is for the previous year, i.e. the income reported in the 1990 Census is for 1989, for the 2000 Census it is for 1999.

residents moved to the town from other parts of New Jersey. Of the population of Barnegat Light in 2000, 55 percent (430 persons) had been born in New Jersey, while 41 percent were born elsewhere in the United States. There is a "community stickiness" factor among persons resident in Barnegat Light, since 70 percent had lived there prior to 1995, but there is also evidence of change which could affect life-style and the culture of the community. One of the elements of "community stickiness" is that many of the "new" residents are retirees who have converted their former vacation homes to year-round residences.

Age structure of the Population of Barnegat Light (source: Census, 1990 & 2000)

Population by Age	1990		2000	
Total population	681	100%	764	100%
Under 15 years	68	10%	92	12.1%
15 - 44 years	225	33%	185	24.2%
Over 44 years	388	57%	487	63.7%

The Community and Fishing

Prior to 1820, fishing operations and maritime trade were conducted in the small settlements on the mainland inside the chain of islands and sand bars fringing the New Jersey Coast. Barnegat Inlet was one of the important channels to the open ocean, with a sheltered anchorage immediately inside the inlet, and ample resource for a fishing community. A lighthouse was built in 1824 to mark the entrance to the inlet. This lighthouse was replaced in 1855 with the second-tallest lighthouse in the United States which operated until 1927. The building continues as both a community landmark and a navigation mark.

In 1881 the Barnegat City Improvement Company was formed and developed the present-day town as a resort and recreation area, with the town owning all the beaches and dunes. The mix of tourism and fishing has continued to the present. Fishing operations are now linked to their markets by road and there is a tight mesh between the winter and summer economies. Local shops and services are sustained by the fishing activities in the winter months, and it is estimated that the direct employment in fisheries and fishing services was of the order of 52 percent of the civilian workforce of 300 persons in 2000. This number does not agree with the Census Bureau's data of fisheries employment of 6.5 percent, probably due to failure of respondents to complete census forms or undercounting because fishermen were at sea. It is known from HMS permit data that 49 local fishermen work on the vessels with HMS permits.

Fishery-related organizations in Barnegat Light include: Blue Water Fishermen's Association; Forked River Tuna Club; Jersey Devils Fishing Club; Beach Haven Marlin and Tuna Club; Long Beach Island Fishing Club; and United National Fishermen's Association.

There are four full service marinas in Barnegat Light in addition to 44 municipal boat slips and a municipal ramp. The marinas and slips are on the bayside of Long Beach Island and extend southwards some 18 blocks from the inlet. Commercial fishing docks and fishhouses also line Bayview Avenue, but are clustered towards the southern end of the street. Five bait and tackle shops, three of which also provide boat rentals, provide services to local and visiting fishermen. The charter fleet working from Barnegat Light is estimated to be 20 boats, including 11 vessels with HMS permits. In addition there are six headboats, three of which have HMS permits, working from the port. About half this fleet is active year-round in Barnegat Light, while another four vessels at least fish elsewhere in the winter months. One charter boat fishes for tuna off North Carolina in the winter and spring, while three other vessels fish from November through April from ports in Florida.

The commercial fishing fleet is diverse and targets different species as they move through local waters. In 2001, some 40 inshore and offshore boats were based in Barnegat Light, including boats used in the shellfish fishery. Barnegat Light is known for its pelagic longline fishery. The fleet targets yellowfin and bigeye tunas for most of the year and swordfish for part of the year. Pelagic and large coastal sharks are important incidental catches and some species like mako, porbeagle, and sandbar sharks are usually kept and sold. The split season for large coastal sharks impacts this fishery because large coastal sharks are less abundant in the mid-Atlantic during the winter season and the fishery is usually closed by the time the sharks are abundant in the area. A few vessels continue to bottom longline for tilefish in the deep waters of the outer continental shelf and canyons. Some captains from this port have begun to fish off the coasts of other countries. Pelagic longline crews are increasingly from other regions, such as Nova Scotia and some of the southern states. Some of the pelagic longline fishermen from Barnegat Light have become distant-water operators, going to the Grand Banks off Newfoundland, the waters off Greenland, as well as the Caribbean, Brazil, and other distant fishing grounds. The owner of one major fleet (six longline vessels) left Barnegat Light in 1999 to fish for HMS in the Pacific Ocean.

Other captains of pelagic longline vessels strongly prefer to work closer to home or to take shorter trips. The options of those who resist going to other ports are far more restricted. Distant water fishing is very disruptive to families and the community. Some local vessels are now converting from pelagic longline fishing to monkfishing, although many who have tried to convert to other fisheries have failed to meet deadlines for limited entry. Another concern of local residents is that the demise of commercial fisheries is likely to transform the use of the waterfront, bringing in condominium development where marinas are now located, an outcome which many long-term residents find undesirable.

The shark fishery is largely incidental to the bluefin tuna and swordfish fisheries, but there is a seasonal directed commercial fishery for sharks from Barnegat Light. In 2001, the commercial landings of shark in Barnegat Light were 197,667 pounds with a value of $161,881. At that time there were 10 shark dealers buying fish from the 23 shark fishing boats, 15 with directed-fishery permits, working from Barnegat Light.

9.4.8 Delaware

Demographic Profile of Delaware (source: U.S. Census, 2000)		
Population:	783,600	
Education:		
High school graduates (25 years or older)	425,122	82.6%
Employment:		
Labor force (16 years and over)	397,360	65.1%
Unemployed	20,549	3.4%
Employment by industry:		
Retail	43,578	11.6%
Manufacturing	49,720	13.2%
Education, health & social services	73,056	19.4%
Arts, recreation, lodging & food services	28,979	7.7%

The commercial shark fishery in Delaware is based in Sussex County, in the ports of Lewes and Millsboro. One licensed shark dealer and three vessels with incidental-catch permits participate in the commercial fishery. Because of the small number of participants in the fishery, shark catch and landings data is confidential at the state level.

The recreational fishery in Delaware Bay and offshore is popular because of the diversity of species and habitats available to anglers. In 2001, the fisheries attracted 333,000 saltwater anglers of whom 226,000 (68 percent) were from out-of-state. In total the anglers made 1,180,000 fishing trips in 2001 (data from NOAA Fisheries, 2002). The retail sales generated by these anglers in Delaware was estimated to be $48.9 million in 2001 and the marine recreational fishing service sector provided some 724 jobs in Delaware (ASA, 2002).

In 2003, there are 130 charter/headboats with HMS permits operating from Delaware communities. Communities in which these HMS-permitted charter/headboats are registered include Bethany Beach, Cedar Creek, Dagsboro, Dewey Beach, Dover, Fenwick Island, Georgetown, Indian River, Lewes, Long Neck, Middletown, Milford, Millsboro, Ocean View, Rehoboth Beach, and Wilmington. The communities with the greatest concentrations of charter/headboats are Indian River (30 vessels), Lewes (17 vessels), Millsboro (10 vessels), and Wilmington (22 vessels).

9.4.9 Maryland

Demographic Profile of Maryland (source: U.S. Census, 2000)		
Population:	5,296,486	
Education:		
High school graduates (25 years or older)	2,930,509	83.8%
Employment:		
Labor force (16 years and over)	2,737,359	67.0%
Unemployed	128,902	3.2%
Employment by industry:		
Retail	273,339	10.5%
Manufacturing	189,327	7.7%
Education, health & social services	538,350	20.6%
Arts, recreation, lodging & food services	177,341	6.8%
Farming, fishing, forestry, & mining	16,178	0.6%

The commercial shark fishery in Maryland is small scale (See Table 9.9). There are licensed shark dealers operating in 4 locations, and 10 vessels (3 with directed-take permits) involved in the fishery. The Maryland shark fishery is incidental to the offshore longline fisheries, although at least two vessels made shark landings in other states in 2001.

In 2001, some 512,000 Maryland residents were marine recreational fishermen. Another 481,000 out-of-state marine anglers also fished in Maryland. Between them these two groups made some 3.8 million fishing trips for saltwater species (NMFS, 2002). The ASA estimated that some $335.9 million in retail sales was generated by saltwater anglers, and the marine recreational fishing industry provided some 6,981 jobs in Maryland in 2001 (ASA, 2002).

The recreational fishery for sharks is largely offshore, although sharks are found in the lower reaches of the Chesapeake Bay. The offshore fishery takes place at least 15 miles out to sea and charter boats often run 60 to 70 miles offshore to areas of deep water. In Maryland, 155 charter/headboats hold HMS permits in 2003. Of these vessels, 70 (45 percent) are registered in Ocean City. No other community in Maryland has more than six charter and/or head boat vessels registered. Other communities involved include Annapolis, Baltimore, Cambridge, Chesapeake City, Chester, Conowingo, Edgewater, Glen Burnie, Ocean Pines, Pasadena, Pocomoke, Salisbury, Severna, St. Michaels, Stevensville, Tilghman, White Hall, and White Haven. No data is available on charter or private boat catches of sharks, and only 14 charter boats (nine percent) advertise that shark catches are among their offerings.

9.4.10 Virginia

Demographic Profile of Virginia (source: U.S. Census, 2000)		
Population:	7,078,515	
Education:		
High school graduates (25 years or older)	3,801,964	81.5%
Employment:		
Labor force (16 years and over)	3,563,762	64.4%
Unemployed	151,125	2.7%
Employment by industry:		
Retail	389,473	11.4%
Manufacturing	387,104	11.3%
Education, health & social services	626,156	18.3%
Arts, recreation, lodging & food services	245,967	7.2%
Farming, fishing, forestry, & mining	43,425	1.3%

The Virginia commercial shark fishery has licensed dealers operating in 17 locations, with two or more dealers operating in Chincoteague, Hampton, Newport News and Virginia Beach. There are nine vessels in the fishery; five with incidental-catch permits and four operating with directed-take permits. Communities involved in the commercial shark fishery, in addition to those noted above, include Bloxom, Chesapeake, Great Falls, Norfolk, Oyster, Sanford, and Wachapreague. Table 9.10 documents the landings reported in Virginia during 2001. Because of the requirements to keep port or county landings data confidential when there are less than three participants in any sector of the fishery, shark landings data is available only for Virginia Beach. Since the Virginia Beach landings of 18,442 pounds is less than five percent of the commercial shark catches by weight in Virginia, it was deemed that there was insufficient data to permit a community assessment of impacts in Virginia.

In 2001, the Virginia recreational saltwater fishery attracted 1,031,000 anglers, of whom just over 50 percent (520,000) were from out-of-state. It is estimated that these saltwater anglers generated some $246.8 million in retail sales in Virginia in 2001 and their activity provided 4,251 jobs in the marine recreational fishing industry (ASA, 2002). Principal species sought were striped bass, flounder, bluefish, weakfish (sea trout) and drum. Offshore fishing was principally for mackerels, tuna, dolphin fish, and billfish.

The Virginia recreational fishery for sharks is similar to that of Delaware and Maryland. There is a very small directed shark fishery in the private boat sector, but most sharks are taken incidentally to the catch of other species. There are 142 charter/headboats in Virginia with HMS permits. Of these, 38 percent note in their advertisements that they are willing to undertake charter trips for shark fishing or that sharks are taken incidentally as part of the species mix available to anglers. The communities with the greatest number of charter boats with HMS permits were Virginia Beach

(26 percent), Norfolk (24 percent), Chincoteague (12 percent), Wachapreague (9 percent) and Portsmouth (4 percent). The principal shark fishing season for recreational anglers is June through October.

9.4.11 North Carolina

Demographic Profile of North Carolina (source: U.S. Census, 1990 & 2000)

	1990	2000
Population:	6,628,637	8,049,313
Education:		
High school graduates (25 years or older)	70.0%	78.2%
Employment:		
Labor force (16 years and over)	72.4%	65.7%
Unemployed	4.9%	3.4%
Employment by industry:		
Retail	18.9%	11.5%
Manufacturing	31.5%	19.7%
Education, health & social services	23.8%	19.2%
Arts, recreation, lodging & food services	4.4%	6.9%
Farming, fishing, forestry, & mining	3.2%	1.6%

The commercial shark fishery has a distinctive split north/south of Cape Hatteras, reflecting the local oceanographic conditions. The Gulf Stream, as it skirts the Cape Hatteras shoals, is twenty miles offshore. This is the closest it approaches land after leaving the Cape Canaveral area. The waters north of Cape Hatteras are influenced by the cold Labrador Current. The area off Dare and Hyde Counties, NC is where these two water bodies mix and provides very rich fishing grounds. South and west of Cape Hatteras, the coast curves away to the west forming the relatively shoal Carolina Bight. Vessels operating in this area have further to travel from shore to the Gulf Stream and do not enjoy the diversity and richness of the fisheries immediately to the north of Cape Hatteras. The closed area for the shark fishery off North Carolina reflects these local oceanographic and ecological conditions, and will have an impact on the commercial fisheries in particular between Oregon Inlet and Cape Fear. The extent and significance of these impacts on fishery participants and communities cannot be estimated from the information currently available to analysts because of the high degree of mobility of the North Carolina fleet and the diversity of its fisheries. It is likely that the commercial shark fishery off Dare and Hyde Counties will continue to be prosecuted, but north of the closed area. Similarly, the small commercial shark fishery in Onslow Bay is likely to move south of the closed area

North of Cape Hatteras, the 2001 commercial shark landings in Dare and Hyde Counties were 88 percent of the state catch of sharks by weight and 89 percent by value. Licensed shark dealers operate in 52 locations in North Carolina, and 38 commercial fishing vessels have shark permits.

In 2002, of the 19 directed-catch permits, 18 are for vessels fishing from Dare County, north of Cape Hatteras, and 1 vessel is from the Wilmington, NC area. Seven of the 19 incidental-take permits are held by vessels based in Dare and Hyde counties, north of Cape Hatteras, and the remaining twelve vessels are based on the southwest coast of North Carolina.

Communities involved in the shark fishery in Dare and Hyde counties include Buxton, Englehard, Hatteras, Manns Harbor, Manteo, Nags Head, Rodanthe, and Wanchese. South and west of Cape Hatteras, communities involved in the commercial shark fishery include Beaufort, Harkers Island, Morehead City, Oak Island, Salterpath, Southport, Swansboro, and Wrightsville Beach. Table 9.11 documents the landings reported in North Carolina during 2001.

The marine recreational fisheries in North Carolina fall into three groups by species, gear and access. Sharks are, however, an incidental catch in all three fisheries. First, the recreational fishery in the Sounds and behind the barrier islands is typically a small, open boat fishery for flounder, croaker and drum, spot and sea-trout. Striped bass (rockfish) forms an important fishery in Albemarle Sound and around the northern inlets. Second, the inshore and ocean beach fisheries target the same species but also include striped bass, bluefish, and king and spanish mackerel. These inshore fisheries require larger boats and heavier gear, but the boats operate within sight of land. Third, the offshore recreational fisheries target billfish, tunas (bluefin, yellowfin and blackfin), mackerels, dolphin fish (mahi mahi), wahoo, and, in the southwestern area, shark Typically the boats are 22 feet long or longer, electronic navigation systems and powered by an inboard engine. Relatively heavy tackle is used, and fighting chairs for use in billfish and giant tuna fishing are usually installed. The offshore boats normally fish 15 to 60 miles offshore. North Carolina marine recreational fisheries are seasonal, but fishing is year-round as fish species move through the area.

In 2001, NOAA Fisheries estimates that 2,006,000 anglers fished in North Carolina's marine waters. Of these fishermen, some 1,301,000 anglers (65 percent) were from out-of-state and 251,000 anglers were from non-coastal counties in North Carolina. Marine recreational fishing is thus an important element in the life and economies of coastal counties. In 1996, expenditures by saltwater anglers in North Carolina were approximately $673 million, accounting for nearly eight percent of the total U.S. expenditures by saltwater anglers. Saltwater fishing in North Carolina incurred expenditures of nearly $1.3 billion (about five percent of the U.S. total), generated wages and salaries of approximately $357 million and created over 19,000 jobs (ASA, 1997 cited by Wilson, 1998). In 2001, ASA estimated that saltwater recreational fisheries generated some $388 million in retail sales and the marine recreational fishing industry provided some 8,551 jobs (ASA, 2002). Tournaments are big business, but none in North Carolina appear to have categories for sharks.

The recreational catches of shark are largely incidental to other fishing activities. In the area north of Hatteras and around Cape Lookout, recreational fishermen view sharks as a nuisance in their pursuit of other fish, particularly tuna, marlin, and swordfish. Because of this, sharks are normally released alive and not kept. In the recent past, most sharks taken by anglers were killed and

discarded in order to reduce the nuisance factor (Johnson *et al*., 1986). The same Sea Grant-sponsored study by Johnson *et al*. of North Carolina recreational fishermen also found that in 1979 only one offshore angler targeted sharks north of Cape Hatteras, whereas a number did off the Brunswick County coast.

This same pattern is repeated in the charter and head boat fishery. None of the charter vessels operating from Currituck, Dare and Hyde counties in 2003 advertised shark fishing trips, although shark encounters were often mentioned in fishing reports. In Brunswick County, charter boats did advertise shark fishing trips, and Carteret County headboats also mentioned shark as an often-caught species in their advertising. The species caught were dusky, tiger, black-tipped, and sandbar sharks. In 2003, North Carolina had the second largest fleet of charter/headboats holding HMS permits with a fleet of 387. Of these boats, 136 (35 percent) operated from communities north of Cape Hatteras. The closed area off North Carolina will not impact the recreational shark fishery to any great extent. The fishery is largely incidental north of Cape Hatteras and is normally a catch and release fishery throughout the state.

Some of these charter boats were highly specialized, for example seeking only billfish. The vessels specializing in tunas usually began the year fishing off Dare or Hyde counties, and then moved north to operate off New Jersey and then later off Cape Cod. Vessels specializing in billfish fisheries, would fish off North Carolina in the summer months and then head to the Caribbean for the winter season. Other charter boats, and some headboats, would fish in North Carolina waters from April through November, and then travel south to Florida to fish from December through March. From the advertizing materials distributed by charter operations it would appear that from 12 to 15 percent of the fleet changed their operating base during the fishing year.

An unusual feature of the North Carolina charter and head boat fleet is the number of boats built locally. This appears to be particularly true for vessels over 35 feet in length and fishing offshore. Similarly, information about captains and crew of the charter fleet emphasized their local connections, and often relatives of different generations fished together. While this information has not been gathered systematically, it appears that community linkages between North Carolina captains and crews are stronger than those in many of the other states.

9.4.11.1 Hatteras

Demographic Profile of Hatteras Township, NC	**(U.S. Census, 1990 & 2000)**	
	1990	2000
Population:	2,675	2,596
Education:		
High school graduates (25 years or older)	74.4%	83.3%
Employment:		
Labor force (16 years and over)	1,381	1,433
Unemployed	4.2%	8.3%
Employment by industry:		
Retail	25.9%	14.9%
Manufacturing	4.0%	2.4%
Education, health & social services	18.9%	18.5%
Arts, recreation, lodging & food services	15.6%	13.4%

Hatteras Township includes the villages of Avon, Buxton, Frisco and Hatteras. Hatteras Village is a rural community at the southern end of Hatteras Island on North Carolina's Outer Banks. Hatteras Island is a dynamic barrier island, bordered by the Atlantic on the east and Pamlico Sound on the west. In the 18th century, Hatteras established itself as a seaport community, where activities included whaling and exporting/importing. Since World War II, the economy of the Hatteras community has depended on charter and commercial fishing. There are five seafood wholesalers, one retail market, and three marinas (Wilson *et al*., 1998). Businesses in surrounding communities such as Manteo and Buxton also add to the marine economy. Commercial fishing is a major occupation on Hatteras Island, where there are approximately 500 to 600 part-time and full-time commercial and charter boat fishermen (Wilson *et al*., 1998). The 2000 Census indicates that there are 132 fishing industry employees working for wages in Hatteras Township. Since fishermen are customarily self-employed either as owner-operators of vessels or as crew/independent contractors receiving a share of the catch or tips as payment for their services, Wilson's estimate of 500-600 part-time and full-time commercial and charter boat fishermen is considered to be accurate for 2003.

Tourism and recreational fishing are also major industries in Hatteras in terms of seasonal employment (CNCSS, 1993). There are three economic "seasons" in Hatteras (CNCSS, 1993). In the spring, weekend and holiday travelers cause an increase in revenue; approximately 30 vessels from the commercial fleet become active in charter fishing beginning in April. During the second season, June through August, family vacations provide tourist income. The third season is the fall, when fishing, surfing and windsurfing are the dominant activities.

The year-round population in Hatteras Township (including the villages of Avon, Buxton, Frisco and Hatteras) has decreased during recent years with mortality and out-migration exceeding births and in-migration. The racial composition of the township has not changed between the 1990 and 2000 censuses; the township remains 99 percent Caucasian by race, with European ancestry predominant. The age structure of the population has changed; the population has aged markedly, with consequences for educational attainment and other demographic indicators. In 1990, 36 percent of the population was 45 years or older, while in 2000 some 46 percent of the year-round residents were aged 45 years or older. The number of households has increased from 1,078 (1990) to 1,148 in 2000, while the average size of households has dropped from 2.34 persons to 2.25 persons/household. These trends are consistent with an aging and declining population as "empty-nesters" and retirement couples and widows/widowers make up a higher proportion of households. In 2000, 22.7 percent of Hatteras Township households did not have earnings, and relied on retirement income and Social Security. Per capita income in the township in 1999 was $21,458 in contrast to $12,796 in 1989.

The recreational fishery from Hatteras for sharks is incidental to the catch of other species, with no directed fishing trips. As one charter boat captain notes on his website, "We usually do not target sharks from our area, but we do have to deal with them when the tuna fishing is good. Sharks love to eat helpless tunas on the way to the boat. We usually catch 2 or 3 mako sharks per season, which are excellent eaters, and a hammerhead or dusky thrown in for good measure" (www.firstcrackcharters.com June, 2003). There is no data available on the species, number and weight of sharks taken in the recreational fishery. The recreational fishery for all species is important in economic terms and in effort applied. The closed area off North Carolina will not impact the recreational shark fishery from Hatteras to any extent; the fishery is already an incidental fishery and catch and release is the norm.

The fishery from Hatteras is a year-round activity, subject to weather conditions. The cycle of the offshore fishery begins in December, when giant bluefin tuna are passing through the area through March. This catch and release fishery is followed by the availability of yellowfin tuna, dolphin, and wahoo from March through December. In the summer months, a catch and release fishery for blue and white marlin, swordfish and sailfish takes place between May and September. If ocean conditions are poor, fishermen are able to fish in the sheltered waters behind the barrier islands and in Pamlico Sound for striped bass, drum, sea trout and redfish.

The three marinas each have a charter boat fleet of independent owner/operators, and each maintains a booking and information system for its fleet. The charter boats operate with a captain and mate or crewman, and often have a second, relief captain available for peak seasons when the boat will be making trips every day. The captain takes his profits (pay) from the revenues earned by the boat, and the mate customarily receives a tip of 15-20 percent of the charter fee from the client. In many cases, the boat will retain the sale rights to fish caught by clients and if the right is exercised, the ex-vessel price is apportioned between boat, captain and mate (crew). At the height of the summer season it is estimated that the recreational fisheries and fishing services (marinas, bait and tackle, etc) in Hatteras provide employment for some 205 persons.

The three marinas in Hatteras provide dockage for as many as 56 offshore charter/headboats, some 15 inshore boats that can fish along the coast, and 6 charter boats that fish only in the Sounds. In addition, there are approximately 210 berths for private boats. Some commercial boats use the marinas during the late fall and winter months, but otherwise dock at fish houses and the fishermen's private docks.

9.4.11.2 Wanchese

Demographic Profile of Wanchese, NC (source: U.S. Census, 1990 & 2000)

	1990	2000
Population:	1,374	1,527
Education:		
High school graduates (25 years or older)	67.0%	76.5%
Employment:		
Labor force (16 years and over)	922	799
Unemployed	10.0%	1.8%
Employment by industry:		
Retail	19.0%	11.7%
Manufacturing	16.1%	13.1%
Education, health & social services	23.1%	22.0%
Arts, recreation, lodging & food services	6.1%	7.2%
Farming, fishing, forestry, & mining	20.0%	8.2%

Wanchese is located on the southern part of Roanoke Island, in the northern Outer Banks. This small fishing village is said to have "changed as little as those who have lived here for generations" (Cutchin, 1997). Wanchese's first seafood dealership was opened in 1936 by a family that still operates two seafood businesses in the community. The village continues to revolve around fishing and fish processing. The Wanchese Seafood Industrial Park was constructed in 1980 by the state; it has 30 acres of leasable land, a 15-acre deep water harbor, and 1,500 feet of commercial-style concrete docks, and seven seafood-related businesses. (CNCSS, 1993). The industrial park is also the scene of the annual blessing of the fleet, which is organized by the Oregon Inlet Users Association.

There are approximately 117 small businesses in Wanchese, 44 of which are commercial fishing or charter fishing businesses (CNCSS, 1993). Support industries, such as boat builders and seafood packers, are also of great importance to the commercial fisheries and to the North Carolina charter-boat fishery. There are three major seafood dealers/processors in Wanchese and five smaller ones. Of the major dealers, one dealer specializes in scallop and flounder, and has 14 vessels including trawlers, scallop vessels and smaller vessels for gill netting as well as two scallop vessels in Alaska (CNCSS, 1993). They have three packaging and processing houses, a fish-packing house and

processing and freezing operations (located in North Carolina, Virginia, and Massachusetts). Seafood is distributed locally and nationally by truck and internationally by air freight. The second dealership, which specializes in hooked fish, is an important seafood distributer. While only operating one vessel, this company buys regularly from 35 local and over 70 non-local vessels. The third dealer, which specializes in bulk fish, packs the fish from its own two vessels. Transportation of their product is set up through an agreement with the Wanchese Fish Company (CNCSS, 1993).

Recent growth in tourism and recreational fishing has sparked competition for a restricted resource. However, commercial and recreational fishermen still see themselves as being part of the same fishing-based community and many come from the same families. Members of the non-fishing public are generally supportive of the fishing industry. Unlike the surrounding communities, and in distinct contrast to Hatteras Township, Wanchese has very little seasonal variation in employment resulting from tourism; what seasonal fluctuations do exist are caused by the availability of the fisheries resources and are countered by the flexibility and opportunistic nature of the Wanchese fishermen (CNCSS, 1993).

The population of Wanchese is 98 percent Caucasian, and mostly of European ancestry. There is, like Hatteras, a strong level of "community stickiness" in Wanchese. In 2000, 75 percent of the population had lived in the same house for five years or more, and 89.7 percent had lived in Dare County for five years or more. There has been a shift in the age structure of the population of Wanchese since the 1990 Census. In 1990, 26 percent of the population were under 15 years of age while, in 2000, 18 percent of the population was under 15. The percentage of those between 15 and 44 years of age remained the same, 46 percent, while in 2000 the population of those 45 years and older had risen nine percent to 36 percent.

In 1990, there were 503 households in Wanchese, with an average of 2.69 persons/household. The number of households had grown to 614 in 2000, with an average of 2.49 persons/household. As in Hatteras, this suggests a population with more "empty-nest" and retiree households than before. Some 87.5% of the households received earnings from an occupation or job, while 12.5 percent of the households received retirement income and 20 percent of the households received Social Security payments.

Wanchese is not a community linked to tourism in the way that most other Outer Banks and Dare County communities are. Of the housing stock, only seven percent were vacation properties in 2000. The marinas and boatyards in Wanchese cater to transient boats and the charter boat fleets, but recreational fishing from Wanchese is more likely to be done by local fishermen in the Albemarle, Currituck, or Pamlico Sounds, rather than by tourists fishing offshore in private or charter boats. The reason for this is the distance to Oregon Inlet, and the presence of the Oregon Inlet Fishing Center with extensive recreational boat docks, facilities for charter boats, and launching ramps with large parking areas close to the inlet.

A large number of commercially important marine fish are landed in Wanchese, including inshore and offshore species. Many fishermen emphasized that they have to be versatile due to quick changes in water temperature and therefore in availability of species in the area (Wilson *et al*., 1998). The species that longline fishermen target off the mid-Atlantic coast include swordfish, sharks, and tunas (primarily, yellowfin and bigeye). Although targeting bluefin tuna with longline gear is prohibited, there is an incidental catch allowance of bluefin tuna as part of other fishing operations. Fishermen aboard large longline vessels fish for swordfish, tunas, and dolphin. Because of the weather, tunas and swordfish are accessible to the medium-sized vessels that gillnet for other species and longline in the summer. Respondents explained that they also gillnet for dogfish, bluefish, and Spanish mackerel (in spring and fall), and trout and croaker (in winter). They also bottom fish for bass and grouper. There are a number of vessels that gillnet in some seasons and then switch over to charterboat fishing in the summer. Other fishing activities in Wanchese include trawling trips for squid in the summer, and fishing for weakfish, croaker, and flounder in the winter. Market considerations are crucial in deciding which species should be targeted by longline vessels (Wilson *et al*., 1998).

Researchers found pressure on this sector of the longline fishery to be substantial. Hiring and managing crew for pelagic longline vessels is increasingly difficult, especially for the larger vessels that need people to stay on for longer trips. There is a lot of turnover in fishing crews, particularly when vessels shift to other fisheries and revenue drops. Many of the larger vessels have already left, and experienced fishermen are finding work overseas and other captains and vessel owners are searching for alternatives to commercial fishing. Some have switched to carpentry and building and others have gone into the charter fishing business. Finding alternative permanent work may prove difficult for many fishermen who are highly skilled in their profession but have less formal education than the average worker (Wilson *et al*., 1998).

As conservation restrictions on the take of other HMS species have increased, sharks have become more important in local catches. In 1998, one dealer representative reported that shark (including dogfish), tuna, and swordfish sales now make up 40 percent, 40 percent, and 10 percent of business, respectively, while in the recent past they comprised 25 percent, 50 percent, and 15 percent of business, respectively (Wilson *et al*., 1998).

By regulation, in 1998 there were two six-month seasons for the shark fishery, one that ran from January to June and a second from July to December. Traditionally, fishermen on larger longline vessels went shark fishing from January until the closure of the first half of the shark season, and then fished with pelagic longlines for tunas or swordfish. HMS landed by these vessels supplied the restaurants in the local area with fresh products. Commercial fishermen and dealers did not like the fact that closures of the shark fishery caused all fishermen to shift at the same time from species to species, because it caused prices to drop. Some marginal fishermen are driven out of the market by the low prices associated with these shifts. Shifts in targeted species also required changing gear, which could be expensive (Wilson *et al*., 1998).

In 1998, commercial fishermen in Wanchese indicated, if the shark season were open in September and October, that they would prefer to fish for sharks at that time. Shark commercial retention limits have made shark fishing less economical for larger vessels; many steam north to fish off New York. Some respondents were supportive of limited entry or ITQs in the shark fishery. When questioned about size limits on sharks, fishermen reported concern about increased discards. However, they already prefer larger sharks because they are more marketable, suggesting that size-driven discarding may already be occurring. Participants also reported that prohibition of retaining dusky sharks would have a substantial impact on Wanchese fishermen (Wilson *et al*., 1998; HMS FMP, 1999).

The closed area off North Carolina will impact the commercial shark fishery, but the degree and extent of these impacts on the participants and community of Wanchese cannot be estimated with the information available at this time. Wanchese vessels will be able to continue fishing for sharks in the areas to the north of the closed area and thus effort will probably be displaced to the north of Oregon Inlet. Since the Wanchese vessels engage in a number of fisheries, the community impacts will probably not be significant overall.

9.4.12 South Carolina

Demographic Profile of South Carolina (source: U.S. Census, 2000)		
Population:	4,012,012	
Education:		
High school graduates (25 years or older)	1,981,731	76.2%
Employment:		
Labor force (16 years and over)	1,938,195	62.2%
Unemployed	113,495	3.6%
Employment by industry:		
Retail	217,604	11.9%
Manufacturing	354,386	19.4%
Education, health & social services	339,708	18.6%
Arts, recreation, lodging & food services	155,109	8.3%

The commercial shark fishery in South Carolina involved eight fishing vessels with directed-catch permits and 14 vessels with incidental catch permits in 2001. There were licensed shark dealers operating in 21 locations in South Carolina. Communities involved in the commercial shark fishery were Charleston, Folly Beach, Garden City, Georgetown, Hampton, Ladson, McClellanville, Mount Pleasant, Murrels Inlet, North Myrtle Beach, and Pawleys Island. Some 83 percent of the commercial shark catch by weight was landed in Charleston County, and 14 percent in Georgetown County. While the shark fishery is approximately one percent of all commercial fishery landings by weight in South Carolina (See Table 9.12), it is only half-of-a-

percent in value. Because of the small catches and low value of the fishery, no profiles were made of the South Carolina fishing communities.

Some 481,000 marine anglers fished in South Carolina's waters in 2001. Of these recreational fishermen, 224,000 (47 percent) were from out-of-state and 77,000 (16 percent) were from non-coastal counties within South Carolina. Estimated retail sales generated by the saltwater fishery in South Carolina in 2001 were some $264 million and the marine recreational fishing industry created some5,498 jobs (ASA, 2002). There is no catch and/or landing information available on the private boat recreational fishery for sharks in South Carolina, and anecdotal information suggests that the shark fishery is incidental to other fisheries, and is primarily catch and release.

South Carolina has a fleet of 139 charter/headboats with HMS permits, many of which fish the Gulf Stream for tuna and billfish, dolphin and wahoo, and take shark as incidental catch. There is a directed fishery by charter/headboats for sharks in South Carolina. Shark fishing trips, including night fishing, are offered by a number of charter operators. Shark are taken, in the directed fishery, from near-shore waters, inlets, and from around breakwaters and jetties. Shark fishing is said to be particularly good from May to December, but sharks are available year-round. Principal species targeted are blacktip, hammerhead, lemon, and tiger shark. The IGFA world-record tiger shark was caught off Cherry Grove Beach, SC, near Myrtle Beach. Charter boat operators advertising shark fishing as special trips or part of general near-shore fishing are found in the communities of Myrtle Beach, North Myrtle Beach, Hilton Head, Georgetown, Pawley's Island, Murrell Inlet, Edisto Beach, Isle of Palms, Seabrook Island, Charleston, Mount Pleasant, Beaufort, and Little River.

9.4.13 Georgia

Demographic Profile of Georgia (source: U.S. Census, 2000)

Population:	8,186,453	
Education:		
High school graduates (25 years or older)	4,074,616	78.6%
Employment:		
Labor force (16 years and over)	4,062,808	65.0%
Unemployed	223,052	3.6%
Employment by industry:		
Retail	459,548	12.0%
Manufacturing	568,830	14.8%
Education, health & social services	675,593	17.6%
Arts, recreation, lodging & food services	274,437	7.1%
Farming, fishing, forestry, & mining	53,201	1.4%

Commercial shark fishing in Georgia is a very small segment of the commercial fisheries in the state (See Table 9.13). There are licensed dealers in two locations in McIntosh County, and five vessels with shark permits, of which two vessels have directed-take permits. Georgia communities involved with the commercial shark fishery are Darien and Townsend, both in McIntosh County.

Marine recreational fishing in Georgia attracted 212,000 anglers in 2001, of whom 18 percent (38,000) were from out-of-state, and 43 percent from non-coastal counties. Saltwater angling is estimated to have generated some $57.8 million in retail sales in Georgia in 2001 and some 1,12 jobs in the marine recreational fishing service sector (ASA, 2002). Principal recreational fisheries are for tarpon and snook inshore, and billfish and tunas offshore. Sharks are taken incidental to these fisheries but there are targeted shark fisheries inshore on spinner, sandbar, and lemon sharks.

Twenty-seven charter/headboats held HMS permits in 2003 and were operating from Georgia coastal communities. These communities were Brunswick, Jekyll Island, Marietta, Savannah, Sea Island, Skidaway Island, and St. Simons Island. Savannah had the greatest number of vessels, 12 vessels (44 percent).

9.4.14 Florida

Demographic Profile of Florida (source: U.S. Census, 1990 & 2000)

	1990	2000
Population:	12,937,926	15,982,378
Education:		
High school graduates (25 years or older)	74.0%	79.9%
Employment:		
Labor force (16 years and over)	58.6%	58.1%
Unemployed	6.1%	3.2%
Employment by industry:		
Retail	19.6%	13.5%
Manufacturing	10.5%	7.3%
Education, health & social services	21.4%	18.1%
Arts, recreation, lodging & food services	6.8%	10.5%
Farming, fishing, forestry, & mining	3.1%	1.3%

There were some significant shifts in Florida's economy in the decade between 1990 and 2000. Traditional sectors of the economy, such as retail trade, manufacturing and farming shrank, while employment in the tourist industry, financial and other services grew. In spite of the population growth of nearly 25 percent in the decade, the ratio between those of an age to be in the labor force and those who were active in the labor force did not change significantly. Some 42 percent

of those older than 16 years were not in the labor force. This reflects a continuing population of retired persons. In fact, Florida has a population with more than 40 percent older than 45, and 19 percent less than 15, years of age. In 2000, 24 percent of Florida's households received retirement income and 33 percent received Social Security income. Households in which income was earned through wages or salary were 74 percent of all households in 2000. Average per capita income in Florida in 1989 was $14,698, and this had increased to $21,557 in 1999.

Florida's fishing industry is one of the largest and most diverse in the region. The commercial shark fishing fleet consists of 286 vessels with shark permits. Of these vessels, 147 have incidental catch permits, with 55 operating from East Coast ports and 92 from Florida's West Coast ports. Directed-take shark permits are held by 139 commercial vessels in Florida, with 65 boats working from East Coast ports and 74 based in West Coast ports. Licensed shark dealers operate in 106 locations in Florida, with 47 locations in East Coast communities and 59 locations in West Coast communities. In 2001, the commercial catch of shark was split between the two coasts with 55 percent by weight going to the East Coast ports. The West Coast ports' shark catches were more valuable and received 52 percent by value of the landings in Florida. Table 9.14 documents the landings reported in Florida during 2001.

The East Coast fishery extends from the Georgia state line to Biscayne Bay. The greatest concentration of commercial landings on the East Coast in 2001 (See Table 9.15) was in Brevard County. The second largest landings in 2001 were in St. Lucie County where 29 percent of the sharks, by weight, are landed. Duval County, in the northeast, had the third greatest landings with almost 18 percent of the catch. Fort Pierce (St. Lucie County) had the greatest concentration of vessels, with 19 commercial boats, while Jacksonville (Duval), Dania (Broward) and Port Salerno (Martin County) each had seven vessels. There were, in 2001, 43 East Coast communities involved in the commercial shark fishery.

The West Coast fishery included all of the Florida Keys, the West Coast and the Florida Panhandle. Pinellas County ports handled 48 percent, by weight, and 51 percent, by value, of the shark landings on the West Coast (See Table 9.16). Monroe County (the Florida Keys) ports handled 29 percent of the West Coast landings. Eighteen vessels were based in Panama City, while St. Petersburg was home to 13 vessels. Largo and Key West were each homeport to10 vessels. There were 48 communities involved in the commercial shark fishery on the West Coast of Florida**.**

Florida has the largest marine recreational fisheries in the United States. In 2001, approximately 6,735 saltwater anglers fished in the waters off Florida and made 28,853,000 fishing trips during that year. Of these fishermen, 3,296,000 (49 percent) were from out-of-state. The retail sales generated by these saltwater anglers in Florida in 2001 were estimated to be $2,987.2 million and the marine recreational fishing industry provided some 59,418 job (ASA, 2002). Sharks are an incidental catch for many fishermen, but some private boat fishermen have a directed fishery for sharks, including lemon, hammerhead, sandbar, blacktip and tiger sharks.

The Florida charter and headboat fleet includes 497 boats with HMS permits. While most do not advertise shark fishing trips, their fishing reports make it clear that they encounter and catch sharks on most trips. Some of the charter boat reports also comment on the "good eatin'" value of some sharks, particularly blacktip and lemon sharks. In all there are 110 communities in Florida with charter boats with HMS permits. The greatest concentrations of Florida-based charter/headboats with HMS permits are found in Miami (47), Panama City (44), Destin and Key West (40 each), Canaveral (24), Islamorada (20), Fort Lauderdale (19), Stuart (18), Pensacola (14), Marathon and St. Augustine (13 each), Palm Beach and Ponce Inlet (11 each), and Key Largo (9). It should be noted that the 497 charter boats/headboats reporting home ports in Florida do not include transient vessels that travel to Florida for the winter and spring fishing seasons.

9.4.14.1 Pompano Beach

Demographic Profile of Pompano Beach (source: U.S. Census, 1990 & 2000)

	1990	2000
Population:	72,411	78,191
Education:		
High school graduates (25 years or older)	73.7%	77.2%
Employment:		
Labor force (16 years and over)	55.7%	53.8%
Unemployed	6.3%	3.6%
Employment by industry:		
Retail	18.6%	13.6%
Manufacturing	8.5%	7.1%
Education, health & social services	13.2%	14.9%
Arts, recreation, lodging & food services	8.4%	11.0%

Pompano Beach is small city directly adjacent to Ft. Lauderdale. The Ft. Lauderdale area is known as the "Yachting Capital of the World" and the "Venice of America" because of the vast canal system which extends throughout Broward County and creates 165 miles of waterfront in the region. Recreational fishing is a very important activity in Pompano Beach, mainly targeting billfish. According to Florida's Bureau of Vessel Titling and Registry, in 1996 and 1997 Broward County had 44,151 registered vessels, with 41,393 pleasure and 2,043 commercial vessels. In contrast to many Florida communities, a substantial amount of the recreational fishing industry is supported by local people in addition to tourists; many small fishing tournaments attract about 75 percent local people and 25 percent tourists. Pompano Beach is also a globally important manufacturing center for commercial longlining equipment (Wilson *et al.,* 1998).

Since the 1990 Census, there have been shifts in the ethnic and racial population of Pompano Beach. In 1990, the population was 70 percent Caucasian and 29 percent Black-American. Some 20 percent of the population was of Hispanic ancestry. In 2000, the population consisted of 67 percent Caucasians, 25 percent Black-Americans, and 8 percent of people of other ethnicities. The proportion of the population with Hispanic ancestry had dropped to 10 percent.

The age structure of the Pompano Beach population did not, however, change during the decade. Children under 15 years comprise 15 percent of the population, persons between 15 and 44 years of age form 40 percent of the population, and 45 percent are aged 45 years or older.

The number of households increased from 31,891 in 1990 to 35,917 in 2000. The average household size in Pompano Beach decreased from 2.2 persons/household in 1990 to 2.1 persons/household in 2000. Of the households in 2000, some 69 percent were in receipt of earned income. Some 36 percent of the households received Social Security payments, while 16 percent of households were in receipt of retirement income from pensions. This suggests that some 30 percent of households were retired and living on fixed incomes.

The per capita income for Pompano Beach in 1989 was $17,382, and greater than the state average by $2,684 per annum. In 2000, per capita income in Pompano Beach was $23,938, and greater than the state average income by $2,381.

As a community, Pompano Beach owes its current infrastructure and social and economic lifestyle to the coming of the railroad in 1896 to a small coastal settlement. The proximity of good fishing and other natural resources encouraged the town and region's development as tourism and retirement center. The local chamber of commerce sponsors three marine festivals every year, and describes Pompano Beach as a "haven for boating, fishing and outdoor activities with its beautiful sunny weather...".

Pompano Beach has a proud longlining heritage and there are several successful businesses that are still involved to some degree with the fleet (Wilson *et al*., 1998). This gives the current small vessel fleet and other longline business some networks of support. At the same time, Pompano Beach is now increasingly a recreational fishing community. There is a great deal of tension between the recreational fishermen and the longliners. At the present time, researchers found that the longline fleet is not receiving community support beyond that supplied from within their own industry. Both sides acknowledge a problem with overfished stocks, but each often blames the other side.

Pompano Beach has a small pelagic longline fleet, remnant of a much larger fleet, that mainly targets tunas and swordfish. There is also some shark fishing farther north along the coast. Among the vessels that dock in Pompano Beach are five small (40 to 50 feet), short-trip, year-round longline vessels, and six or seven seasonal longline vessels. Of these, four vessels held incidental-catch permits for sharks in 2001, and another three vessels held directed-catch

permits for sharks. The most intensive local fishing takes place December through April. The longline fleet conducts business with two seafood dealers in Pompano Beach and one in Dania. Swordfish closures have reduced income by shifting effort to less valuable species, such as sharks. The development of the Pompano Beach area for yachting and recreational fishing has made dockage and access to the water more expensive (HMS FMP, 1999).

Wilson *et al.* (1998) noted that commercial respondents reported increased difficulty in getting quality crew. The smaller vessels take two crew plus the captain. Owner-operators often try to have at least one crew member with them consistently, and then find anyone they can for particular trips. The end result of all of these factors has been a substantial reduction of the Pompano Beach longline fleet. Pompano Beach's remaining pelagic and bottom longline fleet is considered, by both its owners and suppliers, to be in major trouble (Wilson *et al*., 1998). Skilled captains were found to be seeking employment in the Bahamas, as well as with the growing longline fleets in South Africa and South America, while the longline supply business has shifted its emphasis to supplying foreign fleets. In the urban economy of Pompano Beach, non-fishing alternatives for fishermen exist. However, unemployment is moderately high and the work force is fairly well-educated, so finding employment could be competitive. Commercial fishing employments alternatives for vessels and crew are minimal because of limited entry programs in other fisheries

9.4.14.2 Fort Pierce

Demographic Profile of Fort Pierce, FL (source: U.S. Census, 2000)

Population:	37,489	
Education:		
High school graduates (25 years or older)	14,108	59.7%
Employment:		
Labor force (16 years and over)	15,681	55.1%
Unemployed	1,382	4.9%
Employment by industry:		
Retail	1,784	12.5%
Manufacturing	1,139	8.0%
Education, health & social services	2,419	16.9%
Arts, recreation, lodging & food services	1,545	10.8%
Farming, fishing, forestry, & mining	1,119	7.8%

Fort Pierce is located in St. Lucie County, a rapidly developing area in South Florida. St. Lucie County is known as a center for citrus growing, particularly grapefruit. Fort Pierce is on the site of an army fort built in 1838, and remained an isolated outpost until the railroad reached the town in 1900. Fort Pierce was incorporated in 1901, and soon developed as a center for industry and

agribusiness. At the junction of the Florida Turnpike and Interstate 95, Fort Pierce is a thriving intermodal transportation center, distribution point, and tourist stop-over point.

Fort Pierce is a community which is in transition. From a predominantly White community in 1950, Fort Pierce had evolved into a community in 2000 in which the White population was less than half the total. The community grew rapidly between 1960 and 1990, from a population of 24,857 to 36,830. This growth has slowed to less than two percent per decade since 1990. These changes reflect, primarily, changes in agribusiness in Florida and, secondarily, the blue-collar, unskilled employment available in the transportation, food processing, and agricultural sectors.

Fort Pierce's population in 2000 was 49 percent White and 40 percent Black-American. No other ethnic or racial groups dominate the remaining 11 percent of the population. People of Hispanic ancestry (both Black and White) comprise 15 percent of the population of Fort Pierce. Children under 15 years of age form 23 percent of the population, 40 percent are aged between 15 and 44 years, while 37 percent are aged 45 or older.

There were 14,407 households in Fort Pierce, with an average household size of 2.56 persons, in 2001. The population is relatively mobile, since only 46 percent lived in the same house in 2000 as they did in 1995. It is also a relatively poor community, with median household income of $25,121 in 2000, and 31 percent of the population living below poverty level. Per capita income in Fort Pierce in 2000 was $14,345, compared to the state-wide average per capita income of $21,557, or $9,593 less than the per capita income in Pompano Beach. These earnings data reflect the unskilled and seasonal nature of jobs in agribusiness, packing plants and transportation businesses in and around Fort Pierce.

Locals refer to Fort Pierce as the "gateway to the Bahamas" because of the number of sport fishing and other vessels which use Fort Pierce as their departure point for the Bahamas and its associated Gulf Stream fisheries for HMS and other species of fish, including shark. In 2003, Fort Pierce hosted 15 fishing tournaments and related marine activities. The city's marina, in conjunction with other marinas and docks along the Indian River, Indian River Lagoon, and Intracoastal Waterway, provides sufficient dockage for recreational boaters and fishermen and for a commercial fishing fleet, principally longliners but also the six vessels which take sharks using gillnets. Nineteen vessels based in Fort Pierce hold HMS commercial permits. Of these permits, eleven are for the directed fishery. This commercial fleet landed 29 percent, by weight and value, of the Florida East Coast shark fishery in 2001, earning some $425,000 in ex-vessel sales.

The commercial fishing fleet in Fort Pierce has grown in numbers the past decade. Many vessels have moved to the community as dock space has been lost to the commercial fleet in ports nearby. Dealers and fish processors have also consolidated buying and packing operations in Fort Pierce because of the high cost of doing business in the tourism-related coastal communities north and south of Fort Pierce.

With the exception of the gillnet fleet unique to Fort Pierce, the commercial fishery is similar to the commercial fishery of Pompano Beach and is principally conducted during the fall and winter seasons. Smaller vessels switch gears and target species throughout the year, while larger vessels move with the fish stocks and retain the same gear configurations.

9.4.14.3 Madeira Beach

Demographic Profile of Madeira Beach (source: U.S. Census, 1990 & 2000)

	1990	2000
Population:	4,225	4,511
Education:		
High school graduates (25 years or older)	83.8%	87.3%
Employment:		
Labor force (16 years and over)	63.1%	61.5%
Unemployed	2.8%	2.7%
Employment by industry:		
Retail	12.7%	11.4%
Manufacturing	12.2%	11.3%
Education, health & social services	9.2%	7.9%
Arts, recreation, lodging & food services	20.2%	21.6%
Farming, fishing, forestry, & mining	0.2%	0.0%

Madeira Beach is part of the Tampa Bay urban complex, one of several beach suburbs of St. Petersburg. The area is the home of the west- central Florida shark bottom longline fleet. Madeira Beach is also home to a thriving recreational HMS fishery. In terms of revenue, tourism is the number one industry in Pinellas County. Annually, four million visitors contribute about two billion dollars to the economy. The tourism industry also employs almost 60,000 of the residents either directly or indirectly, adding up to $720 million in wages (St. Petersburg-Clearwater Visitors Bureau brochure, 1998). The state of the economy since September 2001 has dampened the tourism industry, and Pinellas County Chamber of Commerce reported that the 2002 visitor and expenditure statistics were similar to those of 1998 (PCCC Report, March, 2003).

Madeira Beach's economy has changed with the changing tourism industry. A sign of the times is the renovation of much of the waterfront along St. John's Pass from a working waterfront of docks, fish houses and chandleries to a boardwalk lined with restaurants and boutiques. Many of the slips remaining are assigned to recreational vessel docking and storage. The once-dominant fishing industry is now a shadowy presence in much of Madeira Beach.

The population of Madeira Beach was 99.8 percent Caucasian in 1990 and 97.1 percent Causcasian in 2000. During the decade, the number of people in the population claiming German ancestry rose from 11 percent to 19.7 percent in 2000, although 92 percent of the population of Madeira Beach were born in the United States. The Madeira Beach population aged during the decade. In 1990, 7 percent of the population were children aged 14 years or less; this proportion had dropped to 6 percent in 2000. The proportion of persons aged 15 to 44 years also dropped from 39 percent in 1990 to 36 percent in 2000. The proportion of persons aged 45 years or more grew from 54 percent of the population to 58 percent.

The number of households in Madeira Beach increased from 2,230 in 1990 to 2,528 in 2000, but the average number of persons in a household declined from 1.88 persons in 1990 to 1.78 in 2000. In 2000, almost 28 percent of the housing units in Madeira were seasonal or recreational units vacant at the time of the Census.

Per capita income in Madeira Beach in 1989 was $17,301; in 1999, per capita income had risen to $30,097, some $8,000 more than the state average per capita income and $15,752 more than the average per capita income in Fort Pierce. Individuals living at or below poverty level comprised 9.8 percent of the Madeira Beach population. Some 72 percent of Madeira Beach's households received earnings from wages or salaries. Twenty-three percent of the households were in receipt of retirement funds or pensions, while 31 percent of the households received income from Social Security.

The offshore fishing industry in Madeira Beach started as a bandit (reel fixed to transom) fishery before it shifted to bottom longlining. Grouper is the traditional fishery for the community. In the 1960s, there were two dealers supported by charterboats selling fish and a small commercial fleet targeting kingfish and grouper. Many species that are now sold, such as amberjack, were considered junk fish in earlier years. As demand for seafood began to grow, higher prices accompanied by investment programs led to substantial investment in commercial fishing within this community.

Longline vessels began to target swordfish in the 1970s, using cloth and nylon line before monofilament longlining became widely used. Local availability of swordfish declined quickly and a group of vessels went north to look for fish. On their way back they set longline gear in deep water and caught a significant amount of shark, tilefish and yellowedge grouper; this was how the bottom longline fishery in Madeira Beach began (Wilson *et al*., 1998). Marginal swordfish vessels began to experiment with various techniques such as straight hooks, auto-baiters and circle hooks. The fleet at Madeira Beach is currently 95 percent bottom longline vessels. There are four seafood dealers in this community. One dealer estimated that before restrictions on shark fishing his business used to be 45 percent grouper, 45 percent shark, and 10 percent swordfish and tuna; now it is 75 percent grouper, 10 percent shark and 15 percent swordfish and tuna (Wilson *et al.,* 1998). With the imposition of the live-bait ban in 2000, the swordfish and tuna landings have decreased appreciably.

Sharks and grouper are both caught with bottom longline gear. For this reason, the majority of longline fishermen hold permits for multiple fisheries. The maximum number of trips fishermen can make is about 15 trips a year, as a bottom longline trip lasts some 7 to 14 days. Grouper fishermen are subject to limited access, a minimum size, area restrictions, seasonal closures, and a quota.

Overall, the Madeira Beach bottom longliners are becoming fewer and more isolated from the rest of the fishing community (Wilson *et al*., 1998). Respondents say that antagonism and competition among dealers has gotten worse in recent years as vessels drop out of fishing, often being sold outside of the country. Many of these crews are living trip to trip and often need credit for engine repair, ice, fuel and even household and personal items. Both the fishermen and an engine supplier reported that the commercial fleet is spending more on maintaining existing gear and vessels rather than buying new equipment. Traditional patterns of dealers building relationships by extending services and credit to vessels are giving way to price-based competition to gain access to vessels (HMS FMP, 1999).

Fishermen in this community have experienced restrictions on gear, harvest, and capacity in many of its important fisheries. Wilson *et al.* found that alternative employment outside of the fishery is available through expanding opportunities in the tourism and recreational fishing industries. However, Wilson *et al.* found that this relatively ready supply of alternative employment threatened the stability of the labor pool for the fishing industry. Some reported that the best captains are leaving the country or moving on to other jobs. Like many other fishing communities, the longline fleet in Madeira Beach is experiencing market competition from imports of their target species. Concerns cited by pelagic longline fishermen were the safety of small vessels during winter openings, and the prospect of small vessels having to pay for observers and VMS (Wilson *et al*., 1998; HMS FMP, 1999).

When the shark bottom longline fishery began, it was easy to catch sharks, but the bottom longline fishery has become marginal because of restrictions and the increased distances the fishermen now have to steam (Wilson *et al*., 1998). Members of the fishing and supply industries reported price fluctuations in the shark fishery, which they attributed to the difficulty in maintaining steady supplies under derby-style quota management. The fins bring the most money and are exported to Asian nations. Shark trips have to be kept as short as possible to maintain good quality meat. Respondents suggest that regulations, particularly the 4,000-pound shark commercial retention limit, have turned the fishery into a small vessel fishery. Even vessels measuring as small as 50 feet in length can have difficulty making a profit (Wilson *et al*., 1998). Some fishermen keep both grouper and shark gear on board (HMS FMP, 1999).

In 2001, Pinellas County commercial shark fishermen landed 48 percent of sharks taken commercially on Florida's West Coast. The ex-vessel value of this catch was in excess of $800,000. There were shark dealers at 11 locations in Pinellas County, and 49 commercial vessels in the shark fleet, of which 31 had directed-take permits. Madeira Beach was homeport in 2001 to 8 shark vessels; 3 with incidental take permits and 5 with directed-take permits.

Approximately 50 to 60 charter/headboats participated in the recreational fisheries of Madeira Beach during the 1990s, and more than 48,000 pleasure vessels were registered in Pinellas County (Florida Bureau of Vessel Titling and Registration, 1996 and 1997). Researchers found tension and distance between the recreational and commercial fishing communities to be high, and recreational fishermen tend to maintain that commercial fishing is to blame for the declining shark populations (Wilson *et al*., 1998). Shark fishing is comparatively less important to recreational fishing in Madeira Beach than other HMS, although researchers reported that the local recreational shark fisheries are very healthy (HMS FMP, 1998).

In 2003, there were no charter or headboats with HMS permits calling Madeira Beach their home port. The renewal and renovation of the town's waterfront, particularly on John's Pass, removed many of the berths and infrastructure which supported both the charter boat fleet and the commercial fishing fleet.

There were shark tournaments in Madeira Beach in the past, mostly sponsored by a vessel or engine manufacturer, but they are no longer held. Stores sell very little shark tackle, but some maintain the industry is beginning to come back. The miles-long remainder of the old Sunshine Skyway bridge is now used as a pier for recreational shark fishing. It is estimated that recreational shark fishing in this community is 90 percent catch and release (HMS FMP, 1999).

9.4.14.4 Panama City

Demographic Profile of Panama City, FL (U.S. Census, 1990 & 2000)

	1990	2000
Population:	34,378	36,417
Education:		
High school graduates (25 years or older)	70.0%	79.2%
Employment:		
Labor force (16 years and over)	57.0%	53.9%
Unemployed	8.1%	3.1%
Employment by industry:		
Retail	14.4%	13.8%
Manufacturing	8.0%	7.0%
Education, health & social services	23.6%	22.0%
Arts, recreation, lodging & food services	11.8%	14.2%
Farming, fishing, forestry, & mining	1.5%	0.5%

Panama City is one of the Florida's top fishing centers offering surf fishing, pier fishing, and charter/headboat fishing, according to the Panama City Tour Guide (Panama City/Bay County Chamber of Commerce, 2003). According to the Florida Bureau of Vessel Titling and Registration, the county has a total of 16,865 registered vessels with 15,359 pleasure and 1,433 commercial vessels. Headboats are an important part of Panama City's tourism. People enjoy bringing children along since these trips are shorter than charterboat trips. Panama City is a summer resort, with little tourist activity in the winter, as well as an important commercial fishing port.

During the winter, recreational fishermen target bottom fish and bluefish. In March, the season begins for Spanish mackerel, cobia, snapper, bonito, little tunny, amberjack, snapper, red porgies, rudder fish, blue runner, bluefish, and redfish. By summer, they also fish for king mackerel, dolphin fish, wahoo, little tunny, and barracuda. White marlin, blue marlin, and sailfish are caught recreationally in late summer. Some charter boats will go shark fishing at night for extra income. In September, the fishery is very mixed, and in October, king mackerel and bonito are popular. Tourists are mainly interested in bottom fishing. Motivations have changed; people used to be interested in catching a lot of fish and taking it home to eat or sell, but now people are satisfied to catch anything (Wilson *et al*., 1998; HMS FMP, 1999).

Panama City saw a big change in its demographics in the decade between 1990 and 2000. In 1990, the age profile was typical of a normal "mature" society; by 2000, it reflected significant aging of the population. In 2000, 57 percent of the population of Panama City was 45 years or older, in contrast to 37 percent in 1990. The proportion of the population aged between 15 and 44 years declined from 43 percent in 1990 to 24 percent in 2000. The proportion of the population aged 14 years or younger did not change significantly; it remained at approximately 19 percent of the population.

Panama City had 14,033 households in 1990, and the population grew during the decade to 14,819 households in 2000. The average household size decreased from 2.38 persons in 1990 to 2.30 persons in 2000, indicating that there might be an increase in "empty nesters" and retiree households. Some 12 percent of households (17 percent of individuals) were below the poverty level in 2000. In 1989, the per capita income in Panama City was $12,169 and was significantly lower than the state average per capita income of $14, 698. This situation persisted in 1999, when the Panama City per capita income had increased to $17,830, but continued to be less than the Florida average of $21,557 per capita.

Like Fort Pierce, Panama City is a transportation hub and has an agricultural and industrial base in addition to its fisheries. And like Fort Pierce, Panama City's commerce rests on a supply of unskilled labor able to service agribusiness, transportation services, and the tourism industry. Panama City has two city marinas in addition to private commercial operations. The Panama City marina is located downtown on the Intracoastal Waterway and provides 240 berths for recreational, commercial and charter/headboat vessels. The second municipal marina, St. Andrews, lies on St. Andrews Bay, closer to the Gulf of Mexico, and provides docking and other

facilities for much of the commercial fishing fleet. This fleet is chiefly composed of shrimp boats. Seven charter/headboats are based in the city marinas. While the largest local employers are hospitals and resort hotels, two shipyards between them employed 650 persons in 2003 (Panama City/Bay County Chamber of Commerce, 2003).

In the early 1980s, yellowfin tuna was the main commercial fishery for Panama City from April through December while bluefin tuna were targeted in the winter. Some of the longline vessels shifted from yellowfin tuna fishing to bottom longline fishing for grouper and sharks in 1998, since the latter required fewer crew members (Wilson *et al*., 1998). Some of these vessels targeted dolphin fish in the summer, and swordfish more rarely. In 1998, two of these vessels were owner operated, two were owned by a dealer, three were each owned by a single person who hired a captain, and two others were jointly owned and had hired captains (Wilson *et al*., 1998)

Some pelagic longline fishermen also participated in the reef fish and bottom longline fishery. There were 16 to 19 grouper vessels operating out of Panama City in 1998. One fish trader interviewed by the researchers in 1998 reported that his current business was 87 percent yellowfin tuna and eight percent snapper, with the remainder being a mix of swordfish, bluefin tuna, dolphin, wahoo, sandbar shark, and escolar. He bought from about 10 vessels in 1998, but had bought from 30 vessels a few years ago (Wilson *et al.,* 1998). The prohibition on the use of live bait in 2000 reduced the tuna and swordfish catches of the commercial fleet and increased use of bottom longline for grouper and shark.

While Panama City was developing tourist and recreational fishing industries, the commercial fishermen were becoming fewer and more isolated from the rest of the community. The competition among dealers was perceived as becoming more aggressive in 1997-1998. Traditional patterns of dealers building relationships by extending services and credit to vessels in the shrimp and longline fisheries were giving way to price-based competition to gain access to vessels. Fishermen in this community had experienced restrictions on gear, harvest, and capacity in many important fisheries. Researchers found in 1998 that alternative employment outside of the fishery was available in the developing tourism and recreational fishing industries. However, researchers concluded that this relatively ready supply of alternative employment threatened the stability of the labor pool for the fishing industry (Wilson *et al*., 1998).

Some of the pelagic longline vessels in Panama City switched their gear to target sharks when the shark fishery is open. The Florida bottom longline fleet primarily targets sandbar sharks for their valuable fins. Researchers in 1998 questioned fishermen about the possibility of implementing a minimum size for sharks. Fishermen in this community estimate that a 58-inch size limit would reduce their catch by 40 to 50 percent. The main desire in the shark fleet appeared to be avoiding disturbances in supply. Members of the fishing and supply industries reported price fluctuations in the shark fishery, which they attributed to the difficulty in maintaining steady supplies under derby-style quota management. Other concerns cited in 1998 were safety of small vessels during winter openings, and the prospect of small vessels having to pay for observers and VMS.

Wilson *et al.* (1998) concluded that the overall effect of increased restrictions on the bottom longline fleet would be increased pressure on grouper and yellowfin tuna, increased difficulty in finding and retaining employees, and an acceleration in the rate at which the fleet's vessels and experienced fishermen are moving overseas, especially to Mexico. Increased restrictions on commercial fishing would likely accelerate the decline of that sector relative to the recreational fishery in Florida (Wilson *et al*., 1998).

In 2001, the commercial shark fishery operating from Bay County ports of Panama City, Lynn Haven, Panama City Beach and Southport landed 13,757 pounds of shark with an ex-vessel value of $16,001. There were shark dealers operating in four locations in the county, and 31 commercial shark fishing boats, seven with directed-take permits, divided between the ports. Panama City had the largest fleet with 18 permitted shark vessels, four of which had directed-take permits while the remaining 14 had incidental-take permits.

Shark fishing is comparatively less important to recreational fishing in Panama City than billfish, although some customers are attracted by shark in particular. Researchers reported in 1998 that the recreational shark fisheries of Panama City were very healthy. They found that tension and distance between the recreational and commercial fishing communities in Panama City were high. Recreational fishermen throughout this area tend to believe that commercial fishing is to blame for the declining shark populations (Wilson *et al*., 1998).

An annual shark tournament was held in Panama City from 1980 to 1996. The change that the fishery experienced in that time was dramatic and the organizers felt that the recreational fishery was wasting a lot of fish given the condition of the resource (Wilson *et al*., 1998). This tournament used to draw people from a couple of hundred miles away. One tackle store owner related that only five to 10 percent of his business is now shark related, whereas it used to be close to 80 percent. The increased popularity of catch and release fishing has actually increased tackle sales because a large, offshore private vessel will keep two sets of tackle on board. Recreational fisherman are concerned about the complexity of the management measures for sharks, which vary by species (Wilson *et al*., 1998).

At this time (2003) Panama City has 34 charter/headboats with HMS permits. Sharks are taken incidental to other catches and most vessels practice catch and release, although two websites described sharks as tasty and encouraged anglers to fish for personal consumption. Seven of the charter boat websites surveyed showed offerings for night shark fishing trips.

9.4.15 Alabama

Demographic Profile of Alabama (source: U.S. Census, 2000)		
Population:	4,447,100	
Education:		
High school graduates (25 years or older)	2,173,319	75.3%
Employment:		
Labor force (16 years and over)	2,047,100	59.3%
Unemployed	126,911	3.7%
Employment by industry:		
Retail	233,742	12.2%
Manufacturing	352,566	18.2%
Education, health & social services	370,274	19.3%
Arts, recreation, lodging & food services	122,333	6.4%

Alabama has a small commercial shark fishery based in five communities. Table 9.17 documents the landings reported in Alabama during 2001. The commercial fleet with shark permits numbers six boats in all; three vessels with directed-take permits and three vessels with incidental-take permits. There are licensed shark dealers working in 12 locations in coastal Alabama. The communities involved in the shark fishery are Andalusia, Bayou la Batre, Elba, Elberta, and Lillian.

The marine recreational fishery off Alabama attracted 503,000 anglers in 2001, who made 1,636,000 fishing trips. Of these recreational fishermen, 194,000 (39 percent) are from out-of-state. Another 98,000 anglers (19.5 percent) are from non-coastal counties within Alabama. The estimated retail sales generated by saltwater anglers in Alabama in 2001 were valued at $235.9 million. Some 5,477 jobs were attributed to the marine recreational fishing industry in 2001 (ASA, 2002). Thus recreational fishing off Alabama also benefits the local tourist industry as it does in Florida. Shark fishing is largely incidental to recreational fishing for other fish species.

There are 72 charter/headboats with HMS permits in Alabama. Some 60 percent (43) of these vessels are operated from Orange Beach, while 17 percent are based in Dauphin Island. The communities involved in the Alabama charter/headboat fishery for sharks and other HMS species are Birmingham, Daphne, Dauphin Island, Dothan, Foley, Fort Morgan, Fowl River, Gulf Shores, Mobile, Ono Island, Orange Beach, and Perdido Beach. There is a small directed shark fishery advertized by some of the charter/headboats, but most take shark incidentally to other fish species throughout the year.

9.4.16 Mississippi

Demographic Profile of Mississippi (source: U.S. Census, 2000)		
Population:	2,844,658	
Education:		
High school graduates (25 years or older)	1,280,487	72.9%
Employment:		
Labor force (16 years and over)	1,267,092	58.7%
Unemployed	93,778	4.3%
Employment by industry:		
Retail	138,646	11.8%
Manufacturing	215,203	18.3%
Education, health & social services	236,382	20.1%
Arts, recreation, lodging & food services	97,698	8.3%
Farming, fishing, forestry, & mining	39,473	3.4%

The commercial shark fishery in Mississippi is very small compared to all other commercial fisheries in the state (See Table 9.18). There are 10 vessels with shark permits, including one with a directed-take permit, and shark dealers work from three locations in Jackson County. Communities involved in the commercial shark fishery are Biloxi and Pascagoula.

Mississippi's saltwater recreational fisheries attracted some 311,000 anglers in 2001. Seventy-thousand (23 percent) of these anglers were from out-of-state, and 44,000 (14 percent) were from non-coastal counties within Mississippi. The ASA estimated that marine recreational fishing generated $50.5 million in retail sales in Mississippi in 2001 and some 1,003 jobs (ASA, 2002) Marine recreational fishing in Mississippi has three modes: shoal water fishing along salt-water marshes, behind barrier islands, and in the sounds; near-shore fishing in relatively shallow water out to some 15 miles from shore, including trips to artificial reefs and oil platforms; and offshore fishing in deeper water with HMS species as a target. Sharks are, however, taken in all three modes and it is reported that some are retained for personal use by anglers. There is no detailed data available on catch and effort rates for sharks in the recreational fishery or on retention of catch *versus* catch-and-release of sharks.

There are 27 charter/headboats with HMS permits home-ported in Mississippi ports. The Mississippi Charter Boat Captains' Association advertises "Light tackle bait fish for small coastal sharks during the summer" as part of the attractions of sport fishing off Mississippi (www.mscharter boats.org; June, 2003). The Association also notes that recreational trolling in the wake of commercial shrimp boats will find "Big Sharks". Among the sharks advertised on charter boat websites are requiem, lemon, sandbar, blacktip, and sharpnose sharks. Approximately two-thirds of the 20 websites sampled advertised shark fishing as part of the

charter boats' offerings to clients. Communities involved in the charter and head boat fishery include Bay St. Louis, Biloxi, Ellisville, Gautier, Gulfport, Long Beach, Pascagoula, Pass Christian, and Picayune. Biloxi and Gulfport are each homeport to about one-third of the charter and head boat fleet with HMS permits.

9.4.17 Louisiana

Demographic Profile of Louisiana (source: U.S. Census, 1990 & 2000)

	1990	2000
Population:	4,219,973	4,468,976
Education:		
High school graduates (25 years or older)	68.0%	74.8%
Employment:		
Labor force (16 years and over)	57.8%	58.9%
Unemployed	9.0%	4.3%
Employment by industry:		
Retail	17.5%	11.9%
Manufacturing	12.5%	10.1%
Education, health & social services	25.3%	21.7%
Arts, recreation, lodging & food services	4.7%	9.1%
Farming, fishing, forestry, & mining	5.7%*	4.2%*

Louisiana was second only to Alaska in the quantity and value of its commercial fisheries in the United States in 2001. Venice, LA, ranked third in the United States for quantity of commercial landings, while Dulac, LA ranked fourth in the nation for value of landings. The menhaden fishery is based in Venice, while shrimping is the principal fishery in Dulac. Both of these fisheries have declined during the past two decades, from the peak year of Louisiana commercial landings in 1984 when 1,931,027,000 pounds of fish were landed in the state.

Commercial landings of large coastal sharks in 2001 (See Table 9.19) declined by 15 percent since 1996. The ex-vessel value of the landings declined by 63.5 percent in the same period. In 2001, shark dealers were operating from 17 locations in Louisiana, and the commercial shark fishing fleet numbered 48 vessels. Six of these vessels held directed take shark permits, while 42 vessels held incidental permits. The communities involved in the commercial shark fishery in 2001 included Boothville-Venice, Buras, Chalmette, Cut-Off, Dulac, Galliano, Gretna, Harvey, Houma, Lockport, Metairie, New Orleans, and Thibodeaux. The largest concentrations of shark vessels were homeported in New Orleans (56 percent), Houma (eight percent), and Dulac and Gretna (six percent each).

The recreational saltwater fisheries off Louisiana attracted some 775,000 anglers in 2001, who between them made 3,615,000 fishing trips. Of these anglers, 16 percent (122,000) were from out-of-state, while 8 percent were from non-coastal counties within Louisiana. The ASA estimated that salterwater angling generated some $409.6 million in Louisiana in 2001, and some 7,786 jobs in marine recreational fisheries (ASA, 2002). The center of fishing activity is off the Mississippi delta, and ports like Boothville-Venice, Port Fourchon and Grand Isle with good road access to the metropolitan areas of Baton Rouge and New Orleans, benefit from their access to good bottom-fishing areas and to "blue-water" areas offshore. Sharks are taken in both the bottom-fishery and in the blue-water fishery.

In 2003, there are 88 charter/headboats with HMS permits operating from Louisiana communities. The majority of websites sampled show that sharks are a component of most trips offered by these vessels. There is no detailed information on shark landings in the recreational fishery, nor is there any detailed information on catch and release of sharks. Communities involved in the charter and head boat fishery for sharks include Venice (22 boats), New Orleans (18 boats), Chauvin/Dulac (12 boats), Houma and Baton Rouge (5 boats each); Port Fourchon (4 boats), Grande Isle, Cut-Off, Chalmette, Galvez, Lake Charles, Leeville and Monroe.

9.4.17.1 Venice

Demographic Profile of Venice (Source: U.S. Census, 1990 & 2000)

	1990	2000
Population:	2,743	2,220
Education:		
High school graduates (25 years or older)	43.5%	48.4%
Employment:		
Labor force (16 years and over)	50.0%	53.0%
Unemployed	6.4%	2.0%
Employment by industry:		
Retail	12.5%	13.1%
Manufacturing	7.1%	4.8%
Education, health & social services	8.9%	14.4%
Arts, recreation, lodging & food services	6.9%	10.4%
Farming, fishing, forestry, & mining	22.5%	22.7%

Boothville-Venice is a "census designated place" and the Bureau of the Census statistics include both small communities. Similarly, NOAA Fisheries links Empire and Venice as a single port. Thus, both the port and community are referred to as Venice in this document.

Venice is located about 30 miles south of the parish seat Point à la Hache, which is flanked by eroding wetlands and levees that border the Mississippi River. The unemployment rate is low

compared to that of Dulac, perhaps because Venice has been the epicenter of oil industry activity in Louisiana. The main job opportunities in Venice are oil, seafood harvest and processing and, increasingly, recreational fishing. Venice extends into the Gulf of Mexico close to billfish areas that are frequented by recreational fishermen. Recreational fishing increased steadily there during the 1990s. Animosity regarding competition for fish extends to the political arena, as commercial and recreational fishermen oppose each other on regulatory issues. Commercial fishery participants claim that they are harassed by law enforcement agents, while recreational fishery participants claim that regulations are not enforced in Venice because there are simply not enough agents to cover the area. Among local commercial fishermen, there is a sense that recreational fishermen have helped create a regulatory environment that is pushing commercial fishermen out of business (Wilson *et al*., 1998).

There is no evidence that local residents participate in commercial fisheries for HMS; most of the commercial vessels landing in Venice are home-ported in New Orleans or other Mississippi River towns further upriver from the Gulf of Mexico. Even Louisiana natives who fish for shark with nets in state waters live in neighboring towns, not in Venice. Shrimp is the largest commercial catch bought and sold in Venice, although this fishery has become less profitable since the late 1980s (Wilson *et al*., 1998). The longline fleet is not well integrated into the Louisiana community of Venice. The longline fishermen are mostly "commuters" from towns and cities further inland, such as New Orleans, and most of them are from a different ethnic background, including many Vietnamese-Americans. Due to the language barrier, many of these fishermen do not participate in public fisheries meetings (HMS FMP, 1999).

Venice's population decreased by 24 percent in the decade between 1990 and 2000. In 2000 there were 2,220 residents of the community. The age structure of the population shows, in 2000, that 26 percent of the residents were under 15 years old, 44 percent were between the ages of 15 and 44 years, and 30 percent were 45 years of age or older. In 1990 there were 844 households with an average size of 3.25 people. The number of households had decreased to 746 in 2000 and the average household size had dropped to 2.96 people.

Per capita income in Venice in 1989 was $6,949; this was higher than the per capita income of Dulac ($4,946); but lower than the state average ($10,635). Thirty-six percent of the population of Venice lived below the poverty level. The median household income was $16,250. Eighteen percent of the households in Venice in 1990 received Social Security, averaging $5,433 per year, and 11 percent of the households received public assistance income, averaging $3,301 per year.

In 1999, the per capita income of Venice residents was $13,123, while the per capita income for the state of Louisiana had increased to $16,912. Of the households in Venice, some 18 percent remained below the poverty level in 2000.

In 1998, several dealers in Venice drew 40 percent of their business from the longline fleets. Another dealer drew only about 20 percent from longline vessels. A large wholesaler dealt only in longline catches and purchased fish from three of the four local dealers. In 1997, 60 percent

of this business was tuna, 30 percent shark and 10 percent swordfish. The competition between dealers in 1998 was perceived as becoming more aggressive (Wilson *et al*., 1998). Traditional patterns of dealers building relationships by extending services and credit to vessels are giving way to price-based competition to gain access to vessels.

While pelagic longline fishermen with large vessels work year-round, pelagic longlining in the area tends to intensify in May and ease up during the wintertime. There are four docks in Venice where longline vessels unload. Docks in Venice employ between five and 15 workers on a seasonal basis for unloading vessels and packing seafood, as well as five to eight people year-round. The docks purchase tuna year round, shrimp from May through December, bottom fish such as drum, catfish, and sheepshead, from January through May, mullet (for the roe) from October through December (HMS FMP, 1998).

Researchers in 1998 found that alternative employment outside of the fishery was available. For instance, the oil industry hired unskilled labor from this area in recent years, and employed three percent of the civilian labor force in 2000. The agricultural sector also provides employment opportunities during the off-season for fishing, as reported by one Vietnamese-American captain. However, researchers found that this relatively ready supply of alternative employment threatened the stability of the labor pool for the fishing industry. The Vietnamese-American community has avoided such personnel problems to some extent by relying on tight kinship networks in both fishing and fish buying, although they did report some difficulty in finding captains. The Vietnamese-American community was the only one studied which reported recent investment in new longline vessels. Concerns cited by the fishermen in Venice included the safety of small vessels during winter openings, and the prospect of small vessels having to pay for observers and VMS (Wilson *et al*., 1998)

Other commercial fisheries in the area that could provide alternative employment include pompano in October, mullet from October to January, shrimp from May to December and oysters from January to May (Wilson *et al*., 1998). Wilson *et al.* concluded that the overall effect of increased restrictions on this fleet would be increased pressure on grouper and yellowfin tuna, increased difficulty in finding and retaining employees, and an acceleration in the rate at which the fleet's vessels and experienced fishermen are moving overseas, especially to Mexico.

Recreational fishermen fish from Venice year-round, but are affected by inclement weather during the winter. There are 22 charter/headboats with HMS permits operating out of Venice in 2003. The larger vessels can fish for yellowfin tuna year round, in addition to inshore species like redfish, snapper and speckled trout. Bluefin tuna are found too far away (100 miles offshore) and recreational fishermen are prohibited from directing effort on bluefin tuna anyway. They fish for billfish, particularly blue marlin, from May through November. Blacktip shark was once a popular catch, but recreational fishermen say they are now too small to be an enjoyable catch. There is some animosity between recreational and commercial fishermen which seems to arise from competition for particular species. Charter boats regularly specify sharks as a species available to their clients.

There are only two marinas in Venice that cater to recreational fishermen, although a third parish-run marina offers vessel slips to both recreational and commercial fishermen. One opened in the mid-1980s and offers boat slips, launches, a hoist, a couple of condominiums, baitshop, fuel and ice. It employs 13 people during peak summer months. Most of the marina's business comes from private vessels from New Orleans and border states. Less than one percent of this business consists of charter boats. The other marina opened only a few years ago, offering 120 pre-paid boat slips, a 64-room two-story hotel, condominiums, a dry dock storage facility, fuel and ice. It employs 12 to 15 people in its newly opened hotel and another 15 to 25 in the marina. Eight charter boats operate from the marina, and there is room for 10 more.

Researchers in 1998 reported that the catch and release ethic for billfish was strong among recreational fishermen in Venice, but local billfishing tournaments require that trophy fish be brought to the dock and weighed. Sportfishermen prefer to catch and retain tunas, dolphin fish, and wahoo for consumption, although they voiced support for tag and release programs (HMS FMP, 1999).

9.4.17.2 Dulac

Demographic Profile of Dulac, LA (source: U.S. Census, 1990 & 2000)

	1990	2000
Population:	3,273	2,458
Education:		
High school graduates (25 years or older)	27.0%	39.1%
Employment:		
Labor force (16 years and over)	46.0%	44.9%
Unemployed	17.5%	3.0%
Employment by industry:		
Retail	12.0%	10.3%
Manufacturing	14.0%	10.0%
Education, health & social services	9.8%	8.5%
Arts, recreation, lodging & food services	9.9%	10.7%
Farming, fishing, forestry, & mining	23.6%	25.9%

Dulac is located in the center of Terrebonne Parish, about 15 miles south of Houma, LA. Houma lies at the intersection of the Houma Navigational Canal and the Intercoastal Waterway and serves as the parish seat and a locale of employment opportunities in offshore equipment building for Dulac residents. Terrebonne Parish government is a consolidated government so most data are gathered on a parish-wide basis.

According to the Terrebonne Parish Planning Department in 1998, the parish did not spend much time tracking the importance of the commercial fishing industry, but anecdotal evidence suggests that it is a long-standing and significant part of the community economy. Landings of tunas,

swordfish, and sharks indicate that Dulac is among the most important fishing ports in the state. However, many of the fishermen who target HMS are a commuter population; they land fish in Dulac or purchase fish in Dulac, but they live elsewhere. Three dealers purchase fish from longline vessels; two are owned and operated by first-generation Vietnamese immigrants, and the other is run by a New Orleans native whose father operates a large tuna wholesale company in Venice.

In 1990, the population of Dulac was about 50 percent Caucasian and almost half of the population was Native American (Houma Indian), a tribe not recognized by the U.S. government. Less than two percent of the population was African-American or Hispanic, and less than two percent of the population was Asian/Pacific islander, despite the fact that most of the longline captains who sustain the Dulac commercial industry for tunas, swordfish, and sharks were Vietnamese. Many of the Caucasians in Dulac are of French or French-Canadian ancestry. By 2000, the population of Dulac had declined significantly, and was composed of 54 percent Caucasians, 40 percent Native Americans (Houma), less than one percent Asian, and a smattering of people of other ethnic groupings. Some 31 percent of the population claimed French or French-Canadian ancestry in 2000.

At the time of the Census in 2000, 26 percent of the population of Dulac were children under the age of 15. Some 33 percent of Dulac's population were 45 years of age or older, and 41 percent were between 15 and 44 years of age.

There were 910 households in Dulac in 1990, with an average size of 3.59 persons/household. By 2000 the number of households had decreased to 768 and the average size of each household had dropped to 3.20 persons. At the time of the 1990 Census nearly half of the households in Dulac were living below the poverty level, with a median household income of $12,653. In 2000, median household income in Dulac had increased to $22,900, but more than 30 percent of households continued to live below poverty level.

Per capita income in Dulac in 1990 was $4,946; for the State of Louisiana, average per capita income was $10,635. By 2000, per capita income in Dulac had risen to $8,785, while for the state as a whole, per capita income had risen to $16,912. Employment in Dulac was principally in the fisheries in 2000 with approximately 160 persons (21 percent of all those with employment) working full time or seasonally in fishing activities.

Pelagic longline fishermen in Dulac target yellowfin tuna all year. Swordfish is not targeted by Dulac longline vessels, and incidentally-caught sharks are often discarded (Wilson *et al*., 1998). The competition between dealers was perceived as becoming more aggressive in 1998. Traditional patterns of dealers building relationships by extending services and credit to vessels were giving way to price-based competition to gain access to vessels. Researchers reported, in 1998, that one dock in Dulac employed three to four people, but laid them all off in 1998. That dealer purchased tuna (50 percent), shark (30 percent), swordfish (20 percent), and dolphin, wahoo, and amber jack (20 percent combined). Another dealer employed six or seven people in

1998, all of whom lived in Dulac. Of this dealer's purchases, 60 percent were tuna, 20 percent were swordfish and 20 percent were divided among other pelagic species like shark, wahoo, amber jack. A third dealer employed six Mexican workers, supplemented by local residents on a seasonal basis (Wilson *et al.*, 1998). The pelagic longline fleet has seen reductions in its catches with the prohibition of the use of live-bait in 2000, and this has impacted community employment.

Researchers in 1998 found that alternative employment outside of the fishery was available. For instance, while unemployment in Louisiana fishing communities has been high in the past, the oil industry hired unskilled labor from this area in recent years. In 1990, 33 residents of Dulac worked in the oil fields and a similar number were employed by the oil industry in 2000. The agricultural sector also provides employment opportunities, as reported by one Vietnamese-American captain, particularly during the off-season for fishing. However, this supply of alternative employment threatened the stability of the labor pool for the fishing industry (Wilson *et al.*, 1998). This was true for both captain and crew positions, particularly among the non-Vietnamese-American population. The Vietnamese-American community avoided such personnel problems to some extent by relying on tight kinship networks in both fishing and fish buying. The Vietnamese-Americans, however, did report some difficulty in finding captains. The Vietnamese-American community was the only one studied which reported recent investment in new longline vessels. In Louisiana, the impacts of regulation may be felt more intensely by the Vietnamese-American community given the extent of their investment in this fishery (HMS FMP, 1998).

Dulac was also a home port for a limited inshore shark bottom longline fishery in Federal waters in 1998. Blacktip shark was the main catch in this fishery. These fishermen did not fish much during the winter because of the safety concerns of these small vessels (Wilson *et al.*, 1998). Typically, sharks are caught between five and 20 miles from shore. Almost all vessels that sell in Dulac are owner-operated. Owners are usually their own captains or they hire a close relative to captain their vessel. Good first mates try to acquire their own vessels. At least five bottom longline vessels were built in 1997 and have been added to the fleet in Dulac. Some participants in the bottom longline fishery for sharks also participated in the reef fish fishery. It would be difficult for shark fishermen to switch into the yellowfin tuna fishery (Wilson *et al.*, 1998). The local fishermen, fishing for shark in state waters, use a gill net and fish under a special state licence; longlining for sharks in state waters is banned.

The primary concern of dock owners and seafood processors is the need to have a consistent supply of fish. At one point in the early 1990s, a Dulac dealer was selling 50,000 pounds of shark fillets a week to supermarket chains. In 1998 they were selling much less because the markets did not like the unpredictability of supply (Wilson *et al.*, 1998).

9.4.18 Texas

Demographic Profile of Texas (source: U.S. Census, 2000)		
Population:	20,851,820	
Education:		
High school graduates (25 years or older)	9,676,332	75.6%
Employment:		
Labor force (16 years and over)	9,830,559	62.9%
Unemployed	596,187	3.8%
Employment by industry:		
Retail	1,108,004	12.0%
Manufacturing	1,093,752	11.8%
Education, health & social services	1,779,801	19.3%
Arts, recreation, lodging & food services	673.016	7.3%

The commercial shark fishery is a small portion of the commercial fisheries of Texas (See Table 9.20). There are licensed shark dealers operating in 7 locations in coastal Texas, and 16 vessels holding commercial shark permits. Of these vessels, five have directed-take permits. Communities involved in the fishery include Bacliff, Franklin, Friendship, Galveston, Kemah, La Porte, Lumberton, Pearland, Pflugerville, Port Isabel, Santa Fe, and Seabrook. The greatest concentration of vessels is in Kemah, which is the homeport for three vessels. Because of the small size of the fishery, no community profiles were undertaken of Texas ports.

There are no MRFSS data available on the participation, catch and effort in marine recreational fisheries in Texas. The ASA estimated that saltwater angling generated some $622.2 million in retail sales in Texas in 2001 and that there were 13,322 jobs in Texas associated with the marine recreational fishing industry (ASA, 2002). There are 129 Texas charter/headboats which, in 2003, hold HMS permits. Most of these take shark as an incidental catch to other near-shore and offshore fish. Communities involved in the charter and head boat fishery include Port Aransas (38 boats), Freeport (17 boats), Galveston (14 boats), Houston (13 boats), and Port Isabel and Port O'Connor with 7 boats each. Other communities that are home ports for HMS-permitted charter/headboats include Alvin, Aransas Pass, Channelview, Corpus Christi, Dickinson, Friendswood, Helotes, Humble, Ingleside, Key Allegro, La Porte, Lake Jackson, Matagorda, Pasadena, Port Mansfield, Portland, Rockport, Sargent, South Padre Island, and Vidor.

Table 9.1 **2001: Commercial Landings, Dealers and Vessel Permits in the Shark Fishery, by State.** Source: NOAA Fisheries

State	Pounds Landed	$ Value Landed	Dealer N	I-Permit Vessel N	D-Permit Vessel N
Alabama	23,959	13,823	10	3	3
California				2	
Connecticut	*	*	1	1	
Delaware	*	*	1	3	
Florida - East	1,955,996	1,483,246	32	55	65
Florida - West	1,608,858	1,584,675	48	92	74
Georgia	*	*	2	3	2
Indiana				1	
Louisiana	1,164,157	692,989	17	42	6
Maine	8,357	10,640	3	4	3
Maryland	15,857	20,101	3	7	3
Massachusetts	21,290	29,348	14	14	6
Mississippi	119,784	29,937	3	9	1
New Hampshire	*	*	2	2	1
New Jersey	229,602	195,613	16	35	27
New York	28,774	50,481	23	12	7
North Carolina	1,139,070	520,153	53	19	19
Rhode Island	11,787	14,959	12	11	1
South Carolina	142,059	123,073	20	14	8
Texas	11,318	7,761	7	11	5
Virginia	394,590	201,938	7	5	4
Virgin Islands				2	
Total	**6,880,659**	**4,981,911**	N-S	**347**	**235**

* Data is confidential; there are less than 3 licensed shark dealers in the state
N-S = not specified; many dealers operate in two or more states
I-Permit = Incidental take permit; D-Permit = Directed fishery permit

Table 9.1a **Number of Charter/headboats with HMS Permits, by State, 2003.** Source: NOAA Fisheries Permit Files as of June 1, 2003.

State	No. of Charter & Headboats	State	No. of Charter & Headboats
Alabama	72	New York	319
Connecticut	61	North Carolina	387
Delaware	130	Ohio	1
Florida	497	Oklahoma	1
Georgia	27	Pennsylvania	42
Louisiana	88	Puerto Rico	16
Maine	42	Rhode Island	93
Maryland	155	South Carolina	139
Massachusetts	332	Tennessee	1
Michigan	3	Texas	129
Mississippi	27	Virginia	142
New Hampshire	42	US Virgin Islands	7
New Jersey	385	Not Known *	6
		TOTAL	3,144

*Vessels are shown by port of registry; these vessels gave the USCG registration center in Falling Waters, WV as their port of registry.

Table 9.2 **2001 Commercial Fishery Landings in Maine**. Source: NOAA Fisheries.

Species	Landings Pounds	Landings Value $	Percent Weight	Percent Value
All Species	239,868,000	251,441,000	100	100
Sharks*	8,357	10,640	<0.01	<0.01

* All sharks excluding dogfish
Percentages are rounded

Table 9.3 **2001 Commercial Fishery Landings in New Hampshire.** Source: NOAA Fisheries.

Species	Landings Pounds	Landings Value $	Percent Weight	Percent Value
All Species	18,584,000	17,865,000	100	100
Sharks*	**	**	<0.01	<0.01

* All shark landings excluding dogfish

** Landings data confidential per NOAA rule of <3 entities (e.g. dealers) engaged in the fishery.

Table 9.4 **2001 Commercial Fishery Landings in Massachusetts**. Source: NOAA Fisheries.

Species	Landings Pounds	Landings Value $	Percent Weight	Percent Value
All Species	187,861,000	288,263,000	100	100
Sharks*	21,290	29,348	0.01	0.01

* All sharks, excluding dogfish;
Percentages are rounded;

Table 9.5 **2001 Commercial Fishery Landings in Rhode Island.** Source: NOAA Fisheries.

Species	Landings Pounds	Landings Value $	Percent Weight	Percent Value
All Species	115,957,000	65,457,000	100	100
Sharks*	11,787	14,959	0.01	0.02

* All sharks, excluding dogfish.
Percentages are rounded.

Table 9.6 **2001 Commercial Fishery Landings in Connecticut.** Source: NOAA Fisheries.

Species	Landings Pounds	Landings Value $	Percent Weight	Percent Value
All Species	18,687,000	30,625,00	100	100
Sharks*	N-S	N-S	<0.001	<0.001

* All sharks, excluding dogfish.
Percentages are rounded.
N-S = Data is not specified per NOAA rule of data confidentiality when there are <3 respondents.

Table 9.7 **2001 Commercial Fishery Landings in New York.** Source: NOAA Fisheries.

Species	Landings Pounds	Landings Value $	Percent Weight	Percent Value
All Species	42,422,000	55,038,000	100	100
Sharks*	28,774	50,481	0.07	0.09

* All sharks, excluding dogfish.
Percentages are rounded.

Table 9.8 **2001 Commercial Fishery Landings in New Jersey.** Source: NOAA Fisheries.

Species	Landings Pounds	Landings Value $	Percent Weight	Percent Value
All Species	168,430,000	109,820,000	100	100
Sharks*	229,602	195,613	0.13	0.18

* All species of sharks, excluding dogfish.
Percentages are rounded.

Table 9.9 **2001 Commercial Fishery Landings in Maryland.** Source: NOAA Fisheries, 2002.

Species	Landings Pounds	Landings Value $	Percent Weight	Percent Value
All Species	55,536,000	55,586,000	100	100
Sharks*	15,857	20,101	0.03	0.04

* All sharks, excluding dogfish.

Table 9.10 **2001 Commercial Fishery Landings in Virginia.** Source: NOAA Fisheries, 2002.

Species	Landings Pounds	Landings Value $	Percent Weight	Percent Value
All Species	561,708,000	119,382,000	100	100
Sharks*	394,590	201,938	0.07	0.17

* All sharks, excluding dogfish.

Table 9.11 **2001 Commercial Fisheries Landings in North Carolina.** Source: NOAA Fisheries, 2002.

Species	Landings Pounds	Landings Value $	Percent Weight	Percent Value
All Species	139,277,000	90,202,000	100	100
Sharks*	1,139,070	520,153	0.82	0.58

* All species of sharks, excluding dogfish.
Percentages are rounded.

Table 9.12 **2001 Commercial Fisheries Landings in South Carolina.** Source: NOAA Fisheries, 2002.

Species	Landings Pounds	Landings Value $	Percent Weight	Percent Value
All Species	14,111,000	23,398,000	100	100
Sharks*	142,059	123,073	1.01	0.52

* All sharks, excluding dogfish.
Percentages are rounded.

Table 9.13 **2001 Commercial Fishery Landings in Georgia.** Source: NOAA Fisheries, 2002.

Species	Landings Pounds	Landings Value $	Percent Weight	Percent Value
All Species	9,036,000	14,752,000	100	100
Sharks*	N-S	N-S	<0.03	<0.01

* All sharks, excluding dogfish.
Percentages are rounded.
N-S Not specified to protect business data confidentiality, per NOAA Fisheries rule

Table 9.14 **2001 Commercial Fishery Landings in Florida.** Source: NOAA Fisheries, 2002.

Species	Landings Pounds	Landings Value $	Percent Weight	Percent Value
All Species	115,235,000	191,946,000	100	100
Sharks*	3,564,854	3,067,921	3.1	1.6

* All sharks, excluding dogfish.
Percentages are rounded

Table 9.15 **2001 Commercial Fishery Landings in East Coast, Florida, Ports.** Source: NOAA Fisheries, 2002.

Species	Landings Pounds	Landings Value $	Percent Weight	Percent Value
All Species	37,130,000	48,136,000	100	100
Sharks*	1,955,996	1,483,246	5.3	3.1

* All sharks, excluding dogfish.
Percentages are rounded.

Table 9.16 **2001 Commercial Fishery Landings in West Coast, Florida, Ports.** Source: NOAA Fisheries, 2002.

Species	Landings Pounds	Landings Value $	Percent Weight	Percent Value
All Species	78,105,000	143,810,000	100	100
Sharks*	1,608,858	1,584,675	2.7	1.1

* All sharks, excluding dogfish.
Percentages are rounded.

Table 9.17 **2001 Commercial Fishery Landings in Alabama.** Source: NOAA Fisheries, 2002.

Species	Landings Pounds	Landings Value $	Percent Weight	Percent Value
All Species	24,740,000	43,170,000	100	100
Sharks*	23,959	13,823	0.1	0.03

* All sharks, excluding dogfish.
Percentages are rounded

Table 9.18 **2001 Commercial Fishery Landings in Mississippi.** Source: NOAA Fisheries, 2002.

Species	Landings Pounds	Landings Value $	Percent Weight	Percent Value
All Species	213,889,000	50,561,000	100	100
Sharks*	119,784	29,937	0.06	0.06

* All sharks, excluding dogfish.
Percentages are rounded

Table 9.19 **2001 Commercial Fishery Landings in Louisiana.** Source: NOAA Fisheries, 2002.

Species	Landings Pounds	Landings Value $	Percent Weight	Percent Value
All Species	1,191,460,000	342,748,000	100	100
Sharks*	1,164,157	692,989	0.1	0.2

*** All sharks, excluding dogfish.**
Percentages are rounded

Table 9.20 **2001 Commercial Fishery Landings in Texas.** Source: NOAA Fisheries, 2002.

Species	Landings Pounds	Landings Value $	Percent Weight	Percent Value
All Species	97,370,000	218,030,000	100	100
Sharks*	11,318	7,761	0.01	0.004

* All sharks, excluding dogfish.
Percentages are rounded.

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10.0 ESSENTIAL FISH HABITAT

10.1 INTRODUCTION

The Magnuson-Stevens Act requires NOAA Fisheries to describe and identify essential fish habitat for each life stage in the fishery management unit, the physical, biological, and chemical characteristics of EFH, and, if known, how these characteristics influence the use of EFH by the species/life stage. FMPs and FMP amendments must also include maps of the geographic locations of EFH or the geographic boundaries within which EFH for each species and life stage is found (Magnuson-Stevens Act, 16 U.S.C. 1801 *et seq*.). Under National Standard 2, conservation and management measures, including the identification and description of EFH, shall be based on the best scientific information available. As described in Section 3.3, and in greater detail below, a review of available literature and information was undertaken to assess habitat use and ecological roles of some species in the HMS fishery management unit. Published and unpublished scientific reports, fishery independent and fishery dependent data, and expert and anecdotal information detailing the habitats used by the managed species were evaluated and synthesized for inclusion in this FMP Amendment (See Section 10.3). Descriptions of EFH, including geographic location, physical, biological and chemical characteristics, and maps showing the extent of EFH for each species and life stage are provided.

A thorough review and identification of EFH for HMS was completed in the 1999 Fishery Management Plan (FMP) for Atlantic Tunas, Swordfish and Sharks. The current FMP Amendment addresses only those species for which there has been a change in management status (blacktip, sandbar, and finetooth sharks), or for which new information has become available (dusky and nurse sharks). The complete five-year review required by the EFH regulations for all other HMS, including other shark species, will be undertaken in 2004.

The Magnuson-Stevens Act also requires that FMPs or FMP amendments minimize to the extent practicable adverse effects on EFH and identify other actions to encourage the conservation and enhancement of EFH (MSA § 303(a)(7)). FMPs or FMP amendments must contain an evaluation of the potential adverse effects of fishing on EFH designated under the FMP, including effects of each fishing activity regulated under the FMP or other Federal FMPs. This evaluation should consider the effects of each fishing activity on each type of habitat found within EFH. FMPs must describe each fishing activity and review and discuss all available relevant information (such as information regarding the intensity, extent, and frequency of any adverse effect on EFH; the type of habitat within EFH that may be affected adversely; and the habitat functions that may be disturbed)(§ 600.815(a)(2)).

Habitat protection is vital to all species and life stages of sharks. EFH for sharks may encompass a wide range of habitats including coastal and estuarine pupping and nursery areas to deep offshore pelagic waters where some species, such as the longfin mako shark, spend their entire lives. Due to their proximity to land, shallow water and poor circulation, coastal and estuarine areas may be most susceptible to environmental and human impacts. Many commercial and

recreational fisheries are also located close to shore, potentially increasing impacts on shark EFH. Offshore areas are not immune to impacts however, as pollutants generated onshore may be transported offshore via river plumes, currents and other hydrographic features. Offshore areas may also by subject to impacts from deep sea fishing vessels. The following sections provide information on the current status of EFH for several shark species, as well as a review of potential impacts from both fishing and non-fishing related activities.

10.2 EFH IDENTIFICATION PROCESS

10.2.1 Process Used for Identification of EFH for Atlantic Sharks

EFH for all HMS species, including sharks, was originally identified in the 1999 HMS FMP. Per Section 600.815 (a)(10) of the EFH regulations, this FMP Amendment updates information on several shark species based on a change in the management status of the species, or on new information that has become available since the 1999 HMS FMP. The 1999 HMS FMP highlighted the importance of coastal nursery and pupping areas in maintaining viable shark populations. As a result, several studies and cooperative research projects aimed at improving NOAA Fisheries' understanding of EFH and shark reproductive habitat requirements have been undertaken since the 1999 HMS FMP.

For example, in 1995, pilot studies of shark nursery areas in Delaware Bay were initiated by the NOAA Fisheries Apex Predator Program (APP). In 1998, the studies were expanded to other coastal states as the Cooperative Atlantic Shark Pupping and Nursery (COASTSPAN) Survey (McCandless and Pratt, 2002) to further identify and delineate shark nursery habitat on the U.S. Atlantic coast. Surveys are conducted by cooperating fisheries agencies and institutions in coastal areas from New Jersey to Georgia. Florida also contributes data, both historical and current. Researchers from the NOAA Fisheries APP and the University of Rhode Island conduct the COASTSPAN survey in Delaware Bay. Results of this research are included in the current update of EFH for several shark species.

Another study initiated since the 1999 HMS FMP was a synthesis document of information on shark nursery grounds along the U.S. Atlantic east coast and the Gulf of Mexico. Researchers from universities and state and Federal agencies in twelve different states from Massachusetts to Texas contributed information to the report (McCandless *et al*., 2002). This information was included in the current review of EFH.

Finally, the Nurse Shark Mating and Nursery Grounds Project, conducted cooperatively by the NOAA Fisheries APP and Albion College (Albion, Michigan) has recently been included in the COASTSPAN program. Since 1991, the researchers have undertaken studies on nurse shark (*Ginglymostoma cirratum*) behavioral ecology in the Dry Tortugas National Park, Florida, focusing on habitat utilization for mating and as nursery grounds.

EFH information from most of these studies is based on distribution information (level 1) derived from systematic presence/absence sampling and relative abundance (CPUE) data. Density information (i.e. number of sharks/m^3) is generally not available due to the type of gear used to collect sharks. For example, the data from the research contributed by the McCandless *et al.* (2002) report were gathered using a wide variety of sampling techniques including gillnet, longline, and trawl surveys. Of the 15 separate research studies conducted from New York to Texas that contributed to the McCandless *et al.* report, only one provided trawl data that might have been used to generate habitat related densities. Additional equipment would have been needed however to collect information on water volume sampled. The other sampling techniques (gillnet and longline) provide presence/absence or relative abundance through CPUE data (e.g. number of sharks/gillnet hour, or number of sharks/100 hooks), but not density data. Additionally, due to the differences in fishing effort, a cross comparison of CPUE among the different studies was not possible.

Despite the lack of density information, other valuable information was derived from these studies, including data on growth rates from recaptured tags and habitat utilization information through sampling, telemetry, and tagging efforts (level 3 data). By determining the life stage of a shark at capture, through size measurement or external features such as umbilical scars on neonates, or parturition signs on mature females, additional information may be derived about habitat utilization. Information on where and when young sharks were pupped, how long they may have been in the area, when they began migrating to deeper water, and whether they returned in subsequent years to the same area may be determined. In combination, all of these data help to determine habitat value and provide a more complete overview of habitat utilization than simple distribution data might suggest.

To the extent possible, these and other types of information from studies of life history dynamics of sharks, reports, and expert opinion were utilized to identify EFH. The sources that were used to identify EFH areas are referenced in the text and in the life history tables in Section 10.4. When environmental information was available, it was included in the EFH descriptions and tables. The information included temperature, dissolved oxygen, salinity ranges, depths, seasons, and geographic locations. The textual accounts for each species serve as the legal description of EFH, and where environmental characterizations are known they have been included. Maps are provided as supplemental material to facilitate visualization of the EFH locations. Based on analyses of the available data, polygons marking the boundaries of EFH for each life stage have been drawn on the maps.

10.2.2 Methodology for Identification of EFH for Atlantic Sharks

The overall approach to be used in analyzing data and identifying EFH is described in the EFH regulations (§ 600.815(a)(1)). The regulations recommend using an organizational approach of categorizing the data according to different levels. The regulations require that, at a minimum, distributional data (level 1 information) be used in the identification of EFH. This level 1 information is based on presence/absence data of the species or life stages in specific habitats

used. Where possible, data sets and information on habitat related densities of species (level 2), growth, reproduction and survival within habitats (level 3) and production rates by habitat (level 4) should be used to identify EFH. The preferred alternatives for EFH in this FMP Amendment (See Section 4.7) propose using existing EFH, and, as appropriate, identifying EFH for each species and life stage as those habitats necessary for spawning, breeding, feeding, or growth to maturity. Additionally, existing EFH is used, and, as appropriate, increased or decreased for species with special needs (e.g., overfished). In the following sections, existing EFH from the 1999 HMS FMP is described, and modifications are included in text and in maps for easy comparison.

Identifying EFH based on species distributional information, such as presence/absence and catch data, is subject to certain limitations. The potential exists to identify habitat that may not be essential, or conversely, to exclude important habitat. In situations where questions of delineating EFH arose, a precautionary approach was used, meaning that an attempt was made to include rather than exclude potential habitats to ensure adequate EFH areas were identified. Several data sets were used in order to provide the broadest possible overview of the habitats utilized by sharks. The data sets are described in greater detail below. Both fisheries dependent and fisheries independent data sets were analyzed.

Description of Data Sets Used to Identify EFH

The Cooperative Shark Tagging Program (CSTP), a research program managed by the Northeast Fisheries Science Center (NEFSC), APP, provided one of the most comprehensive, long-term data sets available on sharks. The data set has a continuous time series of observations dating back to 1962. Between 1962 and 2001, more than 171,000 sharks of 52 species have been tagged and more than 10,000 sharks of 33 species have been recaptured. Information is collected by distributing tags to scientists and commercial and recreational fishermen who record information on the date, location, gear, size and sex of the tagged shark prior to releasing it. In the event that a tagged shark is recaptured, information about migration, species distribution, age and growth, and mortality may be determined.

The Commercial Shark Fishery Observer Program (CSFOP), administered by the Florida Museum of Natural History, University of Florida, has been collecting information on the directed shark bottom longline fishery since 1994. A voluntary program for many years, it became mandatory in 2002. Trained observers collect fishery-dependent information on the location of each longline set, species composition, number of each species caught, and information on individual sharks such as length and sex. The coverage for this data set extends from the Atlantic east coast into the Gulf of Mexico. Data from this program are essential to monitoring the fishery and providing distributional information for many different sharks species.

The COASTSPAN program, also administered by the NEFSC, APP, has been collecting information on shark nursery areas for several Atlantic east coast states since 1998. The purpose of these surveys is to assess the geographical and seasonal extent of shark nursery habitat,

determine which shark species use these areas and gauge the relative importance of these coastal habitats. The information is collected by NOAA scientists and state and university researchers who monitor shark populations in Delaware, North Carolina, South Carolina, and Georgia. Historical and current data has also been contributed by Florida.

In 2002, a synthesis document of shark nursery research conducted along the U.S. Atlantic and Gulf of Mexico coasts was completed, resulting in additional information on shark EFH. The data collected by the various researchers were synthesized into a single standardized data set to provide a comprehensive view of shark nursery and pupping areas in state waters. The information included in this data set was derived through a variety of collecting methods including longline, gillnet and trawl surveys, and standardized to include information on location, species, length, and data source.

The Southeast Fishery Longline Shark Survey, administered by NOAA Fisheries, Southeast Fisheries Science Center (SEFSC), Pascagoula Laboratory, has been conducting biological surveys to assess the relative abundance and distribution of coastal sharks since 1995. Biological data is collected from all captures and associated environmental data is recorded from each longline location. Most of the sharks captured are tagged and released. The longline surveys provide a useful fisheries independent data base for sharks.

The Pelagic Longline Observer Program, administered by SEFSC in Miami, has been monitoring the commercial pelagic longline fishery since 1992. The program places trained observers aboard commercial fishing boats in the swordfish directed fishery. Although not targeted, sharks are frequently caught as bycatch in the longline fishery. The observers collect information on location, number of fish caught per set, species identification, sex, length, and weight.

Other data sets included in the analysis were the Southern Atlantic SEAMAP Shallow Water Trawl Survey administered by the South Carolina Department of Natural Resources, the Virginia Institute of Marine Sciences Longline Survey, and the Mote Marine Laboratory, Center for Shark Research.

After careful screening to ensure standardization and quality of the data, all of the data sets were combined into a single database for analysis in a Geographic Information System (GIS) program. By combining all of the data sets, the number of observations for an individual life stage for a single species ranged from several hundred to over 18,000. Each observation included the species name, life stage, total length in cm, location in latitude and longitude coordinates, date of collection, and data source.

To visually represent species' distributions, data from all data sets were combined and analyzed by species and life stage in a GIS program. To identify areas with the highest concentration of observations, individual observations were assigned to 10 minute squares (See Figure 10.1). Each square represents 100 square nautical miles. Depending on the species, the number of observations per square ranged from zero to several hundred. The squares were color-coded

according to the number of observations per square, with highest concentrations in black and lowest concentrations in white, and a color scale was generated to reflect the frequency of occurrence. This allows the reader to quickly identify areas of highest concentration, which may have been difficult to do by simply plotting observations. Depending on the number of observations in the data set, and the status of the species, a higher or lower number of observations per 10 minute grid was used as a guide for identifying potential EFH areas. For example, for blacktip sharks, a rebuilt species with a large number of observations, a guide of >10 observations per 10 minute square was used to select areas of highest concentrations. For finetooth shark, a species for which there is not as much data and which is currently experiencing overfishing, a more precautionary level of > 1 observation per 10 minute square was used as a guide to help identify potential EFH areas. The number of observations per grid were used as a guide only. In certain instances there may have been outliers that were not included in the EFH area even though they fell within the range being considered. The number of observations per grid that was used as a guide, and the percentage of observed distribution points included in EFH under alternative L4 as a result are provided in Table 10.1.

The average percentage of observed distribution points included in EFH areas was 77 percent (See Table 10.1), and ranged from a high of 97 percent for neonate finetooth and blacktip sharks to a low of 47 percent for adult nurse sharks. The percentages were not used a priori as a guide to include or exclude areas from EFH, but rather were calculated after the EFH boundaries were established and are provided for illustrative purposes only. The percentages indicate that the earliest life stages tend to aggregate more than adults and hence have higher percentages of observed distributions included in EFH. For finetooth sharks, for example, 97 percent of the neonate observed distribution points are included in EFH, whereas the percentages for juveniles and adults are 88 and 74 percent respectively. Although accurate estimates of area could not be calculated, a qualitative examination of the EFH maps (Figures 10.6b,c,d) shows that the EFH area for neonates is considerably smaller than that of juveniles and adults.

Since this Amendment is meant to provide an update to the EFH areas identified in the 1999 HMS FMP, those areas (shapefiles) used to map EFH in the 1999 HMS FMP were used as the starting point, and adjustments were made to those shapefiles based on new or updated information. In areas where there was a readily identifiable geographic or bathymetric feature that coincided with or overlapped areas of aggregations, the feature was used to delineate the boundary, or a portion of the boundary, for the identified EFH. Where expert opinion was available and data points were scarce, areas were identified as EFH based on our best interpretation of life history accounts. EFH boundaries were digitized and processed into maps to supplement the text descriptions and tabular information provided in this FMP Amendment. Only those habitats that occur within the boundaries as they are interpreted through the combined text, maps and tables are considered EFH. If there are differences between the descriptions of EFH in text, maps, and tables, the textual description is ultimately determinative of the limits of EFH (See Section 600.815(a)(1)(IV)(B)).

EFH regulations require identification of EFH for each life stage of the managed species. Accordingly, EFH has been identified for each life stage of sharks. The size ranges of the life stages in the current Amendment as well as size ranges in the 1999 HMS FMP are presented in Table 10.2. The table reflects new information and updates to the 1999 HMS FMP size ranges. Summary tables of life history and habitat associations are included in Section 10.4 and reflect updated information regarding newly identified or existing EFH for several shark species. In the 1999 HMS FMP, the smallest size class was identified as "neonates and early juveniles." This definition has been modified to include primarily neonates and only small young-of-the-year sharks in order to better define and identify nursery areas. The total length cutoff for this size class is determined as the maximum embryo size in term females plus 10 percent of the maximum embryo size. This criteria was used because it helps to eliminate some of the small one-year-old sharks that fall within the young-of the-year size range, making it easier to identify primary nursery areas (where pupping occurs and young-of-the-year are present). This criteria can also be more easily applied to other species given the lack of published data on growth rates for many species, especially during the first year. This modification should also better represent the habitat shift between primary nursery areas and secondary nursery areas (occupied by age 1+ sharks); although many species do overlap habitat use between these two size classes.

The middle size class designated in the 1999 HMS FMP, "late juveniles and subadults," has been renamed as simply "juveniles". This size class includes all immature sharks from young juveniles to older or late juveniles. Some overlap between the "neonate and early juveniles" and the "adult" EFH areas may occur, depending on the species, due to the return to primary nursery areas by many juveniles, age 1+, and the developing conformity to adult migration patterns by late juveniles.

As in the 1999 HMS FMP, the largest size class, "adults," still consists of mature sharks based on the size at first maturity for females of the species. Changes to the size range of the adult size class for some species have been made based on new information on the size at first maturity for females of those particular species.

10.3 Life History Accounts and Essential Fish Habitat Descriptions

10.3.1 Large Coastal Sharks

10.3.1.1 Requiem Sharks

The requiem sharks comprise one of the largest shark families (*Carcharhinidae*), and are among the most economically valuable of all sharks. They are small to large sharks characterized by a flattened snout, with the fifth gill slit over or behind the origin of the pectoral fin, the first dorsal fin originating well ahead of the pelvic fins, and a caudal fin with an upper lobe that is nearly twice as long as the lower lobe. They include the blacktip, sandbar, tiger, bull, dusky and spinner sharks (Castro, 1993).

10.3.1.1.1 <u>Blacktip shark (*Carcharhinus limbatus*)</u> The blacktip shark is circumtropical in shallow coastal waters and offshore surface waters of the continental shelves. In the southeastern United States it ranges from Virginia to Florida and the Gulf of Mexico. Garrick (1982), on examining a large number of museum specimens, believed it to be a single worldwide species. Dudley and Cliff (1993), working off South Africa, and Castro (1996), working on blacktip sharks off the southeastern United States, showed that there were significant differences among the various populations. For example, the median size for blacktip sharks in the Atlantic is 126.6 cm fork length, whereas the median size in the Gulf region is 117.3 cm fork length. The blacktip shark is a fast moving shark that is often seen at the surface, frequently leaping and spinning out of the water. It often forms large schools that migrate seasonally north-south along the coast. This species is much sought after in the eastern United States because of the quality of its flesh. The blacktip and the sandbar shark are the two primary species in the U.S. commercial fisheries. In the markets of the United States "blacktip" has become synonymous with good quality shark; therefore, many other species are also sold under that name. Habitat associations are summarized in Table 10.3.

Reproductive potential: Off the southeastern United States males mature at between 142 and 145 cm total length and females at about 156 cm total length (Castro 1996). According to Branstetter and McEachran (1986), in the western north Atlantic, males mature at 139 to 145 cm total length at four to five years, and females at 153 cm total length at six to seven years. A similar pattern is evident in the Atlantic and Gulf of Mexico with larger size at maturity in the Atlantic than in the Gulf region. However, these ages are unvalidated and based on a small sample. Branstetter and McEachran (1986) estimated the maximum age at 10 years, and gave the von Bertalanffy parameters for combined sexes as: $L_\infty = 171$, $K = 0.284$, $t_o = -1.5$.

The young are born at 55 to 60 cm total length in late May and early June in shallow coastal nurseries from Georgia to the Carolinas (Castro, 1996), and in Bay systems in the Gulf of Mexico (Carlson, 2002; Parsons, 2002) and the Texas coast (Jones and Grace, 2002) Litters range from one to eight pups (Bigelow and Schroeder, 1948) with a mean of four. The gestation cycle lasts about a year; the reproductive cycle is biennial (Castro, 1996).

According to Castro (1993b), the nurseries are on the seaward side of coastal islands of the Carolinas, at depths of two to four meters. Carlson (2002) found neonates in depths of 2.1 to 6.0 m under a variety of habitat conditions. Castro (1993b) found neonates over muddy bottoms off Georgia and the Carolinas, while Hueter found them over seagrass beds off west Florida (unpublished Mote Laboratory CSR data). Neonates and juveniles were found off west Florida (from the Florida Keys to Tampa Bay) at temperatures of 18.5° to 33.6° C, salinities of 15.8 to 37.0 ppt, and DO of 3.5 to 9.0 mg/l. The neonates were found from April to September, while juveniles were found there nearly year-round.

Impact of fisheries: The blacktip shark is caught in many diverse fisheries throughout the world. Off the southeastern United States, it is caught in commercial longlines set in shallow coastal waters, but it is also pursued as a gamefish. There are localized gillnet fisheries in Federal waters

off Florida that target blacktips during their migrations, when the schools are close to shore in clear waters. Aircraft are often used to direct net boats to the migrating schools, often resulting in the trapping of large schools. The species is pursued commercially throughout its range and is targeted because it is often found in shallow coastal waters. Its habit of migrating in large schools along shorelines makes it extremely vulnerable to organized drift gillnet fisheries.

***Essential Fish Habitat for Blacktip Shark (Figures 10.2 a-d)*:**

Neonate (≤ 69 cm total length) : The 1999 HMS FMP identified EFH for neonates/early juveniles (≤ 99 cm) as shallow coastal waters to the 25 m isobath, from Bull's Bay, SC at 33.5˚ N, south to Cape Canaveral, FL at 28.5˚ N; also, on the west coast of Florida from Thousand Islands at 26˚ N to Cedar Key, FL at 29˚ N, especially Tampa Bay and Charlotte Harbor, FL. Additionally, shallow coastal waters with muddy bottoms less than five meters deep on the seaward side of coastal islands from Apalachee Bay to St. Andrews Bay, FL.

The current Amendment retains the EFH areas identified above with the following modifications. The length of neonates is defined as ≤ 69 cm. EFH includes shallow coastal waters south of the Thousand Islands, FL at 26˚ N south to Key West, FL at 24.5˚ N; also the northeastern Gulf of Mexico (Apalachee Bay, Apalachicola Bay, St. Joseph Bay, Crooked Island Sound and St Andrew Bay) at 85˚ W to the mouth of St. Louis Bay and the Terrebonne Timbalier Bay System, LA at 91.2˚ W; also, all major bay systems along the Gulf coast of Texas from Sabine Lake to Lower Laguna Madre.

Juvenile (69 to 155 cm total length): The 1999 HMS FMP identified EFH for late juveniles/subadults (90 to 155 cm) as shallow coastal waters from the shoreline to the 25 m isobath: from Cape Hatteras, NC at 35.25˚ N to 29˚ N at Ponce de Leon Inlet; the west coast of Florida, including the Florida Keys and Florida Bay, north to Cedar Key at 29˚ N; from Cape San Blas, FL north of 29.5˚ N to the east coast of the Mississippi River delta north of 29˚ N; also, the west coast of Texas from Galveston, west of 94.5˚ N, to the U.S./Mexico border.

The current Amendment retains the EFH areas identified above with the following modifications. The length of juveniles is defined as 69-155 cm. EFH includes areas from the northeastern Gulf of Mexico (Apalachee Bay, Apalachicola Bay, St. Joseph Bay, Crooked Island Sound and St Andrew Bay) to the mouth of St. Louis Bay and the Terrebonne Timbalier Bay System, LA; also, all major bay systems along the Gulf coast of Texas from Sabine Lake to Lower Laguna Madre.

Adult (≥ 155 cm total length): The 1999 HMS FMP identified EFH for adults (≥156 cm) as shallow coastal waters of the Outer Banks, NC from the shoreline to the 200 m isobath between 36˚ N and 34.5˚ N; shallow coastal waters offshore to the 50 m isobath from St. Augustine, FL (30˚ N) to offshore Cape Canaveral, FL (28.5˚ N); on the west coast of Florida, shallow coastal waters to the 50 m isobath from 81˚ W in Florida Bay, to 85˚ W, east of Cape San Blas, FL.

The current Amendment retains the EFH areas identified above with the following modifications. The length of adults is defined as ≥155 cm. EFH includes areas north of St. Augustine, FL at 30° N to Cumberland Island, GA at 30.9°N, but excludes areas south from Apalachicola Bay to Tarpon Springs at 28.2°N.

10.3.1.1.2 <u>Dusky shark (*Carcharhinus obscurus*)</u>. The dusky shark is common in warm and temperate continental waters throughout the world. It is a migratory species which moves north-south with the seasons. This is one of the larger species found from inshore waters to the outer reaches of continental shelves. It used to be important as a commercial species and a game fish, but is currently prohibited. Habitat associations are summarized in Table 10.4.

Reproductive potential: Males mature at 290 cm total length and reach at least 340 cm total length. The females mature at about 300 cm total length and reach up to 365 cm total length. The dusky shark matures at about 17 years and is considered a slow growing species (Natanson, 1990). Litters consist of six to14 pups, which measure 85 to 90 cm total length at birth (Castro, 1983). The gestation period is believed to be about 16 months (Clark and von Schmidt, 1965), but this has not been confirmed. Natanson (1990) gave the following parameters for males L_{max}= 351 cm FL (420 cm total length), K= .047, t_o = –5.83; and females at L_{max}= 316 cm total length (378 cm total length) K= .061, t_o=-4.83. The growth rate is believed to be about 10 cm/yr for the young and five cm/yr for the adults.

The nursery areas are in coastal waters. Castro (1993c) reported that dusky sharks gave birth in Bulls Bay, SC, in April and May. Musick and Colvocoresses (1986) stated that the species gives birth in the Chesapeake Bay, MD in June and July, however Grubbs and Musick (2002) note that they use nearshore waters in VA as nursery areas but rarely enter estuaries.

Impact of fisheries: The dusky shark has played an important role in the coastal shark fisheries for flesh and fins, and is taken as bycatch in the swordfish and tuna fisheries. The dusky shark is one of the slowest growing requiem sharks and is often caught on both bottom and pelagic longlines, making it highly vulnerable to overfishing. Dusky sharks are currently prohibited and are a candidate for listing under the ESA.

***Essential Fish Habitat for Dusky Shark (Figures 10.3 a-d)*:**

Neonate (≤ 110 cm total length): The 1999 HMS FMP identified EFH for neonates/early juveniles (≤ 115 cm total length) as shallow coastal waters, inlets and estuaries to the 25 m isobath from the eastern end of Long Island, NY at 72° W south to Cape Lookout, NC at 34.5° N; from Cape Lookout south to West Palm Beach, FL (27.5° N), shallow coastal waters, inlets and estuaries and offshore areas to the 90 m isobath.

The current Amendment retains the EFH areas identified above with the following modifications. The length of neonates is defined as ≤110 cm. EFH includes areas out to the 200 m isobath off

the states of Maryland south to North Carolina, and out to the 70 m isobath off New Jersey north to Long Island, NY.

Juvenile (110 to 299 cm total length): The 1999 HMS FMP identified EFH for late juveniles/subadults (116 to 300 cm) as areas off the coast of southern New England from 70° W west and south, coastal and pelagic waters between the 25 and 200 m isobaths; shallow coastal waters, inlets and estuaries to the 200 m isobath from Assateague Island at the Virginia/Maryland border (38° N) to Jacksonville, FL at 30° N; shallow coastal waters, inlets and estuaries to the 500 m isobath continuing south to the Dry Tortugas, FL at 83° W.

The current Amendment retains the EFH areas identified above with the following modifications. The length of juveniles is defined as 110-299 cm total length.

Adult (≥ 299 cm total length): The 1999 HMS FMP identified EFH for adults (≥301 cm) as pelagic waters offshore the Virginia/North Carolina border at 36.5° N south to Ft. Lauderdale, FL at 28° N between the 25 and 200 m isobaths.

The current Amendment retains the EFH areas identified above with the following modifications. The length of adults is defined as ≥299 cm. EFH includes coastal waters offshore from the Virginia/North Carolina border at 36.5° N south to Cape Romain, NC out to the 25 m isobath; also, coastal waters offshore from the Georgia/Florida border at 30.8° N to Cape Canaveral at 28.5° N.

10.3.1.1.3 <u>Sandbar shark (*Carcharhinus plumbeus*)</u>. The sandbar shark is cosmopolitan in subtropical and warm temperate waters. It is a common species found in many coastal habitats. It is a bottom-dwelling species most common in 20 to 55 m of water, but occasionally found at depths of about 200 m. Habitat associations are summarized in Table 10.5.

Reproductive potential: The sandbar shark is a slow growing species. Both sexes reach maturity at about 147 cm total length or approximately 5 feet (Merson, 1998). Estimates of age at maturity range from 15 to 16 years (Sminkey and Musick, 1995) to 29 to 30 years (Casey and Natanson, 1992), although 15 to 16 years is the commonly accepted age of maturity. The von Bertalanffy growth parameters were proposed for combined sexes are L_∞= 186 cm FL (224 cm total length; 168 cm PCL), K= 0.046, t_o= -6.45 by Casey and Natanson (1992); and re-evaluated by Sminkey and Musick (1995) as L_∞= 164 cm PCL (219 cm total length; 182 cm Fl), K= 0.089, t_o= -3.8.

Young are born at about 60 cm total length (smaller in the northern parts of the North American range) from March to July. Litters consist of one to14 pups, with nine being the average (Springer, 1960). The gestation period lasts about a year and reproduction is biennial (Musick *et al,.* 1993). Hoff (1990) used an age at maturity of 15 years, a life span of 35 years, and a two-year reproductive cycle, to calculate that each female may reproduce only 10 times. New

maturity estimates and the increased mortality in the fishery may reduce that reproductive potential much further.

In the United States the sandbar shark has its nurseries in shallow coastal waters from Cape Canaveral, FL (Springer, 1960), to Great Bay, NJ (Merson and Pratt, 2002). Delaware Bay, DE (McCandless *et al.*, 2002), Chesapeake Bay, MD (Grubbs and Musick, 2002), and the waters off Cape Hatteras, NC (Jensen *et al.*, 2002) are important primary and secondary nurseries. Juveniles return to Delaware Bay after a winter absence around May 15, and are found as far north as Martha's Vineyard, MA in the summer. Neonates have been captured in Delaware Bay in late June. Young of the year were present in Delaware Bay until early October when the temperature fell below 21˚ C. Another nursery may exist along the west coast of Florida and along the northeast Gulf of Mexico. Hueter and Tyminski (2002) found neonates off Yankeetown, FL, from April to July, in temperatures of 25.0˚ to 29.0˚ C, and salinities of 20.4 to 25.9 ppt. Neonate sandbar sharks were found in an area between Indian Pass and St. Andrew Sound, FL in June when the temperature had reached 25˚ C (Carlson, 2002).

Impact of fisheries: The sandbar shark is one of the most important commercial species in the shark fishery of the southeastern United States, along with blacktip sharks. It is a preferred species because of the high quality of its flesh and large fins. Commercial longline fishermen pursue sandbar stocks in their north-south migrations along the coast; their catches can be as much as 80 to 90 percent sandbar sharks in some areas. Musick *et al.* (1993) have documented a severe decline in CPUE of the sandbar shark in the Chesapeake Bay area. It is considered highly vulnerable to overfishing because of its slow maturation and heavy fishing pressure, as evidenced in the catch per unit effort (CPUE) declines in U.S. fisheries.

***Essential Fish Habitat (EFH) for Sandbar Shark (Figures 10.4 a-d)*:**

Neonate (≤ 71 cm total length): The 1999 HMS FMP identified EFH for neonates/early juveniles (≤ 90 cm total length) as shallow coastal areas to the 25 m isobath from Montauk, NY at 72˚ W, south to Cape Canaveral, FL at 80.5˚ W (all year); nursery areas in shallow coastal waters from Great Bay, NJ to Cape Canaveral, FL, especially Delaware and Chesapeake Bays (seasonal-summer); also shallow coastal waters to up to a depth of 50 m on the west coast of Florida and the Florida Keys from Key Largo at 80.5˚ W north to south of Cape San Blas, FL at 85.25˚ W. Typical parameters: salinity-greater than 22 ppt; temperatures-greater than 21˚ C.

The current Amendment retains the EFH areas identified above with the following modifications. The length of neonates is defined as ≤ 71 cm. EFH identified on the west coast of Florida is reduced from the 50 m isobath to the 30 m isobath and the seaward extent of EFH is reduced to approximately 20 miles offshore from the Virginia/Maryland border at 37.8˚ N south to Pamlico Sound, NC at 35.4˚ N.

Juvenile (71 to 147 cm total length): The 1999 HMS FMP identified EFH for late juveniles/subadults (≤ 90 cm total length) as areas offshore southern New England and Long

Island, NY, all waters, coastal and pelagic, north of 40° N and west of 70° W; also, south of 40° N at Barnegat Inlet, NJ, to Cape Canaveral, FL (27.5° N), shallow coastal areas to the 25 m isobath; also, in the winter, from 39° N to 36° N, in the Mid-Atlantic Bight, at the shelf break, benthic areas between the 90 and 200 m isobaths; also, on the west coast of Florida, from shallow coastal waters to the 50 m isobath, from Florida Bay and the Keys at Key Largo north to Cape San Blas, FL at 85.5° W.

The current Amendment retains the EFH areas identified above with the following modifications. The length of juveniles is defined as 71-147 cm. EFH includes Cape Poge Bay, MA around Chappaquiddick Island, MA, and off the south shore of Cape Cod, MA, but excludes an area running from 39.2° N off the coast of New Jersey south to 35.2° N off Cape Hatteras, NC. This is a long, finger-like projection roughly following the 200 m isobath.

Adult (≥ 147 cm total length): The 1999 HMS FMP identified EFH for adults (≥180 cm total length) as areas on the east coast of the U.S., shallow coastal areas from the coast to the 50 m isobath from Nantucket, MA, south to Miami, FL; also, shallow coastal areas from the coast to the 90 m isobath around peninsular Florida to the Florida panhandle at 85.5° W, near Cape San Blas, FL including the Keys and saline portions of Florida Bay.

The current Amendment retains the EFH areas identified above with the following modifications. The length of adults is defined as ≥147 cm. EFH excludes an area running from 39.2° N off the coast of New Jersey south to 35.2° N off of Cape Hatteras, NC. This is a long, finger-like projection roughly following the 200 m isobath.

Habitat Areas of Particular Concern (HAPC): Important nursery and pupping grounds have been identified in shallow areas and at the mouth of Great Bay, NJ, in lower and middle Delaware Bay, DE, lower Chesapeake Bay, MD, and near the Outer Banks, NC, and in areas of Pamlico Sound and adjacent to Hatteras and Ocracoke Islands, NC, and offshore of those islands. The current Amendment does not propose any changes to sandbar shark HAPC (See Figure 10.4e).

10.3.1.2 Nurse Sharks - Family Ginglymostomatidae

The family Ginglymostomatidae is comprised of nurse sharks and carpet sharks. They are sluggish, bottom-dwelling sharks of shallow tropical waters. They are characterized by the presence of fleshy nasal barbels or feelers just anterior to the mouth and a deep groove connecting the nostril with the mouth. Other characteristics include short snouts with rectangular mouths and small eyes (Castro, 1993).

10.3.1.2.1 <u>Nurse shark (*Ginglymostoma cirratum*)</u>. The nurse shark inhabits littoral waters in both sides of the tropical and subtropical Atlantic, ranging from tropical West Africa and the Cape Verde Islands in the east, and from Cape Hatteras, NC to Brazil in the west. It is also found in the east Pacific, ranging from the Gulf of California to Panama and Ecuador (Bigelow and Schroeder, 1948). It is a shallow water species, often found lying motionless on the bottom

under coral reefs or rocks. It often congregates in large numbers in shallow water (Castro, 1983; Pratt and Carrier, 2002) Habitat associations are summarized in Table 10.6.

Reproductive potential: The nurse shark matures at about 225 cm total length (Springer, 1938). Litters consist of 20 to 30 pups, the young measuring about 30 cm total length at birth. The gestation period is about five to six months and reproduction is biennial (Castro, 2000). The age at maturity is unknown, but the nurse shark is a long-lived species. Clark (1963) reported an aquarium specimen living up to 24 years in captivity.

Its nurseries are in shallow turtle grass (*Thalassia*) beds and shallow coral reefs (Castro, 2000; Pratt and Carrier, 2002). However, juveniles are also found around mangrove islands in south Florida. Hueter and Tyminski (2002) found numerous juveniles along the west coast of Florida, in temperatures of 17.5˚ to 32.9˚ C, salinities of 28.0 to 38.5 ppt, and DO of 3.1 to 9.7 mg/l. Large numbers of nurse sharks often congregate in shallow waters off the Florida Keys and the Bahamas at mating time in June and July (Fowler, 1906; Gudger, 1912; Pratt and Carrier, 2002). A small area has been set up for protection of mating sharks at Fort Jefferson in the Dry Tortugas. It is not certain, however, whether this area is a primary mating ground or a refuge for mated females.

Impact of fisheries: In North America and the Caribbean the nurse shark has often been pursued for its hide, which is said to be more valuable than that of any other shark (Springer, 1950a). The fins have no value and the meat is of questionable value (Springer, 1979). The U.S. commercial bottom longline fleet catches few nurse sharks.

***Essential Fish Habitat for Nurse Shark (See Figure 10.5 a-d)*:**

Neonate (≤ 36 cm total length): The 1999 HMS FMP identified EFH for neonates (≥ 60 cm total length) as areas of shallow coastal areas from West Palm Beach, FL, south to the Dry Tortugas in waters less than 25 m deep.

The current Amendment retains the EFH areas identified above with the following modifications. The length of neonates is defined as ≤ 36 cm total length. EFH includes Charlotte Harbor, FL at 82˚ W and 26.8˚ N in waters less than 25 m deep.

Juvenile (37 to 221 cm total length): The 1999 HMS FMP identified EFH for late juveniles/subadults (61 to 225 cm total length) as shallow coastal waters from the shoreline to the 25 m isobath off the east coast of Florida from south of Cumberland Island, GA (at 30.5˚ N) to the Dry Tortugas; also shallow coastal waters from Charlotte Harbor, FL (at 26˚ N) to the north end of Tampa Bay, FL (at 28˚ N); also, off southern Puerto Rico, shallow coastal waters out to the 25 m isobath from 66.5˚ W to the southwest tip of the island.

The current Amendment retains the EFH areas identified above with the following modifications. The length of juveniles is defined as 37 to 221 cm total length. EFH includes areas in the northeast Gulf of Mexico (Apalachee Bay, Apalachicola Bay, and Crooked Island Sound, FL).

Adults (≥ 221 cm total length): The 1999 HMS FMP identified EFH for adults (≥226 cm total length) as shallow coastal waters from the shoreline to the 25 m isobath off the east coast of Florida from south of Cumberland Island, GA (at 30.5˚ N) to the Dry Tortugas; also, shallow coastal waters from Charlotte Harbor, FL (at 26˚ N) to the north end of Tampa Bay, FL (at 28˚ N); also, off southern Puerto Rico, shallow coastal waters out to the 25 m isobath from 66.5˚ W to the southwest tip of the island.

The current Amendment retains the EFH areas identified above with the following modifications. The length of adults is defined as 37 to 221 cm total length. No other changes to the 1999 EFH areas are proposed.

10.3.2 Small Coastal Sharks

10.3.2.1 Finetooth shark (*Carcharhinus isodon*). This is a common inshore species of the west Atlantic. It ranges from North Carolina to Brazil. It is abundant along the southeastern United States and the Gulf of Mexico (Castro, 1983). Sharks captured in the northeastern Gulf of Mexico ranged in size from 48 to 150 cm total length, were generally found in water temperatures averaging 27.3˚C, and depths of 4.2 m (Carlson, 2002). Important nursery habitat is also located in South Carolina (Ulrich and Riley, 2002), Louisiana (Neer *et al*., 2002), and the coast of Texas (Jones and Grace, 2002). Habitat associations are summarized in Table 10.7.

Reproductive potential: Males mature at about 130 cm total length and females mature at about 135 cm total length. The young measure 48 to 58 cm total length at birth. Litters range from two to six embryos, with an average of four. The gestation period lasts about a year, and the reproductive cycle is biennial. Some of the nurseries are in shallow coastal waters of South Carolina (Castro, 1993b).

Impact of fisheries: According to the SCS stock assessment, finetooth sharks are caught commercially almost exclusively in the South Atlantic region and mostly with gillnets (approximately 80 percent of finetooth landings) and longlines (approximately 20 percent). The SCS stock assessment estimates 16,658 finetooth sharks were landed commercially in 2000, and of these, only 8 percent were from HMS fisheries. The majority of the catch thus appears to come from fishermen in non-HMS fisheries. The species is vulnerable to overfishing because of its biennial reproductive cycle and small brood size.

***Essential Fish Habitat for Finetooth Shark (See Figure 10.6 a-d)*:**

Neonate (≤ 65 cm total length): The 1999 HMS FMP identified EFH for neonates (≤90 cm total length) as shallow coastal waters of South Carolina, Georgia, and Florida out to the 25 m

isobath from 33˚ N to 30˚ N. Additionally, shallow coastal waters less than five meters deep with muddy bottoms, and on the seaward side of coastal islands from Apalachee Bay to St. Andrews Bay, FL, especially around the mouth of the Apalachicola River.

The current Amendment retains the EFH areas identified above with the following modifications. The length of neonates is defined as ≤ 65 cm total length. EFH includes coastal waters out to the 25 m isobath from Mobile Bay, AL to Bay St. Louis, MS from 88˚ W to 89.5˚ W, and from near Sabine Pass, TX to Laguna Madre, TX.

Juvenile (65 to 135 cm total length): The 1999 HMS FMP identified EFH for juveniles (91 to 135 cm total length) as identical to neonate EFH: shallow coastal waters of South Carolina, Georgia, and Florida out to the 25 m isobath from 33˚ N to 30˚ N. Additionally, shallow coastal waters less than five meters deep with muddy bottoms, and on the seaward side of coastal islands from Apalachee Bay to St. Andrews Bay, FL, especially around the mouth of the Apalachicola River.

The current Amendment retains the EFH areas identified above with the following modifications. The length of juveniles is defined as 65 to 135 cm total length. EFH includes coastal waters out to the 25 m isobath from Mobile Bay, AL to Atchafalaya Bay, LA from 88˚ W to 91.4˚ W, and from near Sabine Pass, TX at 94.2˚ W to Laguna Madre, TX at 26˚ N; also, coastal waters out to the 25 m isobath from South Carolina north to Cape Hatteras, NC at 35.5˚ N.

Adult (≥ 135 cm total length): The 1999 HMS FMP identified EFH for adults (≥136 cm total length) as identical to neonate EFH: shallow coastal waters of South Carolina, Georgia, and Florida out to the 25 m isobath from 33˚N to 30˚ N. Additionally, shallow coastal waters less than five meters deep with muddy bottoms, and on the seaward side of coastal islands from Apalachee Bay to St. Andrews Bay, FL, especially around the mouth of the Apalachicola River.

The current Amendment retains the EFH areas identified above with the following modifications. The length of adults is defined as 135 cm total length. EFH includes areas identical to those for juveniles: coastal waters out to the 25 m isobath from Mobile Bay, AL to Atchafalaya Bay, LA from 88˚ W to 91.4˚ W, and from near Sabine Pass, TX at 94.2˚ W to Laguna Madre, TX at 26˚ N; also, coastal waters out to the 25 m isobath from South Carolina north to Cape Hatteras, NC at 35.5˚ N.

10.4 THREATS TO ESSENTIAL FISH HABITAT

This section identifies the principal fishing and non-fishing related threats to shark EFH, as identified and described in Section 10.2 of this chapter. It also provides examples and information concerning the relationship between those threats and EFH, and describes actions to conserve and enhance EFH that may minimize adverse impacts on shark EFH.

Many shark species use bays, estuaries, and shallow coastal waters as pupping and nursery areas. In only a few cases are there specific bottom habitats that can be attributed to influencing the choice of habitats, e.g., young-of-the-year bonnethead sharks are associated with sea grass beds while adults prefer deeper areas with sand or clay bottoms (Carlson, 2002). Pelagic species (or life stages), are most often associated with areas of convergence or oceanographic fronts such those found over submarine canyons, the edge of the continental shelf, or the boundary currents (edge) of the Gulf Stream. Although there is no substrate or hard structure in the traditional sense, these water column habitats can be characterized by their physical, chemical and biological parameters.

10.4.1 Fishing Activities That May Adversely Affect EFH

The Magnuson-Stevens Act requires NOAA Fisheries to identify adverse effects on EFH caused by fishing activities, and further requires that the fisheries are managed so as to minimize such impacts. The EFH regulations explain that "adverse effects from fishing may include physical, chemical, or biological alterations of the substrate, and loss of, or injury to, benthic organisms, prey species and their habitat, and other components of the ecosystem." The regulations require that FMPs or FMP amendments contain an assessment of the potential adverse effects of all fishing gears and practices used in waters described as EFH. The assessment must consider the relative impacts of gears on all different types of EFH identified. Special consideration is to be given to the analysis of impacts from gears that will affect Habitat Areas of Particular Concern (HAPC).

The EFH regulations also require that FMPs or FMP amendments include management measures that minimize adverse effects on EFH from fishing, to the extent practicable. To decide if minimization of an adverse effect from fishing is practicable, NOAA Fisheries must consider: (1) whether, and to what extent, the fishing activity is adversely impacting EFH, including the fishery; (2) the nature and extent of the adverse effect on EFH; and, (3) whether the management measures are practicable, taking into consideration the long and short-term costs as well as the benefits to the fishery and its EFH, along with other appropriate factors consistent with National Standard 7. The best scientific information available must be used, as well as other appropriate information sources, as available. Where information gaps are identified through the assessment process, the establishment of research closure areas and other measures should be considered to evaluate the impact of any fishing activity that physically alters EFH.

This section includes an assessment of fishing gears and practices that are used in the shark fisheries, accompanied by conservation recommendations to minimize the potential impacts. Also included is a brief discussion of the scientific review of information relating to fishing impacts on habitat. In recent reviews of fishing impacts on habitat, Jennings and Kaiser (1998) and Auster and Langton (1998) characterize fishing impacts hierarchically: impacts on structural components of the habitat, effects on community structure, and effects on ecosystem processes. In this section the impacts of shark fishing activities will be addressed in the same format, followed by comments on non-shark fishing impacts on shark EFH, and also the identification of

research priorities to provide additional information that can be used to improve future amendments to the FMP EFH provisions.

Physical Impacts of HMS Fishing Gears on EFH

The following is a comprehensive list of all gear types used in HMS fisheries:

Atlantic Highly Migratory Species

Directed Fishery	Approved Gear
Atlantic Swordfish:	
A. Handgear fishery	A. Rod and reel, harpoon, handline, bandit gear
B. Longline fishery	B. Longline
Atlantic Sharks[1]:	
A. Hook and line fishery	A. Rod and reel, handline
B. Handgear fishery	B. Rod and reel, handline, bandit gear
C. Longline fishery	C. Longline
D. Gillnet fishery	D. Gillnet
Atlantic Tuna:	
A. Handgear fishery	A. Rod and reel, handline, harpoon, bandit gear
B. Purse seine fishery	B. Purse seine
C. Longline fishery	C. Longline
D. Harpoon fishery	D. Harpoon
E. Recreational fishery	E. Rod and reel, handline

None of the proposed gear modifications are expected to have an impact on shark EFH.

Of the approved gears that are used in the HMS fisheries, only bottom longlines, principally targeting large coastal sharks, make contact with the bottom. If bottom longline gear becomes hung or entangled on bottom substrates such as rock, and hard and soft corals, it could have some adverse impacts. However, the nature of these impacts to shark EFH overall is considered to be minimal. As noted in Section 10.1, EFH for sharks may encompass a wide range of habitats from coastal waters to deep offshore pelagic waters along the U.S. Atlantic and Gulf of Mexico coasts. Currently, little information exists on the effects of bottom longlining on benthic habitat. The principal components of the longline that can produce seabed effects are the anchors or weights, hooks, and mainline (Johnson, 2002). The only data currently available regarding bottom longline impacts is from submersible observations of halibut longline gear off southeast

[1] This FMP Amendment proposes to modify the list of approved recreational gear types to allow only handline and rod and reel. Currently, fishermen may use gears traditionally considered to be commercial gears.

Alaska in 1992 (NPFMC 1992). The 1999 NOAA Fisheries EFH Workshop categorized the impact of bottom longline gear on mud, sand, and hard-bottom as low (Barnett, 2001).

The Gulf of Mexico and Caribbean Fishery Management Councils are evaluating the impacts of several gear types, including bottom longline, on EFH areas identified under their respective reef fish and coral reef fisheries (Gulf of Mexico DEIS, 2003; Caribbean Fishery Management Council DEIS, 2003). Specifically, both Councils are evaluating measures to minimize the impacts of bottom longline gear on coral reef habitat identified as EFH for several of their managed species. If those measures are finalized, NOAA Fisheries will consider further rulemaking, as necessary, for the Atlantic shark fisheries, because there may be overlap in fishery participants.

As a precautionary measure, NOAA Fisheries recommends that fishermen take appropriate steps to identify bottom obstructions and "hangs" and avoid setting gear in areas where it may become entangled and potentially disrupt benthic habitats. If gear is lost, diligent efforts should be made to recover the lost gear to avoid further fouling (disturbance) of the underwater habitat through ghost fishing.

Impacts on HMS EFH from non-HMS Fishing Gears and Practices

Because sharks use both estuarine and coastal inshore habitats, their EFH may be negatively impacted by fisheries that target species other than sharks. These fisheries may be either state or Federally managed. Trawl fisheries that scrape the substrate, disturb boulders and their associated epiphytes or epifauna, resuspend sediments, flatten burrows and disrupt seagrass beds have the potential to alter the habitat characteristics that are important for survival of early life stages of many targeted and non-targeted species. In particular, shark pupping and nursery habitats may be subjected to fishing impacts from gears of other fisheries, e.g., shrimp trawling, but the degree of overlap between the various trawl fisheries and shark EFH, the extent to which habitat is altered by these gears, and the resulting impact on EFH are currently not known. Further research would be required to determine habitat-related production rates for sharks (the highest, most refined level of information available with which to identify EFH, and which is currently not available for sharks) and the potential impact of other fisheries on these production rates.

NOAA Fisheries is aware of shark bycatch occurring in other fisheries such as the shrimp trawl fishery which catches large numbers of SCS, and the menhaden fishery which catches LCS. Both of these sources of mortality have been taken into account in the most recent 2002 LCS and SCS stock assessments. It is unclear which species comprise the bulk of the SCS bycatch in the shrimp trawl fishery, however, the SCS stock assessment indicated that despite this bycatch, SCS is not overfished and overfishing is not occurring. The LCS bycatch in the menhaden fishery is comprised mainly of blacktip sharks which are also not overfished and overfishing is not occurring. Other than these direct sources of mortality, there is currently no information to

indicate that either of these fisheries or any other non-HMS fisheries are having a negative impact on shark EFH.

The degree of impact and long term habitat modification depends on the severity and frequency of the impacts as well as the amount of recovery time between impacts (Barnette, 2001, Auster and Langton, 1998). The extent to which particular parameters are altered by trawl gear is somewhat dependent on the configuration of the gear and the manner in which the gear is fished. Additional efforts are required to study shark EFH areas that are fished for non-HMS species and identify fishing gears that impact these habitats. Research into the spatial distribution of these activities, the frequency of disturbance, and the short and long-term changes induced in the habitat are of primary importance. A better understanding of the habitat characteristics that influence the abundance of managed species within those habitats is also needed in order to better understand the effects of fishing activities on habitat suitability for sharks.

Besides altering the physical characteristics of EFH, other fisheries may potentially remove prey species that make up the necessary biological components of shark EFH. However, currently, there is no evidence that other fisheries are having such an impact on shark EFH.

EFH Conservation Recommendations

The EFH regulations require actions to prevent, mitigate, or minimize any adverse effects from fishing, to the extent practicable, if there is evidence that a fishing practice is having an identifiable adverse effect on EFH, based on the assessment of fishing gears on EFH. At this time, there is no evidence that physical effects caused by fishing under this Amendment, or under other fisheries, are adversely affecting shark EFH to the extent that detrimental effects can be identified on the habitat or the fisheries. However, the following two conservation recommendations, discussed above as a precautionary measure, should be used whenever possible in the event that impacts to coral reef or other hard bottom EFH habitat may be occurring but unverified: (1) fishers should take appropriate measures to identify bottom obstructions and avoid setting gear in areas where it may become entangled; and (2) if gear is lost, diligent efforts should be undertaken to recover the lost gear.

Other Actions related to EFH

In addition, this FMP Amendment is considering the use of a time/area closure as a possible management option to reduce the incidental bycatch of prohibited species such as the dusky shark, as well as juvenile sandbar sharks (See Chapter 4) in EFH and HAPC areas off of North Carolina. Specifically, a time/area closure is being proposed under this FMP Amendment in order to reduce dusky and sandbar shark bycatch from January through July of each year. Besides serving as a tool to reduce bycatch and rebuild stocks, seasonal closures could also help maintain the biological integrity of EFH and reduce the chance of altering the biological characteristics of EFH. From an EFH perspective, the alternative of time/area closures is seen as a desirable step toward not only reducing bycatch, but potentially conserving and enhancing

EFH. As such, NOAA Fisheries recommends time/area closures as a conservation measure for the protection of adult and juvenile shark EFH.

Proposed quota reductions in this FMP are one measure being adopted that may have a positive impact on shark EFH. By preserving more of the age structure in the population and a diversity of trophic levels, this measure could lend added stability to the ecosystem upon which the HMS fisheries depend. A reduction in overall catch may be a means to conserve sharks as well as shark EFH.

Limited access is another means of conserving EFH. Under the 1999 FMP, a limited access permitting program was implemented which helped to reduce overall impacts on EFH by reducing fishing effort. Limited access may prevent fishing by individuals unfamiliar with the gear and bottom habitat and who may be more likely to damage EFH through improper setting of gear.

10.4.2 Non-fishing Threats to EFH

Section 600.815 (a)(4) of the EFH regulations requires that FMPs identify non-fishing related activities that may adversely affect EFH of managed species, either quantitatively or qualitatively, or both. In addition, Section 600.815 (a)(6) of the regulations requires that FMPs recommend conservation measures describing options to avoid, minimize, or compensate for the adverse effects identified. As the jurisdiction and the EFH of this FMP Amendment overlaps with the EFH identified by the respective Councils of the eastern United States, the threats to EFH and conservation measures compiled for this document are a synthesis of those listed in the Councils' EFH amendments. The information in this section has been adapted, with permission, from EFH amendments prepared by the Mid-Atlantic Fishery Management Council, the South Atlantic Fishery Management Council (1998), and the Gulf of Mexico Fishery Management Council. Original sources of information are cited in those documents.

Broad categories of activities that may adversely affect HMS EFH include, but are not limited to: (1) actions that physically alter structural components or substrate, e.g., dredging, filling, excavations, water diversions, impoundments and other hydrologic modifications; (2) actions that result in changes in habitat quality, e.g., point source discharges, activities that contribute to non-point source pollution and increased sedimentation, introduction of potentially hazardous materials, or activities that diminish or disrupt the functions of EFH. If these actions are persistent or intense enough, they can result in major changes in habitat quantity as well as quality, conversion of habitats, or in complete abandonment of habitats by some species.

In addition to identifying activities with the potential to adversely affect EFH, the Magnuson-Stevens Act and the EFH regulations require the inclusion of actions to encourage the conservation and enhancement of EFH. Each activity discussed below is followed by actions to encourage the conservation and enhancement of EFH to avoid, minimize or mitigate adverse effects on EFH.

10.4.2.1 Marine Sand and Minerals Mining

Mining for sand (e.g., for beach nourishment projects), gravel, and shell stock in estuarine and coastal waters can result in water column effects by changing circulation patterns, increasing turbidity, and decreasing oxygen concentrations at deeply excavated sites where flushing is minimal. Ocean extraction of mineral nodules is a possibility for some non-renewable minerals now facing depletion on land. Such operations are proposed for the continental shelf and the deep ocean proper. Deep borrow pits created by mining may become seasonally or permanently anaerobic. Marine mining also elevates suspended materials at mining sites, creating turbidity plumes that may move several kilometers from these sites. Resuspension of sediments can affect water clarity over wide areas, and could also potentially affect pelagic eggs and larvae. In addition, resuspended sediments may contain contaminants such as heavy metals, pesticides, herbicides, and other toxins.

Actions to Encourage Conservation and Enhancement of EFH:

- Sand mining and beach nourishment should not be allowed in HMS EFH during seasons when HMS are utilizing the area, particularly during spawning seasons.
- Gravel extraction operations should be managed to avoid or minimize impacts to the bathymetric structure in estuarine and nearshore areas.
- An integrated environmental assessment, management, and monitoring program should be a part of any gravel or sand extraction operation, and encouraged at Federal and state levels.
- Planning and design of mining activities should avoid significant resource areas important as HMS EFH.
- Mitigation and restoration should be an integral part of the management of gravel and sand extraction policies.

10.4.2.2 Offshore Oil and Gas Operations

Offshore oil and gas operations (exploration, development, production, transportation and decommissioning) pose a significant level of potential threat to marine, coastal and estuarine ecosystems. Exploration and recovery operations may cause substantial localized bottom disturbance. However, more pertinent to HMS is the threat of contaminating operational wastes associated with offshore exploration and development, the major operational wastes being drilling muds and cuttings and formation waters.

Actions to Encourage Conservation and Enhancement of EFH:

- A plan should be in place to avoid the release of hydrocarbons, hydrocarbon-containing substances, drilling muds, or any other potentially toxic substance into the aquatic environment. Storage of these materials should be in enclosed tanks whenever feasible or, if not, in lined mud pits or other approved sites. Equipment should be maintained to prevent leakage. Catchment basins for collecting and storing surface runoff should be included in the project design.

- Exploration/production activities and facilities should be designed and maintained in a manner that will maintain natural water flow regimes, avoid blocking surface drainage, and avoid erosion in adjacent coastal areas.

- Activities should avoid wetlands. Drilling should be conducted from uplands, existing drill sites, canals, bayous or deep bay waters (greater than six feet), wherever possible, rather than dredging canals or constructing board roads. When wetland use is unavoidable, work in previously disturbed wetlands is preferable to work in high quality or undisturbed wetlands. If this is not possible, temporary roads (preferably board roads) to provide access are more desirable than dredging canals because roads generally impact less acreage and are easier to restore than canals. If the well is a producer, the drill pad should be reduced to the minimum size necessary to conduct production activities and the disturbed area should be restored to pre-project conditions.

- Upon completion or abandonment of wells in wetlands, all unnecessary equipment should be removed and the area restored to pre-project elevations. The well site, various pits, levees, roads and other work areas should be graded to pre-project marsh elevations and then restored with indigenous wetland vegetation. Abandoned canals frequently need plugging and capping with erosion-resistant material at their origin to minimize bank erosion and to prevent saltwater intrusion. In addition, abandoned canals will frequently need to be backfilled to maximize fish and wildlife production in the area and to restore natural sheet flows. Spoil banks containing uncontaminated materials should be backfilled into borrow areas or breached at regular intervals to re-establish hydrological connections.

- In open bays maximum use should be made of existing navigable waters already having sufficient width and depth for access to the drill sites.

- An oil spill response plan should be developed and coordinated with Federal and state resource agencies.

- Activities on the OCS should be conducted so that petroleum-based substances such as drilling muds, oil residues, produced waters, or other toxic substances are not released into the water or onto the sea floor: drill cuttings should be shunted through a conduit and discharged near the sea floor, or transported ashore or to less sensitive, NMFS-approved offshore locations; drilling and production structures,

including pipelines, generally should not be located within one mile of the base of a live reef.

- Prior to pipeline construction, less damaging, alternative modes of oil and gas transportation should be explored.

- State natural resource agencies should be involved in the preliminary pipeline planning process to prevent violations of water quality and habitat protection laws and to minimize impact of pipeline construction and operation on aquatic resources.

- Pipeline alignments should be located along routes that minimize damage to marine and estuarine habitats. Buried pipelines should be examined periodically for maintenance of adequate earthen cover.

- All vessels transporting fuels and other hazardous materials should be required to carry equipment to contain and retrieve the spill. Dispersants shall not be used to clean up fuels and hazardous materials unless approved by the EPA/Coast Guard and fishery agencies.

- NPDES permit conditions such as those relating to dissolved oxygen, temperature, impingement and entrainment, under the Clean Water Act should be monitored and strictly enforced in areas that could affect HMS EFH.

- NPDES permits should be reviewed every five years for all energy production facilities.

10.4.2.3 Coastal Development

Coastal development activities include urban, suburban, commercial, and industrial construction, along with development of corresponding infrastructure. These activities may result in erosion and sedimentation, dredging and filling (see following sub-section), point and non-point source discharges of nutrients, chemicals, and cooling water into streams, rivers, estuaries and ocean waters. Coastal development can also lead to the destruction of coastal wetlands, resulting in the elimination of protective buffer zones that serve to filter sediments, nutrients, and contaminants.

Actions to Encourage Conservation and Enhancement of EFH:

- Adverse impacts resulting from construction should be avoided whenever practicable alternatives are identified. For those impacts that cannot be avoided, minimization through implementation of Best Management Practices (BMPs) should be employed. For those impacts that can neither be avoided nor minimized, compensation through replacement of equivalent functions and values should be required.

- Coastal development traditionally has involved dredging and filling of shallows and wetlands, hardening of shorelines, clearing of riparian vegetation, and other activities that adversely affect the habitats of living marine resources. Mitigative measures should be required for all development activities with the potential to degrade HMS EFH, whether conducted within the EFH or in adjacent areas that influence HMS EFH.

- Destruction of wetlands and shallow coastal water habitats should not be permitted in areas adjacent to HMS EFH. Mitigating or compensating measures should be employed where destruction is unavoidable. Project proponents should demonstrate that project implementation will not negatively affect HMS, their habitat, or their food sources.

- Flood control projects in waterways draining into EFH should be designed to include mitigative measures and constructed using BMPs. For example, stream relocation and channelization should be avoided whenever practicable. However, should no practicable alternatives exist, relocated channels should be of comparable length and sinuosity as the natural channels they replace to maintain the quality of water entering receiving waters (i.e., HMS EFH).

- Watershed protection/site development should be encouraged. Comprehensive planning for development on a watershed scale (and for small-scale site development as well) should be undertaken, including planning and designing to protect sensitive ecological areas, minimizing land disturbances and retaining natural drainage and vegetation whenever possible. To be truly effective, watershed planning efforts should include existing facilities even though they are not subject to EFH consultation.

- Pollution prevention activities, including techniques and activities to prevent non-point source pollutants from entering surface waters, should be implemented. Primary emphasis should be placed on public education to promote methods for proper disposal and/or recycling of hazardous chemicals, management practices for lawns and gardens, onsite disposal systems (OSDSs), and commercial enterprises such as service stations and parking lots.

- Construction erosion/sediment control measures should be used to reduce erosion and transport of sediment from construction sites to surface waters. A sediment and erosion control plan should be developed and approved prior to land disturbance.

- Runoff from new development should be managed so as to meet two conditions: 1) the average annual total suspended solids loadings after construction is completed are no greater than pre-development loadings; and 2) to the extent practicable, post-development peak runoff rate and average volume are maintained at levels that are similar to pre-development levels.

- Construction site chemical control measures should address the transport of toxic chemicals to surface water by limiting the application, generation, and migration of chemical contaminants (i.e., petrochemicals, pesticides) and providing proper storage and disposal.

- New OSDSs should be built to reduce nutrient/pathogen loadings to surface waters. OSDSs should be designed, installed and operated properly and to be situated away from open waterbodies and sensitive resources such as wetlands, and floodplains. Protective separation between the OSDS and the groundwater table should be established. The OSDS unit should be designed to reduce nitrogen loadings in areas where surface waters may be adversely affected. Operating OSDSs should prevent surface water discharges and reduce pollutant loadings to ground water. Inspection at regular intervals and repair or replacement of faulty systems should occur.

- Roads, highways, bridges and airports should be situated away from areas that are sensitive ecosystems and susceptible to erosion and sediment loss. The siting of such structures should not adversely impact water quality, should minimize land disturbances, and should retain natural vegetation and drainage features.

- Construction projects of roads, highways, bridges and airports should implement approved erosion and sediment control plans prior to construction to reduce erosion and improve retention of sediments onsite during and after construction.

- Construction site chemical control measures for roads, highways, and bridges should limit toxic and nutrient loadings at construction sites by ensuring the proper use, storage, and disposal of toxic materials to prevent significant chemical and nutrient runoff to surface waters.

- Operation and maintenance activities for roads, highways, bridges, and airports should be developed so as to reduce pollutant loadings to receiving waters during operation and maintenance.

- Runoff systems should be developed for roads, highways, bridges, and airports to reduce pollutant concentrations in runoff from existing roads, highways, and bridges. Runoff management systems should identify priority pollutant reduction opportunities and schedule implementation of retrofit projects to protect impacted areas and threatened surface waters.

- The planning process for new and maintenance channel dredging projects should include an evaluation of the potential effects on the physical and chemical characteristics of surface waters that may occur as a result of the proposed work, and should reduce undesirable impacts. When the operation and maintenance programs for existing modified channels are reviewed, they should identify and

implement any available opportunities to improve the physical and chemical characteristics of surface waters in those channels.

- Bridges should be designed to include collection systems which convey surface water runoff to land-based sedimentation basins.

- Sewage treatment discharges should be treated to meet state water quality standards. Implementation of up-to-date methodologies for reducing discharges of biocides (e.g., chlorine) and other toxic substances is encouraged.

- Use of land treatment and upland disposal/storage techniques of solid waste from sewage treatment should be implemented where possible. Use of vegetated wetlands as natural filters and pollutant assimilators for large scale wastewater discharges should be limited to those instances where wetlands have been specifically created for this purpose. The use of such constructed wetlands for water treatment should be encouraged wherever the overall environmental and ecological suitability of such an action can been demonstrated.

- Sewage discharge points in coastal waters should be located well away from critical habitats. Proposals to locate outfalls in coastal waters must be accompanied by hydrographic studies that demonstrate year round dispersal characteristics and provide proof that effluents will not reach or affect fragile and productive habitats.

- Dechlorination facilities or lagoon effluent holding facilities should be used to destroy chlorine at sewage treatment plants.

- No toxic substances in concentrations harmful (synergistically or otherwise) to humans, fish, wildlife, and aquatic life should be discharged. The EPA's Water Quality Criteria Series should be used as a guideline for determining harmful concentration levels. Use of the best available technology to control industrial waste water discharges should be required in areas adjacent to habitats essential to HMS. Any new potential discharge that will influence HMS EFH must be shown not to have a harmful effect on HMS or their habitat.

- The siting of industries requiring water diversions and large-volume water withdrawals should be avoided in areas influencing HMS EFH. Project proponents should demonstrate that project implementation will not negatively affect HMS, their EFH, or their food supply. Where such facilities currently exist, best management practices should be employed to minimize adverse effects on the aquatic environment.

- All NPDES permits should be reviewed and strictly enforced in areas affecting HMS EFH.

- Hazardous waste sites should be cleaned up (i.e., remediated) to prevent contaminants from entering aquatic food chains. Remedial actions affecting aquatic and wetland habitats should be designed to facilitate restoration of ecological functions and values.

10.4.2.4 Dredging and Disposal of Dredge Material

Dredging operations occur in estuaries, nearshore areas, and offshore in order to maintain certain areas for activities such as shipping, boating, construction of infrastructure (e.g., offshore oil and gas pipelines), and marine mining. Disposal of the dredged material takes place in designated open water disposal areas, often near the dredge site. These operations result in negative impacts on the marine environment. Of particular concern regarding HMS EFH is the temporary degradation of water quality due to the resuspension of bottom materials, resulting in water column turbidity, potential contamination due to the release of toxic substances (metals and organics), and reduced oxygen levels due to the release of oxygen-consuming substances (e.g., nutrients, sulfides). Even with the use of approved practices and disposal sites, ocean disposal of dredged materials is expected to cause environmental harm since contaminants will continue to be released, and localized turbidity plumes and reduced oxygen zones may persist.

Actions to Encourage Conservation and Enhancement of EFH:

- Best engineering and management practices (e.g., seasonal restrictions, modified dredging methods, and/or disposal options) should be employed for all dredging and in-water construction projects. Such projects should be permitted only for water dependent purposes when no feasible alternatives are available. Mitigating or compensating measures should be employed where significant adverse impacts are unavoidable. Project proponents should demonstrate that project implementation will not negatively affect HMS, their EFH, or their food sources.

- Project guidelines should make allowances to cease operations or take additional precautions to avoid adversely affecting HMS EFH during seasons when sensitive HMS life stages might be most susceptible to disruption (e.g., seasons when spawning is occurring).

- When projects are considered and in review for open water disposal permits for dredged material, Federal permitting agencies should identify the direct and indirect impacts such projects may have on HMS EFH.

- Uncontaminated dredged material may be viewed as a potentially reusable resource if properly placed and beneficial uses of these materials should be investigated. Materials that are suitable for beach nourishment, marsh construction or other beneficial purposes should be utilized for these purposes as long as the design of the project minimizes impacts on HMS EFH.

- "Beneficial Use" proposals in areas of HMS EFH should be compatible with existing uses by HMS. If no beneficial uses are identified, dredged material should be placed in contained upland sites. The capacity of these disposal areas should be used to the fullest extent possible. This may necessitate dewatering of the material or increasing the elevation of embankments to augment the holding capacity of the site. Techniques could be applied that render dredged material suitable for export or for use in re-establishing wetland vegetation.

- No unconfined disposal of contaminated dredge material should be allowed in HMS EFH.

- Disposal sites should be located in uplands when possible.

10.4.2.5 Agriculture (and Silviculture)

Agricultural and silvicultural practices can affect estuarine, coastal and marine water quality through nutrient enrichment and chemical contamination from animal wastes, fertilizers, pesticides and other chemicals via non-point source runoff or via drainage systems that serve as conduits for contaminant discharge into natural waterways. In addition, uncontrolled or improper irrigation practices can contribute to non-point source pollution, and may exacerbate contaminant flushing into coastal waters. Major impacts also include nutrient over-enrichment with subsequent deoxygenation of surface waters, algal blooms - which can also produce hypoxic or anoxic conditions - and stimulation of toxic dinoflagellate growth. Excessively enriched waters often will not support fish, and also may not support food web assemblages and other ecological assemblages needed to sustain desirable species and populations. Agricultural activities also increase sediment transport in adjacent water bodies, resulting in high turbidity. Many of these same concerns may apply to silviculture, as well.

Actions to Encourage Conservation and Enhancement of EFH:

- Federal agencies, in conjunction with state agencies, should establish and approve criteria for vegetated buffer strips in agricultural areas adjacent to estuarine and coastal HMS EFH in order to minimize pesticide, fertilizer, and sediment loads to these areas critical for HMS survival. The effective width of these vegetated buffer strips should vary with the slope of the terrain and soil permeability.

- Concerned Federal agencies (e.g., Natural Resources Conservation Service) should conduct or contribute to programs and demonstration projects to educate farmers on improved agricultural practices that would minimize the use and wastage of pesticides, fertilizers, and top soil, and reduce the adverse effects of these materials on HMS EFH.

- Delivery of sediment from agricultural lands to receiving waters should be minimized. Land owners have a choice of one of two approaches: 1) apply the

erosion component of the U.S. Department of Agriculture's Conservation Management System through such practices as conservation tillage, strip cropping, contour farming, and terracing; or 2) design and install a combination of practices to remove settleable solids and associated pollutants in runoff for all but the largest storms.

- New and existing confined animal facilities should be designed to limit discharges to waters of the United States by storing wastewater and runoff caused by all storms up to and including the 25-year frequency storms. For smaller existing facilities, the management systems that collect solids, reduce contaminant concentrations, and reduce runoff should be designed and implemented to minimize the discharge of contaminants in both facility wastewater and runoff caused by all storms up to and including 25-year frequency storms.

- Stored runoff and solids should be managed through proper waste utilization and the use of disposal methods which minimize impacts to surface and ground water.

- Development and implementation of comprehensive nutrient management plans should be undertaken, including development of a nutrient budget for the crop, identification of the types and amounts of nutrients necessary to produce a crop based on realistic crop yield expectations, and an identification of the environmental hazards of the site.

- Pesticide and herbicide management should minimize water quality problems by reducing pesticide use, improving the timing and efficiency of application (not within 24 hours of expected rain or irrigation), preventing backflow of pesticides into water supplies, and improving calibration of pesticide spray equipment. Improved methods should be used such as integrated pest management (IPM) strategies. IPM strategies include evaluating current pest problems in relation to the cropping history, previous pest control measures, and applying pesticides only when an economic benefit to the producer will be achieved (i.e., application based on economic thresholds). If pesticide applications are necessary, pesticides should be selected to minimize environmental impacts such as persistence, toxicity, and leaching potential.

- Livestock grazing should protect sensitive areas, including streambanks, wetlands, estuaries, ponds, lake shores, and riparian zones. Protection is to be achieved with improved grazing management that reduces the physical damage and direct loading of animal waste and sediment to sensitive areas, i.e., by restricting livestock access or providing stream crossings.

- Upland erosion should be reduced by either applying the range and pasture components of a Conservation Management System, or maintaining the land in accordance with the activity plans established by either the Bureau of Land Management or the Forest Service. Such techniques include the restriction of

livestock from sensitive areas through locating salt, shade, and alternative drinking sources away from sensitive areas, and providing livestock stream crossings.

- Irrigation systems that deliver necessary quantities of water yet reduce non-point pollution to surface waters and groundwater should be developed and implemented.

- BMPs should be implemented to minimize habitat impacts when agricultural ditches are excavated through wetlands that drain to HMS EFH.

- NPDES/SPDES permits, in consultation with state fishery agencies, should be required for agricultural ditch systems that discharge into areas adjacent to HMS EFH.

10.4.2.6 Aquaculture and Mariculture

Aquaculture is an expanding industry in the United States, with most facilities located in farmland, tidal, intertidal and coastal areas. Aquaculture related impacts that adversely affect the chemical and biological nature of coastal ecosystems include the discharge of excessive waste products and the release of exotic organisms and toxic substances. Problems resulting from the introduction of food and fecal wastes may be similar to those resulting from certain agricultural activities.

Actions to Encourage Conservation and Enhancement of EFH:

- Mariculture operations should be located, designed and operated to avoid or minimize adverse impacts on estuarine and marine habitats and native fishery stocks. Those impacts that cannot be eliminated should be fully mitigated.

- Mariculture facilities should be operated in a manner that minimizes impacts on the local environment by utilizing water conservation practices and effluent discharge standards that protect existing designated uses of receiving waters.

- Federal and state agencies should cooperatively promulgate and enforce measures to ensure that diseases from culture operations do not adversely affect wild stocks. Animals that are to be moved from one biogeographic area to another or to natural waters should be quarantined to prevent disease transmission.

- To prevent disruption of natural aquatic communities, cultured organisms should not be allowed to escape; the use of organisms native to each facility's region is strongly encouraged.

- Commercial aquaculture facilities and enhancement programs should consider the genetic make-up of the cultured organisms in order to protect the genetic integrity of native fishes.

- Aquaculture facilities should meet prevailing environmental standards for wastewater treatment and sludge control.

10.4.2.7 Navigation

Navigation-related threats to estuarine, coastal, and offshore environments that have the potential to affect HMS EFH include navigation support activities such as excavation and maintenance of channels (including disposal of excavated sediments) which result in the elevation of turbidity and resuspension of contaminants; construction and operation of ports, mooring and cargo facilities; construction of ship repair facilities; and construction of channel stabilization structures such as jetties and revetments. In offshore locations the disposal of dredged material is the most significant navigation related threat, resulting in localized burial of benthic communities and degradation of water quality. In addition, threats to both nearshore and offshore waters are posed by vessel operation activities such as the discharge and spillage of oil, other hazardous materials, trash and cargo, all of which may result in localized water quality degradation and direct effects on HMS, especially eggs, larvae and neonates that may be present. Wakes from vessel operation may also exacerbate shoreline erosion, effecting habitat modification and potential degradation.

Actions to Encourage Conservation and Enhancement of EFH:

- Permanent dredged material disposal sites should be located in upland areas. Where long-term maintenance is anticipated, upland disposal sites should be acquired and maintained for the entire project life.

- Construction techniques (e.g., silt curtains) should minimize turbidity and dispersal of dredged materials into HMS EFH.

- Propwashing should not be used as a dredging method.

- Channels and access canals should not be constructed in areas known to have high sediment contamination levels. If construction must occur in these areas, specific techniques, including the use of silt curtains, are needed to contain suspended contaminants.

- Alignments of channels and access canals should utilize existing channels, canals and other deep water areas to minimize initial and maintenance dredging requirements. All canals and channels should be clearly marked to avoid damage to adjacent bottoms from propwashing.

- Access channels and canals should be designed to ensure adequate flushing to avoid creating low dissolved oxygen conditions or sumps for heavy metals and other contaminants. Widths of access channels in open water should be minimized to avoid impacts to aquatic substrates. In canal subdivisions channels and canals within the development should be no deeper than the parent body of water and should be a uniform depth or become gradually shallower inland.

- To ensure adequate circulation confined and dead-end canals should be avoided by utilizing bridges or culverts that ensure exchange of the entire water column. In general, depths of canals should be minimized, widths maximized, and canals oriented towards the prevailing summer winds in order to enhance water exchange.

- Consideration should be given to the use of locks in navigation channels and access canals which connect more saline areas to fresher areas.

- To the maximum extent practicable, all navigation channels and access canals should be backfilled upon abandonment and restored to as near pre-project condition as possible. Plugs, weirs or other water control structures may also be necessary as determined on a case-by-case basis.

- All vessels transporting fuels and other hazardous materials should be required to carry equipment to contain and retrieve the spill.

- Dispersants should not be used to clean up fuels and hazardous materials unless approved by the EPA/Coast Guard after consultation with fisheries agencies.

10.4.2.8 Marinas and Recreational Boating

Marinas and recreational boating are increasingly popular uses of coastal areas. As marinas are located at the water's edge, there is often no buffering of associated pollutants released into the water column. Impacts caused by marinas include lowered dissolved oxygen, increased temperatures, bioaccumulation of pollutants by organisms, toxic contamination of water and sediments, resuspension of sediments and toxics during construction, eutrophication, change in circulation patterns, shoaling, and shoreline erosion. Pollutants that result from marina activities include nutrients, metals including copper released from antifouling paints, petroleum hydrocarbons, pathogens, and polychlorinated biphenyls. Also, chemicals commonly used to treat timber used for piers and bulkheads - creosote, copper, chromium, and arsenic salts - are introduced into the water. Other potential impacts associated with recreational boating are the result of improper sewage disposal, fuel and oil spillage, cleaning operations, and disposal of fish waste. Propellers from boats can also cause direct damage to multiple life stages of organisms, including eggs, larvae/neonates, juveniles and adults; destratification; elevated temperatures, and increased turbidity and contaminants by resuspending bottom materials.

Actions to Encourage Conservation and Enhancement of EFH:

- Water quality must be considered in the siting and design of both new and expanding marinas.

- Marinas are best created from excavated uplands that are designed so that water quality degradation does not occur. Applicants should consider basin flushing characteristics and other design features such as surface and waste water collection and treatment facilities. Marina siting and design should allow for maximum flushing of the site. Adequate flushing reduces the potential for the stagnation of water in a marina and helps to maintain the biological productivity as well as reduce the potential for toxic accumulation in bottom sediments. Catchment basins for collecting and storing runoff should be included as components of the site development plan.

- Marinas should be designed and located so as to protect against adverse impacts on important habitat areas as designated by local, state, or federal governments.

- Where shoreline erosion is a non-point source pollution problem, shorelines should be stabilized. Vegetative methods are strongly preferred.

- Runoff control strategies, which include the use of pollution prevention activities and the proper design of hull maintenance areas, should be implemented at marina sites.

- Marinas with fueling facilities should be designed to include measures for reducing oil and gas spillage into the aquatic environment. Fueling stations should be located and designed so that in the case of an accident spill contaminants can be contained in a limited area. Fueling stations should have fuel containment equipment as well as a spill contingency plan.

- To prevent the discharge of sewage directly to coastal waters new and expanding marinas should install pumpout, pump station, and restroom facilities where needed. Pumpout facilities should be maintained in operational condition and their use should be encouraged to reduce untreated sewage discharges to surface waters.

- Solid wastes produced by the operation, cleaning, maintenance, and repair of boats should be properly disposed of in order to limit their entry to surface waters.

- Sound fish waste management should be part of the project design, including a combination of fish cleaning restrictions, public education, and proper disposal facilities.

- Appropriate storage, transfer, containment, and disposal facilities for liquid materials commonly used in boat maintenance, along with the encouragement of recycling of these materials, should be required.

- The amount of fuel and oil leakage from fuel tank air vents should be reduced.

- Potentially harmful hull cleaners and bottom paints (and their release into marinas and coastal waters) should be minimized.

- Public education/outreach/training programs should be instituted for boaters, as well as marina operators, to prevent improper disposal of polluting materials.

10.4.2.9 Ocean Dumping

The disposal of dredged sediments and hazardous and/or toxic materials (e.g., industrial wastes) containing concentrations of heavy metals, pesticides, petroleum products, radioactive wastes, pathogens, etc., in the ocean degrades water quality and benthic habitats. These effects may be evident not only within the immediate vicinity of the dumping activity, but also at farther locations, as well, due to current transport and the potential influence of other hydrographic features. The disposal of uncontaminated dredged material, including adverse effects on EFH and appropriate conservation measures are addressed in Section 10.4.2.4 of this chapter. Disposal of hazardous and toxic materials by U.S. flag vessels and vessels operating in the U.S. territorial sea and contiguous zone is currently prohibited under the Marine Protection Research and Sanctuaries Act (MPRSA), although under certain circumstances the Environmental Protection Agency may issue emergency permits for dumping industrial wastes into the ocean. Major dumping threats to the marine environment are therefore limited mostly to illegal dumping and accidental disposal of material in unauthorized locations. However, given the amount of debris that is deposited along the Nation's beaches every year, including hazardous materials such as medical wastes, it is evident that effects from such dumping may be substantial.

Actions to Encourage Conservation and Enhancement of EFH:

- Federal and state agencies mandated with ocean dumping enforcement responsibilities should continue to implement and enforce all legislation, rules and regulations, and consider increasing monitoring efforts where warranted.

- Disposal of hazardous materials within areas designated as EFH for HMS should not be allowed under any circumstances, including emergency permit situations.

10.4.3 Cumulative Impacts

The EFH regulations suggest that cumulative impacts should be analyzed for adverse effects on EFH. Cumulative impact analysis is a locale-specific activity that will be undertaken as additional information on specific habitat locations and threats to that habitat can be accessed, and as additional spatial techniques are developed to properly analyze that information. For this FMP cumulative impacts will be addressed by describing the types of threats and effects that have been documented to have adverse effects on fish habitat, cumulatively.

Cumulative impacts on the environment are those that result from the incremental impact of actions added to other past, present and reasonably foreseeable future actions. Such cumulative impacts generally occur in inshore and estuarine areas, and can result from individually minor, but collectively significant, actions taking place over a period of time. These impacts include water quality degradation due to nutrient enrichment, other organic and inorganic contaminants associated with coastal development, activities related to marine transportation, and loss of coastal habitats, including wetlands and sea grasses. The rate and magnitude of these human-induced changes on EFH, whether cumulative, synergistic, or individually large, is influenced by natural parameters such as temperature, wind, currents, rainfall, salinity, etc. Consequently, the level of threat posed by a particular activity or group of activities may vary considerably from location to location. These multiple effects can, however, result in adverse impacts on HMS EFH.

Wetland loss is a cumulative impact that results from activities related to coastal development: residential and industrial construction, dredging and dredge spoil placement, port development, marinas and recreational boating, sewage treatment and disposal, industrial wastewater and solid waste disposal, ocean disposal, marine mining, and aquaculture. In the late 1970s and early 1980s the country was losing wetlands at an estimated rate of 300,000 acres per year. The Clean Water Act and state wetland protection programs have helped to decrease wetland losses to 117,000 acres per year, between 1985 and 1995. Estimates of wetlands loss differ according to agency. The USDA estimates attributes 57 percent wetland loss to development, 20 percent to agriculture, 13 percent to deepwater habitat, and 10 percent to forest land, rangeland, and other uses. Of the wetlands lost to uplands between 1985 and 1995, the U.S. Fish and Wildlife Service estimates that 79 percent of wetlands were lost to upland agriculture. Urban development, and "other" types of land use activities were responsible for six percent and 15 percent, respectively.

Nutrient enrichment has become a major cumulative problem for many coastal waters. Nutrient loading results from the individual activities of coastal development, non-point source pollution, marinas and recreational boating, sewage treatment and disposal, industrial wastewater and solid waste disposal, ocean disposal, agriculture, and aquaculture. Excess nutrients from land based activities accumulate in the soil, pollute the atmosphere, pollute ground water, or move into streams and coastal waters. Nutrient inputs are known to have a direct effect on water quality. For example, in extreme conditions excess nutrients can stimulate excessive algal blooms or dinoflagellate growth that can lead to increased turbidity, decreased dissolved oxygen, and changes in community structure, a condition known as eutrophication. Examples of such dinoflagellates or algae include *Gymnodinium breve* the dinoflagellate that causes neurotoxic shellfish poisoning, dinoflagellates of the genus *Alexandrium* which causes paralytic shellfish poisoning, *Aureococcus anophagefferens* the algae which causes "brown tides", and diatoms of the genus *Pseudo-nitzschia* which cause amnesic shellfish poisoning. *Pfiesteria piscicida* is a recently-described toxic dinoflagellate that has been documented in the water column in coastal areas of Delaware, Maryland, and North Carolina. Another *Pfiesteria*-like organism has been documented in St. John's River, FL. This organism has been associated with fish kills in some areas.

In addition to the direct cumulative effects incurred by development activities, inshore and coastal habitats are also jeopardized by persistent increases in certain chemical discharges. The combination of incremental losses of wetland habitat, changes in hydrology, and nutrient and chemical inputs produced over time, can be extremely harmful to marine and estuarine biota, resulting in diseases and declines in the abundance and quality of the affected resources.

Future investigations will seek to analyze cumulative impacts within specific geographic locations (certain estuarine, coastal and offshore habitats) in order to evaluate the cumulative impacts on HMS EFH. Information and techniques that are developed for this process will be used to supplement future revisions of these EFH provisions as the information becomes available.

Actions to Encourage Conservation and Enhancement of EFH:

- Conservation measures for individual activities that contribute to cumulative impacts are covered in the previous sections. Participation in watershed scale planning efforts should be encouraged.

10.5 RESEARCH AND INFORMATION NEEDS

Based on the present state of information concerning the habitat associations of HMS, the following research and information needs have been identified:

Ecosystem Structure and Function

- Continue the delineation of shark nurseries; establish the geographic boundaries of the summer nurseries of commercially important species.
- Continue to study and refine locations of the winter nurseries of commercially important species.
- Expand the use of archival tagging and satellite telemetry in shark species, particularly of juvenile sharks in seasonal migrations, to better define locations, distributions, and environmental tolerances.
- Determine if sharks return to their natal nurseries; determine if females return to the same nursery each time they give birth.
- Determine growth and survival rates of each life stage; develop age determination validations.
- Determine habitat relationships such as temperature (e.g., the relation to thermal fronts) and salinity, spatially as well as seasonally; determine the significance of

areas of aggregation; determine the role of coastal/inshore habitats in supporting neonates and juveniles.

Effects of Habitat Alteration

- Document the effects of habitat alteration, including the inflow of organic and inorganic pollutants, increased turbidity, loss of coastal marshes and sea grasses, and changes in freshwater inflow, on the survival of neonate and juvenile sharks in inshore and estuarine areas.
- Identify fisheries that operate in shark EFH and characterize threats from fishery practices to shark EFH, particularly nursery areas.
- Determine impacts from fishing activities on shark EFH; document the degree of overlap between fishing effort in HMS and non-HMS fisheries and shark EFH.

Impact and Recovery Indicators

- Analyze historical changes that have occurred in locations such as Tampa Bay, FL where trends in environmental degradation appear to have been reversed in recent years, resulting in rebounds of depressed shark (blacktip) populations.

Synthesis and Information Transfer

- Incorporate/develop spatially consistent databases of environmental conditions throughout the sharks' ranges (e.g., temperature, salinity, currents).
- Further analyze fishery dependent data to construct a clearer view of relative abundances.
- Contour abundance information to better visualize areas where sharks are most commonly encountered.
- Construct spatial databases for early life history stages (neonates and early juveniles), incorporating seasonal changes.
- Derive objective criteria to model areas of likelihood for relative abundances of sharks based on environmental parameters.
- Define and model habitat suitability based on seasonal analyses of species tolerances of environmental conditions.

Table 10.1 Percentage of observed distribution points included in EFH identified areas under alternative L4 by species and life stage.

Species	Life Stage	Number of Observations per 100 Square Miles Used as a Guide	Number of Observations in EFH Identified Area	Total Number of Observations	Percent of Observations in EFH Area
Blacktip	Neonate	>10	3,550	3,666	97%
	Juvenile	>10	7,375	10,085	73%
	Adult	>10	1,340	2,195	61%
Dusky	Neonate	>6	2,072	2,636	79%
	Juvenile	>6	5,016	6,331	79%
	Adult	>6	150	244	61%
Sandbar	Neonate	>10	5,492	5,804	95%
	Juvenile	>10	13,921	18,186	77%
	Adult	>10	13,126	18,442	71%
Nurse	Neonate	>10	No Data	No Data	-
	Juvenile	>10	1,331	1,795	74%
	Adult	>10	215	457	47%
Finetooth	Neonate	>1	592	612	97%
	Juvenile	>1	1,895	2,142	88%
	Adult	>1	64	87	74%
			Total: 56,139	Total: 72,682	Average: 77%

Table 10.2 Size ranges for different shark life stages from the 1999 HMS FMP and current Amendment.

1999 HMS FMP Large Coastal Sharks	Map Neonates/ early juveniles TL (cm) ≤ or range	Text Pup size TL (cm)	Map Late Juveniles/ subadults TL (cm)	Text: M maturity TL (cm) ≥ or range	Text: F maturity TL (cm) ≥ or range	Map Adults TL (cm) ≥ or range
Ginglymostomatidae Ginglymostoma cirratum	13-60	30	61-225	225		226
Carcharhinidae Carcharhinus limbatus	99	55-60	100-155	142-145 139-145	156 153	156
C. obscurus	115	85-100	116-300	290	300	301
C. plumbeus	90	60	90-179	180		180
Small Coastal Sharks **Carcharhinidae** C. isodon	90	48-58	91-135	130	135	136
HMS FMP Amendment 1 **Large Coastal Sharks**	**Neonates** **TL (cm)** **<**	**Literature** embryo size range in term females **TL (cm)**	**Juveniles** **TL (cm)**	**Literature** M maturity TL (cm) ≥ or range	**Literature** **F maturity** **TL (cm)** **≥ or range**	**Adults** **TL (cm)** **>**
Ginglymostomatidae Ginglymostoma cirratum	N/A*	28-30.5 Castro 00	37-221	214-214.6 Castro 00	222-232 Castro 00	221
Carcharhinidae Carcharhinus limbatus	69	58-62.5 Castro 93b & 96	69-155	142.5-145 Castro 96	156 Castro 96	155
C. obscurus	110	85-100 Castro 83	111-299	290 Castro 83	300 Castro 83	299
C. plumbeus	71	44.2-64 Castro 93b	71-147	139-153 Merson 98	148-175 Merson 98	147
Small Coastal Sharks **Carcharhinidae** C. isodon	65	43.7-58 Castro 93a & 93b	65-135	133 Castro 93	136 Castro 93	135

Table 10.3 Blacktip shark (*Carcharinus limbatus*) Life History and Habitat Characteristics

Life Stage	Species Distributions		Habitat Characteristics				Source*
	Location	Season	Temp (˚C)	DO (mg/l)	Sal (ppt)	Depth (m)	
			B = bottom and S = surface				
Neonate and young of the year (YOY)	Off Yaupon and Holden Beaches, NC	summer primary nursery	no data	no data	no data	no data	Jensen et al (2002)
	SC estuarine and nearshore waters	summer primary nursery, pupping late May/early June to early July	no data	no data	no data	no data	Ulrich and Riley, SEAMAP (2002)
	GA estuarine waters	summer primary nursery (June-Sept)	21-30.4	4.35-6.08	22-36.1	0.5-11.6	Belcher and Shierling Gurshin
	Yankeetown to 10,000 Islands on the west coast of Florida, Cape Canaveral on the east coast of FL and the Florida Keys. Also found in the Marquesas Islands west of the Florida Keys	summer primary nursery (June-Oct); FL Keys – found year round; Marquesas Islands – overwintering grounds	19.1-33.6	3.28-9.26	15.8-41.1	0.9-12.5	Hueter and Tyminski, Michel and Steiner
	Northeast Gulf of Mexico (Apalachee Bay, Apalachicola Bay, St. Joseph Bay, Crooked Island Sound and St Andrew Bay)	summer primary nursery	22.5-31.4	3.6-7	19-38	2.1-6	Carlson
	From the mouth of St Louis Bay, MS to the tip of Fort Morgan, AL	summer primary nursery	B 29.3 S 30.6	B 6.6 S 6.6	B 20.3 S 17.8	3.4	Parsons (env. parameters are average values
	Terrebonne/Timbalier Bay System, LA	summer primary nursery (May-Sept)	22.6-32.4	no data	18-34.7	1.2-5.2	Neer et al
	All major bay systems along the Gulf coast of Texas from Sabine Lake to Lower Laguna Madre	summer primary nursery (May-Sept)	16.7-34	no data	0-54	no data	Jones and Grace
Juvenile	Nearshore and inshore waters from Cape Hatteras and Core Sound to Holden Beach, NC	summer secondary nursery	no data	no data	no data	no data	Jensen et al.
	SC estuarine and nearshore waters	secondary summer and overwintering nursery (May-Dec)	18-24	no data	no data	no data	Ulrich and Riley, SEAMAP, Hueter and Tyminski
	GA estuarine waters	summer secondary nursery (June-Sept)	21-30.4	4.35-6.08	22-36.1	0.5-11.6	Belcher and Shierling, Gurshin
	Yankeetown to 10,000 Islands on the west coast of Florida, Cape Canaveral on the east coast of FL and the Florida Keys	summer secondary nursery (March-Nov); warm water effluents of Tampa Bay and Yankeetown power plants during winter months	20.8-33.6	2-8.3	27-38	0.7-5	Hueter and Tyminski, Miche and Steiner
	Northeast Gulf of Mexico (Apalachee Bay, Apalachicola Bay, St. Joseph Bay, Crooked Island Sound and St Andrew Bay) north central Gulf of Mexico	summer secondary nursery	16-32.5	1.9-8.3	19-38	0.7-6.4	Carlson
	Coastal Alabama off Dauphin Island and Mobile Point	summer secondary nursery	B 27.3-28.1	B 3.2-6.2	B 34.3-37	5.8-7.6	Gurshin
	From the mouth of St Louis Bay, MS to the tip of Fort Morgan, AL	summer secondary nursery	B 28 S 28.8	B 6.3 S 6.9	B 19.4 S 17.7	3.1	Parsons (env. parameters are average values)
	Terrebonne/Timbalier Bay System, LA	summer secondary nursery (April-Nov)	22.6-32.4	no data	18-34.7	1.2-5.2	Neer et al
	All major bay systems along the Gulf coast of Texas from Galveston Bay to Lower Laguna Madre, except Corpus Christi Bay	summer secondary nursery					Jones and Grace
Adult	Outer Banks of NC, St Augustine to Cape Canaveral, FL,		Unk	Unk	Unk	Unk	

* Contributing authors in: McCandless, C.T., H.L. Pratt Jr., and N.E. Kohler. 2002. Shark nursery grounds of the Gulf of Mexico and the East Coast waters of the United States: an overview. Authors and papers are cited separately in References section.

Table 10.4 Dusky shark (*Carcharinus obscurus*) Life History and Habitat Characteristics

Life Stage	Species Distributions		Habitat Characteristics				Source*
	Location	Season	Temp (˚C)	DO (mg/l)	Sal (ppt)	Depth (m)	
			B = bottom and S = surface				
Neonate and young of the year (YOY)	Nearshore waters from Cape Hatteras to Bogue Banks and off Holden Beach, NC	Oct and Nov; pupping April and May off Holden beach	no data	no data	no data	no data	Jensen et al, SEAMAP
	SC coastal waters	transient or overwintering nursery (Nov)	18	no data	no data	no data	Ulrich and Riley
Juvenile	In the coastal waters of Martha's Vineyard, MA (off East and South Beaches of Chappaquiddick Island)	summer secondary nursery	17-24	no data	no data	4.8-19.2	Skomal
	Exposed nearshore waters in Virginia, rarely enter the estuaries (one juvenile female (79cm PCL) caught in lower Chesapeake Bay in August of 1990	summer secondary nursery	no data	no data	no data	no data	Grubbs and Musick
	Nearshore waters from Cape Hatteras to Holden Beach, NC	summer secondary and overwintering nursery grounds	18.1-22.2	no data	no data	4.3-15.5	Jensen et al, SEAMAP
	SC coastal waters	transient or overwintering nursery (Nov)	18	no data	no data	no data	Ulrich and Riley
Adult	Pelagic waters offshore the Virginia/North Carolina border and south to Fort Lauderdale, FL Nearshore waters beginning at the border of Georgia and Florida south to Fort Lauderdale	Migrations moving north-south with the seasons	Unk	Unk	Unk	Unk	

* Contributing authors in: McCandless, C.T., H.L. Pratt Jr., and N.E. Kohler. 2002. Shark nursery grounds of the Gulf of Mexico and the East Coast waters of the United States: an overview. Authors and papers are cited separately in References section.

Table 10.5 Sandbar shark (*Carcharinus plumbeus*) Life History and Habitat Characteristics

Life Stage	Species Distributions		Habitat Characteristics				Source*
	Location	Season	Temp (˚C)	DO (mg/l)	Sal (ppt)	Depth (m)	
			B = bottom and S = surface				
Neonate and young of the year (YOY)	Great Bay, NJ	summer primary nursery (pupping early July)	23.8	7.01	26.5	2.4	Merson and Pratt
	Delaware Bay (DE & NJ waters)	summer primary nursery (June-Oct with majority of pupping from late June to early July)	18-29.9	no data	18.3-30.4	0.9-16.6	McCandless et al
	Lower Chesapeake Bay, VA and the tidal creeks and lagoons along Virginia's Eastern Shore	summer primary nursery	17-28	no data	no data	no data	Grubbs and Musick
	In coastal waters from Cape Hatteras to Bogue Banks, off Holden Beach and in Pamlico Sound, NC	summer primary nursery (May-July); overwintering grounds off Cape Hatteras, NC (catches increase greatly in Oct and Nov)	no data	no data	no data	no data	Jensen et al, SEAMAP
	SC estuarine and nearshore coastal waters	summer primary nursery (May-Sept), with coastal waters also serving as overwintering grounds	no data	no data	no data	no data	Ulrich and Riley
	GA estuarine waters	summer primary nursery (June-Sept)	26.9-30.1	4-5.9	29.6-30.1	3.7-13.1	Belcher and Shierling
	Off Yankeetown, FL (N=3)	summer primary nursery	25-29	no data	20.4-25.4	2.4-3.7	Hueter and Tyminski
	Northeast Gulf of Mexico (Apalachicola Bay and Crooked Island	summer primary nursery	26.6-30.8	5-7.3	19-39	3-5.2	Carlson
Juvenile	Cape Poge Bay, MA, around Chappaquiddick Island, MA (East and South Beaches), and off the south shore of Cape Cod, MA	summer secondary nursery (June -Oct)	20-24	no data	no data	2.4-6.4	Skomal
	Delaware Bay (DE & NJ waters)	summer secondary nursery (May-Oct)	15.5-30	no data	18.3-31.4	0.8-23	McCandless et al
	Lower Chesapeake Bay, VA and the tidal creeks and lagoons along Virginia's Eastern Shore	summer secondary nursery (May-Oct)	17-28	no data	no data	no data	Grubbs and Musick
	Coastal NC waters	summer secondary nursery; overwintering grounds off Cape Hatteras, NC	22.6-28.1	no data	no data	no data	Jensen et al, SEAMAP
	SC estuarine and coastal waters	summer secondary (April - Sept) and overwintering grounds (Dec)	15-28	no data	no data	no data	Ulrich and Riley, SEAMAP
	GA estuarine waters	summer secondary nursery (June-Sept)	26.9-30.1	4-5.9	29.6-30.1	3.7-13.1	Belcher and Shierling
	Northeast Gulf of Mexico (Apalachicola Bay and Crooked Island Sound)	summer secondary nursery	19.8-30.8	5-7.3	19-36	2.1-5.2	Carlson
	North central Gulf of Mexico (just north of Cat and Horn Islands, MS) (N=4)	summer secondary nursery	23.3-24.4	8-8.3	13.4-14.8	2.1	Parsons
	Upper Texas coast, LA coast, and Bulls Bay, SC	spring/summer secondary nursery	no data	no data	no data	no data	Hueter and Tyminski
Adult	Unk	Unk	Unk	Unk	Unk	Unk	

* Contributing authors in: McCandless, C.T., H.L. Pratt Jr., and N.E. Kohler. 2002. Shark nursery grounds of the Gulf of Mexico and the East Coast waters of the United States: an overview. Authors and papers are cited separately in References section.

Table 10.6 Nurse shark (*Ginglymostoma cirratum*) Life History and Habitat Characteristics

Life Stage	Species Distributions		Habitat Characteristics				Source*
	Location	Season	Temp (˚C)	DO (mg/l)	Sal (ppt)	Depth (m)	
			B = bottom and S = surface				
Neonate and young of the year (YOY)	Charlotte Harbor, FL and the Florida Keys	primary nursery	31.7	7.01	33.9	2.1	Hueter and Tyminski
Juvenile	Tampa Bay, Charlotte Harbor, 10,000 Islands Estuary and the Florida Keys	secondary nursery (April-Nov)	17.5-32.9	3.1-9.7	28-38.5	0.6-2.9	Hueter and Tyminski, Michel and Steiner
	Dry Tortugas, FL	summer secondary nursery	no data	no data	no data	no data	Pratt and Carrier
	Northeast Gulf of Mexico (Apalachee Bay, Apalachicola Bay, and Crooked Island Sound)	summer secondary nursery	22.6-28.1	5-8.3	27-37	3.5-6	Carlson
Adult	From tropical West Africa and the Cape Verde Islands in the east, and from Cape Hatteras to Brazil in the west. Littoral waters of the tropical and subtropical Atlantic, shallow water, often under coral reefs or rocks	Unk	Unk	Unk	Unk	Unk	

* Contributing authors in: McCandless, C.T., H.L. Pratt Jr., and N.E. Kohler. 2002. Shark nursery grounds of the Gulf of Mexico and the East Coast waters of the United States: an overview. Authors and papers are cited separately in References section.

Table 10.7 Finetooth shark (*Carcharinus isodon*) Life History and Habitat Characteristics

Life Stage	Species Distributions		Habitat Characteristics				Source*
	Location	Season	Temp (˚C)	DO (mg/l)	Sal (ppt)	Depth (m)	
			B = bottom and S = surface				
Neonate and young of the year (YOY)	SC estuarine waters	summer primary nursery (June - Sept), pupping early to mid June	no data	no data	no data	no data	Ulrich and Riley
	GA estuarine and coastal waters	transient or overwintering nursery (Nov)	above 25	no data	23-26	0.5-5	Belcher and Shierling, Gurshin, SEAMAP
	Northeast Gulf of Mexico (Apalachicola Bay and Crooked Island Sound)	summer primary nursery	26.4-31.4	4.5-5.6	25-36	3.3-5	Carlson
	Terrebonne/Timbalier Bay System, LA	summer primary nursery (May-Aug)	25.3-32.1	no data	19-34.3	0.6-4.9	Neer et al
	Galveston, Matagorda, Aransas, Corpus Christi and the Lower Laguna Madre major bay systems of Texas	summer primary nursery (April-Nov)	19.2-30.6	no data	no data	16-36	Jones and Grace
Juvenile	Cape Hatteras to Holden Beach, NC	secondary summer nursery for older juveniles	22-30.6	no data	no data	3.1-10.7	Jensen et al
	SC estuarine (primarily early juveniles) and nearshore coastal waters (primarily late juveniles)	summer secondary nursery (May-Oct)	20-28	no data	no data	no data	Ulrich and Riley
	GA estuarine waters	summer secondary nursery	25-28.2	6.21	23-32.1	0.5-4.3	Gurshin
	Northeast Gulf of Mexico (Apalachicola Bay, Crooked Island Sound and St Andrew Bay)	summer secondary nursery	19.5-31.4	3.6-6.8	19-38	2.3-5.3	Carlson
	Coastal Alabama off Dauphin Island and Mobile Point (N=3)	summer secondary nursery	B 26.1-27.5 S 28.8-31.5	B 0.3-2.4 S 5.3-7.3	B 33.3-36.3 S 23.5-32.4	4.9-7.6	Gurshin
	Terrebonne/Timbalier Bay System, LA	summer secondary nursery	25.3-32.1	no data	19-34.3	0.6-4.9	Neer et al
	All major bay systems along the Gulf coast of Texas from Galveston Bay to Lower Laguna Madre, except Upper Laguna Madre	summer secondary nursery	no data	no data	no data	no data	Jones and Grace
	Along the beaches of the lower TX coast	spring and fall migrations	33.8	8.5	11.5	2.1-5.5	Hueter and Tyminski
Adult	Western Atlantic, from NC to Brazil, SE U.S. and Gulf of Mexico	Unk					
	Northeast Gulf of Mexico especially around the mouth of the Apalachicola River	April-Oct	22-32	5.0-8.0	28-35	<5	Castro, J.I. 1983 Carlson

* Contributing authors in: McCandless, C.T., H.L. Pratt Jr., and N.E. Kohler. 2002. Shark nursery grounds of the Gulf of Mexico and the East Coast waters of the United States: an overview. Authors and papers are cited separately in References section.

Figure 10.1 Ten minute square grid used for distribution analysis.

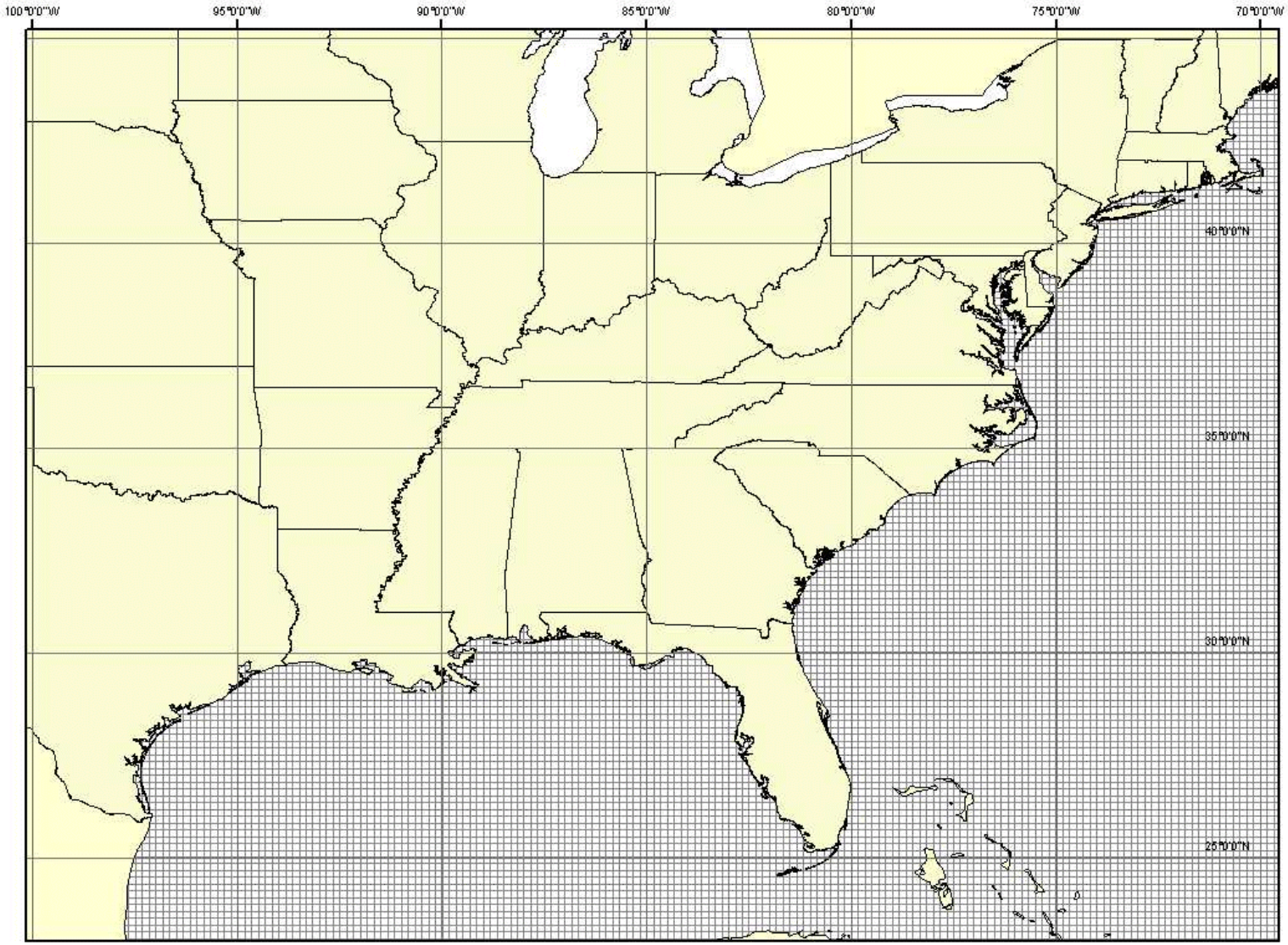

Figure 10.2a Essential Fish Habitat - Blacktip Shark, All Life Stages Combined

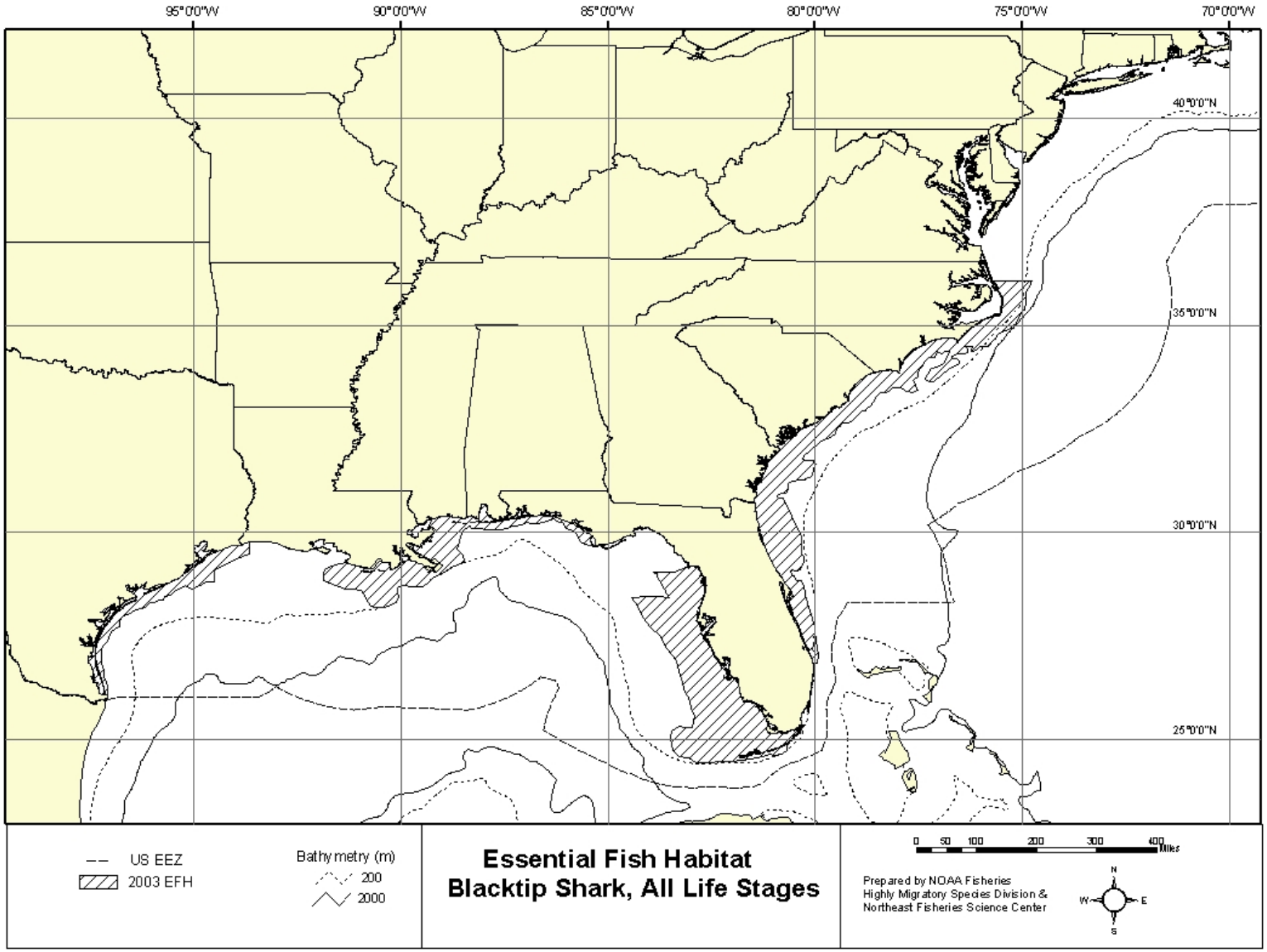

Figure 10.2b Essential Fish Habitat - Blacktip Shark, Neonate

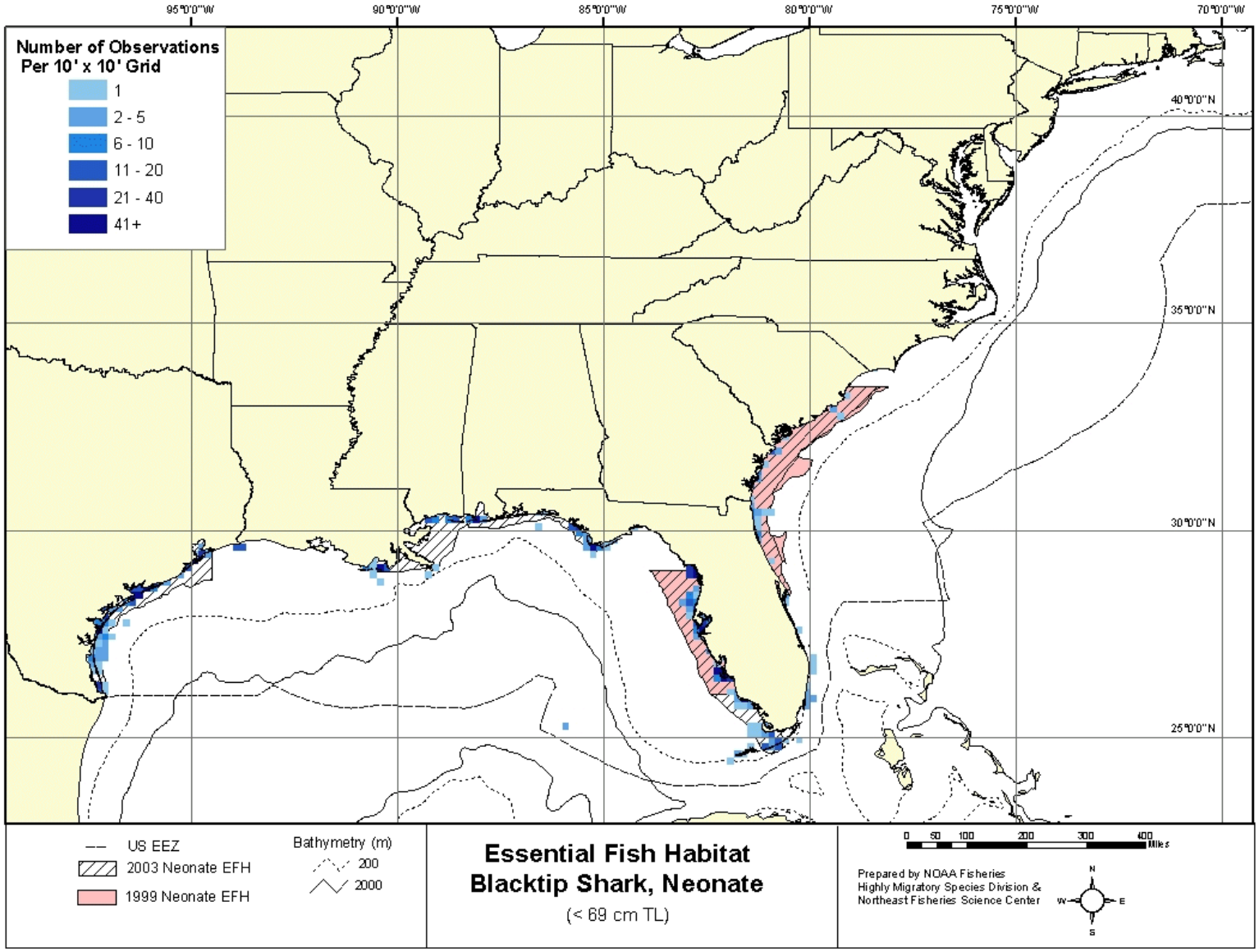

Figure 10.2c Essential Fish Habitat - Blacktip Shark, Juvenile

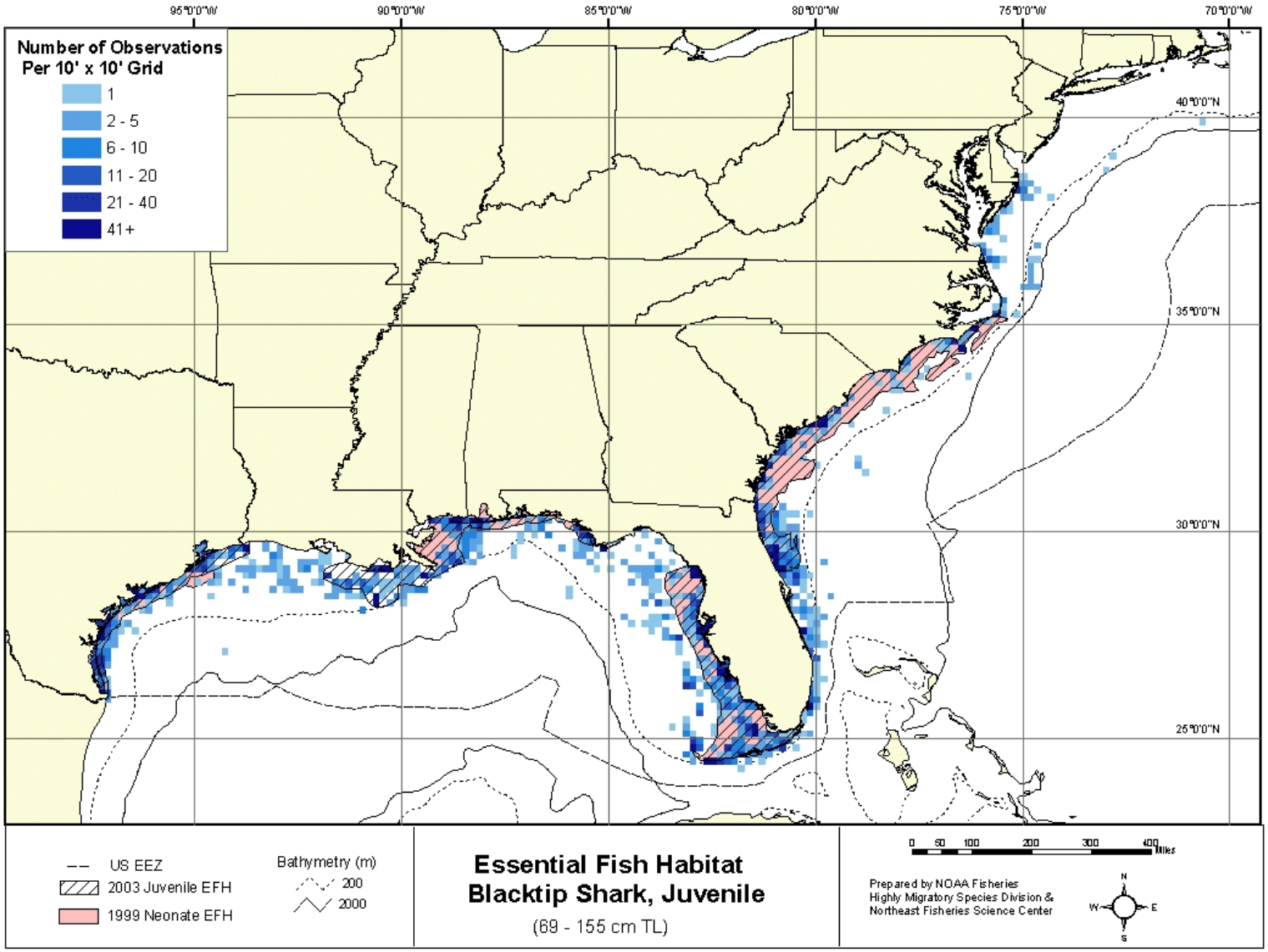

Figure 10.2d Essential Fish Habitat - Blacktip Shark, Adult

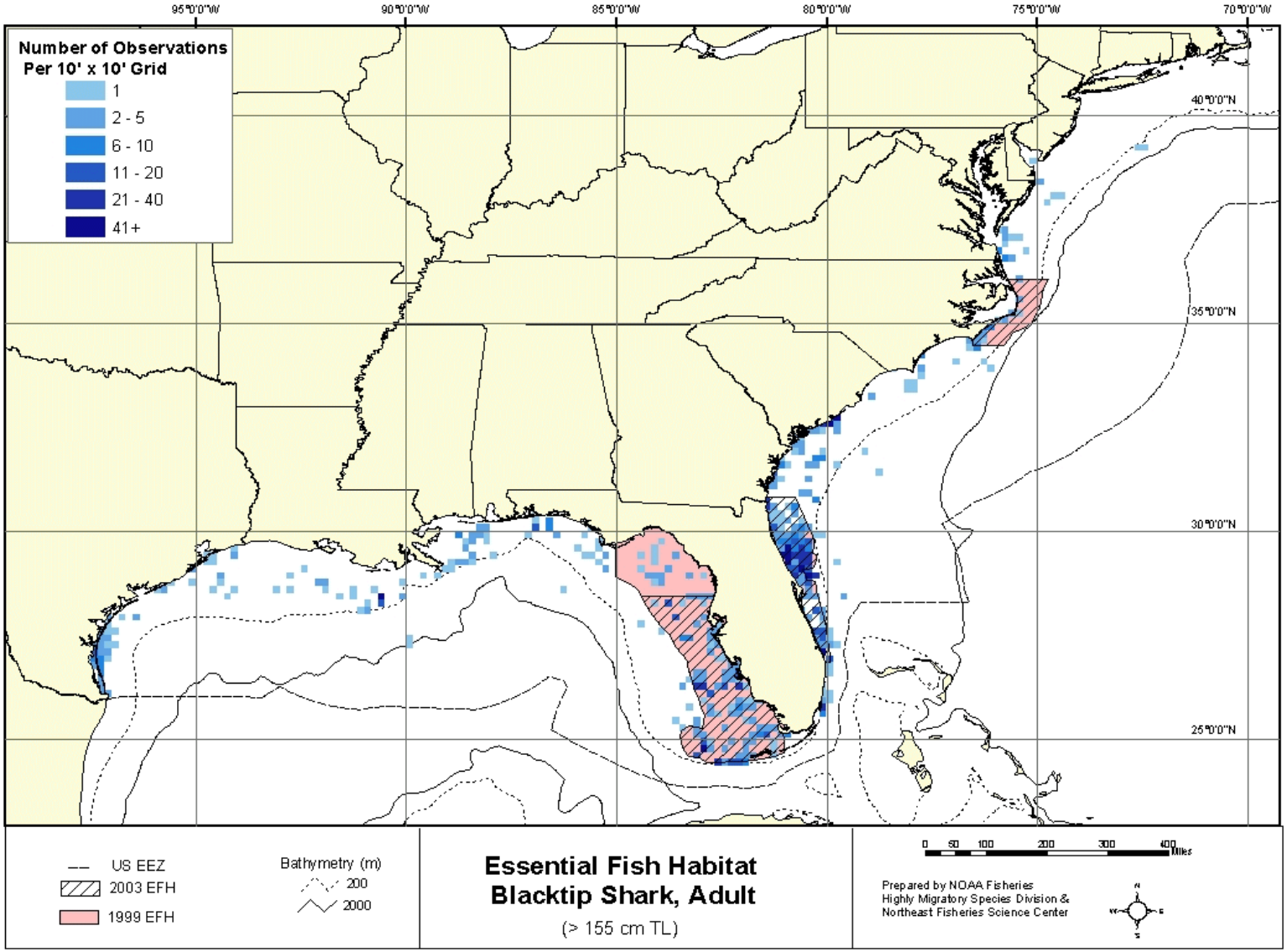

Figure 10.3a Essential Fish Habitat - Dusky Shark, All Life Stages

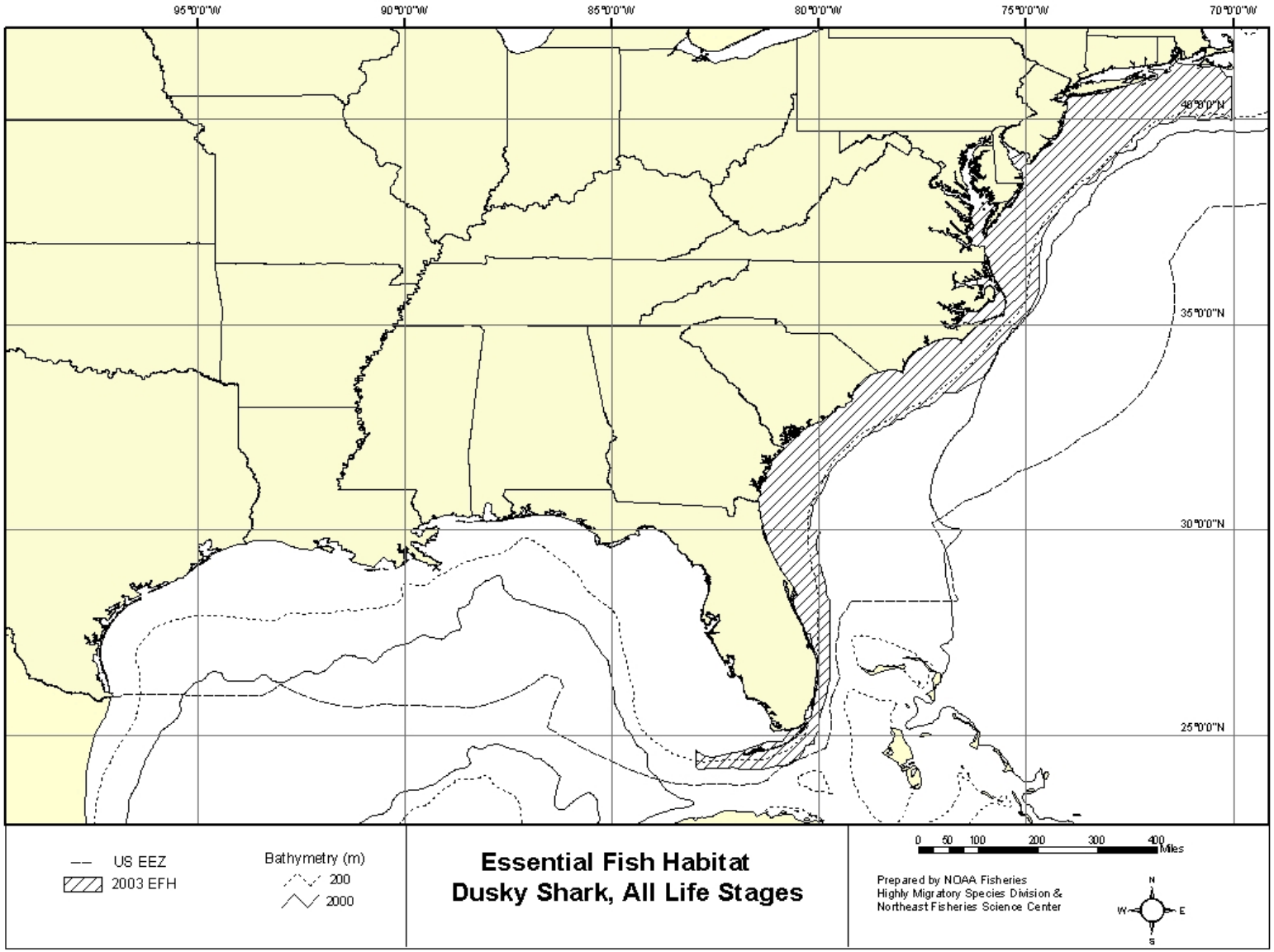

Figure 10.3b Essential Fish Habitat - Dusky Shark, Neonate

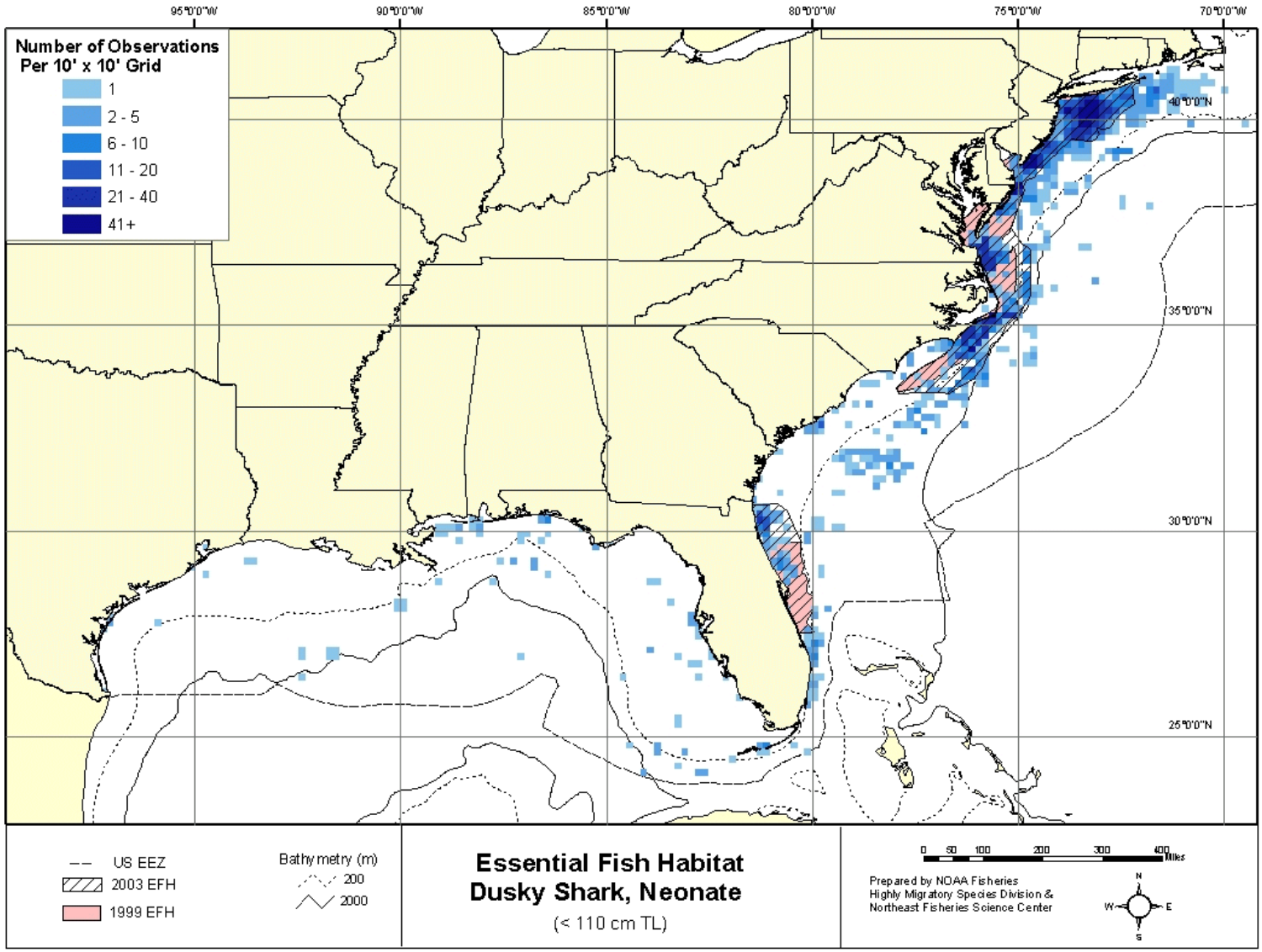

Figure 10.3c Essential Fish Habitat - Dusky Shark, Juvenile

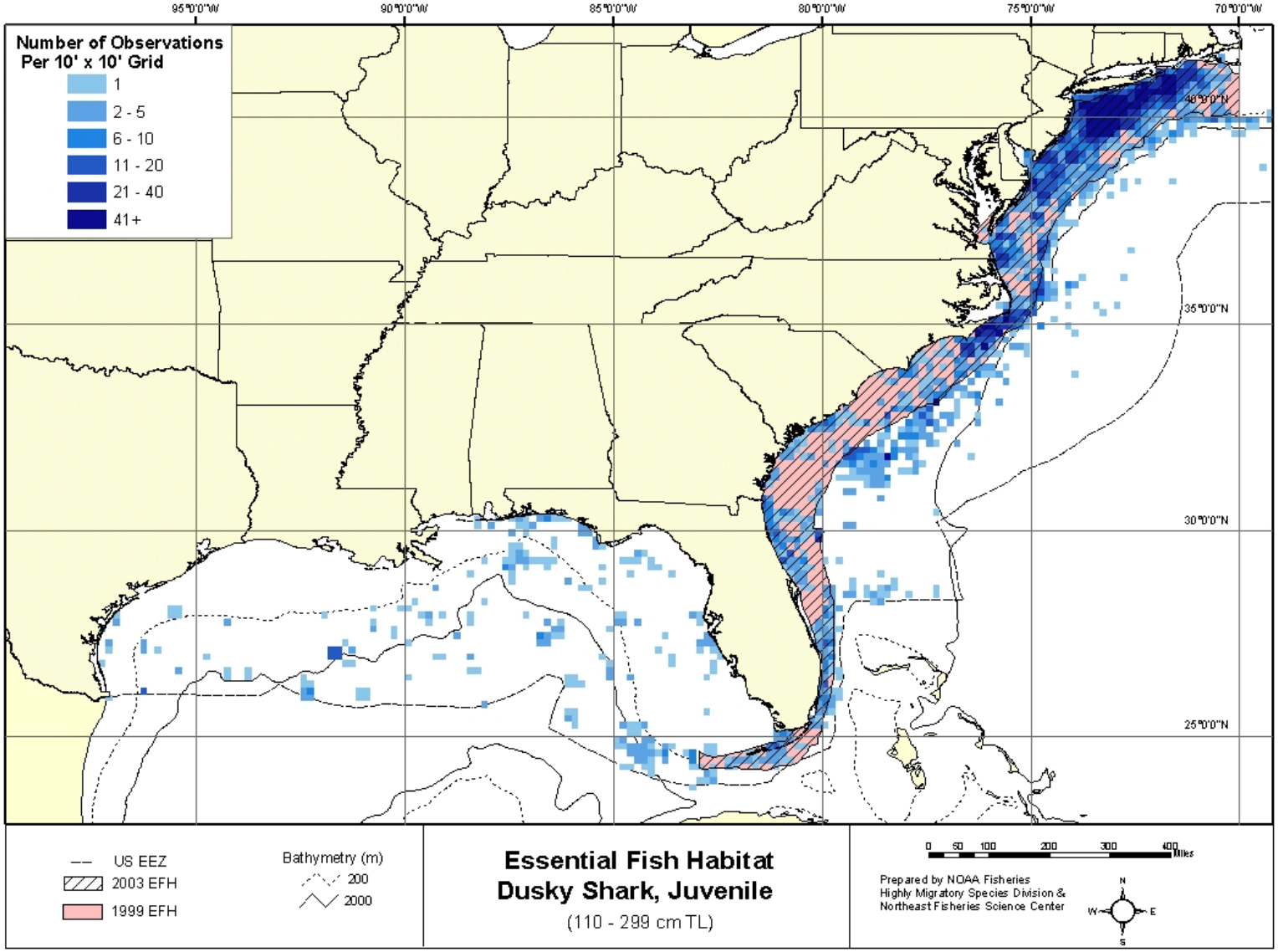

Figure 10.3d Essential Fish Habitat - Dusky Shark, Adult

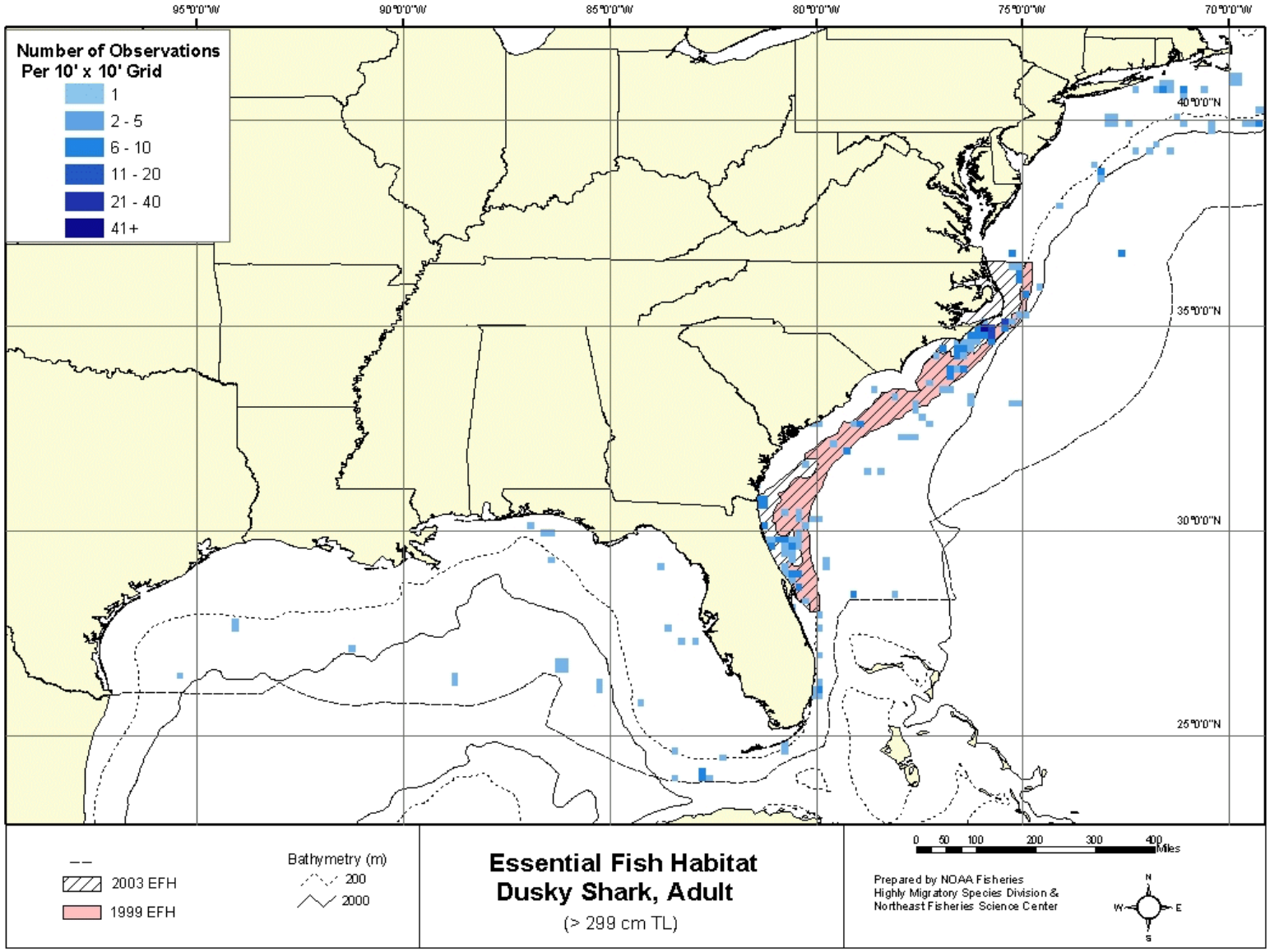

Figure 10.4a Essential Fish Habitat - Sandbar Shark, All Life Stages

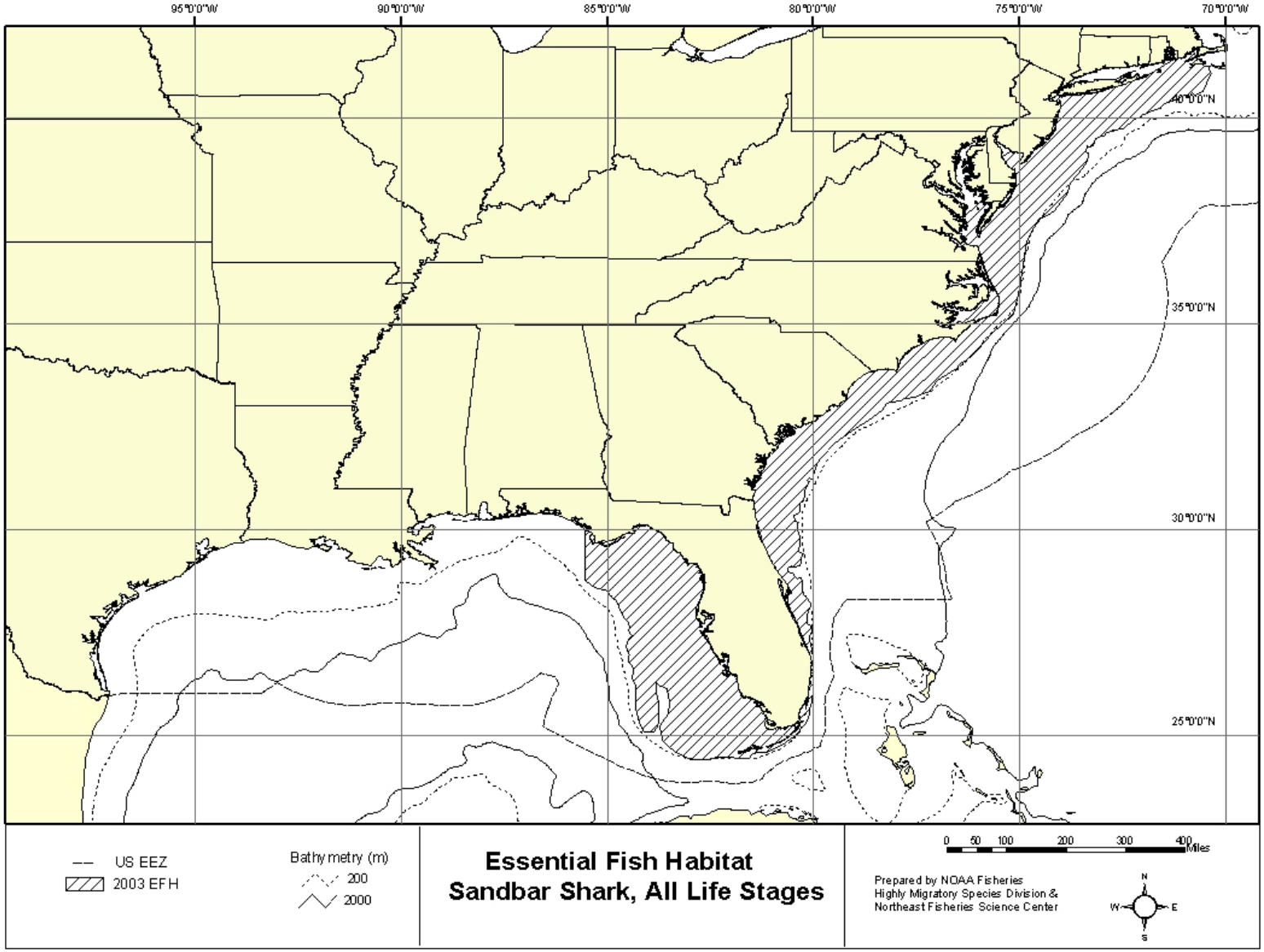

Figure 10.4b Essential Fish Habitat - Sandbar Shark, Neonate

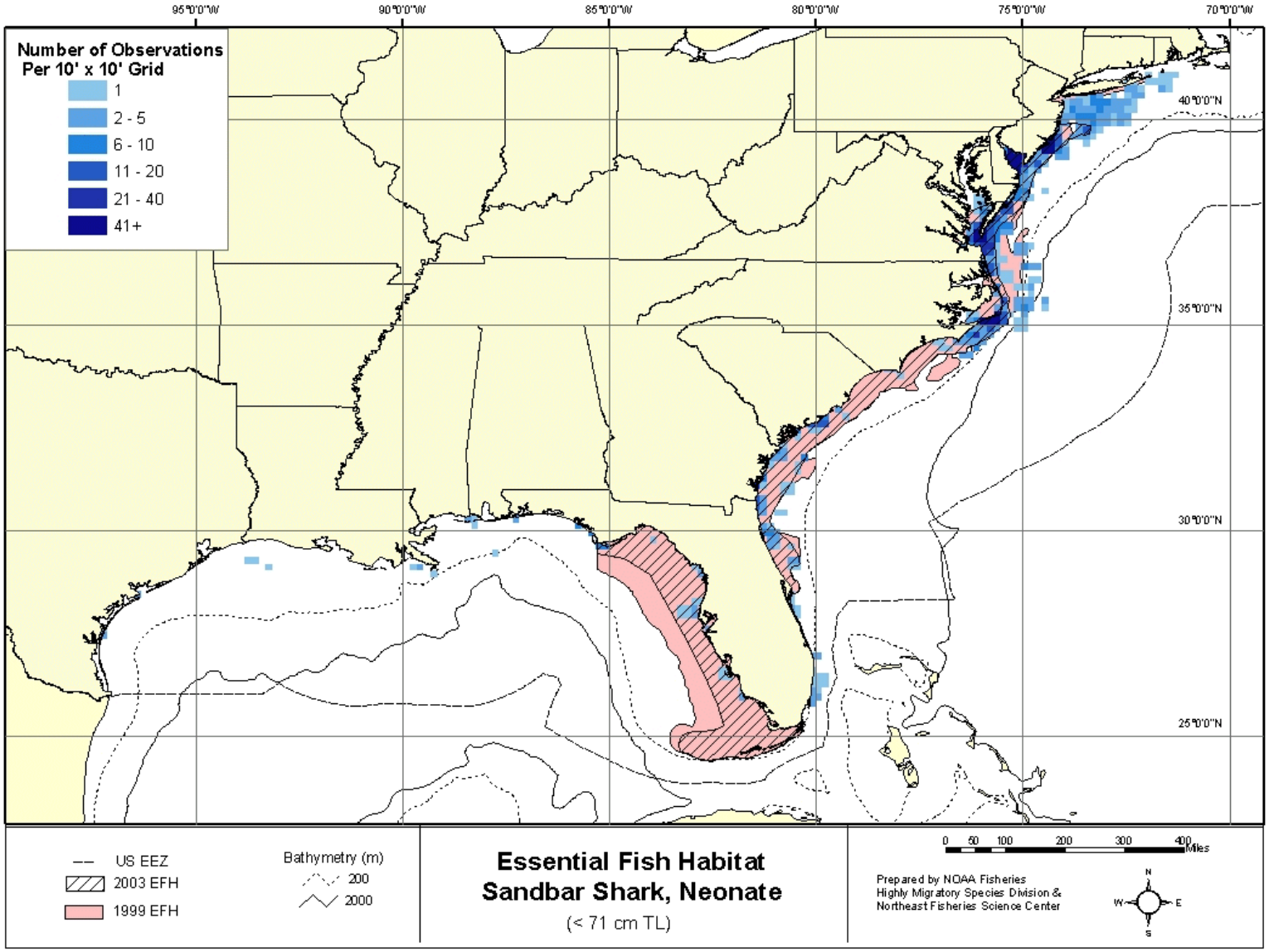

Figure 10.4c Essential Fish Habitat - Sandbar Shark, Juvenile

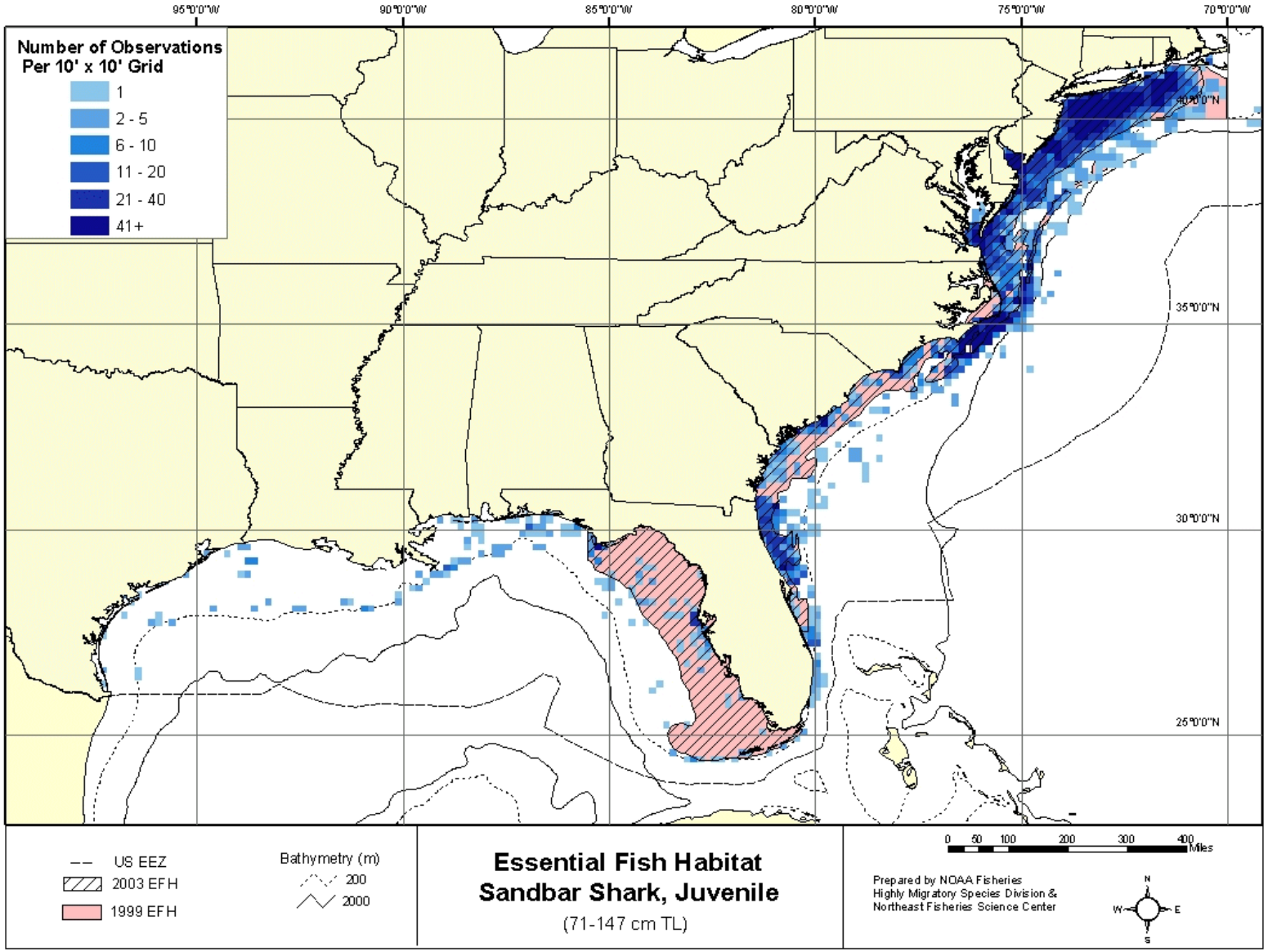

Figure 10.4d Essential Fish Habitat - Sandbar Shark, Adult

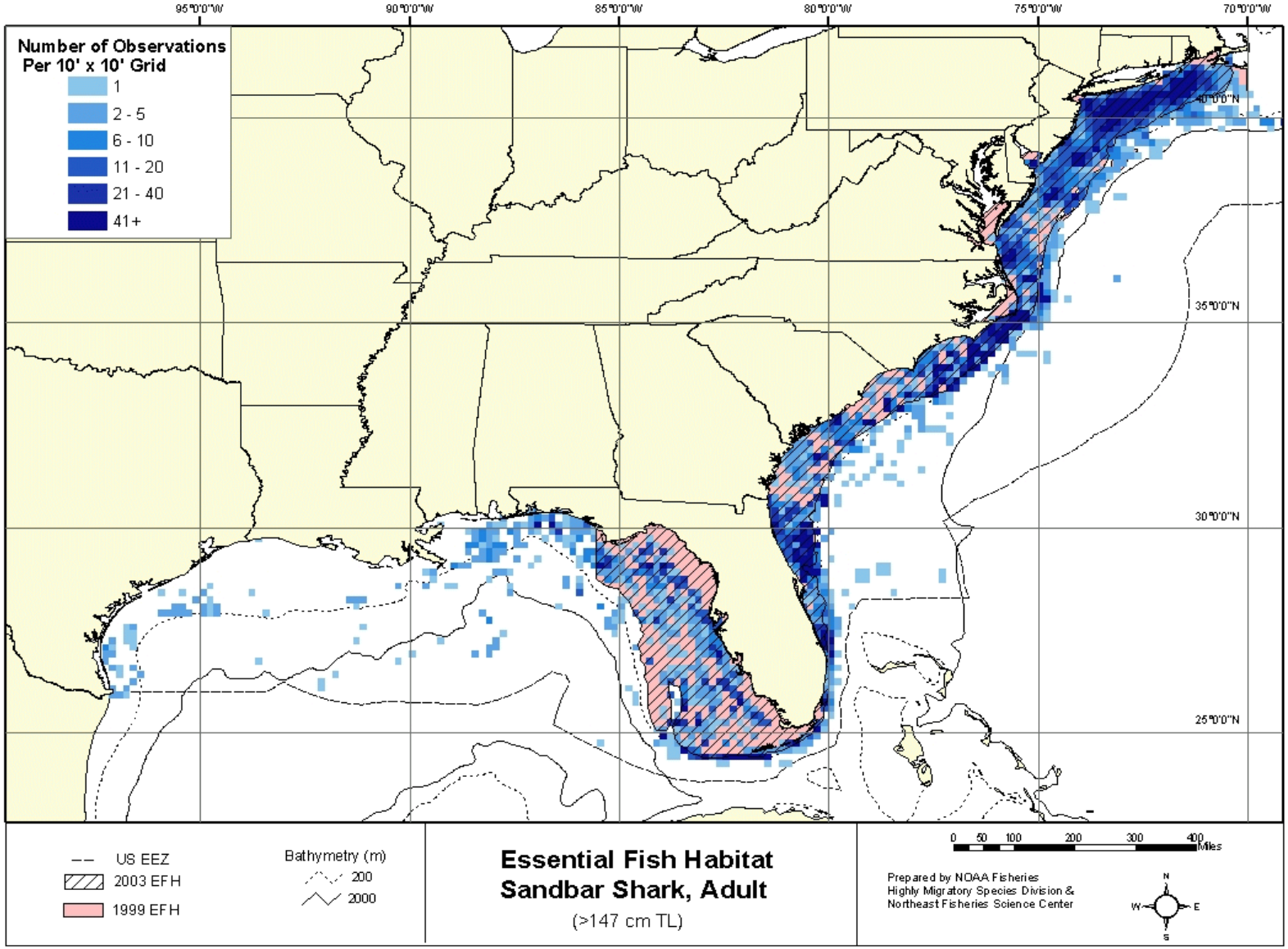

Figure 10.4e Habitat Area of Particular Concern - Sandbar Shark

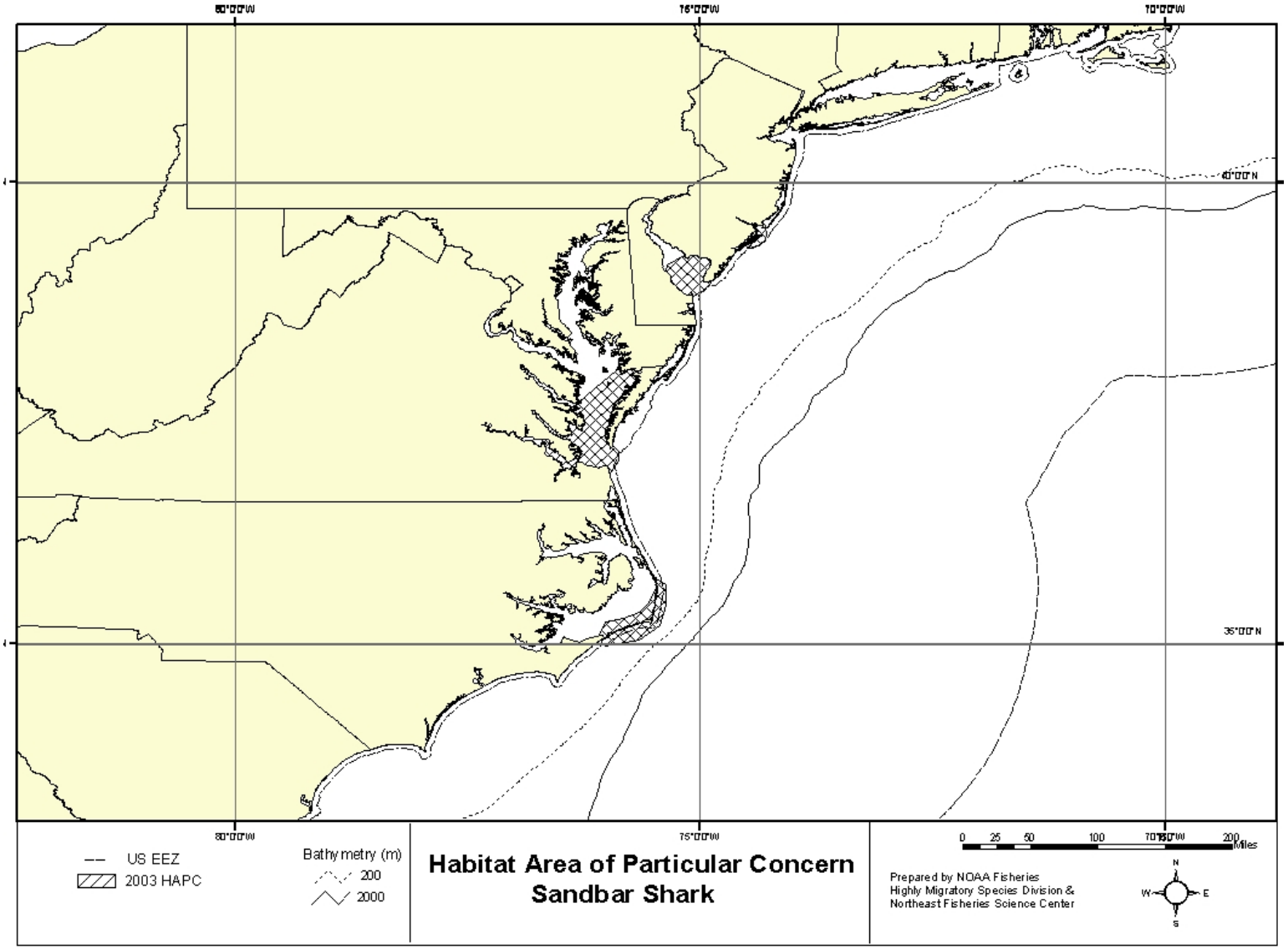

Figure 10.5a Essential Fish Habitat - Nurse Shark, All Life Stages

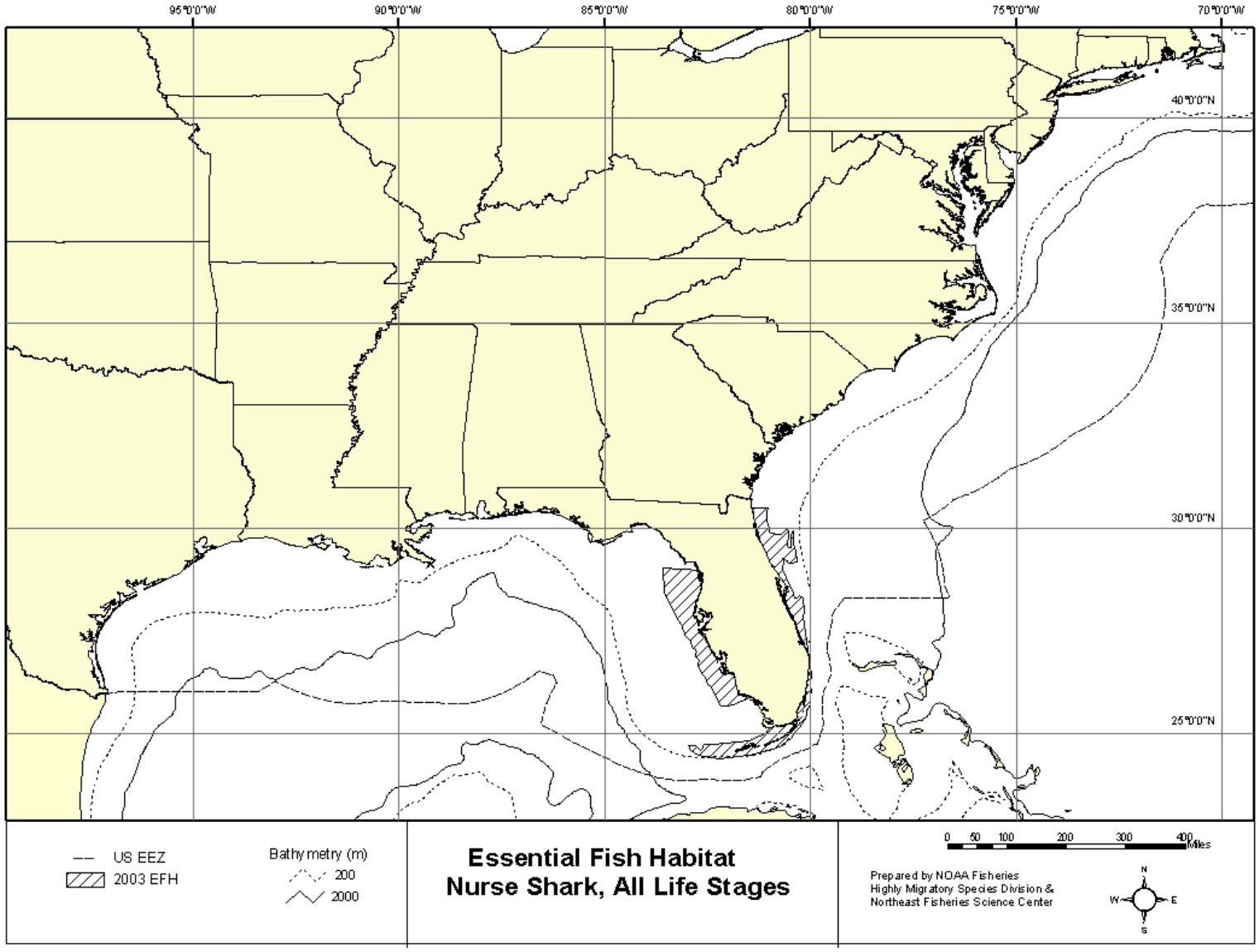

Figure 10.5b Essential Fish Habitat - Nurse Shark, Neonate

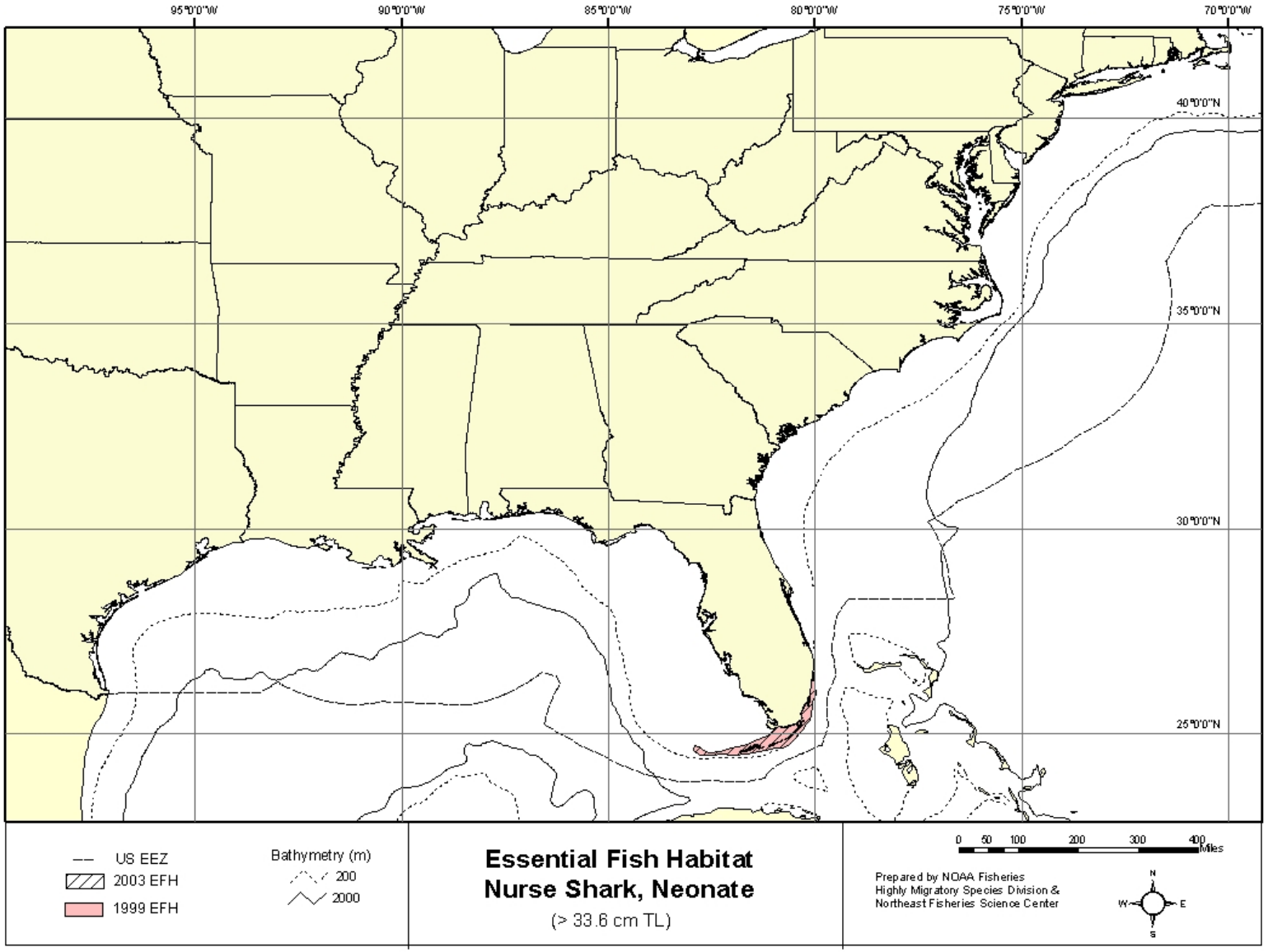

Figure 10.5c Essential Fish Habitat - Nurse Shark, Juvenile

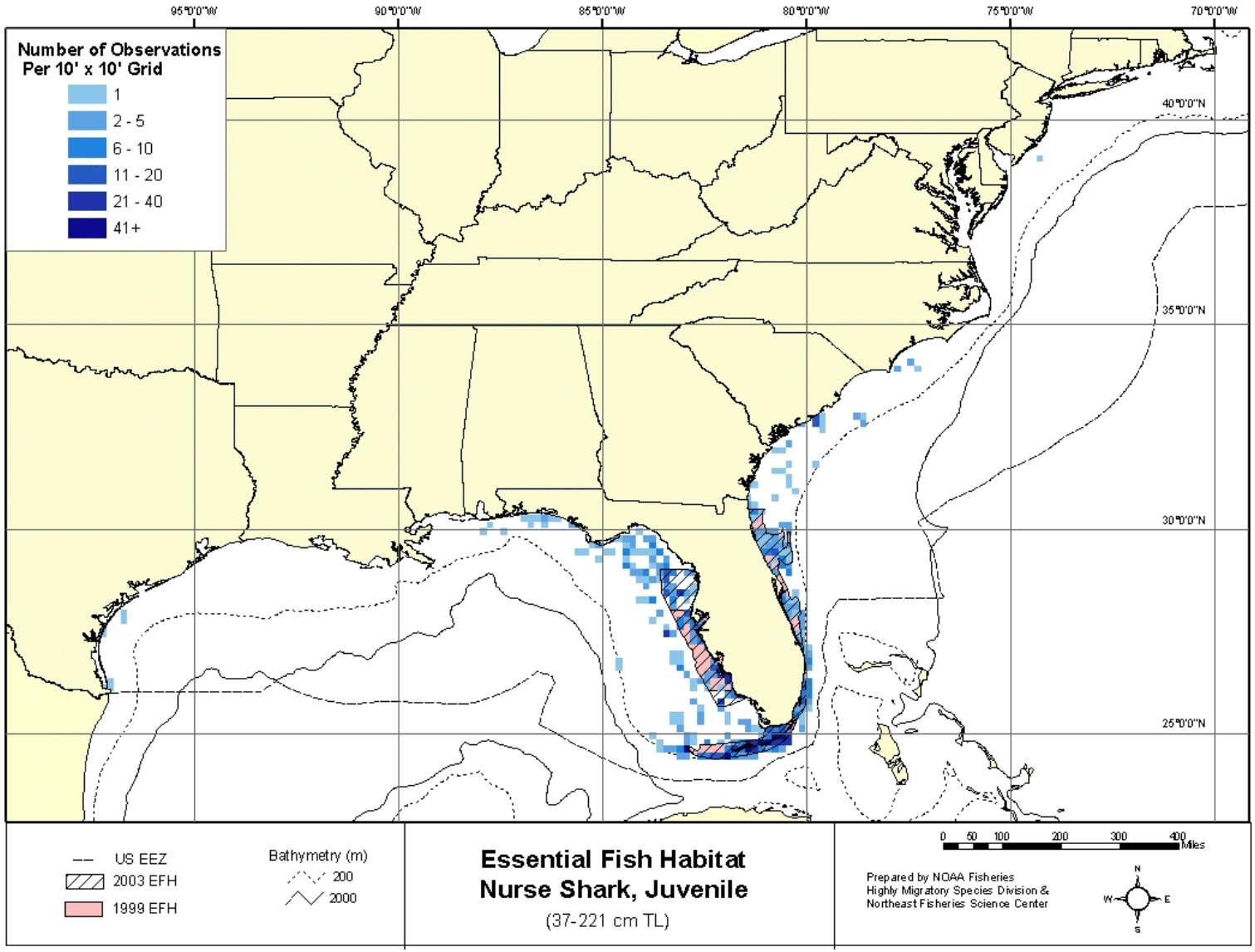

Figure 10.5d Essential Fish Habitat - Nurse Shark, Adult

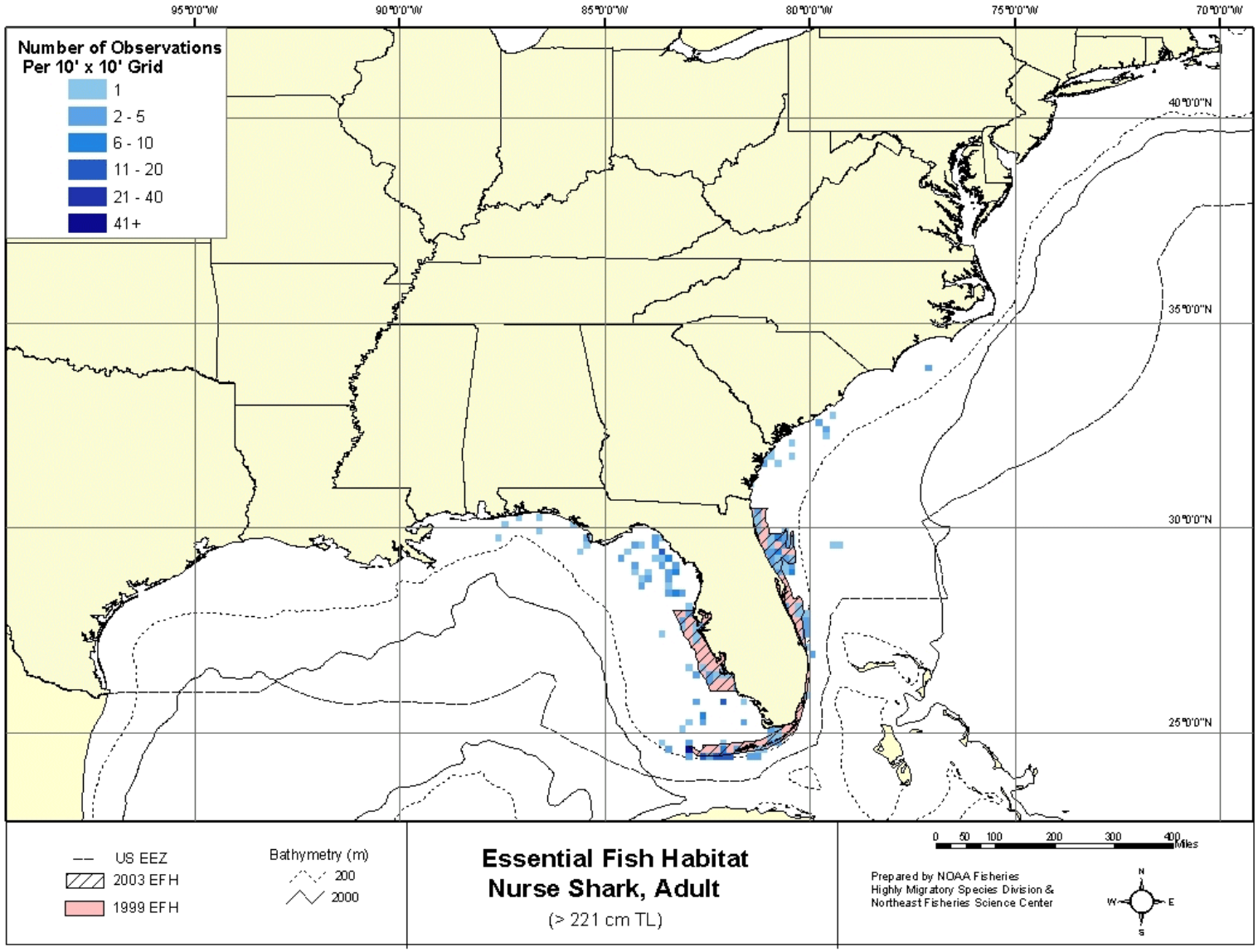

Figure 10.6a Essential Fish Habitat - Finetooth Shark, All Life Stages

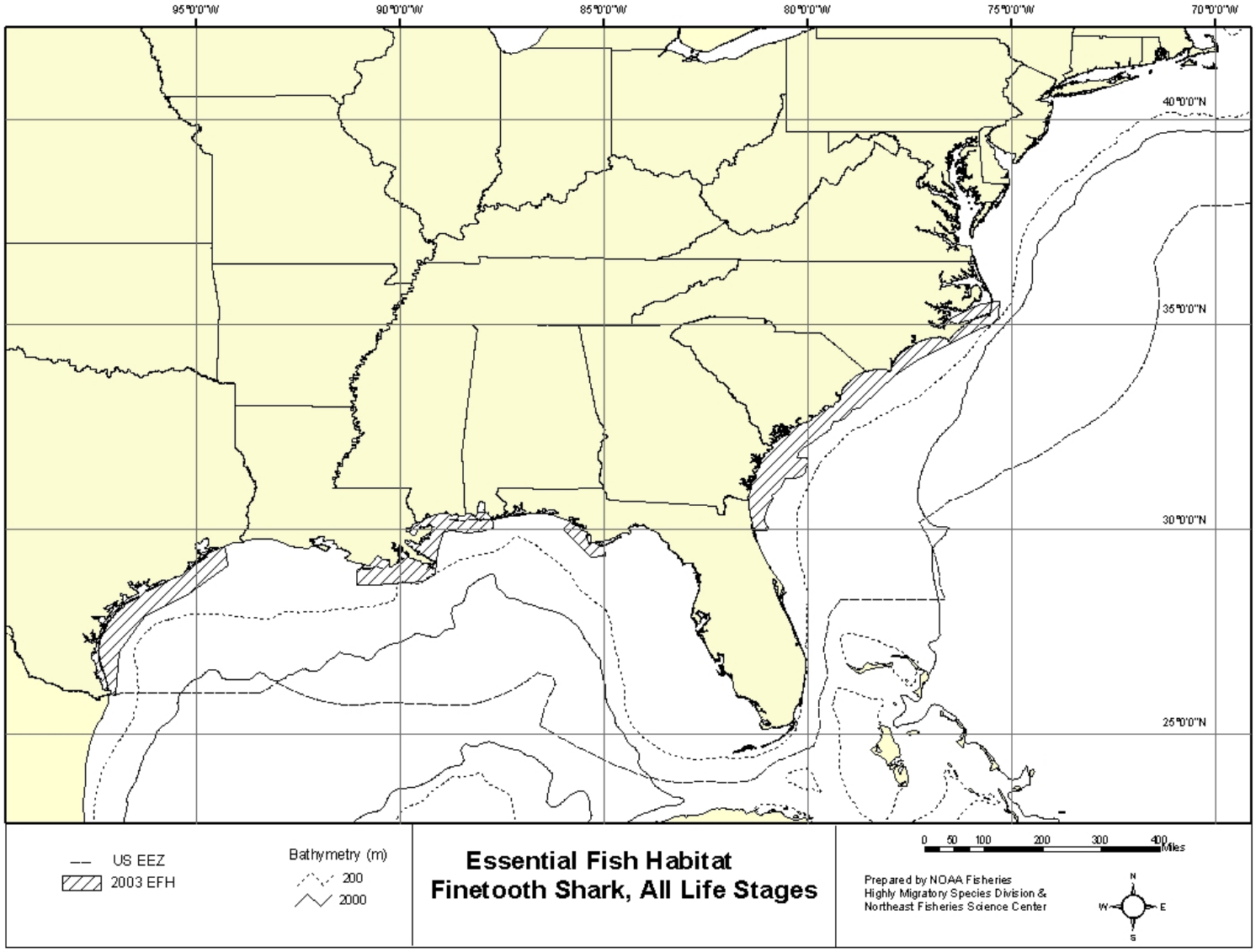

Figure 10.6b Essential Fish Habitat - Finetooth Shark, Neonate

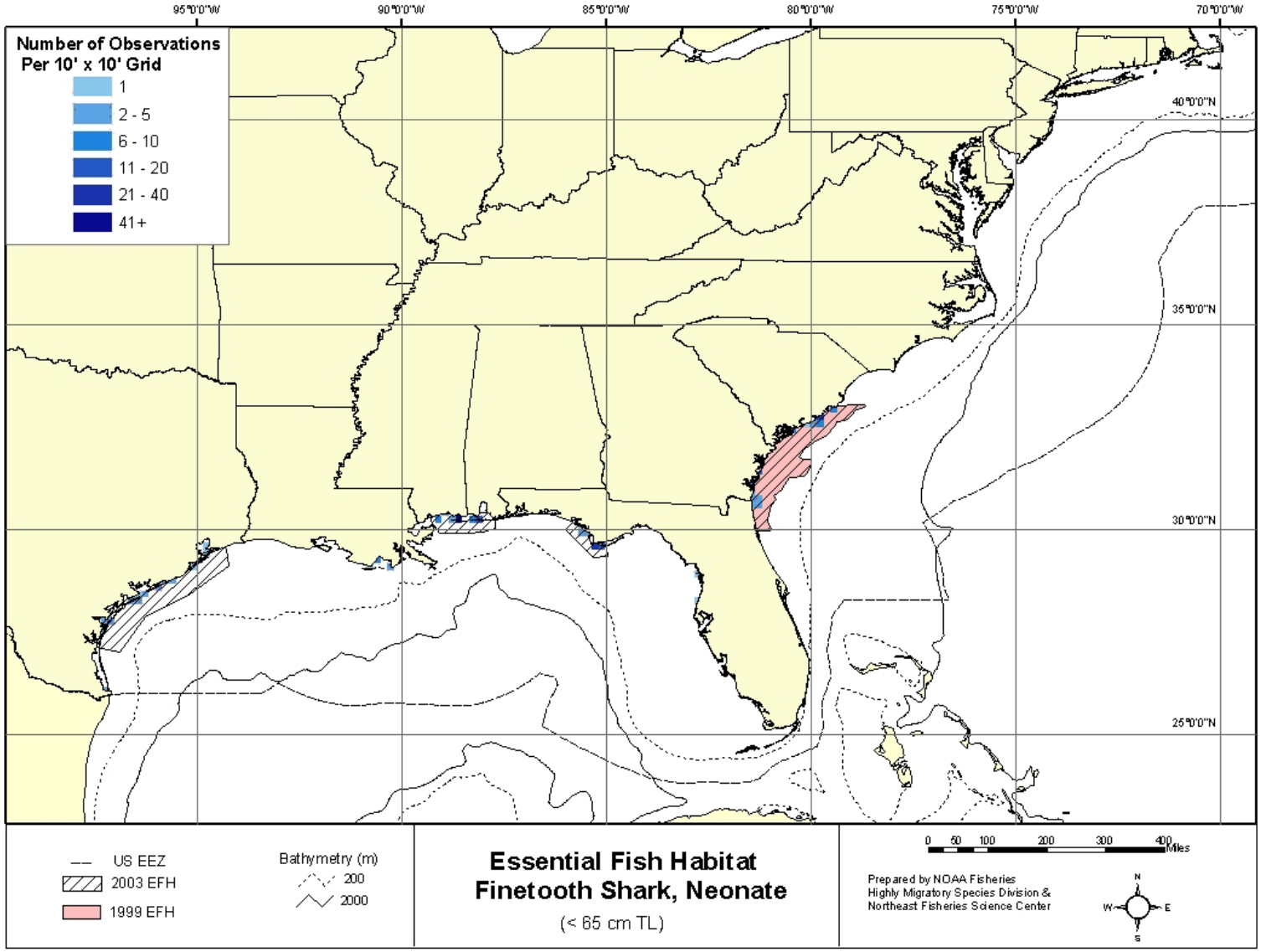

Figure 10.6c Essential Fish Habitat - Finetooth Shark, Juvenile

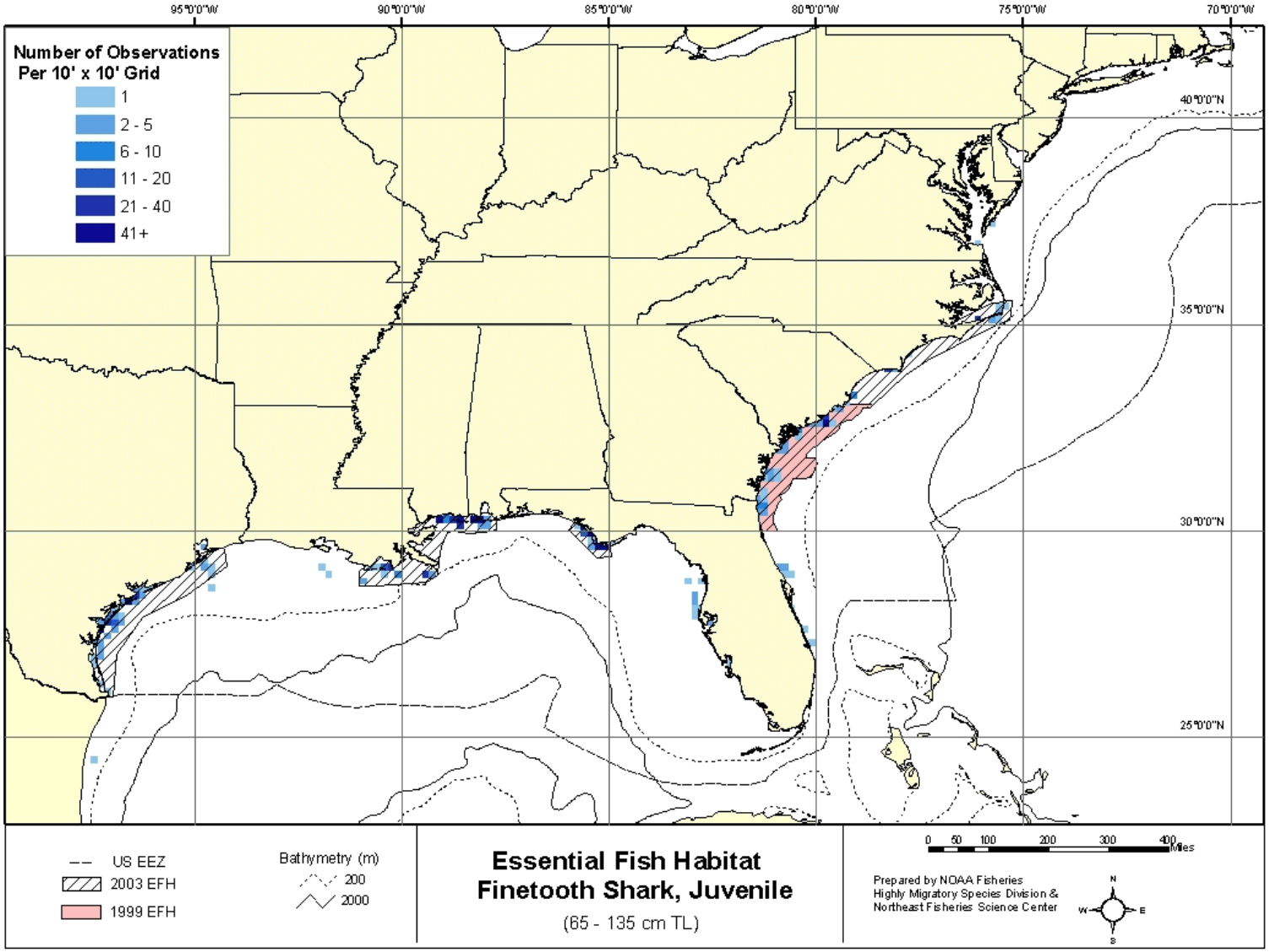

Figure 10.6d Essential Fish Habitat - Finetooth Shark, Adult

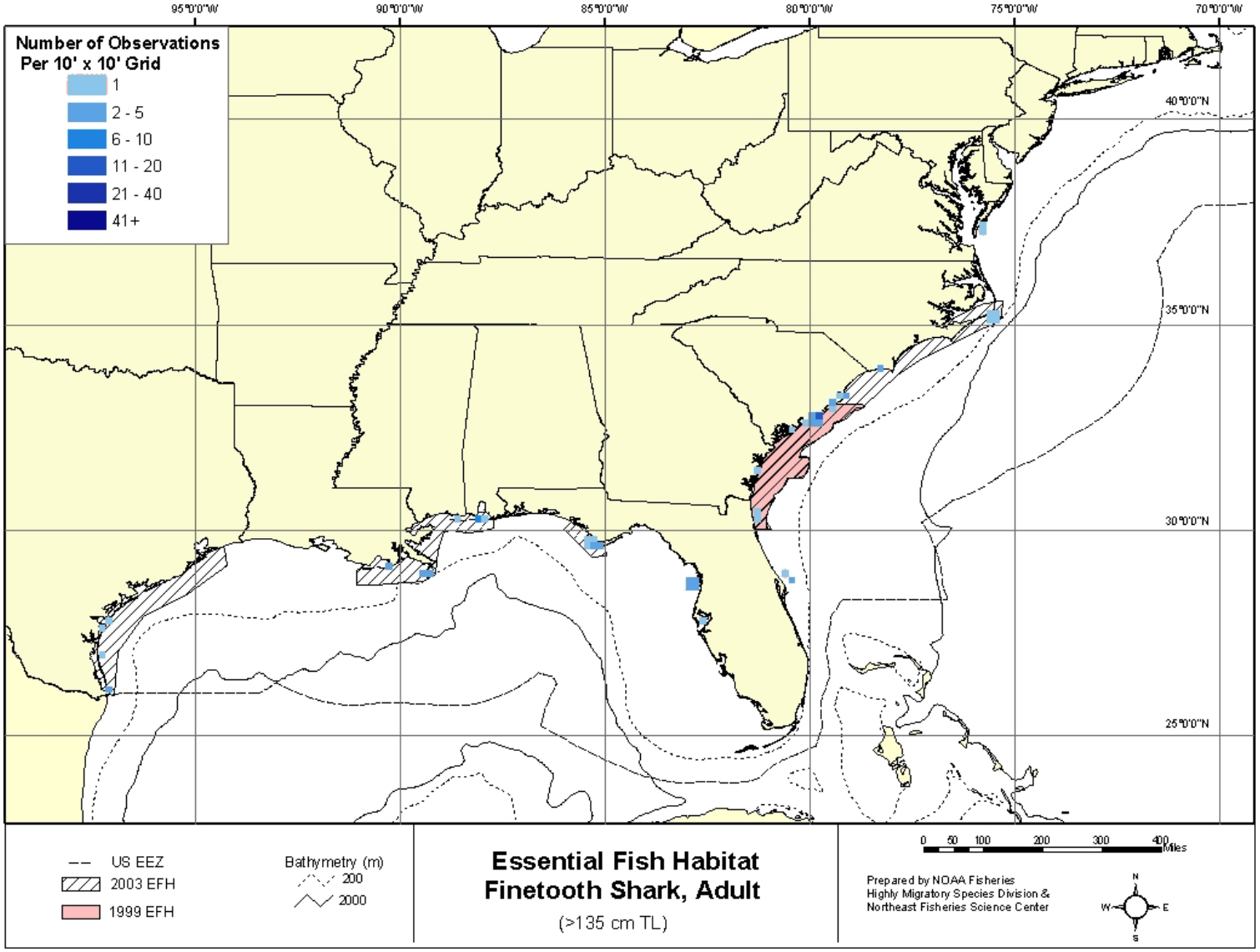

Table 10.8 List of Data Sources and Contacts Used to Update EFH Information.

American Littoral Society
Contact info: Pam Carlsen, 732-291-0055, The American Littoral Society, Sandy Hook, Highlands, NJ 07732

Cooperative Atlantic States Shark Pupping and Nursery Areas (COASTSPAN)
Contact info: Cami McCandless, Apex Predators Program, NMFS Narragansett Lab, 28 Tarzwell Drive, Narragansett, RI 02882

Cooperative Tagging Center
Contact info: Eric Prince, 305-361-4248, ext. 248 eric.prince@noaa.gov, Southeast Fishery Science Center, Room 320A, 75 Virginia Beach Drive, Miami, Florida 33149

Marine Recreational Fisheries Statistics Survey (MRFSS)
Contact info: David Van Voorhees, 301-713-2328, ext.154, dave.van.voorhees@noaa.gov, NMFS, F/ST1, Building SSMC3, Room 12454, 1315 East West Hwy, Silver Spring, MD 20910-3282

NMFS Northeast Longline Shark Survey
Contact info: Lisa Natanson, 401-782-3320, lisa.natanson@noaa.gov, Apex Predators Program, NOAA Fisheries Narragansett Lab, 28 Tarzwell Drive, Narragansett RI, 02882

Mote Center for Shark Research
Contact info: Robert Hueter, 941-388-4441, ext. 323, rhueter@mote.org, Center for Shark Research, Mote Marine Laboratory, 1600 Ken Thompson Pkwy, Sarasota, FL 34236.

NOAA Fisheries Cooperative Shark Tagging Program
Contact info: Nancy Kohler, 401-782-3332, nancy.kohler@noaa.gov, Apex Predators Program, NOAA Fisheries Narragansett Lab, 28 Tarzwell Drive, Narragansett, RI 02882

NOAA Fisheries Southeast Longline Shark Survey
Contact info: Mark Grace, 228-762-4591, ext. 281, mgrace@triton.pas.nmfs.gov, Southeast Fisheries Science Center, Pascagoula Laboratory, P.O. Drawer 1207, Pascagoula, MS 39567

Pelagic Longline Logbook (Fisheries Logbook System)
Contact info: John Poffenberger, 305-361-4263, ext. 235, john.poffenberger@noaa.gov, Southeast Fishery Science Center, Room 201, 75 Virginia Beach Drive, Miami, Florida 33149

Pelagic Observer Program
Contact info: Dennis Lee, 305-361-4247, ext. 247 dennis.lee@noaa.gov, Southeast Fishery Science Center, Room 324, 75 Virginia Beach Drive, Miami, Florida 33149

SCDNR Marine Game Fish Tagging Program
Contact info: Robert Wiggers, 843-953-9363, SCDNR Marine Game Fish Tagging Program, Office of Fisheries Management, P.O. Box 12559, Charleston, SC 29422

Shark Observer Program.
Contact info: George Burgess, 352-392-2360, gburgess@flmnh.ufl.edu, Florida Museum of Natural History-Division of Fishes, University of Florida, Gainesville, FL 32611
Southern Atlantic SEAMAP Shallow Water Trawl Survey
Contact info: Pearse Webster, 843-762-5111, websterp@xiphias.mrd.dnr.state.sc.us, SC Department of Natural Resources

Virginia Insitutue of Marine Science Longline Survey
Contact info: John A. Musick, 804-684-7317, jmusick@vims.edu, Virginia Institute of Marine Science, P.O. Box 1346, Gloucester Point, Virginia 23062-1346

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11.0 OTHER CONSIDERATIONS

11.1 NATIONAL STANDARDS

The analyses in this document are consistent with the NS guidelines set forth in the 50 CFR part 600 regulations. The preferred alternatives facilitate rebuilding of shark species by closing a known nursery and pupping area, by creating regional quotas based on MSY and recent participation, by establishing a trimester fishing year, by implementing gear restrictions, and by providing for the thorough and accurate identification of EFH. This is consistent with NS 1, which provides that conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the OY from each fishery. NOAA Fisheries continues to work to protect highly migratory species in the Atlantic Ocean throughout their range, while also implementing domestic measures that are consistent with domestic legislation. The analyses are based on the best scientific information available (NS 2), including a peer reviewed LCS stock assessment, a SCS stock assessment, observer data, and fishery dependent and independent data, which provide for management of these stocks, throughout their ranges (NS 3). The HMS FMP requires periodic stock assessments for species or species-groups. Thus, while this Amendment is based on the best available science at this time, NOAA Fisheries will, as new information becomes available, make appropriate adjustments to the rebuilding plan through rulemakings to ensure that rebuilding occurs within the time frame established.

With regard to NS 4, the preferred time/area closure and VMS requirement are not direct allocations of fishing privileges nor do they discriminate between residents of different states. The time/area closure may disadvantage shark fishermen living in the areas adjacent to the closed area because they would have to travel to an open area, but a closure is justified under NS 4 as a conservation measure to eliminate bycatch of neonate and juvenile dusky and sandbar sharks in a known pupping and nursery area with no discriminatory intent. Furthermore, the closure and VMS requirement apply to all directed shark bottom longline fishermen, so fishermen from all states would be subject to the same restrictions. The establishment of regional quotas is not a direct allocation nor does it discriminate between shark fishermen in different regions. The quota allocations are based on average historical landings and are intended to enhance equity. Even if the establishment of regional quotas might be considered an allocation, the regional quota system is consistent with NS 4. It is fair and equitable because it is based on historical landings, and NOAA Fisheries will be able to monitor how quotas are used and adjust them over time to promote achievement of OY. Regional quotas are also consistent with the FMP objectives of (1) better coordinating domestic conservation and management of shark fisheries considering the multispecies nature of many HMS fisheries, overlapping regional and individual participation, international management concerns, historical fishing patterns and participation, and other relevant factors as well as (2) minimizing, to the extent practicable, the economic displacement and other adverse impacts on fishing communities during the transition from overfished fisheries to healthy ones. In addition, it will not impose any hardships because the quotas are based on average historical landings (over the past three years) expressed as a percentage of average landings across all regions. The regional quotas promote conservation, and because they are

based on historical information, they will not result in any person or entity acquiring excessive shares of fishing privileges.

The LCS complex is overfished and overfishing is occurring. The FMP objectives, consistent with NS 1, include preventing overfishing, rebuilding overfished stocks, and reducing bycatch. Given these responsibilities, the preferred alternatives consider efficiency where practicable (NS 5). Specifically, preferred alternative D2 promotes efficiency by not implementing a minimum size for commercially caught LCS, SCS, or pelagic sharks. The preferred time/area closure (alternative K2) combined with the VMS requirements (alternative J4) will allow the fishery to operate at the lowest possible cost (e.g., fishing effort, administration, and enforcement) (NS 5). With regard to NS 6, the preferred alternatives are flexible enough to be changed under the FMP framework to accommodate biological, social, and economic variability. Specifically, the mechanism for adding and removing species from the prohibited species group could allow for more rapid and adaptive management. NOAA Fisheries will continue data collection programs with respect to this fishery in order to assess the effectiveness of the program. NOAA Fisheries considered the costs and benefits of the alternatives using social and economic inputs in Chapters 4, 6, and 9 of this document, as required by NS 7 and NS 8. As reflected in those chapters, in analyzing and comparing the ecological, economic, and social impacts of various alternatives, including no action alternatives, NOAA Fisheries has concluded that the benefits of the preferred alternatives are real and substantial relative to administrative, research, and enforcement costs, and costs to the industry (NS 7).

Consistent with NS 8, NOAA Fisheries has considered the impacts of these alternatives, to the extent practicable, on fishing communities in Chapter 9. As described in Chapters 4, 6, and 9, certain measures, such as preferred alternative K2, may impact particular communities, however, these measures are needed in order to ensure that the overfished/overfishing problem is addresses in the LCS fishery. Given the need to address overfishing, the preferred alternatives minimize adverse impacts to the extent practicable. This document specifically addresses NS 9 by preferring alternatives that minimize bycatch and bycatch mortality, to the extent practicable, in the Atlantic shark fisheries. As reflected in Chapters 4, 6, and 9, NOAA Fisheries has analyzed the ecological impacts of various bycatch alternatives on the bycatch species and protected species and related economic and social impacts, as well as administrative, enforcement, and management considerations. Based on these analyses and in consideration of the other national standards, NOAA Fisheries has concluded that the preferred bycatch alternatives minimize bycatch and minimize the mortality of such bycatch to the extent practicable. In terms of NS 10, the preferred alternatives described in Chapters 2 and 4 will not require fishermen to fish in an unsafe manner. Specifically, preferred alternative J4 requires the use VMS which promotes the safety of life at sea. NOAA Fisheries urges fishermen to use caution, but cannot control what individual fishermen do in response to the preferred time/area closure or other preferred alternatives.

11.2 PAPERWORK REDUCTION ACT

In addition to existing bycatch reduction measures (alternative J1), alternative J4 (preferred) would require VMS on shark gillnet vessels during right whale calving season and would require VMS on directed bottom longline shark fishing vessels operating near the time/area closure off of North Carolina (alternative K2).

In response to preferred alternatives J4 (VMS requirements) and K2 (implementation of a time/area closure off North Carolina) a Paperwork Reduction Act (PRA) package was completed and submitted to the Office of Management and Budget for data collection with VMS in Atlantic shark fisheries. This new information collection (OMB NO.: 0648 - 0483) was approved on 09/28/2003 and expires on 09/30/2006.

The VMS program would be used by NOAA Fisheries to reduce observer program costs and improve enforcement of existing and proposed time/area closures, to monitor the fleet during closed periods, to deter illegal fishing, to increase efficiency of surveillance patrols, to facilitate enforcement investigations, and to support enforcement of other regulations, such as closed seasons, once a quota has been reached.

The VMS program would aid NOAA Fisheries' Office of Law Enforcement in monitoring and enforcing the existing and preferred time/area closures effecting commercial shark fisheries. Currently, shark gillnet fishermen must comply with specific requirements in the Southeast U.S. Observer Area (from 32°00' N to 26°46.5' N and extending from the shore eastward to 80°00' W) and specific gear prohibitions in the Southeast U.S. Restricted Area (from 32°00' N to 27°51' N and extending from the shore eastward to 80°00' W), from November 15 - March 31. This time/area closure was implemented to minimize right whale interactions as part of the Atlantic Large Whale Take Reduction Plan and authorized under the Marine Mammal Protection Act.

Additionally, an area from Oregon Inlet, North Carolina at 35˚41' North offshore to 74˚51' West, then following the 60 fathom contour to 35˚30' North and 74˚46' West and continuing along the 60 fathom contour south to 33˚51' North and 76˚24' West will be closed to directed shark fishing vessels with bottom longline gear on board from January 1 - July 31 (Figures 2.2 and 4.1). This time/area closure is designed to reduce bycatch and mortality of neonate and juvenile dusky and sandbar sharks in compliance with National Standard 9 of the Magnuson-Stevens Act.

Approximately 14 directed bottom longline shark fishing vessels will be required to install VMS units and activate them during the January 1 - July 31 time/area closure period. However, NOAA Fisheries estimates that only seven of these vessels will need to purchase new VMS units (see analysis in Appendix 4). The five currently active shark gillnet vessels will be required to install VMS units and activate them during the November 15 - March 31 right whale calving period. Since there is no limit on the number of limited access permit holders that can use shark gillnet gear (the total number of vessels is limited, not the gear), it is possible that the number of vessels required to install VMS units during the right whale calving period could increase,

although NOAA Fisheries does not believe that this fishery will expand. Traditional methods of surveillance by ships and planes would be ineffective in patrolling these large areas. VMS is designed to automatically provide periodic position reports on all vessels with transmitting units installed.

Using VMS to verify the location of a vessel is passive and automatic, requiring no reporting time on the part of the vessel operator. More specifically, possible benefits for management include increased compliance with time/area restrictions, enhanced enforcement effectiveness, and improved catch/effort data collection. Other possible benefits of the VMS include increased vessel safety and dependable and confidential communications, which may improve fleet management.

Monitoring and enforcement are essential components of fisheries management. Monitoring fishing vessels facilitates enforcement of NOAA Fisheries' conservation and management regulations by enabling detection of violations. Monitoring also promotes compliance by having a general deterrent effect. Lack of proper monitoring and enforcement makes it difficult to gauge the effectiveness of conservation and management measures and may compromise their success. In the case of overfished stocks, success is necessary to prevent further overfishing and subsequent decline to dangerously low stock levels. As a practical matter it is very difficult for enforcement personnel to effectively monitor the full operational range of the U.S. directed shark fishing fleet without having some method of detecting a vessel's location. With respect to shark gillnet and shark bottom longline time/area closures in particular, the size of the closed areas significantly diminishes the likelihood of detection through conventional surveillance methods.

VMS is the best technology available at this time for monitoring vessel locations to aid enforcement efforts. The integrated Global Positioning System (GPS) provides a near real-time mechanism for submitting accurate position reports. VMS is considered much more accurate than the existing system (i.e., self-reported logbooks) for reporting geographical distribution of fishing effort for each trip. Fishing vessel logbook records (NOAA FORM 88-186) are submitted by fishermen no later than seven days after offloading and provide limited information regarding the distribution of fishing effort. NOAA Fisheries is aware of problems with the accuracy of self-reported logbooks. Logbooks provide essentially one statistical grid location per species per trip and that information is not reported until after the trip is complete. VMS, on the other hand, provides 24 position reports each day for the duration of the trip. This also allows enforcement to react immediately if a vessel is found fishing in a closed area.

Some vessel owners, in other fisheries, have taken advantage of this technology by linking personal computers to the VMS units so that improved communications with other vessels and port facilities can be made. This has personal, business, and safety advantages for fishermen and may provide a platform for future electronic logbook reporting of both target and non-target species.

The preferred regulations will require shark fishing vessels to install VMS units at an initial average cost of approximately $1,300-3,250 ($1,000-2,500 per unit and $300-750 installation fee), an average annual maintenance cost of approximately $500/year, and approximately $1.44/day for position reports. In an attempt to provide vessel owners with flexibility and help minimize costs, NOAA Fisheries has type-approved four VMS units from two manufacturers for use in the pelagic longline fisheries. No VMS units have been type-approved specifically for use in the Atlantic shark fisheries as of this date. Based on the range of VMS units commercially available, NOAA Fisheries expects any VMS unit type-approved for Atlantic shark fisheries to be similar or identical to those type-approved for the pelagic longline fisheries. NOAA Fisheries Office of Law Enforcement will publish in the Federal Register a type-approval list for units and service providers before the requirement is fully implemented/effective

Once the VMS is installed, no action is required on the part of the vessel operator except to verify that the system is on. While at sea, position reports will be automatically sent from the VMS on an hourly basis.

There would be no significant costs to the Federal government. NOAA Fisheries is developing an integrated hardware and tracking system to manage the various VMS programs being developed for many other U.S. fisheries. Those costs are already covered by current programs of the Office of Law Enforcement and are extraneous to this collection. Given the current capacity of these systems, incremental costs specifically attributable to the Atlantic shark fisheries VMS program are negligible.

11.3 ONGOING MANAGEMENT AND THE PROCEDURE FOR ADJUSTING THE MANAGEMENT MEASURES

Section 3.10 of the HMS FMP outlined the process for amending or modifying regulations via framework or FMP amendment action. In the HMS FMP, NOAA Fisheries stated that:

> Based on the annual SAFE report, deliberations of the AP, and other relevant factors, [NOAA Fisheries] will determine whether any adjustments to the regulations are necessary to implement the FMP's management measures and to achieve the management objectives and rebuilding programs stated in this FMP. Adjustments made through the framework to meet the objectives of the FMP may include changes in:
>
> - actions to implement ICCAT recommendations, as appropriate;
> - domestic quotas;
> - Atlantic tunas Purse Seine category cap on bluefin tuna quota;
> - commercial retention limits;
> - recreational retention limits;
> - maximum sustainable yield or optimum yield levels based on the latest stock assessment or updates in the SAFE report;

- species size limits;
- permitting and reporting requirements;
- composition of the species groups;
- fishing year or season;
- time/area restrictions;
- target catch requirements;
- gear prohibitions, modifications, or use restrictions;
- effort restrictions; and
- essential fish habitat.

Based on this FMP Amendment, NOAA Fisheries is adding the following items to the list of regulations that could be adjusted through a framework action to meet the objectives of the FMP:

- any shark species management group based on additions to or removals from the prohibited species list;
- classification system within shark species groups;
- shark management regions and the regional quotas; and,
- quota allocations between shark fishing seasons.

References for Section 11.0
No references cited.

References for Section 11.1
No references cited.

References for Section 11.2
No references cited.

References for Section 11.3
No references cited.

12.0 LIST OF PREPARERS

The development of this draft FMP Amendment involved input from many people within NOAA Fisheries, NOAA Fisheries contractors, and input from constituent groups including the HMS Advisory Panel. Major contributors, in alphabetical order, include, but are not limited to:

Karyl Brewster-Geisz
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Chris Rilling
Margo Schulze-Haugen
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Christopher Rogers

The development of this draft FMP Amendment also involved considerable input from other staff members and Offices throughout NOAA including the Southeast Fisheries Science Center, the Office of Habitat Conservation, the Office of Protected Resources, Caroline Park, Stacey Nathanson, Nancy Thompson, Gerry Scott, and John Hansel.

13.0 LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS CONSULTED AND TO WHOM COPIES OF THE EIS WILL BE SENT

Under 304(g)(1)(A) of the Magnuson-Stevens Act and under the regulatory process for managing HMS, NOAA Fisheries is required to consult with affected Fishery Management Councils, ICCAT commissioners and advisory groups, and the Advisory Panels established under the Magnuson-Stevens Act regarding amendments to the HMS FMP. As such, NOAA Fisheries sent the Issues and Options paper and a pre-draft document to all consulting parties and to the Atlantic States and Gulf States Marine Fisheries Commissions. NOAA Fisheries also requested time to present the issues in this document to the Fishery Management Councils. At the time of drafting, NOAA Fisheries was allotted time to discuss this Amendment at the Gulf of Mexico Fishery Management Council Meeting in Naples, Florida; the New England Fishery Management Council Meeting in Portland, Maine; and the Mid-Atlantic Fishery Management Council Meeting in Baltimore, Maryland.

During the scoping process for this document, NOAA Fisheries held seven scoping meetings along the Atlantic and Gulf of Mexico coasts to accept numerous written comments. One of the scoping meetings was held at the February 2002 HMS Advisory Panel meeting. NOAA Fisheries summarized the comments received in Appendix 2 of this document.

During the public comment period for this document and associated proposed rule, NOAA Fisheries held six public hearings (e.g. New Orleans, LA; Madeira Beach, FL; Montauk, NY; Pawleys Island, SC; Manteo, NC; Atlantic Beach, FL), attended three Council meetings (e.g. Gulf of Mexico Fishery Management Council; New England Fishery Management Council; Mid-Atlantic Fishery Management Council), and convened the HMS Advisory Panel to obtain comments. NOAA Fisheries also sent copies of the DEIS and associated proposed rule to all consulting parties, members of the HMS Advisory Panel, the Atlantic States and Gulf States Marine Fisheries Commissions, the Offices of Protected Resources, Habitat Conservation, Law Enforcement, and the Southeast Fisheries Science Center within NOAA, the U.S. Coast Guard, Environmental Protection Agency and its regions, as well as to any interested members of the public. Comments on the draft document and associated proposed rule were accepted from August 1, 2003 through October 3, 2003. NOAA Fisheries received 36 written comments, which are summarized in Appendix 5 of this document.

APPENDIX 1 THE PEER REVIEW OF THE 2002 LCS STOCK ASSESSMENT

NOAA Fisheries announced the availability of the LCS stock assessment on October 17, 2002 (67 FR 64098). At that time, NOAA Fisheries submitted the stock assessment and the related documents to Natural Resources Consultants, Inc. (NRC) to be independently reviewed per the peer review process outlined in the settlement agreement with Southern Offshore Fishing Association *et al* (SOFA). NRC selected three independent parties to conduct the peer review: Dr. Terry Quinn II, Dr. Kim Holland, and Dr. Dayton L. Alverson. The names of the reviewers were not disclosed to NOAA Fisheries, SOFA, or the public until the review was complete. The entire peer review process was completed on December 20, 2002, after the emergency rule and its accompanying documents was finalized. Copies of the peer reviews are available on the web at http://www.nmfs.noaa.gov/sfa/hmspg.html or by contacting Karyl Brewster-Geisz at (301) 713-2347.

Overall, the peer reviews concluded that the models and methodology used in the 2002 LCS stock assessment were appropriate. Thus, the peer reviews reaffirmed NOAA Fisheries determination that the 2002 LCS stock assessment constitutes the best available science. Because the peer reviews do not find any fundamental errors or flaws in the 2002 LCS stock assessment, the results of the peer reviews did not change NOAA Fisheries' decision to implement the management measures in emergency rule. The peer reviews will also be considered in Amendment 1 to the HMS FMP.

The executive summaries of the three reviewers, as submitted to NOAA Fisheries, are below.

Executive Summary of Dr. Quinn II:

> My review of the 2002 assessment of large coastal sharks suggests that a state-of-the-art was performed using the best scientific information available. Alternative datasets were constructed for catch to represent the uncertainties in the data. Several indices of abundance were compiled and used in the assessment with two weighting systems. Six alternative stock assessment models were evaluated, and five of these were used in the stock assessment document. Alternative harvest policies from no catch to 150% of the year 2000 catch were contrasted, and management implications were discussed.
>
> The stock assessment results show that there is great uncertainty in estimates of abundance, fishing mortality, and management parameters such as MSY. This difficulty can be traced to and high variability, uncertainty, and conflicting information in the data. The stock assessment wisely uses Bayesian analyses to provide an objective, albeit uncertain, assessment of stock status.
>
> The stock assessment concludes that the condition of sandbar and blacktip sharks is good. Using "inference by subtraction", it concludes that there is no evidence that some species in the LCS complex may be in a poor condition. The declines in some of the

indices of abundance since the 1970s and 1980s mean that these results from the assessment of the LCS complex may actually be valid. The problem is that the stock assessment did not examine individual species to see where the problems may lie. Whether there is sufficient information on which to take management action depends on the level of risk one is willing to accept. There is neither positive proof of an effect on the complex nor positive proof of no effect. It should be noted that many shark species have low productivity and are long-lived, so that failure to take action could result in long-term depletion of some species.

Improvements to the assessment can be made in the future. Further investigation of indices should be undertaken. Assessments should be done for more species or species groups in the LCS complex. Further investigation of age and age-sex-area models should occur. Investigation of alternative and robust harvest policies in contrast to the current constant-catch policy should occur in the future.

Executive Summary of Dr. Holland:

This review covers material (methods, results and recommendations) contained in both the 2002 Shark Evaluation Workshop Report (SEW) and the subsequent 2002 Stock Assessment (SA). The evaluation was based on a careful review of these documents and the accompanying background literature. In addressing specific items contained within the Scope of Work, particular emphasis was placed on evaluating the way in which the 2002 SEW and 2002 SA responded to the recommendations of previous independent reviews of the 1998 SEW.

I find the 2002 SEW to be a good faith effort by NMFS to address the various criticisms and concerns that were raised regarding the methods, results and recommendations of 1998 SEW. The scope of work of the various 2002 SEW working groups represented a logical approach to providing the best available scientific data for the various analyses and their subsequent interpretation. The current analyses incorporated several substantive changes or additions to those of the 1998 SEW. Many of these changes were in accord with the suggestions of previous reviewers and included age-structured models, models that consider delayed recruitment of animals into the fishery and models that attempt to capture the potential differences in responses to exploitation of open versus closed populations, among others. Recently acquired biological data (e.g., juvenile survival rates) were incorporated into the analyses. Also, considerable effort was expended in trying to reconstruct historical catch rates to provide longer time series. As suggested by reviewers of the 1998 SEW, sensitivity analyses were applied to the results of the various models. In the 2002 iteration, the weighting and importance functions are explicitly described as are the other criteria used for evaluating which results make 'more sense' than others do. As suggested by commercial shark fishing interests, estimates of the Mexican catch were incorporated into the models.

The 2002 SEW and the Stock Assessment are scientifically rigorous bodies of work. These exhaustive attempts to include the multiplicity of recommendations from previous reviews are almost self-defeating; so many permutations were considered that the assessment document is cumbersome and difficult to digest. Fortunately (or unfortunately), there is an overwhelming consistency to the results; the LCS resources of the Western Atlantic and Gulf of Mexico have been exploited beyond sustainable rates and populations are at or below levels required to sustain MSY. Recent management restrictions may have halted the decline in these stocks but current exploitation rates will not stabilize them at (or allow them to rebuild to) MSY levels. These results are consistent with the results of the 1998 SEW. The reliability of the models and their pertinence to stock management continue to be impacted by the paucity of historical catch data and uncertainty about the reliability of certain data sources. However, I find that the catch levels recommended in the 2002 Stock Assessment follow logically from the results that were presented in the document especially when viewed in light of the Precautionary Approach to resource management. To improve future stock assessments, NMFS should support on-board observer programs and programs (e.g., VIMS, Mote, NMFS-Mississippi) that acquire fishery independent estimates of abundance. Movement and habitat utilization research should be high priorities.

Executive Summary of Dr. Alverson:

The author found some difficulty in relating the work of the SEW to the subsequent major stock assessment document undertaken by the NMFS and it was not always clear whether NMFS had followed the suggestions of the SEW in regard to procedures and recommended mixing rates between the U.S. and Mexico stocks and other potential out migrations. Nevertheless, in my opinion, the works of the 2002 SEW and the NMFS are highly professional in character, management recommendations contained in the 2002 SEW and NMFS (Sept.) documents are based on appropriate fisheries stock assessment techniques and that the scientist based their conclusions on relevant available science. The major effort of the 2002 SEW and NMFS efforts were dedicated to responding to comments made by independent scientists regarding the information base, the need to standardize data sets, underlying assumptions used and the legitimacy and nature of the models employed. In this regard the SEW/NMFS scientists have undertaken an exhaustive effort to organize and reassemble the catch data to include information on catches in Mexico and bycatch mortality, standardize data sets and extended the modeling to include age dependent data and open populations. In addition, a range of statistical methods has been employed to evaluate the model's sensitivity to different inputs and to examine model performance. These efforts demonstrate a very real commitment to respond to earlier identified problems noted by industry and outside reviewers. In my view, the SEW/NMFS scientists provide a range of projections upon which managers can precede with appropriate measures to maintain the sustainability of the LCS resources. Since the comments on the status of stocks and the need for potential management actions is only found in the NMFS document it is not clear how

the SEW members have or would have responded to the NMFS generic management comments. This reviewer is in general agreement with the findings and recommendations of the SEW/NMFS 2002 reports.

In the future, work of the SEW should be completed at the time of the meeting of the selected SEW scientists and not dependent on work subsequently done outside the SEW by any party. It is suggested that over the next several years the scientists concentrate on improving life history, taxonomic and behavioral aspects of important LCSs. Some attempt to examine open and closed populations should consider the probability of recovery. In the LCS group, reductions in the TAC of species other than sandbar and blacktip sharks should be considered, as proposed by the NMFS. For sandbar and other sharks further reductions in fishing related mortalities should be achieved through the decrease of bycatch mortality and/or increasing the survival of sharks caught as bycatch in non-target fisheries. The possibility of increasing the catch of blacktip sharks should be carefully examined. Considering the uncertainty in some of the CPUE indices, perhaps the TAC should remain unchanged and the trend in the population reviewed over the next several years.

APPENDIX 2 SCOPING SUMMARY REPORT

Summary of Comments Received During Scoping For Amendment 1 to the Fishery Management Plan for Atlantic Tunas, Swordfish, and Sharks

November 15, 2002, through March 17, 2003

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April 15, 2003

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1.0 Why is NOAA Fisheries Amending the HMS FMP?

In 1999, the National Marine Fisheries Service (NOAA Fisheries) finalized the Fishery Management Plan for Atlantic Tunas, Swordfish, and Sharks (also known as the "Highly Migratory Species Fishery Management Plan" or HMS FMP). Soon after it was finalized a number of fishing interests sued NOAA Fisheries on various management measures in the HMS FMP. As a result, not all of the management measures in the HMS FMP were implemented. Additionally, as a result of a settlement agreement with commercial shark fishing interests, NOAA Fisheries had the 1998 large coastal shark (LCS) stock assessment peer reviewed. After considering the results of the peer reviews, NOAA Fisheries determined that the projections of the models used in the 1998 LCS stock assessment no longer constitute the best available science (December 28, 2001, 66 FR 67118).

In 2002, NOAA Fisheries released the first small coastal shark (SCS) stock assessment since 1992 (May 8, 2002, 67 FR 30879) and a new LCS stock assessment (October 17, 2002, 67 FR 64098). The LCS stock assessment incorporated the comments and suggestions of the peer reviews of the 1998 LCS stock assessment. Additionally, the 2002 LCS stock assessment was peer reviewed. The results of the recent peer reviews were generally positive.

Because of the information in the 2002 LCS and SCS stock assessments and because many of the shark related management measures in the HMS FMP were based on science which NOAA Fisheries no longer believes is the best available, NOAA Fisheries must amend the regulations in the HMS FMP. NOAA Fisheries expects Amendment 1 to the HMS FMP to examine management alternatives available to rebuild or prevent overfishing of Atlantic sharks, consistent with the LCS and SCS stock assessments, the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), and other relevant Federal laws. Amendment 1 may also consider alternatives to adjust the process of issuing exempted fishing permits (EFPs) for HMS.

2.0 What was the Purpose of Scoping?

The first phase in preparing an environmental impact statement (EIS) for a fishery management plan amendment is called Scoping. During Scoping, the public has a chance to consider and comment on all the issues related to the subject at hand. In this case, the subject matter was shark management and the issuance of EFPs for HMS. The advice and comments received during Scoping is critical because it is used to explore the full range of alternative approaches to future management and because it allows the public to become involved in the process before any regulations are fully analyzed or proposed.

To facilitate the process of collecting comments, NOAA Fisheries released an Issues and Options paper and held seven public hearings along the Atlantic and Gulf of Mexico coasts (January 27, 2003, 68 FR 3853). The comment period for Scoping ended on March 17, 2003 (November 15, 2003, 67 FR 69180). A number of issues and options beyond those presented in the Issues and

Options paper were identified by the public during the series of scoping meetings. All comments received during Scoping will be considered when drafting the amendment to the HMS FMP.

3.0 What were the Comments Received?

Below is a summary of the major comments received during scoping. Comments are arranged by major issue and are not in any particular order.

3.1 Commercial Management

Quotas and Mortality

- Quotas need to be sustainable
- All sources of mortality including dead discards and state landings must counted against the commercial quota
- All dead discards by all commercial vessels should be counted against the commercial quota; this will allow a powerful incentive for commercial and recreational fishermen to lobby shrimp trawlers and other fisheries to reduce the number of sharks they inadvertently kill
- Dead discards should be counted against the commercial quota; only figuring them into stock assessments does not provide incentive to fishermen to minimize bycatch
- Dead discards should be estimated from observer reports, not logbooks
- NOAA Fisheries should set a simple quota as was done in the past and not confuse the stakeholders
- Louisiana regulations already conforms to Federal closures; other states need to do the same
- Does the quota account for increased pelagic longline discards in the fishery?
- Because NOAA Fisheries does not have timely reports of dead discards, quotas should not account for dead discards and state landings in order to minimize confusion to the fishermen
- Would rather have a shorter season and keep all the fish; allow some landings of Dusky sharks to reduce dead discards (80% of Dusky sharks caught are dead); put the extra quota into a reserve
- Quotas should be managed via the aggregates because we cannot catch just one species; don't go species specific
- Species-specific management is the best way to protect vulnerable species but because the gear is non-selective, the species must be managed as one unit
- Bycatch of sharks in non-HMS fisheries needs to be minimized and counted against any directed fishery quota in order to sustain shark populations
- Fishermen should develop more selective fishing methods to allow for species-specific management
- Because the gear is non-selective, the quota for the entire LCS complex should be reduced by 50% consistent with the stock assessment
- Management should be based on the weakest stock; the current aggregate quota structure

focuses on the most commercially valuable species thereby neglecting the conservation needs of the most vulnerable species

- Due to difficulty identifying species, LCS should be managed as a unit but quotas should be linked to the species that is the most overfished; once that quota is reached, the fishery should be closed
- Allowing an additional month of non-ridgeback fishing will only increase dead discards; this is inconsistent with the rule to reduce dead discards in bluefin fishery
- NOAA Fisheries should analyze temporal-specific quota options such as a quarterly structure that would allow closure during the spring pupping season
- Temporal specific quotas would be a win-win situation; split the season into four quarters and close the second quarter for pupping season. This will spread the markets out and the big run of Dusky sharks in the spring will get away. Other quota options are too tough to enforce
- NOAA Fisheries should analyze the benefits of combining quota options such as a regional ridgeback quota to improve dusky shark recovery
- Quotas should be based on landings with target reference points, not fishing mortality which is better suited for faster-growing species
- Quotas should be set concurrent with shark stock assessments (every 2-4 years) that incorporates a 70% probability of success
- Adjustments for overages and discards must be made every year
- Keep quota within the year; if there is quota left over from the winter, add it to the last quarter within the year
- The current "rolling" quota system in place works well; if you go over, subtract it from the same season in the following year; this provides geographic equity
- Quotas must be supplemented by gear limitations and alterations including restrictions and modifications to reduce bycatch
- Quotas should not be increased; the species are all near or at their maximum sustainable yield
- There is nothing on the dealer reports that indicates ridgeback/non-ridgeback; If there are 3 sandbars and 1 blacktip in a bin, they are considered sandbars (i.e., ridgeback) and vice versa.

<u>Minimum size</u>

- NOAA Fisheries should implement the 137 cm FL or larger for ridgeback sharks to protect juveniles
- NOAA Fisheries should examine slot limits to protect the largest reproductive females and improve chances of rebuilding dusky sharks
- Species-specific size limits are difficult to enforce and will lead to less protection than one size limit
- The commercial size limit should not be lowered
- Commercial minimum sizes should be species-specific to reduce confusion between variations in morphology between species
- If a minimum size is implemented, there should also be a tolerance allowance to reduce

dead discards

- The sandbar interdorsal measurement in the current regulations does not fit the morphology of silky or other LCS; if it isn't fixed, regulatory dead discards could increase
- The fishery tries for larger fish because they are worth more but some small fish are caught; why create dead discards with a minimum size
- Minimum sizes increase discards and discard mortality
- There are ways to minimize discard mortality such as dehooking devices

Trip limits

- NOAA Fisheries should maintain the 4,000 lb trip limit
- NOAA Fisheries should not allow incidental landings during a directed closure
- NOAA Fisheries should allow a set-aside incidental quota to reduce and/or eliminate unnecessary discarding during a directed LCS fishery closure
- Incidental landings during a fishery closure should be allowed if they are truly incidental; incidental catch limits should be lowered if landings are allowed after a closure
- The permits should be re-allocated; the number of directed permits should be reduced and the number of incidental permits increased and given to shrimpers to give them an incentive to land sharks
- The trip limit should be increased to 6,000 lb dw to allow commercial fishermen make a better profit
- The trip limit, if increased, should not exceed 5,000 to 6,000 lbs
- 40' - 50' boats can hold 8,000 pounds
- Many vessels catch more than 4,000 pounds per set with less than 10 miles and 750 hooks
- NOAA Fisheries could allow for maximum gear length instead of a trip limit
- A tolerance of 10% should be made for overages in trip limit due to variations in conditions beyond the captain's or crew's control
- Need a tolerance level or an increased trip limit because otherwise fishermen have to break the law or risk their gear or their life
- Work out some penalty if trip limit is exceeded, like not fish the next day; any tolerance should apply only to a set, not a trip
- 4,000 lbs is best because it extends the season but there should be some mechanism or tolerance for sets that exceed the limit
- NOAA Fisheries should maintain the incidental trip limit
- NOAA Fisheries should not create regulatory discards for incidental permit holders; create an incidental quota
- Is the season staying open all year with the 4000 lb limit? If it is, then increase the trip limit; if it isn't, then you should maybe open the season at 4000 lbs and then lower it as an inseason adjustment as the season progresses

Season Openings and Closings

- Fishery openings and closings should be announced 30 days prior to the fishery opening

so fishermen have an opportunity to plan for closure, secure markets, and adjust efforts

- NOAA Fisheries should give 30 day advanced notice of season openings and 14 day notice of closures; NOAA Fisheries should monitor shark dealers more frequently as the season nears its end to ensure the quota is not overharvested
- NOAA Fisheries should announce closures 14 days before closure date
- Prefer a system similar to the bluefin call-in reports so everyone knows where the quota is
- The further ahead we are warned, from a business perspective, the better. We need more time to plan
- From a supplier perspective, the time ahead of the closure doesn't matter much because the product is mostly frozen now
- All open and closed seasons for all species should be synchronized
- NOAA Fisheries should close during "pupping season" (April-June) and allow some exempted permits for fishing offshore outside of nursery grounds
- Currently the seasons open on two holidays - New Year's Eve and July 4; this is bad for the markets and enforcement; opening on the 7th would help
- Look at average lengths of trips and it may vary by area. The inshore fleet might be able to use five days

General

- Sharks have never been a species that could support a sustainable commercial industry
- The commercial fleet should be reduced
- Supporting the commercial industry is a violation of the Magnuson-Stevens Act and renders any management of the recreational sector useless
- Commercial shark fishing should be halted immediately
- NOAA Fisheries should work with states to ensure consistent regulations
- The shark fin to carcass weight should be raised to 6% from 5% to prevent fishermen from getting into trouble with the law if they catch too many sandbar sharks
- The latest shark fin sale numbers show that commercial sale of shark fins is not being managed properly
- Finning should be banned
- NOAA Fisheries should offer a buyback program for the shark drift gillnet fishery
- NOAA Fisheries should not close the shark drift gillnet fishery
- NOAA Fisheries should implement a strategy to ensure all states close with Federal closures
- Is effort in shark fisheries increasing from fishermen displaced by the pelagic longline closed areas?
- Let's not go to individual transferable quotas. It seems that foreign owners have bought into and taken over other domestic fisheries. Let's keep it a public resource
- Individual quotas might help by eliminating derby fishing. Currently fishermen don't have time to repair their vessels
- One large shark may bring the equivalent price of 40 small sharks, so in this sense the industry is self-regulating

3.2 Recreational Management

Retention limit

- Limit should be 2 sharks, not 1
- Increasing the bag limit will lead to increased mortality of juveniles
- Because SCS sharks are in good shape, NOAA Fisheries should increase bag limit to 5 SCS (except finetooth) per person per trip
- The LCS bag limit should be increased to 2 per vessel to comply with the fair and equitable provision of the Magnuson-Stevens Act
- Consider allowing 2 sharks/vessel and 1 Atlantic sharpnose/person
- Recreational fishermen should be allowed 1 LCS or pelagic shark/vessel/trip and 1 sharpnose/person/trip and 1 bonnethead/person/trip
- NOAA Fisheries could eventually deal with charter/headboat or tournament-specific bag limits
- Let anglers have at least 1 bonnethead shark
- It is very difficult for general public to identify sharks to species; it makes more sense to have vessel limits rather than species specific limits
- Recreational fishermen do not want more restrictive measures to cover southern problems
- If the stocks can sustain additional harvest, we would like to harvest more
- The recreational limit should never fall below one shark per vessel per trip
- If you are going to raise the commercial quota, we would like to see a fair and equitable increase in the recreational sector (i.e., bag limit) so we might be able to land maybe two mako sharks

Minimum size

- NOAA Fisheries should analyze a recreational slot limit or a larger minimum size to enhance dusky rebuilding
- Anglers should have a larger share of the quota and fewer ridiculous size limits; the sacrifice should be by commercial fishermen not by anglers
- Because the minimum size is not in place for commercial fishermen, it should not remain in place for recreational fishermen
- NOAA Fisheries should maintain the current minimum size expect for sharpnose and bonnethead

General

- Most anglers tag and release (90 percent)
- Anglers harvest sharks in a manner that causes the least harm to the biomass of these species
- Tournament radio transmissions keep abreast of the weight needed to win allowing more fish to be released
- Current recreational regulations are based on the 1998 stock assessment that was overturned; commercial and recreational management measures should be equitable
- The recreational community has always been good at policing themselves

- While identification is difficult, most anglers can distinguish between pelagic sharks, LCS, and SCS; NOAA Fisheries can set regulations according to these groups
- NOAA Fisheries needs to work on increasing compliance with current regulations
- How can NOAA Fisheries consider adding new measures when the simplest regulations (e.g., 4.5 ft FL size limit) aren't even adhered to?
- Charter and headboats should be allowed to head, gut, fin, and fillet at sea because, like commercial fishermen, they can identify sharks; landing form should be maintained for all other anglers
- Authorized gear should remain at status quo for recreational fishermen
- NOAA Fisheries needs to define "trip" as one day or multi-day
- NOAA Fisheries should require dehooking devices on recreational vessels
- Current landings form regulation is fine
- Authorized gear should be limited to rod and reel and handline. Concern was expressed over small numbers of people now bow hunting for sharks

3.3 Bycatch of Sharks and Protected Species

- Require the guidelines for handling of sea turtles to be posted and also augment and enhance them to create a handbook. This will provide vessel operators with additional information to release sea turtles with the best methods available and will reduce post-release mortality.
- NOAA Fisheries should implement the same measures for bottom longline as is in place for pelagic longline regarding safe handling of protected species, line cutters, dipnets, dehooking devices
- Require line clippers on board commercial and recreational vessels
- Require dehooking devices on board commercial and recreational vessels
- Specify the design type approved for line clipper and dehooking devices
- Using a dehooking device is a lot of work for fishermen
- Dehooking devices allow fish to be released alive with minimum harm; it takes five seconds to release fish, it is not hard to do, and it is very effective
- Require attendance at workshops to teach the proper handling and release methods
- Keep posting the sea turtle handling and release guidelines as only requirement
- Voluntary workshops have not worked well in the past; any requirement for workshops should dictate how frequently they need to attend and if owner, captain, and crew need to attend
- If a buyback occurs (reference to gillnet buyback option), then participants in the program should have their permits permanently revoked, which would prohibit these participants from fishing in the same fishery in another area
- NOAA Fisheries should look at other gear types for interactions with protected resources
- NOAA Fisheries should also look at rolling closures (e.g., the ones in the northeast fisheries) as a means to reduce interactions with protected resources
- Juvenile sharks must be protected
- NOAA Fisheries needs to examine mitigation measures for the Gulf menhaden purse

seine fishery and the shrimp trawl fishery to reduce shark bycatch

- Shrimpers should use Nordmore grates to reduce shark bycatch
- NOAA Fisheries needs to look at a strategy to reduce bycatch and discard mortality of particularly depleted species such as dusky and sand tiger sharks
- Blue-dyed bait is not a viable option since experiments have shown that sea turtles take blue-dyed bait as readily as other bait
- NOAA Fisheries should implement 100% observer coverage in the drift gillnet fishery because of the large number of turtle takes in recent years
- NOAA Fisheries should maintain continuous net checks in the drift gillnet fishery
- NOAA Fisheries should not prohibit drift gillnets in this fishery
- Live release of all non-targeted species should be mandatory
- Shark fisheries should not be open during shark pupping season

3.4 Time/Area Closures

- NOAA Fisheries should establish no fishing zones to protect the remaining shark populations
- NOAA Fisheries should have time/area closures to protect pupping, nursery, and spawning grounds
- There are two periods a year when sharks come in for pupping; these periods are known and should be closed
- Most pupping grounds are inshore or are in mangroves
- NOAA Fisheries should not close pupping or nursery areas
- Closed areas are only effective in reducing bycatch when the area is closed to all fishing (i.e., not just shark fisheries). This is primarily because other fisheries can come in during a shark closure and incidentally catch non-targeted species. NOAA Fisheries should evaluate the effects of closures in meeting plan objectives for reducing bycatch of sharks. If closures are to occur, then they must be very species specific
- Vessel Monitoring Systems (VMS) are the key for real-time openings and closings
- NOAA Fisheries should not close areas because of the loss of fishing opportunities and the disparity it would cause between states and regions
- If areas are closed, NOAA Fisheries should allow access to them via EFPs, particularly for experimental fisheries such as the one in the Northeast Distant closed area
- In a non-selective fishery, size limits do not reduce fatal interactions and thus have little impact on mortality; NOAA Fisheries should examine time/area closures to reduce mortality on juveniles and pupping adults
- Time/area closures of spawning and nursery grounds are more effective at reducing mortality than minimum sizes because many sharks do not survive the capture experience
- Time/area closures can cause hardship on fishermen and communities; other methods of bycatch reduction are preferred
- Recreational fishermen have been voluntarily releasing animals for years and, with the number of devices available, have minimized mortality; time/area closures are not needed for this fishery

- Time/area closures during pupping season and within 50 fathoms would protect nursery grounds of the majority of shark species
- Closed areas to protect sea turtles would cause a lot of hardship to fishermen, families, and the fishing communities; mitigation measures should be used instead
- Don't close the migration corridors; you would have to close the entire ocean

3.5 Essential Fish Habitat

- How well defined is shark essential fish habitat (EFH) beyond the area included in catch data?
- NOAA Fisheries needs to publish and distribute the results of the 2002 American Fisheries Society symposium on shark habitat
- NOAA Fisheries should protect shark EFH
- NOAA Fisheries should incorporate Stewart Springer's information on nursery areas into EFH designations
- EFH, if closed, needs to be closed to all fishing

3.6 Exempted Fishing Permits

- The issuance of EFPs should remain burdensome, particularly for prohibited species and are candidates for ESA listing
- The current process of issuing EFPs has worked well
- NOAA Fisheries should retain the maximum flexibility concerning EFPs for scientific research purposes; bycatch reduction research cannot be done without the current flexibility
- The small number of sharks landed for aquarium use is relatively insignificant compared to the number taken in commercial and recreational fisheries; these animals continue to contribute over the long term to the educational and conservation missions that are shared with NOAA Fisheries; NOAA Fisheries should have a distinct quota for public display of sharks
- Move excess shark display quota issued via EFPs to the commercial quota
- NOAA Fisheries should issue a type of permit to allow for live display collection with its own set of regulations and reporting requirements
- NOAA Fisheries should allow more experimental fisheries to test for sustainability of some species such as bignose sharks
- NOAA Fisheries should allow fishermen to retain catch and market it to offset expenses (as an incentive for participating in research)
- No collections of prohibited species should be allowed; take them off the prohibited species list and then allow collections
- The 60 mt allowance for public display of sharks is too much
- States would rather see NOAA Fisheries use numbers of fish instead of weight
- The 60 days notice of application prior to action is too short. The state would prefer a longer application and evaluation time (i.e., at least a year); For example, an application

could be submitted in the current calendar year and then, if approved, a permit would be issued for the next calendar year

- NOAA Fisheries should employ more stringent reporting requirements (i.e., where it goes and what is the disposition of the fish upon delivery) for public display collections
- NOAA Fisheries should separate research activities from aquarium trade collections
- NOAA Fisheries should enhance enforcement of the aquarium trade
- NOAA Fisheries should have better accounting mechanisms in the aquarium trade industry (i.e., linking collectors with aquarium to publicly display collected shark)
- NOAA Fisheries should not issue EFPs for *profit* (e.g., selling sharks for public display)

3.7 Prohibited Species and Deepwater and Other Sharks

- NOAA Fisheries should not change the prohibited species list
- What are the current prohibited species?
- Because of its status, finetooth should be added to the prohibited species list
- Finetooth should not be added to the prohibited species list
- NOAA Fisheries should go back to the original prohibited species list
- NOAA Fisheries should remove bignose, dusky, Caribbean reef, night, Caribbean sharpnose, and Atlantic angel from the prohibited species list; bignose and dusky have a significant international population; dusky shark populations are increasing; Caribbean reef only caught as bycatch; night shark is commonly caught as bycatch; Caribbean sharpnose is often confused with Atlantic sharpnose and is common in the Caribbean; Atlantic angel is common bycatch in mid-Atlantic nearshore areas
- The current prohibited species list has increased waste
- Dusky sharks have high bycatch mortality; NOAA Fisheries should consider a set aside, possibly use the second harvest approach, but not regulatory discards; NOAA Fisheries could also considering allowing the retention of dusky sharks for scientific research
- Encourage live release of dusky sharks; fishermen would release them because we've seen what can happen; use commercial peer pressure like a sticker that says "I release live duskies" to get better compliance; you'll get better results that way than with a rule
- Let us keep the dead ones and release the live ones
- Nobody wants a tiger or a great white
- Take dusky and sand tiger sharks off prohibited species list; prohibiting these species is creating dead discards
- Sand tigers are plentiful but we don't land them anyway. Sand tigers are hardy and survive release
- Logbooks don't include sand tigers so NOAA Fisheries is not getting the data
- Deepwater and other sharks should be added to the prohibited species list particularly since the draft NPOA for Fisheries Capacity Reduction lists the deepwater and other shark fishery as overcapitalized
- Narrowtooth shark has never been caught by U.S. fishermen and should be removed from the management unit
- NOAA Fisheries should maintain status quo with deepwater/other sharks

- NOAA Fisheries should just collect data on deepwater/other sharks
- Deepwater and other species are only encountered in wreckfish fishery and are not marketable
- If the deepwater and other species became prohibited species, would other fisheries be closed down?
- If deepwater and other species are not being harvested then it does not matter if you add them to the prohibited species list

3.8 Education

- Educate the public, everyone including fishermen
- If NOAA Fisheries provides funding, the recreational community could host workshops to help reduce post-release mortality
- The amendment should facilitate the display of all species to help education; to do this you need to streamline the process of obtaining an EFP
- Limiting zoo and aquarium access to any species restricts the ability of the aquarium to educate people
- Effective recreational fishing limits can be achieved with enhanced public education

3.9 General Comments

- NOAA Fisheries is directly responsible for the dramatic decline in overall shark populations due to their failure to enforce the stipulations of the Magnuson-Stevens Act
- What are management's specific data needs? VMS? Observer? Logbooks?
- Seems like biological decisions are made and economics don't matter. If a biologist says shut it down, it gets shut down regardless of economics. Seems like biology outweighs economics
- Emphasize enforcement over acceptance and accounting for overages, undersize landings, prohibited species
- NOAA Fisheries is not accounting for sharks caught in the Virgin Islands; a large amount of sharks, probably equal to the U.S. harvest, are being caught there
- Management measures should contain adequate means of enforcement in order to minimize shark and prohibited species bycatch
- Management measures should be consistent with scientific advice and the precautionary approach
- Management since 1993 is working; don't try to change too much too quick
- NOAA Fisheries needs to increase observer coverage to statistically significant levels to ensure adequate data collection
- NOAA Fisheries needs to focus its priorities on ending overfishing, minimizing bycatch, and addressing habitat mandates

4.0 What Happens Now?

As described in section 2.0, Scoping is the first phase in the EIS/FMP amendment process. NOAA Fisheries is now in the process of considering all the comments received during Scoping and preparing a draft EIS/FMP amendment and proposed regulations. Once the draft EIS/FMP amendment and proposed rule is released, there is a second comment period where the public has a chance to comment on the proposed regulations. At the end of that comment period, NOAA Fisheries considers the new comments and prepares a final EIS/FMP amendment. When the final EIS/FMP amendment is released, there is a third, shorter comment period on the EIS alone. At the end of that comment period, NOAA Fisheries publishes a final rule based on the final EIS/FMP amendment. An outline of this process is shown in Table 1.

For this amendment, NOAA Fisheries expects the final regulations to be effective on January 1, 2004, the start of the shark fishing year. Under this timeframe, the proposed regulations would be released by the summer of 2003 and the final regulations would be published by the end of 2003.

Table 1. Summary of the Steps in the EIS/FMP Amendment Process

1. Scoping/Initial Public Comment	A. Notice of intent	Completed (11/15/2002, 67 FR 69180)
	B. Release of Issues and Option Paper	Completed (1/27/2003, 68 FR 3853)
	C. Hold public meetings	Completed
	D. End of comment period	Completed
2. Draft EIS/FMP Amendment and Proposed Rule	A. Consider comments received in Scoping	*In Process*
	B. Draft documents	*In Process*
	C. Publish proposed rule and Notice of Availability in Federal Register	Expected late Spring/early Summer 2003
	D. Hold public meetings	
	E. End of comment period	Expected in early August
3. Final EIS/FMP Amendment	A. Consider comments received on draft documents	Expected late Summer/early Fall 2003
	B. Finalize documents	
	C. Publish Notice of Availability in Federal Register	

	D. End of comment period	
4. Final Rule	A. Consider comments received on draft documents and Final EIS/FMP Amendment	Expected late Fall/early Winter 2003
	B. Finalize document and responses to comments	
	C. Publish rule in Federal Register	

APPENDIX 3 **STATE RULES AND REGULATIONS PERTAINING TO HIGHLY MIGRATORY SPECIES, AS OF 6/19/2003.**

Note that state regulations are subject to change. Contact the appropriate state personnel to ensure that the regulations listed below remain current.

State	HMS Rules and Regulations					Regulatory Details	Contact Information
	Regulations				*Cite Reference*		
	Tuna	*Swords*	*Billfish*	*Sharks*			
ME	✓			✓	Tuna -ME Rev. Stat. Ann. tit. 12, §§ 6001, 6502, and 6551 Sharks - Code ME R. 13-188 § 50.02	Tuna - Retention limit - 1 tuna/year - non resident special tuna permit holder; Unlawful to fish for tuna with gear other than harpoon or hook and line or possess tuna taken in unlawful manner Sharks - Regulations apply to Spiny dogfish only	ME Department of Marine Resources George Lapointe Phone: 207/624-6553 Fax: 207/624-6024
NH	✕		✓	✓	Tuna - FIS 603.10 (REPEALED) Billfish - FIS 603.13 Sharks - FIS 603.19	Billfish - Possession limit - 1 billfish/trip; Minimum size - Blue marlin - 99"; White marlin - 66"; Sailfish - 57"; May be taken by hook and line only; Unlawful to sell billfish Sharks - Regulations apply to Spiny dogfish only	NH Fish and Game Clare McBane Phone: 603/868-1095 Fax: 603/868-3305
MA	✓		✓	✓	Tuna - MA Regs. Code tit. 322 § 6.04 Billfish - MA Regs. Code tit. 322, § 6.11 Sharks - www.state.ma.us/defwele/dmf.CommercialFishing/regulations.htm; MA Marine Fisheries Regulation Summaries 2002	Tuna - Reference to ATCA and Federal regulations Billfish - Possession limit - 1fish/trip; Recreational minimum size - Blue marlin - 86"; Sailfish - 57"; White marlin - 62"; Billfish may be taken by hook and line only; spearing, netting, snagging are prohibited; Sale of billfish is prohibited Sharks - Regulations apply to Spiny dogfish only	MA Division of Marine Fisheries David Pierce Phone: 617/626-1530 Fax: 617/626-1509
RI				✓	Sharks - RIMFC Regulations § 7.15	Sharks - Regulations apply to Spiny dogfish only	RI Department of Environment Management Brian Murphy Phone: 401/783-2304

✓ = Regulation in effect
✱ = Regulation in development
✕ = Regulation repealed
FL = Fork Length
CL = Carcass Length
TL = Total Length
LJFL = Lower Jaw Fork Length
CFL = Curved Fork Length
DW = Dressed Weight
SCS = Small Coastal Sharks
LCS = Large Coastal Sharks

State	HMS Rules and Regulations					Regulatory Details	Contact Information
	Regulations				*Cite Reference*		
	Tuna	*Swords*	*Billfish*	*Sharks*			
CT				✓✱		Sharks - Regulations apply to Spiny dogfish only; New regulations are anticipated shortly to implement ASMFC spiny dogfish plan	CT Department of Environmental Protection Eric Smith Phone: 860/434-6043 Fax: 860/434-6150
NY			✓	✓	Billfish -NY Environmental Conservation § 13-0339 (5) Sharks - NY Environmental Conservation § 13-0338; State of New York Codes, Rules and Regulations (Section 40.1)	Billfish - Blue marlin, White marlin, Sailfish, and Longbill spearfish shall not be bought, sold or offered for sale; Striped marlin, Black marlin, Shortbill spearfish shall not be bought, sold or offered for sale Sharks - Shark finning prohibited; Reference to the Federal regulations 50 CFR part 635; Prohibited sharks listed	NY Department of Environmental Conservation Byron Young Phone: 631/444-0435 Fax:631/444-0449
NJ				✓	Sharks -NJ Administrative Code tit. 7, §§ 25-18.1 - 25- 18.2	Sharks - Commercial/Recreational possession limit - 2 fish/vessel; Finning prohibited; May be eviscerated dorsal fin to pre-caudal pit must be at least 23" in length; Total length must be 48" in length	NJ Fish, Game and Wildlife Bruce Freeman Phone: 609/292-2083
DE	✓	✓	✓	✓	Billfish - DE Code Ann. tit. 7, § 1310 Sharks - DE Code Regulations 70 200 004.	Tuna/Swordfish/Billfish/Sharks - Reference to Federal regulations; Prohibition on sale of Atl. Sailfish and Blue/White/Striped marlin Sharks - Creel limit on regulated sharks 1fish/day; Creel limit for sharpnose is 2/day; Minimum size on regulated sharks - 54 in FL	DE Division of Fish and Wildlife Roy Miller Phone: 302/739-5295

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State	HMS Rules and Regulations					Regulatory Details	Contact Information
	Regulations				*Cite Reference*		
	Tuna	*Swords*	*Billfish*	*Sharks*			
MD	✓	✓	✓	✓	Tuna - Code of Maryland Regulations tit. 8, § 02.12.01 and tit. 8, § 02.05.23 Swordfish - Code of Maryland Regulations tit. 8, § 02.12.01 and tit. 8, § 02.05.27 Billfish - Code of Maryland Regulations tit. 8, § 02.12.01 and tit. 8, § 02.05.26 Sharks - Code of Maryland Regulations tit 8, § 02.05.17	Tuna - Reference to listing Bluefin Tuna as "in need of conservation"; Reference to Federal regulations and recreational catch required to be tagged Swordfish - Reference to listing Swordfish as "in need of conservation"; Reference to Federal regulations and recreational catch required to be tagged Billfish - Reference to listing Billfish as "in need of conservation"; Reference to Federal regulations and recreational catch required to be tagged Sharks - Minimum size - 58" FL; 31" carcass; Reference to prohibition on finning and Federal regulations; Recreational catch limit - 1 fish/person/day; Commercial catch limit - 4,000 lbs/day; Reference to 50 CFR 635	MD Department of Natural Resources Harley Speir Phone: 410/260-8303
VA			✓	✓	Billfish - 4 VA Administrative Code 20-350 Sharks - 4 VA Administrative Code 20-490	Billfish - Prohibition on sale of billfish Sharks - Possession limit - 1 fish/person; 1 fish for each person on board boat with common hold; Minimum size - 58" FL (Commercial Only); 31" CL (Commercial Only); 7500 lb/vessel/day limit; 200 lb limit on shark carcasses less than 31" minimum CL taken within VA state waters; Finning prohibited	VA Marine Resources Commission Jack Travelstead Phone: 757/247-2247 Fax: 757/247-2020
NC			✓	✓	Billfish -NC Administrative Code tit. 15A, r.3M.0507 Sharks -NC Administrative Code tit. 15A, r.3M.0505	Billfish - Recreational possession limit - 1 Blue or White marlin/vessel/trip; 1 Sailfish/person/day; Minimum size - Blue marlin - 99"; White marlin - 66"; Sailfish - 63"; unlawful to sell or offer for sale Blue or White marlin and Sailfish Sharks - Director may impose restrictions for size, seasons, areas, quantity, etc.; Proclamations consistent with closures for LCS, SCS, and Pelagics	NC Division of Marine Fisheries Preston Pate Phone: 252/726-7021 Fax: 252/726-0254

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State	HMS Rules and Regulations					Regulatory Details	Contact Information
	Regulations				*Cite Reference*		
	Tuna	*Swords*	*Billfish*	*Sharks*			
SC	✓		✓	✓	Tuna -SC Code Ann. § 50-5-2730 Billfish - SC Code Ann. § 50-5-1700 Sharks -SC Code Ann. § 50-5-2725	Tuna - Reference to ATCA and MSA regulations for Tuna Billfish - Unlawful to sell billfish; hook and line gear only; unlawful to possess while transporting gillnets, seines, or other commercial gear Sharks - Retention limit - 2 Atlantic sharpnose/per/day and 1 Bonnethead/person/day; No minimum size for recreationally caught bonnethead sharks; No need for Federal recreational angler permit to fish for shark in state waters; Reference to Federal commercial regulations and closures	SC Department of Natural Resources David Cupka Phone: 843/953-9050 Fax: 912/262-2318
GA			✓	✓	Gear Restrictions - GA Code Ann. § 27-4-7; Billfish - GA Code Ann. § 27-4-130.2; GA Comp. R. & Regs. § 391-2-4-.04 Sharks - GA Code Ann. § 27-4-130.1; GA Comp. R. & Regs. § 391-2-4-.04	Gear Restrictions - Use of gillnets prohibited in state waters for harvest of Sailfish, Blue Marlin, White Marlin, Sand Tiger shark, Small Composite shark, and shark in general Billfish -Possession prohibited in state waters Sharks - Daily limit 2; Possession limit 2 person/vessel (whichever less); Minimum size 48"; Limit 1 shark less than 84"; Sand tiger sharks daily/possession limit none; Closed season for Sand Tiger shark January 1-December 31; Small composite sharks daily limit 2 person/vessel (whichever less); Possession limit 2; Minimum size 30"; Reference to Federal creel and possession limits, minimum sizes, commercial quotas and permits.	GA Department of Natural Resources Henry Ansley Phone: 912/264-7218 Fax: 912/262-3143

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State	HMS Rules and Regulations					Regulatory Details	Contact Information
	Regulations				*Cite Reference*		
	Tuna	*Swords*	*Billfish*	*Sharks*			
FL		✓	✓	✓	Sharks -FL Administrative Code Ann. r.68B-44.003 and -44.005; FL Administrative Cod Ann. r. 68B-33.0034	Billfish - Retention limit (Blue Marlin/White Marlin/Sailfish - Aggregate bag limit of 1fish/person/day; gear restriction (hook and line only); Minimum size limits (Blue Marlin - 99 in LJFL; White Marlin - 66 in LJFL; Sailfish - 63 in LJFL); Any Sailfish, Blue Marlin, or White Marlin caught in state waters must be reported to NOAA within 24 hours Swordfish - Minimum size - 47 in LJFL; Possession limit 1 fish/person/day or 3 fish/vessel/day; Sale prohibited Sharks - Retention limit - 1 shark/person/day; Maximum of 2 sharks/vessel (with two or more persons on board); Reference to Federal regulations regarding commercial season, closures, and prohibition on sale; Finning prohibited	FL Fish and Wildlife Conservation Commission Robert Kramer Phone: 850/488-6058 Fax: 850/488-7152
AL	✓	✓	✓	✓	Sharks - AL Administrative Code r. 220-2-.46, r.220-3-.30, r.220-3-.37	Tuna/Swordfish/Billfish/Sharks - Reference to Federal regulations Sharks - Recreational daily bag limit - 2 sharpnose/person/day; all other species - 1fish/person/day; Recreational minimum size all sharks (except sharpnose) - 54" FL; Reference to shark commercial season and bycatch provisions	AL Department of Conservation and Natural Resources Major Jenkins

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State	HMS Rules and Regulations					Regulatory Details	Contact Information
	Regulations				*Cite Reference*		
	Tuna	*Swords*	*Billfish*	*Sharks*			
LA	✓	✓	✓	✓	Tuna -LA Administrative Code tit. 76, § 361 Swords/Billfish - LA Administrative Code tit. 76, § 355 Sharks - LA Administrative Code tit. 76, § 357	Tuna - Recreational bag and possession limit Yellowfin (3 fish/person); Rec/Commercial minimum size -Yellowfin, Bigeye and Bluefin (27 in CFL) Billfish/Swordfish - Minimum size - Blue marlin (99 in LJFL), White marlin (66" LJFL), Sailfish (63 in LJFL), Swordfish (29 in carcass length or 33 lbs dw); Recreational creel limit - 5 swordfish/vessel/trip Sharks - Minimum size - 54" except sharpnose; Possession limit - 1 fish/vessel/trip; Trip limit 4,000 lbs dw LCS; Reference to Federal regulations	LA Department of Wildlife and Fisheries Randy Pausina Phone: 225/765-2889
MS	✓		✓	✓	Tuna/Billfish/Sharks - MS Code R. 43 000 040, Ord. 7.025	Tuna - Minimum size - Bigeye (27 in CFL); Yellowfin (27 in CFL); Bag limit none in commercial; Bag limit of 3 yellowfin tuna/person in recreational Billfish - No take provisions for commercially harvested Blue and White marlin and Sailfish; Recreational minimum size - Blue marlin (99 in LJFL); White marlin (66 in LJFL); Sailfish (63 in LJFL) Sharks - Recreational minimum size - LCS/Pelagics (37 in TL); SCS (25 in TL); Recreational bag limit - LCS/Pelagics (1/person up to 3/vessel); SCS (4/person)	MS Department of Marine Resources

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State	HMS Rules and Regulations					Regulatory Details	Contact Information
	Regulations				*Cite Reference*		
	Tuna	*Swords*	*Billfish*	*Sharks*			
TX		✓	✓	✓	Billfish/Sharks - TX Administrative Code tit. 31, § 65.72	Blue Marlin, White Marlin, Sailfish, Sharks, Longbill spearfish, and Broadbill swordfish are gamefish and may only be taken with pole and line (including rod and reel) Blue Marlin, White Marlin, Sailfish, and Longbill spearfish may not be sold for any purpose Billfish - Bag limit none; Minimum size (Blue Marlin - 131 in TL; White Marlin - 86 in TL; Sailfish - 84 in TL) Sharks - Recreational retention limit 1fish/person/day; Commercial/Recreational possession limit is twice the daily bag limit (i.e., 1 fish/person/day); Commercial/Recreational minimum size 24 in TL	TX Parks & Wildlife Randy Blankinship Phone: 956/350-4490 Fax: 956/350-3470

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Appendix 4 Consideration of the Scope of VMS Requirements in the Atlantic HMS Bottom Longline Fishery

A4.1 Introduction

As described in Chapters 2 and 4, NOAA Fisheries will be requiring the use of VMS on vessels that have been issued a directed shark limited access permit (LAP) and have bottom longline gear on board in order to aid in enforcing a time/area closure off the coasts of North Carolina. The analysis described below were undertaken in order to determine if all shark bottom longline vessels, including those in the Gulf of Mexico and off the coast of Florida, need to install and maintain a working VMS unit or if the area could be enforced if only a subset of the fleet installs and maintains a VMS unit on board.

A4.2 Materials and Methods

On September 25, 2000, the U.S. District Court for the District of Columbia instructed NOAA Fisheries to undertake further consideration of the scope of VMS requirements for the Atlantic HMS pelagic longline fleet (BlueWater Fisherman's Association v. Mineta, 122 F. Supp. 2d 150 (D.D.C. 2000)). In response, NOAA Fisheries conducted an analysis that compared the homeport listed on the permit application of a vessel and the areas fished by that vessel. The court upheld the VMS requirement for the pelagic longline fleet. NOAA Fisheries used the same methods described in the document provided to the court[1] for this analysis. This document contains only a summary of those methods.

Data

For the purpose of this analysis, NOAA Fisheries compared fishermen who held a shark LAP in October 2003 to self-reported data in the pelagic longline logbook and the snapper-grouper, king mackerel, Spanish mackerel and shark logbook in 2000 and 2001. These logbooks are maintained by the Southeast Fisheries Science Center and are the two primary logbooks that shark fishermen use to report their landings. A few fishermen may also report landings in the northeast multispecies logbook but those fishermen generally do not use bottom longline gear.

There were over 580 vessels that held a shark LAP in October 2003. Of these, 91 vessels reported landing sharks with bottom longline gear in 2001 and 84 vessels reported landing sharks with bottom longline gear in 2000. Vessels that both reported landings in either 2000 or 2001 and that have a current permit are considered "active" vessels for the purposes of this analysis.

NOAA Fisheries analyzed several subsets of vessels using "homeport" and vessel length

[1] NOAA Fisheries. 2001. Reconsideration of the scope of vessel monitoring system requirements in the Atlantic pelagic longline fishery. DOC. NOAA. HMS Management Division, Silver Spring, MD. 44p.

information on the shark permit application/renewal forms submitted by fishermen to the permit office in the Southeast Regional Office. A homeport is defined as the city and state where the vessel is customarily kept. NOAA Fisheries assumes that vessels that are not mobile fish in areas near their homeport state. Additionally, NOAA Fisheries assumes that larger vessels could travel long distances easier and potentially, in a safer manner, than smaller vessels, with greater potential to fish near several closed areas in a year.

To analyze each alternative, NOAA Fisheries divided the Atlantic Ocean and Gulf of Mexico into five fishing areas based roughly on the common statistical areas used by Cramer and Adams (2001) but modified so that the boundaries of the fishing areas coincide with the latitude/longitude of a nearby state boundary line. The fishing areas are: Gulf of Mexico, Florida east and west coast, South Atlantic Bight, Mid-Atlantic Bight and New England, and the area beyond these four areas off the main coast of the United States. The fishing areas where the vessels reported landings were categorized in the appropriate fishing areas. Additionally, the homeport state was categorized in the appropriate fishing area. No vessels reported fishing in the area off the coast of the United States; therefore, that area is not considered further in the analysis.

Using these area designations, it was possible to determine the mobility of the vessels by comparing the vessel's homeport fishing area/state to where the vessel's fishing trips occurred. This allowed an analysis of whether a vessel fished exclusively "near" its state of homeport (i.e., fishing only in its homeport fishing area) or whether it also ventured beyond its homeport fishing area. This method gives a good general indication of a vessel's mobility and in some cases the degree of mobility. As to degree, this method works better in some cases than in others. It appears to work well for states such as Louisiana, which is in the middle of the fishing area zone. However, it is a less accurate indicator of degree of mobility in the case of a vessel homeported near the border of two states, such as Florida and Georgia. In that case, a vessel may be just as likely to fish in the area next to its homeport fishing area as in the area designated as its homeport fishing area. Thus, it is important to consider not only if the vessel fished in its homeport fishing area, but also where the vessel fished in relation to its homeport fishing area. Accordingly, for each alternative NOAA Fisheries examined the number of trips that occurred in each fishing area and the homeport state of the vessels fishing those trips.

Subsets Examined

NOAA Fisheries examined several different subsets of the fleet in order to determine if VMS would be needed on only a subset of the fleet or on the entire fleet. The subsets examined include:

- All active vessels in 2000 and 2001;
- All active vessels greater than 45 feet in length;
- All active vessels with homeports in the South Atlantic Bight and the Mid-Atlantic Bight (the closed area is encompassed within both of these areas);

- All active vessels that fished exclusively in the selected closed area and time; and,
- All active vessels that fished in both the selected closed area and in what would be the remaining open areas.

A4.3 Results

The results of this analysis can be found in Table A1. A summary of the results for each subset is below.

Active vessels in 2000 and 2001

NOAA Fisheries found that no active vessel fished in more than two areas in either 2000 or 2001 and that 82 and 89 percent in 2000 and 2001, respectively, reported fishing in only one area. Over 80 percent of all trips were taken in the same area as the listed homeport for a vessel and the rest of the trips were in the area next to the homeport. In both years, over 60 percent of all trips were taken off the coast of Florida and over 20 percent were taken in the South Atlantic Bight.

Active vessels over 45 feet in length

Active vessel lengths ranged from 24 to 70 feet and averaged 44 feet and vessel length from all permit holders ranged from 14 to 126 feet and averaged 48 feet. NOAA Fisheries decided to use 45 feet for this analysis because it approximates the average length of the vessel in the shark fishery. NOAA Fisheries found that of the 39 and 42 active vessels over 45 feet in length in 2000 and 2001, respectively, 89 percent fished in one area and 85 percent of the trips were fished in their homeport area. In other words, longer vessels do not appear to be any more mobile than the rest of the fleet.

Active vessels with homeports in the South Atlantic Bight and the Mid-Atlantic Bight

Of the 21 and 22 vessels with homeports near the revised closed area in 2000 and 2001, respectively, 79 percent fished in one area and 65 percent of all fishing trips were in their homeport area. Thirty five percent of the trips were fished one area away from their homeport area. Ninety one percent of the trips were fished either in the South Atlantic Bight or in the Mid-Atlantic Bight/New England areas. None of the vessels fished in the Gulf of Mexico.

Active vessels that fished exclusively in the selected closed area and time

Only three vessels fished exclusively in the revised closed area and time. Because there are so few vessels, for confidentiality concerns, NOAA Fisheries cannot release the estimated number of vessels fishing in any particular area. However, results do indicate that the majority of these vessels and trips did occur in the homeport area.

Active vessels that fished in both the revised closed area and time and other areas

Of the 15 and 17 vessels that fished in both the revised closed area and other areas in both 2000 and 2001, respectively, 84 percent fished in one area and 16 percent fished in two areas. Seventy nine percent of the trips occurred in the vessel's homeport area. Two percent of the trips occurred in the Gulf of Mexico, 75 percent occurred in the Florida region, and 23 percent occurred in the South Atlantic Bight. No trips occurred in the Mid-Atlantic bight/New England regions.

A4.4 Conclusions

This analysis shows that most bottom longline vessels that have been issued a shark LAP stay near the homeport reported to the permit office and are not particularly mobile. NOAA Fisheries feels that the vessels who reported fishing in two different regions were probably fishing on the edge of the two regions and were not fishing across large distances. While the analysis centered on the homeport reported to the permit office, NOAA Fisheries does not want to make homeport a basis for the requirement of VMS because permit holders could easily change their designated homeport to avoid buying a VMS unit. Thus, based on this analysis, NOAA Fisheries feels that VMS for the bottom longline fleet can be restricted to the vessels that are fishing and/or landing fish in or near the region of the closed area.

NOAA Fisheries found that 14 and 13 active vessels in 2000 and 2001, respectively, fished in the revised closed area and a surrounding area (i.e., between 33° N. lat and 37° N. lat). Of these vessels, 8 and 6 active vessels in 2000 and 2001, respectively, also hold a swordfish directed or incidental LAP and therefore would likely already have VMS installed due to a requirement for pelagic longline vessels to have VMS. Thus, NOAA Fisheries estimates that approximately 14 bottom longline vessels would be directly affected by this requirement and that approximately 7 of those vessels would need to obtain VMS under this requirement.

Table A4.1 Results of analysis to determine the scope of the VMS requirements for the Atlantic shark bottom longline fishery.

Description	Number of Vessels	Percent	Number of Vessels	Percent
	All active vessels in 2000		*All active vessels in 2001*	
Number of vessels	84		91	
Vessels that fished in 1 area	69	82	81	89
Vessels that fished in 2 areas	15	18	10	11
Number of trips	888		847	
Number of trips in homeport area	730	82	724	85
Number of trips 1 area away from homeport area	157	18	123	15
Number of trips more than 1 area away from homeport area	0	0	0	0
Number of trips in Gulf of Mexico area	48	5	45	5
Number of trips in Florida area	547	62	587	69
Number of trips in South Atlantic Bight area	190	21	179	21
Number of trips in Mid-Atlantic/New England area	102	11	36	4
	Active vessels greater than 45 feet		*Active vessels with homeport near closed area*	
Number of vessels - combined both years	81		43	
Vessels that fished in 1 area	72	89	34	79
Vessels that fished in 2 areas	9	11	9	21
Number of trips	797		456	
Number of trips in homeport area	679	85	298	65
Number of trips 1 area away from homeport area	118	15	158	35
Number of trips more than 1 area away from homeport area	0	0	0	0
Number of trips in Gulf of Mexico area	82	10	0	0
Number of trips in Florida area	469	59	42	9
Number of trips in South Atlantic Bight area	174	22	276	61
Number of trips in Mid-Atlantic/New England area	72	9	138	30
	Active vessels fishing in both open and selected closed areas		*Active vessels that fished exclusively in closed area*	
Number of vessels	32		Protected for confidentiality	
Vessels that fished in 1 area	27	84		
Vessels that fished in 2 areas	5	16		

Description	Number of Vessels	Percent	Number of Vessels	Percent
Number of trips	248			
Number of trips in homeport area	195	79		
Number of trips 1 area away from homeport area	53	21		
Number of trips more than 1 area away from homeport area	0	0		
Number of trips in Gulf of Mexico area	4	2		
Number of trips in Florida area	187	75		
Number of trips in South Atlantic Bight area	57	23		
Number of trips in Mid-Atlantic/New England area	0	0		

Appendix 5 Comments and Responses to Public Comments Received on Amendment 1 to the HMS FMP.

Numerous comments were received on Amendment 1, which contains a draft Environmental Impact Statement, a draft Regulatory Impact Review, an Initial Regulatory Flexibility Analysis, and a draft Social Impact Analysis, and its proposed rule. Comments received were submitted either via letter or orally over the phone, at the public hearings, or at the HMS AP meeting. This appendix contains a summary of the major comments received and NOAA Fisheries' response. NOAA Fisheries would like to thank the all people and agencies who took the time to prepare written comments, attend public hearings, or call. A list of persons or agencies who submitted written comments are below. If you would like copies of one or more of the comments, please contact the HMS Management Division at (301) 713-2347.

1.	08/02/2003	Letter from B. Sachau
2.	08/11/2003	Letter from Carl Erickson, FV Southern Star
3.	08/24/2003	Letter from Shawn Dick, Aquatic Release Conservation
4.	08/27/2003	Letter from Phillip Frank, Florida Keys National Wildlife Refuges, U.S. Fish and Wildlife Service
5.	08/29/2003	Letter from Jason Berry
6.	09/08/2003	Letter from Eric Abrams
7.	09/09/2003	Letter from Tim Hobbs, National Coalition for Marine Conservation
8.	09/09/2003	Letter from Peter Schumann
9.	09/16/2003	Letter from Mark Reinfandt
10.	09/18/2003	Letter from Bobbi Walker, Chairman, Gulf of Mexico Fishery Management Council
11.	09/20/2003	Postcard from B. Sachau
12.	99/23/2003	Letter from Anne Norton Miller, U.S. Environmental Protection Agency
13.	09/23/2003	Letter from Duane Harris, Sea Georgia Adventures
14.	09/24/2003	Letter from Keith Aitken, Pre-paid Legal Services
15.	09/24/2003	Letter from Ricks Savage, Chairman, Mid-Atlantic Fishery Management Council
16.	09/25/2003	Letter from Pete Herber, Coastal Conservation Association of Georgia
17.	09/25/2003	Comments presented at public hearing - Georgia Department of Natural Resources
18.	09/25/2003	Letter from Russell Hudson, President, Directed Fisheries Inc.
19.	09/29/2003	Letter from Russell Hudson, President, Directed Fisheries Inc.
20.	09/30/2003	Letter from Marc Stettner, President, Northeast Hook Fisherman's Association
21.	09/30/2003	Letter form T. Edward Kotas, Chairman, Sharkfest/Key West Institute
22.	09/30/2003	Letter from Charlotte Gray Hudson, Oceana
23.	09/30/2003	Letter from Kristin Raabe, Aquatic Release Conservation
24.	10/01/2003	Letter from Al Ristori, Editor, Newark Star-Ledger, The Fisherman magazines, and Salt Water Sportsman

25.	10/02/2003	Letter from David Cupka, Chairman, South Atlantic Fishery Management Council
26.	10/02/2003	Letter from Samuel Baker, President, Southeast Florida Shark Driftnet Association, with attachments regarding proposals to the South Atlantic Fishery Management Council
27.	10/03/2003	Letter from Jerry F. Schill, President, North Carolina Fisheries Association, Inc.
28.	10/03/2003	Letter from Louis B. Daniel, III, Assistant to the Fisheries Director, State of North Carolina Department of Environment and Natural Resources Division of Marine Fisheries
29.	10/03/2003	Letter from Glen A. Hopkins
30.	10/03/2003	Letter from Elizabeth A. Babcock and Liz Lauck, Wildlife Conservation Society
31.	10/03/2003	Letter from Marydele Donnelly and Coby Dolan, The Ocean Conservancy
32.	10/03/2003	Letter from Sonja Fordham and Coby Dolan, The Ocean Conservancy
33.	10/03/2003	Letter from Nelson Beideman, Executive Director, Blue Water Fishermen's Association
34.	10/03/2003	Letter from Melissa Neiman-Kelting
35.	10/03/2003	Letter from Susan Shipman, Director, Georgia Department of Natural Resources, Coastal Resources Division
36.	10/03/2003	Letter from Russell Hudson, President, Directed Shark Fisheries, Inc.

A5.1 LCS Rebuilding Time frame

Comment 1: If prohibiting fishing for 10 years does not quite give a 70-percent chance of rebuilding the LCS complex to MSY, then prohibit fishing for 20 years.

Response: Prohibiting shark fishing for 20 years would give an 86-percent chance of rebuilding the LCS complex to MSY. This is greater than the 50-percent minimum required by the HMS FMP or the 70-percent that NOAA Fisheries uses as a guide for regarding shark management measures. However, prohibiting shark fishing for 20 years would not be consistent with the Magnuson-Stevens Act which allows NOAA Fisheries to consider a number of factors when determining the rebuilding time frame including impacts on fishing communities. If NOAA Fisheries were to prohibit fishing for 20 years, a number of businesses including fishermen, processors, and suppliers, could be forced out of business and a number of communities, including recreational fishing communities, would be adversely affected. Additionally, prohibiting fishing for 20 years would eliminate the fishery-dependent data that is needed to accurately assess the status of the stocks. Given these impacts, the objectives of the HMS FMP and this Amendment, the requirements of Magnuson-Stevens Act and other domestic law, and the results of the 2002 large and small coastal shark stock assessments, NOAA Fisheries does not believe that shark fishing should be prohibited for 20 years.

Comment 2: Our confidence in the 70-percent chance to rebuild figure is low given the number

of uncertainties and deficiencies in the plan particularly the fact that the quota is not reduced by 50 percent, the time/area closures to protect juveniles will not be implemented immediately, there is no size limit in place, and NOAA Fisheries has not accounted for all sources of mortality such as state landings.

Response: While there are a number of uncertainties and unquantifiable effects in the rebuilding plan outlined in Amendment 1, NOAA Fisheries is confident that the combination of management measures should have a 70-percent chance of rebuilding the LCS complex. The 2002 LCS stock assessment found that reducing the catches by 50 percent would have, on average, a 67-percent chance of rebuilding LCS in 30 years. While the rebuilding time frame in the amendment is shorter than 30 years and the commercial quota is reduced by 45 percent, not 50 percent, NOAA Fisheries is implementing a number of other management measures that should reduce fishing mortality and increase the reproductive potential of several stocks in the LCS complex. For example, the time/area closure will protect juvenile sharks as recommended by the 2002 LCS stock assessment. Numerous studies have shown that protecting this life stage provides the greatest benefit to increasing the population size. NOAA Fisheries feels that this time/area closure will be more effective at protecting juvenile sharks and rebuilding the population than a commercial minimum size because with a minimum size commercial fishermen would be forced to discard undersized sharks and those discarded sharks would not be counted against the commercial trip limit, which could allow for more sharks to be caught and potentially discarded. In the long-term, if dead discards were to increase as a result of a minimum size, then the commercial and recreational portions of the optimum yield would decrease and both the commercial quota level and recreational retention limit could be reduced. NOAA Fisheries does not have the same concerns for a minimum size in the recreational fishery because the recreational fishery is believed to have low post-release mortality rates and has already been limited to one shark per trip, not including the exception for Atlantic sharpnose and bonnethead sharks. NOAA Fisheries is also implementing management measures, such as the requirement for commercial fishermen to carry and use line cutters and dehooking devices, that should minimize the mortality of sharks that are caught and released. Together, these management measures, along with accounting for all sources of fishing mortality (including both Federal and State commercial landings, dead discards, and recreational catches), increasing and improving education and outreach, and increasing compliance with the recreational regulations, should give the LCS complex a 70-percent chance of rebuilding within the rebuilding time frame.

Additionally, the HMS FMP requires NOAA Fisheries to conduct periodic stock assessments for species or species-groups. If the results of future stock assessments and new information indicate that the LCS complex is not likely to be rebuilt within the revised time frame, NOAA Fisheries can adjust the reduction in the commercial quota or other management measures to ensure a 70-percent probability in rebuilding the stock over the course of the 26-year rebuilding period. Additionally, as more species-specific information becomes available, NOAA Fisheries will attempt to conduct species-specific assessments in order to ensure that any future management measure focuses on those species that are the most vulnerable or that need the most protection.

Comment 3: In considering the management options and probability of rebuilding sharks, having an additional set of alternatives with a higher probability of success would have been useful for comparison purposes. As it stands, the most conservative alternatives are the ones chosen as the preferred alternatives and may be insufficient to meet the management goals. As such, the preferred alternatives in the amendment should be considered the absolute minimum necessary to manage sharks consistent with the advice of the 2002 stock assessments.

Response: As required under NEPA, NOAA Fisheries considered a wide range of alternatives designed to rebuild LCS. The range of alternatives included those that could be considered risk-prone (e.g., removing the retention and/or size limits in the recreational fishery) to risk-averse (e.g., allowing no retention in the recreational fishery). From all the alternatives considered, NOAA Fisheries selected a group of alternatives that, consistent with the Magnuson-Stevens Act, is likely to rebuild the LCS complex within the revised rebuilding time frame while allowing for a viable shark fishery. If the results of future stock assessments indicate it is needed, NOAA Fisheries can adjust the commercial quota or other management measures to ensure a 70-percent probability of rebuilding the stock over the course of the 26-year rebuilding period.

Comment 4: The proposed rebuilding time frame is the maximum allowed under the National Standard guidelines and is set using the entire complex rather than considering the biology of each individual species. We encourage NOAA Fisheries to consider stratifying the time frame by considering the biology for individual species.

Response: NOAA Fisheries agrees that the revised rebuilding time frame is the maximum allowed under the National Standard guidelines. NOAA Fisheries would like to move toward more species-specific management in the future and will do so if fishermen can demonstrate a better ability to target and/or avoid certain species of sharks, if species-identification among commercial and recreational fishermen and commercial dealers improves, and if enough scientific data is collected that allows for more species-specific stock assessments. Thus, NOAA Fisheries will consider revising the basis for calculating the commercial quota and the classification scheme to consider a more species-specific approach to management when sufficient data are available to effectively do so.

Comment 5: The rebuilding time frame should be calculated from the time the fishery was declared overfished, in this case 1999. Restarting the clock based on new assessment information is not required by the Magnuson-Stevens Act.

Response: NOAA Fisheries had originally finalized a rebuilding plan in the 1999 HMS FMP that was designed to rebuild ridgeback LCS in 39 years and non-ridgeback LCS in 30 years. This rebuilding plan was based on the projections from the 1998 LCS stock assessment. Based on a peer review of that stock assessment, NOAA Fisheries determined that the projections from that stock assessment should not be used as the basis for management decisions. For this reason and as a result of the change in status of the two primary LCS species in the fishery, NOAA Fisheries determined it was necessary to revise the rebuilding plan. Under National Standard 1, a

rebuilding plan begins when the first measures to rebuild the stock are implemented. It is important to note that under this revised rebuilding plan, the LCS complex will be rebuilt by 2030 which coincides with the time period projected for rebuilding non-ridgeback LCS sharks under the 1999 HMS FMP (2029) and is less than the 1999 HMS FMP rebuilding time period projected for ridgeback LCS sharks (2038).

Comment 6: The proposed rebuilding time frame is illegal and runs counter to the precautionary approach. The LCS complex can and must be rebuilt within the 10-year time limit envisioned by Congress.

Response: NOAA Fisheries does not believe the revised 26-year rebuilding time frame is illegal. The Magnuson-Stevens Act specifies that if a stock can rebuild in less than 10 years, that the rebuilding time frame can be no longer than 10 years. Additionally, if a stock will take 10 years or more to rebuild, the rebuilding time frame can be as long as the time to rebuild with no fishing plus a mean generation time. Furthermore, the Magnuson-Stevens Act specifies a number of factors to consider regarding the rebuilding time frame. In 1997, NOAA Fisheries used a 50-percent probability of rebuilding to design interim management measures that would stabilize the fishery until a rebuilding plan could be finalized. In the HMS FMP, NOAA Fisheries finalized an alternative that specified that any rebuilding management measure should be at least 50-percent certain of rebuilding the stock for HMS in general, and, because of their slow growth and low reproductive potential, 70-percent certain of rebuilding the stock for sharks. After taking into account the biology of the stocks, the results of the 2002 LCS stock assessment, the requirements of the Magnuson-Stevens Act and the National Standard Guidelines, the criteria in the HMS FMP, and the status of the fishing communities that rely on economic activities involving the capture of these fish, NOAA Fisheries does not believe that a 10-year rebuilding period is appropriate for the LCS complex. If NOAA Fisheries decided to close the fishery in order to rebuild in the shortest amount of time, the fishery would need to be closed for more than 10 years in order to meet the 70-percent probability of rebuilding the stock. Under that scenario, NOAA Fisheries would have to close the commercial fishery, place a no-retention limitation on the recreational fishery, and work with all Councils and States to prevent any take of sharks in non-HMS fisheries or in areas under state jurisdiction. However, a 26-year rebuilding time frame will provide time for NOAA Fisheries to ensure all LCS will rebuild while also allowing for a viable shark fishery.

Comment 7: Applying a 70-percent probability to the setting of a time frame does nothing to enhance conservation and increases risk to the sharks. Choosing the 27-year time frame over a 10-year time frame is, at best, conservation neutral because the management measures, at least for 2004, are the same regardless of the rebuilding end date. At worst, choosing the longer time frame is riskier because it allows shark stocks to linger longer at lower biomass levels and could allow for inappropriate increases in fishing effort in future years before the complex is rebuilt.

Response: NOAA Fisheries disagrees that a 70-percent probability of achieving the rebuilding target will do nothing to enhance conservation and will increase the risk to the sharks.

Additionally, NOAA Fisheries disagrees that a 10-year time frame would be consistent with the same management measures as the revised 26-year time frame. In the HMS FMP, NOAA Fisheries decided to use a higher probability standard for sharks because the biology of sharks is different than other HMS and fish in that they take a number of years to mature, have few pups per brood, and generally only reproduce every other or every three years. This, combined with the fact that they are migratory and that some of their prey species are overfished, has led to the determination that a higher level of certainty is required when setting management actions for sharks. Thus, a 70-percent probability level is appropriate and will ultimately reduce the risk to sharks. If NOAA Fisheries were to choose a 10-year rebuilding time frame, NOAA Fisheries would need to close the fishery but would still not reach a 70-percent probability of rebuilding the LCS complex.

Comment 8: Probabilities of success should be applied only once a rebuilding time frame is set. The HMS FMP, other FMPs, and courts have all noted that management measures must have at least a 50-percent chance of success. The 2002 LCS stock assessment found that a 50-percent reduction in catch has a 50-percent chance of rebuilding the LCS complex within 10 years. Thus, the plan meets the minimum probability of success. Ironically, NOAA Fisheries does not apply the 70-percent guide to the selected time frame, noting instead that 64 percent is close enough.

Response: NOAA Fisheries disagrees that probabilities of success should be applied only once a rebuilding time frame is set. That approach is inconsistent with the Magnuson-Stevens Act and with the National Standard guidelines. Under that approach, NOAA Fisheries would have no basis for determining whether or not a stock could likely rebuild in less than 10 years or more than 10 years. This could result in unrealistic rebuilding time frames that could be so short as to leave no option other than closing the fishery or that could be so long as to never result in rebuilding the stock. Instead, NOAA Fisheries uses the probability of success both in setting the rebuilding time frame and in selecting all the alternatives to ensure that, taken together, the suite of alternatives will meet the probability standard. Thus, in Amendment 1, while reducing the overall catch by 45 percent does not give a 70-percent probability of success, the combination of catch reductions with other management actions that will likely reduce mortality of released catch or protect juvenile sharks does have a 70-percent probability of success.

A5.2 Commercial Management Measures

A. LCS Classification

Comment 1: NOAA Fisheries received a range of comments regarding the proposed classification. Comments received included: it is easier to comply with one closure date; violators can take advantage of two closure dates. We support the preferred alternative because it will simplify the regulations and reduce regulatory discards. We agree that species-specific quotas are not reasonable now and therefore support the re-aggregating the LCS complex; however, NOAA Fisheries should not abandon the goal of species-specific management. Because fishermen can actively target sandbar and blacktip sharks, we prefer the alternative that

allows for species-specific shark groupings (alternative A4) or, alternatively, the ridgeback/non-ridgeback species groupings (alternative A1). The stock assessment recommended that every effort be made to manage the LCS fishery on a species by species basis; thus, we support alternative A1, LCS groupings with different closure dates possible.

Response: NOAA Fisheries considered five different shark classifications for LCS in development of the proposed and final rule. The alternative which would implement an aggregate LCS classification with one closure date is preferred because, in combination with the other preferred alternatives, it is (1) expected to maintain historic fishing practices (since 1993) and food availability in the market place, (2) expected to reduce burden on fishermen for sorting, (3) expected to decrease, or at least not increase, the number of protected resource interactions; and (4) not expected to increase regulatory discards. During this rulemaking process NOAA Fisheries heard that many fishery participants cannot accurately identify or effectively target individual shark species. As such, NOAA Fisheries does not believe that a species-based classification is warranted at this time. However, NOAA may consider implementation of species-based LCS classifications when the ability to accurately identify and effectively target shark species improves.

Comment 2: The preferred alternative is the same classification that was in place from 1993 through 2002 but is not consistent with the rebuilt status of sandbar and blacktip shark or the economic needs of shark fishermen.

Response: The preferred alternative for LCS classification (i.e., aggregate LCS, one closure date; alternative A3) seeks to minimize bycatch (i.e., regulatory discards) of both rebuilt and overfished species of LCS, which would otherwise occur under separate closure dates or partial closures of a mixed fishery. While sandbar and blacktip sharks are no longer overfished and, in the case of blacktip sharks, may be able to withstand an increase in harvest, NOAA Fisheries also needs to rebuild overfished LCS. Based on comments that fisherman cannot identify or target specific species of shark, NOAA Fisheries does not believe species-specific management is feasible at this time. Additionally, NOAA Fisheries also believes that this alternative allows fishermen the opportunity to catch the entire quota without decreasing efficiency (i.e., increased time to sort catch, increased time at sea to make up for lost catch resulting from regulatory discards, etc.). Therefore the economic needs of fishermen are maximized with alternative A3, as compared with the other alternatives considered.

Comment 3: NOAA Fisheries should increase research, survey, and monitoring efforts to acquire the critical information on individual life histories, ecological requirements, and stock conditions to enable more species-specific management. NOAA Fisheries should develop a plan of action for moving towards species-specific management in the future.

Response: NOAA Fisheries is supportive of increasing scientific research, surveys, and monitoring efforts of shark populations, provided that funding is available to do so. Currently, NOAA Fisheries funds a number of shark focused research programs including, but not limited

to: (1) cooperative shark research (i.e., between SEFSC and Mote Marine Laboratory), (2) reducing blue shark bycatch in pelagic longline fisheries, (3) delineation of winter nursery grounds, migratory patterns, and critical habitat of juvenile sandbar sharks in the western Atlantic ocean, and (4) various observer programs in the shark fishery. NOAA Fisheries will review species-specific information and incorporate such information into stock assessments, as appropriate, as it becomes available and intends to pursue workshops to improve species identification by fishermen and dealers in the future. As such, NOAA Fisheries may consider implementation of species-based LCS classifications when the ability to accurately identify and effectively target shark species improves.

Comment 4: National Standard 1 requires NOAA Fisheries to adopt alternatives that result in the lowest quotas for vulnerable and overfished species and minimize bycatch to the greatest extent possible. Therefore, NOAA Fisheries should adopt alternative A5, which would aggregate LCS and close the fishery when the quota for the most vulnerable species is meet.

Response: National Standard 1 mandates that "conservation and management measures shall prevent overfishing while achieving on a continuing basis, the optimum yield from each fishery for the United States fishing industry." NOAA Fisheries believes that the preferred alternative (i.e., A3) best complies with National Standard 1 of the other alternatives considered because it in combination with C2 will allow for LCS to rebuild while allowing optimum yield to be taken from the fishery. Additionally, the selected alternative is expected to decrease, or at least not increase, the number of protected resource interactions and not expected to increase regulatory discards, which is consistent with National Standard 9. As described in the Amendment, NOAA Fisheries did not feel alternative A5 was a viable alternative at this time because to date there is limited data available on individual LCS species beyond that of sandbar and blacktip. Without species-specific assessments, it is difficult to say which LCS species have highest vulnerability or even what the quota should be for any individual species. NOAA Fisheries may consider this alternative as more information becomes available in the future.

B. Shark Quota Administration

Comment 1: NOAA Fisheries received a range of comments regarding the combination of regional quotas and trimester seasons. Comments included: We support the proposed administration of regional and trimester seasons. We cannot support the proposed administration of regional and trimester seasons. Regional and trimester seasons will provide for more flexible management and improve quotas as a management tool. The regional quotas and trimester seasons will force vessels down to Florida for the January opening and will force them to fish for a shorter amount of time.

Response: NOAA Fisheries considered three separate alternatives regarding seasons and two alternatives pertaining to regional quotas. NOAA Fisheries believes that the combination of trimester seasons with regional quotas will (1) aggregate the majority of shark pupping into one fishing season (i.e., second trimester) as opposed to divide it into two or more seasons, which is

possible with either the semi-annual or quarterly season approaches, (2) provide managers with flexibility to adjust regional quotas, where necessary, to prevent mortality on juveniles and reproductive female sharks, (3) provide a higher degree of resolution on which to manage seasonal fisheries, (4) minimize the social and economic costs associated with switching gear more often (i.e., only three times as opposed to four per year), (5) give a higher percentage of the quota to each open season than would occur under a quarterly season approach, and (6) will increase the number of open seasons (i.e., three as opposed to two) and spread them across the calendar year, thereby promoting greater economic stability of fishery participants. For these reasons, NOAA Fisheries supports implementation of trimester seasons and regional quotas.

Comment 2: NOAA Fisheries received a range of comments regarding the proposed trimester approach. Comments included: The entire season, from January through November, should be closed to protect fish. The second semi-annual season closes too early. The trimester seasons will spread out the landings and avoid current price drops. The trimester approach will allow fishermen to catch sharks when grouper prices are lower and helps sharks be available year-round. Trimester seasons appear to have the greatest potential to accommodate shark pupping activities. The second trimester season should be closed to all shark fishing to reduce the catch of juveniles.

Response: NOAA Fisheries considered three different seasons for the shark fishery in the development of the proposed and final rule. Trimester seasons are preferred because they will allow managers the flexibility to open and close seasons to match species requirements such as aggregating shark pupping seasons into one fishing season, as opposed to spreading pupping time-frames over multiple open seasons. Trimesters will also avoid undesirable dates (i.e., July 1st) for market openings. Additionally, trimester seasons will give fishermen a greater chance to build new markets for sharks, given that there will be more open seasons (i.e., three as opposed to two) spread across the calendar year. Increasing the number of open seasons and effectively spreading open seasons out more evenly over the calendar year will, in the long-term, result in greater economic stability for fishermen and associated communities.

Comment 3: NOAA Fisheries should keep the semi-annual seasons and open the second season on July 15th each year.

Response: NOAA Fisheries believes that maintaining semi-annual seasons could have negative ecological, social, and/or economic impacts should semi-annual seasons continue to extend into pupping seasons. Given that LCS are overfished and overfishing is occurring, continued mortality levels on juvenile and reproductive females could cause the complex to decline further overtime. Further declines in LCS stock status could result in additional reductions in available quota and/or other management measures, which could impact fishermen and fishing communities both economically and socially. NOAA Fisheries agrees that the July 1st opening for the second semi-annual season makes it difficult for fishermen to establish markets with the forthcoming July 4th holiday. As such, NOAA Fisheries supports adoption of trimester seasons, which will aggregate the majority of shark pupping into one fishing season (i.e., second

trimester) and simultaneously avoid market problems associated with a July 1st opening, given that openings under a trimester approach would occur on January 1, May 1, and September 1 of each year.

Comment 4: NOAA Fisheries should start each season at the same time to help disperse fishing effort and promote equitable distribution of the allowable quota.

Response: While opening shark seasons at the same time for all regions may help to disperse fishing effort and promote equitable distribution of the allowable quota, NOAA Fisheries believes that allowing managers flexibility to determine alternative season opening dates (i.e., by region) will promote further consideration of safety at sea and give greater fishing opportunities based upon fish availability in each region.

Comment 5: August and September are not good times for shark fishing. Most of the effort should be in October through December. Therefore, the quota should be reapportioned from the first two trimesters to the last trimester.

Response: NOAA Fisheries recognizes that there are temporal differences in catch-per-unit-effort as well as catch composition in the shark fishery. As such, annual quotas need not be split equally between trimester seasons. Instead, trimester seasons will allow managers to establish quotas for each open season based on markets, pupping season, effort concerns, and other relevant factors. Initially, NOAA Fisheries will split the available quota equally between trimesters for the first year or two and will re-evaluate this approach via rulemaking, if necessary, based upon observed catch rates and other factors, such as stock status.

Comment 6: NOAA Fisheries received a range of comments specific to the proposed percentages for regional quotas. The comments included: the historical percentage of small coastal sharks in the Gulf of Mexico is incorrect due to improper identification and reporting. The regional quota proposed for the North Atlantic is below the actual take and would be filled quickly between the vessels fishing in the region. The North Atlantic proposed portion of the LCS quota is too large and should be reduced; the percentage was probably inflated due to misidentification of sandbar sharks. The South Atlantic proposed portion for SCS is too large due to misinformation and misidentification; there are just as many LCS reported in that region as SCS. We can only support regional quotas if one region does not prevent another region from having a fair shot at the fishery.

Response: NOAA Fisheries combined information from two separate databases containing regional landings information as reported by dealers and states to NOAA Fisheries. NOAA Fisheries believes that the landings reported by dealers and states represents the best available information pertaining to regional data. Given that implementation of regional quotas seeks to maintain historical landings, as opposed to reducing landings, NOAA Fisheries does not expect this alternative to change previous fishing practices or result in any significant economic impact. Fishery participants will be allowed to fish in any region, provided that the season for the region

in question is open and that the quota for that region has not been taken. Over time, this alternative may allow NOAA Fisheries the flexibility to manage quotas to each region's maximum economic advantage. NOAA Fisheries recognizes the need for more accurate species identification and as such, the agency will pursue mandatory workshops through a future rulemaking that will focus on improving species identification by fishery participants and possibly dealers and enforcement agents.

Comment 7: How will NOAA Fisheries enforce the regional quota approach? Will there be three separate permits for vessels fishing within the regions or can a vessel fish in an open region and land catch in a closed region? We are only supportive of the regional quota approach if permitted vessels can fish in any region.

Response: Federal fishery participants will be allowed to fish in any region, provided that the season for the region in question is open and that the quota for that region has not been taken. As such, NOAA Fisheries will not be issuing regional permits to vessels authorizing them to fish in a given region. Rather, each regional quota will be enforced by monitoring illegal fishing activity in each region, as is done in the Atlantic bluefin tuna fishery. As is current practice, the closure date for each region will be announced before the start of the season. Additionally, state agencies may have different permit and closure requirements. As such, fishery participants are encouraged to check with state agencies, where state permit and/or closure requirements are in question.

Comment 8: NOAA Fisheries should not use data from 1999 to 2001 to establish the regional quotas. Instead, NOAA Fisheries should use data from the 1980s (i.e., before management) in order to get an idea of where the fishery historically operated. If this is done, the North Atlantic will account for over half the landings.

Response: Calendar years 1999-2001 were used as the basis for establishing regional quotas because (1) they represent the period of time following the last major change in management of the shark fishery, (2) fall after implementation of limited access permits, and (3) represent the time-frame for which the best regional data is available. Using a longer timeframe or only data from the past may not provide an accurate representation of the current fishery. Over time, NOAA Fisheries may decide to adjust the regional quota, via rulemaking in order to ensure each region has an opportunity to fish.

Comment 9: NOAA Fisheries should pay particular attention to regional differences in shark pupping activity and use its discretion in allocating quotas and setting seasons so as to best prevent mortality of congregating pregnant females, pups, and juveniles.

Response: NOAA Fisheries agrees that spatial differences in fishery practices and catches warrant further consideration regional quotas as a means to prevent mortality of congregating reproductive females, pups, and juvenile sharks. Shark pupping data indicate that spatial differences exist between species utilization of various shark pupping grounds. For example,

species within the SCS complex utilize pupping grounds between South Carolina and the Gulf of Mexico, whereas some species within the LCS complex utilize only the Atlantic coast for pupping grounds. As such, NOAA Fisheries will periodically assess regional differences in shark pupping activity and should changes be required, quota adjustments will be carried out via framework action.

C. Shark Quota Basis

Comment 1: We support the preferred alternative of an MSY basis. In the future, NOAA Fisheries should estimate MSY on a species-specific basis for all LCS. NOAA Fisheries should establish a similar approach for pelagic sharks when a validated assessment is available.

Response: NOAA Fisheries supports using MSY as a basis for establishing commercial quotas. NOAA Fisheries must determine the maximum sustainable yield (MSY) as well as optimum yield (OY) and specify status determination criteria to allow a determination of the status of the stock. As such, the 1999 HMS FMP defined fishing mortality and biomass levels necessary to produce MSY and OY on a continuing basis. Given that these definitions are not subject to change in this amendment/final rule, MSY based quotas provide a direct means for determining appropriate fishery management action. MSY and OY estimates are readily available from stock assessment outputs and can be updated annually if necessary. NOAA Fisheries is currently limited in its ability to estimate MSY for all shark species within each of the management units. However, as new information becomes available, NOAA Fisheries will strive to integrate more species-specific information into stock assessments, where MSY could be calculated. Once the international stock assessment for pelagic sharks is complete, NOAA Fisheries will re-evaluate the appropriateness of existing pelagic shark quotas and the basis for calculating commercial quotas for these species.

Comment 2: NOAA Fisheries received several comments regarding the reduction in LCS quota by 40 percent instead of the recommended 50 percent. Comments included: Because the proposed alternative reduces MSY by only 40 percent instead of the recommended 50 percent, NOAA Fisheries should adopt other conservation methods such as gear restrictions and time/area closures whose effects can be quantified to show that they achieve the mortality goal of rebuilding with a 70-percent probability. The 40-percent reduction is not reasonable; there is no reliable basis to stray from the scientific advice. The assessment recommendation is based on a 50-percent probability of successful rebuilding; if NOAA Fisheries were to apply the 70 percent guide, the proposed reduction would be larger not smaller than 50 percent. Therefore, NOAA Fisheries should reduce the quota by a minimum of 50 percent.

Response: The preferred quota alternatives will implement an LCS aggregate quota based upon a 45-percent reduction of average maximum sustainable catch (MSC) for LCS, multiplied by the percentage of commercial catch attributable to the LCS complex. NOAA Fisheries reduced the 50 percent recommended reduction by five percent after consider the following factors: (1) while the stock assessment did say that the LCS complex should be reduced by 50 percent, it also said

that the reductions should be on species other than sandbar and blacktip; (2) observer data indicates that sandbar and blacktip sharks comprise approximately 67 percent of the LCS catch, indicating that a quota reduction would mostly apply to those species; (3) the peer reviews indicated that the complex assessment may not be as accurate as individual species because of biological differences between species; (4) CPUE data for silky, tiger, and scalloped hammerhead do not indicate a decline; and (5) the other preferred measures such as the time/area closure will reduce mortality and/or dead discards. Furthermore, the percent reduction has been revised upward from the 40-percent reduction originally proposed in the DEIS based upon public comment received during public hearings. NOAA Fisheries feels that a 45-percent reduction in addition to the other preferred alternatives is reasonable and will rebuild the LCS complex. The Southeast Fisheries Science Center has indicated that the combination of the preferred alternatives, namely the quota reductions and time/area closure, would increase compliance in the fishery and allow for the LCS complex to rebuild within the specified time-frame. As such, NOAA Fisheries does not believe that further reductions in LCS commercial quota are warranted at this time. However, NOAA Fisheries will adjust the quota over time based upon future stock assessments to ensure that the LCS complex rebuilds.

Comment 3: NOAA Fisheries must also account for state fisheries mortality estimates when setting quotas.

Response: State landings are included as part of the commercial landings percentage used to calculate the commercial quotas. Thus, the commercial quota is established to include landings by Federal and state fishermen. Any overharvests or underharvests will be accounted for in the same season of the following year.

Comment 4: We support the preferred alternative but the draft amendment is unclear on how information from future stock assessments will be used in setting quotas. Would 60 percent of MSY always be used regardless of the population level?

Response: The LCS aggregate quota is based upon a 45-percent reduction of average maximum sustainable catch (MSC) for LCS, multiplied by the percentage of commercial catch attributable to the LCS complex. As such, this percent reduction may not be used when setting future quotas. Instead, NOAA Fisheries will assess the appropriateness of percent reductions and/or increases as new information becomes available in future stock assessments in order to ensure that the LCS complex rebuilds within the rebuilding timeframe.

Comment 5: We support the proposed MSY basis as long as that calculation continues to incorporate a target fishing mortality rate at 75 percent of F_{MSY}. We would also support expanding this precautionary buffer by lowering the percent of F but not increasing the rate toward F_{MSY}.

Response: The 1999 HMS FMP defined fishing mortality and biomass levels necessary to produce MSY and OY on a continuing basis. In summary, a species is considered overfished

when the current biomass (B) is less than the minimum stock size threshold. The minimum stock size threshold is determined based on the natural mortality of the stock and the biomass at Maximum Sustainable Yield (B_{MSY}). The MSY is the maximum long-term average yield that can be produced by a stock on a continuing basis. Overfishing is occurring on a species if the current fishing mortality (F) is greater than the fishing mortality at MSY (F_{MSY}). When one or both of these measures occur, a species is declared overfished and action to rebuild the stock and/or prevent overfishing is needed within one year. A species is considered rebuilt when B is greater than B_{MSY} and F is less than F_{MSY}. A species is considered healthy when B is greater than or equal to the biomass at optimum yield (B_{OY}) and F is less than or equal to the fishing mortality at optimum yield (F_{OY}). NOAA Fisheries is not changing these definitions in this amendment, thus the target control rule for managing healthy stocks continues to be 75 percent of F_{MSY}. This definition is consistent with the National Standard guildelines.

D. Minimum Size Restrictions

Comment 1: NOAA Fisheries received a range of comments regarding what the minimum size should be. Comments included: We support the no commercial minimum size alternative. The minimum size in the HMS FMP was based on sandbar sharks but does not fit for all ridgeback LCS species. We support the proposed no minimum size because the minimum size was established for sandbar sharks which is no longer overfished and because it will help reduce regulatory discards. We support a minimum size for sharks. The minimum size of any shark should be 15 feet. If recreational fishermen have a minimum size to protect juveniles, commercial fishermen should have a minimum size as well. We could support no commercial minimum size if juveniles of all species were protected by time/area closures; the proposed time/area closure does not do this.

Response: NOAA Fisheries considered six different minimum size alternatives for possible implementation in the commercial fishery. The alternative which would not implement a minimum size for the commercial fishery is preferred because, in combination with the other preferred alternatives, most notably the time/area closure offshore North Carolina, it will minimize regulatory discards as well as minimize economic and social impacts to commercial fishermen. NOAA Fisheries believes that the time/area closure offshore North Carolina will provide adequate protection for juvenile and neonate sharks. Furthermore, NOAA Fisheries believes that commercial gear, unlike recreational gear, can have high post release mortality rates. Therefore commercial management measures, which are aimed at reducing (i.e., quota reductions) or preventing (i.e., via time/area closures) catch are better for protecting juvenile and neonate sharks.

Comment 2: NOAA Fisheries made a strong case in the HMS FMP for a minimum size based on protecting the age classes with the highest reproductive potential, demographic information, and the proportion of sharks brought to the boat dead. Now that NOAA Fisheries is backing away from a ridgeback LCS quota, this measure is needed to protect the most sensitive life stages of ridgeback LCS (sandbar and dusky sharks in particular). NOAA Fisheries should maintain the

minimum size, show quantitative analyses that indicate a minimum size is not needed, or replace it with more effective species-specific measures to protect juvenile dusky and sandbar sharks.

Response: NOAA Fisheries does not agree that maintenance of the minimum size under the no action alternative in the commercial fishery is warranted at this time. This Amendment selects several commercial management measures including, but not limited to, trimester seasons, regional quotas, reductions in the LCS quota, bycatch reduction measures, and a time/area closure, which are intended to reduce mortality of LCS. Scientific review and associated quantitative analyses performed by the Southeast Fisheries Science Center document that the combination of the preferred alternatives as outlined in the DEIS, would allow for the LCS complex to rebuild within the specified time-frame outlined. Furthermore, NOAA Fisheries has revised upward the percent reduction (i.e., from 40% to 45%) associated with commercial quotas for the LCS complex to further ensure that rebuilding goals are realized. As such, NOAA Fisheries does not believe that the addition of a minimum size in the commercial shark fishery is warranted at this time.

Comment 3: If NOAA Fisheries does not adopt a minimum size, it must adopt a time/area closure to reduce bycatch of juvenile and neonate sharks to levels at least as great as would be achieved with minimum sizes.

Response: NOAA Fisheries agrees that implementation of a time/area closure would reduce bycatch of juvenile and neonate sharks. However, implementation of the time/area closure alone would not be sufficient to meet the rebuilding target for the LCS complex. As such, NOAA Fisheries supports implementation of multiple management measures including, but not limited to reductions in the LCS quota, bycatch reduction measures, and time/area closures, which are intended reduce bycatch of juvenile and neonate sharks.

Comment 4: NOAA Fisheries should establish sub-group or species-specific minimum sizes within the LCS, SCS, and/or pelagic shark species groups as justified by new or updated research.

Response: NOAA Fisheries disagrees that at this time minimum sizes should be established for sub-groups or individual species within each management unit. While a commercial minimum size would seek to protect and reduce fishing mortality on juvenile sharks, any conservation benefits gained may be offset by increases in regulatory discards and associated post-release mortality given that commercial fishermen may be unable to avoid mixed-size aggregations of some shark species. For instance, while sandbar sharks tend to segregate by size, blacktip sharks and other species do not. Regulatory discards may also result in effort increases by fishermen in order to make up for lost catches, which could also result in increased interactions with protected (i.e., sea turtles and marine mammals) and non-targeted (i.e. prohibited sharks and other finfish) species. Additionally, regulatory discards of LCS are not counted against the 4,000 pound trip limit. Thus, if a fisherman should catch a set full of undersized sharks, those sharks would be discarded and the fisherman could set the gear again, possibly in another school of small sharks.

If the ability of fishermen to target certain species of sharks improves, then NOAA Fisheries may once again consider minimum sizes in the commercial fishery.

Comment 5: Commercial fishermen have long claimed that most sharks come in alive. Therefore, there does not seem to be any rationale for the insistence by NOAA Fisheries that the recreational minimum size is essential to protect the species while similar measures for commercial fisheries are eliminated. A commercial minimum size for mako sharks is overdue. Longliners are willing to compromise for a minimum size on mako sharks.

Response: Commercial fishery observer data indicate that a number of LCS exhibit low survivability following longline capture. These species include spinner (63 percent dead when brought to the vessel), dusky (81 percent), scalloped hammerhead (87 percent), blacktip (88 percent), silky (90 percent), and great hammerhead (95 percent) (Burgess and Morgan, 2003). As such, NOAA Fisheries believes that implementation of a minimum size in the commercial fishery would result in significant increases in regulatory discards of LCS.

E. Commercial Shark Quota: General

Comment 1: NOAA Fisheries received a range of comments regarding what the commercial quota level should be. Comments included: Commercial quota levels should be reduced or even eliminated until the complex recovers. Quotas should be reduced by 700 percent. We support the quota alternatives (classification, administration, and basis) insofar as that together they result in the lowest overall quotas to ensure sustainable levels for all species and protect juveniles.

Response: NOAA Fisheries did not propose a specific quota level. Instead, NOAA Fisheries considered a wide range of quotas that resulted from the combination of classification and quota basis alternatives. These alternatives resulted in the possibility of seven different commercial quotas for LCS and three different commercial quotas for SCS. Each quota alternative carefully considered the results of the 2002 stock assessments for LCS and SCS. The preferred quota alternatives will implement commercial quota levels of 1,017 mt dw for the LCS aggregate and 454 mt dw for the SCS aggregate. NOAA Fisheries believes these quota levels will rebuild the LCS complex within the necessary time-frame and prevent overfishing of SCS. If future stock assessments indicate adjustments are necessary to meet these goals, then the preferred quota basis alternative will allow NOAA Fisheries the flexibility to address such adjustments.

Comment 2: The most recent stock assessment called for a 50-percent reduction in catches for the LCS complex but the preferred alternatives combined result in a 34-percent reduction in commercial catch from recent years (1,692.7 mt dw to 1,109 mt dw). While the additional measures may result in further reductions in mortality, the other proposed measures could increase the quotas and undermine management.

Response: NOAA Fisheries believes that the combination of preferred alternatives including, but not limited to, a commercial quota with a 45-percent reduction in catches and a time/area closure

aimed at protecting juvenile and neonate sharks will rebuild the LCS complex. This is further substantiated by analyses performed by the Southeast Fisheries Science Center which document that the combination of the preferred alternatives as outlined in the DEIS would allow for the LCS complex to rebuild within the specified time-frame outlined. Furthermore, NOAA Fisheries does not believe that the other preferred alternatives (i.e., trimester seasons and regional quotas), as outlined in the FEIS, will result in an increase in quotas that would undermine management.

Comment 3: NOAA Fisheries received several comments regarding the apparent increase in quota from the total of 816 mt dw in the HMS FMP to the proposed 1,109 mt dw. Comments included: Even though LCS are overfished and overfishing is occurring, NOAA Fisheries is proposing to increase the LCS quota by 35 percent; this is hard to understand. NOAA Fisheries should move forward with the MSY quota basis but maintain the 816 mt dw quota level until a new, validated stock assessment can be carried out.

Response: The no action alternative would implement commercial quota levels for LCS (i.e., 620 mt dw for ridgeback LCS and 196 mt dw for non-ridgeback LCS) totaling 816 mt dw, which were approved in the 1999 HMS FMP based on projection models in the 1998 LCS stock assessment. These quota levels were never implemented due to a court approved settlement agreement. Taking into consideration the settlement agreement, the results of the 1998 stock assessment peer reviews, and other information, NOAA Fisheries maintained the 1997 commercial quotas for LCS (i.e., 1,285 mt dw) as an interim measure pending completion of this amendment. As such, except for 2003, commercial fishermen have been fishing under the LCS quota of 1,285 mt dw, since 1997. Therefore, the preferred alternatives, which would implement a LCS quota of 1,017, represent a 21-percent reduction in available quota compared to the 1,285 mt dw baseline.

Comment 4: The LCS quota component of the species-specific quota (alternative A4) is too low and should be doubled in order to reduce the potential for regulatory discards.

Response: NOAA Fisheries disagrees that the resulting species-specific quota alternative considered for LCS is too low. Both alternatives considered for species-specific quotas (i.e., MSY and average landings) incorporated an appropriate percent reduction, as recommended in the 2002 LCS stock assessment. Additionally, the 2002 stock assessment clearly indicated that LCS reductions should focus on species other than sandbar and blacktip. Because regulatory discards will occur as a result of implementing species-specific quotas in the LCS fishery, NOAA Fisheries selected alternatives, which in combination with one another will aggregate LCS species and establish one commercial quota for the complex.

Comment 5: Fishing pressure on all LCS species except sandbar and blacktip has been abated since the HMS FMP. Any need to reduce the potential for bycatch of the other species via the use of an aggregate quota at a low quota level is inconsistent with the status and biomass levels of the principal commercial species and subject to the practicability standard of National Standard 9. It is not practicable to reduce the commercial fishery now that the primary

commercial species are rebuilt.

Response: National Standard 9 states that "conservation and management measures shall, to the extent practicable (a) minimize bycatch and (b) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch." As such, NOAA Fisheries believes that the preferred alternatives, which would aggregate LCS species and establish one commercial quota for the complex, will minimize bycatch (i.e., regulatory discards of shark) resulting from partial closures (i.e., multiple closure dates by LCS grouping or individual species as a result of quotas being taken) of a mixed fishery and allow fishermen the opportunity to catch the entire quota. Additionally, the number of protected resource interactions may decrease, or at least not increase, if fishermen do not have to increase effort in order to make up for lost catch during partial closures and given that quotas will be lower for LCS as a result of combining preferred alternatives.

Comment 6: Mexican fishermen catch huge amounts of sharks. Why are U.S. fishermen limited? These limitations on U.S. fishermen has kept prices down.

Response: NOAA Fisheries has regulatory jurisdiction over the exclusive economic zone (i.e., from generally 3 nautical miles seaward to the 200 nautical mile limit) in U.S. waters but cannot regulate the fishing activities of other countries. However, consistent with the National Plan of Action and the Shark Finning Prohibition Act, NOAA Fisheries is continuing cooperative research efforts with other countries (e.g., Canada and Mexico) and engaging in deeper dialogues with international fishery management organizations such as ICCAT, FAO, and others as appropriate for shark management.

Comment 7: We need an adequate incidental quota to reduce/eliminate regulatory discards and cover the inevitable secondary catches in many fisheries.

Response: NOAA Fisheries agrees that such an alternative could be a viable alternative for reducing regulatory discards. As such, NOAA Fisheries will investigate this and similar alternatives further in a future rulemaking.

A5.3 Recreational Management Measures

A. Retention Limit

Comment 1: NOAA Fisheries received a range of comments regarding the appropriate recreational retention limit. These comments include: We support the preferred alternative and suggest that anglers also be allowed one additional blacktip shark because the stock is rebuilt; only one shark of any species per vessel per trip should be allowed because most recreational anglers cannot identify individual shark species; the proposed alternative is appropriate and precautionary because the recreational sector has been fishing under regulations based on a stock assessment that was overturned and, therefore, contributed more to rebuilding; we do not oppose

the proposed addition of bonnethead, but urge NOAA Fisheries to monitor this species to prevent overexploitation; South Carolina has already taken the proposed action based on the same stock assessment results; any additional catch reductions that may be required to meet management goals should come from the commercial sector before considering further cuts to the recreational sector; recreational fishermen kill sharks for no reason and cause numerous dead discards to wash up on the beach; and, recreational take levels should be reduced.

Response: NOAA Fisheries believes that alternative E2 (one shark per vessel per trip plus one Atlantic sharpnose and one bonnethead shark per person per trip) is appropriate for the recreational shark fishery. This alternative could reduce recreational harvest levels by the 80 - 85 percent required under this amendment's rebuilding plan if angler compliance increases. NOAA Fisheries analyzed other alternatives in this amendment that would have allowed the retention of additional LCS, SCS, and pelagic sharks (alternatives E3, E4, and E7). However, because the 2002 LCS stock assessment indicates that the LCS complex needs a reduction in fishing mortality and many recreational anglers cannot correctly identify sharks, NOAA Fisheries does not believe that those alternatives would achieve the level of reduction needed to rebuild LCS. With regard to discards and mortality in the recreational fishery, NOAA Fisheries urges anglers to comply with size and retention limits and release sharks in a manner that maximizes their survival. NOAA Fisheries may adjust size and retention limits in the future based on the results of future stock assessments.

Comment 2: NOAA Fisheries received several comments regarding methods of increasing compliance within the recreational fishery. These comments include: Any non-compliance by the recreational sector is due to confusion with the current regulations and, to a lesser extent, the proper identification of different shark species; NOAA Fisheries can solve these problems by increasing angler education and outreach; compliance and enforcement is not strong in Federal waters; and, NOAA Fisheries should increase outreach by using the internet, linking the HMS regulations to the NOAA weather page, and printing flyers for marinas, Sea Grant, port agents, and states to hand out.

Response: NOAA Fisheries agrees that compliance in the recreational fishery needs to be increased and is working to increase outreach and available educational materials. NOAA Fisheries will distribute a revised Atlantic shark recreational fishery brochure after the final rule for this amendment is published. It will contain information regarding HMS Angling category permits, HMS Charter/Headboat permits, bag limits and minimum sizes, release information, landing restrictions, the no sale provision, HMS tournament registration, tagging information, as well as species that may be retained, and species that must be released. Additional brochures on other HMS fisheries are available. NOAA Fisheries is also currently producing an identification guide for sharks, tunas, and billfishes of the Atlantic and Gulf of Mexico that should be available shortly. Further, NOAA Fisheries received public comment in favor of mandatory educational workshops for anglers and commercial fishermen discussing species identification, release techniques, and regulations. The Agency (NOAA Fisheries) intends to move forward with requiring participation in mandatory workshops in a future rulemaking and will attempt to make

voluntary workshops available to the public in the interim.

Comment 3: The one-shark per boat limit is not a problem except in tournaments where anglers may be forced to decide between keeping an eligible shark or taking a chance on catching a larger one. The difference between allowing one or two recreationally caught sharks would be minuscule on an annual basis, in comparison with what a longliner could kill during the same time period.

Response: NOAA Fisheries disagrees that allowing recreational anglers an additional shark each would have minor impacts compared to the commercial fleet. Currently, recreational fishermen take more sharks than commercial fishermen (142,000 LCS in 2001 versus 99,200 LCS in the commercial fishery). Additionally, recreational fishermen catch smaller sharks than commercial fishermen (average size of approximately 10 pounds versus 36 pounds in the commercial fishery). This information, combined with the facts that most anglers cannot correctly identify sharks and the LCS stock assessment recommended protecting juvenile LCS, has led NOAA Fisheries to the one shark limit. Further, the vast numbers of recreational anglers could lead to large numbers of LCS being taken. NOAA Fisheries analyzed an alternative (E4) that would have allowed vessels with HMS Angling category permits participating in registered tournaments, or HMS CHB permit holders on for hire trips, to retain one shark per person, up to two sharks per vessel, per trip, as well as one Atlantic sharpnose and one bonnethead per person per trip. NOAA Fisheries believes that this alternative would have resulted in mortality levels greater than those expected from alternatives E1, E2, and E3, and is not consistent with the 2002 LCS stock assessment which indicates that the LCS complex needs a reduction in fishing mortality. Additionally, without more information regarding the status of pelagic sharks, this alternative could have been detrimental to pelagic sharks. However, this alternative could be combined with other fishing controls (e.g., increased minimum sizes) so that overall mortality is not increased. NOAA Fisheries may consider this approach in the future.

Comment 4: Many tournaments have restricted eligible species only to makos and threshers in order to avoid the waste of sharks not normally taken for food.

Response: NOAA Fisheries appreciates and encourages conservation efforts by anglers and tournament organizers.

B. Minimum Size Restrictions

Comment 1: NOAA Fisheries received a range of comments regarding the recreational minimum size. The comments include: We support the proposed alternative because a minimum size helps to promote the live release of young sharks; the number of recreational fishermen who fish for sharks from Maine to Texas could number in the millions, which could significantly affect the mortality of juvenile sharks especially if there is no minimum size; South Carolina has already taken this proposed measure; most recreational anglers support a minimum size larger than is being proposed; because many fish are killed before they are measured, particularly if they are

dangerous, we cannot support a recreational minimum size; and, an exception to the minimum size for blacknose sharks should be added, because they are not overfished and do not reach the proposed minimum size.

Response: NOAA Fisheries believes that the alternative F2 (4.5 feet fork length for all sharks, no size limit for Atlantic sharpnose and bonnethead sharks) is appropriate for the recreational shark fishery. Sharks caught in recreational fisheries are thought to have low post-release mortality rates and the preferred 4.5 foot fork length minimum size limit should minimize fishing mortality on the stages that contribute the most to population growth by maintaining catch-and-release fishing on juvenile and subadult sharks. The allowances for the retention of Atlantic sharpnose and bonnethead sharks without a minimum size were preferred because these species are easily identified, not overfished or experiencing overfishing, do not commonly reach the current 4.5 foot fork length minimum size limit, and are important recreational catches is some regions. Exceptions for other SCS species were not analyzed in this amendment because of difficulties with identification (e.g., blacknose sharks) or because they are currently experiencing overfishing (e.g., finetooth sharks).

NOAA Fisheries received public comment concerning the safety of anglers who are required to measure live sharks in order to retain them. The Agency recommends that anglers mark areas on the outside of fishing vessel hulls (e.g., at the waterline or boot stripe) with the minimum size. If a shark is smaller than this measurement, it should be released. If a shark is larger than the measurement and not a prohibited species, it could be retained and killed before bringing it onboard.

Comment 2: Information on proper release techniques and equipment should be made available to the recreational sector.

Response: NOAA Fisheries agrees and believes that workshops (alternative J8) demonstrating proper handling and release techniques for finfish, sharks, and protected resources, and discussing regulations and species identification could reduce bycatch mortality, improve compliance with current regulations, and improve accuracy of reported data. NOAA Fisheries received public comment in favor of mandatory workshops discussing these issues. The Agency intends to move forward with requiring participation in mandatory workshops in a future rulemaking and will attempt to make voluntary workshops available to the public in the interim.

C. Authorized Gears

Comment 1: NOAA Fisheries received a range of comments regarding authorized gears. These comments include: We support the preferred alternative; recreational fishing techniques should be limited to rod and reel and handlines; spearfishing gear should also be added to the list of allowable recreational fishing gears; bandit gear is not appropriate for the recreational fishery; bandit gear should be an allowable gear; and, harpoon gear should be added to the list because many fishermen feel it is easier and safer to use harpoons than gaffs.

Response: NOAA Fisheries believes that alternative G2 (rod and reel and handline gear) is appropriate for the recreational shark fishery. This alternative will promote the use of gears with lower bycatch and bycatch mortality of sharks, finfish, and protected species, and will promote consistency within recreational HMS fisheries. Bandit gear was not selected as an allowable gear because it has traditionally been considered a commercial fishing gear and because the vast majority of recreational fishermen use rod and reel or handline gear. Spearfishing gear has not been an allowable gear in the recreational shark fishery and therefore was not included. However, implements used to secure rod and reel or handline catches alongside a vessel (e.g., gaffs and harpoons) are being allowed.

Comment 2: Limiting the recreational fishery to handline and rod and reel would prohibit landings by recreational gillnet fishermen.

Response: This is correct. All sharks caught recreationally with gears other than rod and reel and handline in Federal waters must be released. NOAA Fisheries does not believe that this measure will increase discards substantially, because the vast majority of recreational fishermen already use rod and reel or handline gear and recreational fishermen, including those using gillnets, have been limited to one shark per vessel per trip since 1999.

Comment 3: NOAA Fisheries should provide a provision that would allow disabled anglers who cannot hold the gear to fish.

Response: NOAA Fisheries agrees and will allow fishermen who are unable to hold or operate rod and reel or handline gear to apply for an exempted fishing permit that would allow them to fish for sharks recreationally with alternative gear.

A5.4 Bycatch Reduction Management Measures

A. Gear Restrictions

i. Authorized gear

Comment 1: NOAA Fisheries received a range of comments regarding the proposed regulation to ban drift gillnet fishing and allow strikenet fishing only. The comments include: Strikenetting and drift gillnetting should be stopped; no observations of these gear types is accurate; because of bycatch problems, many states have passed regulations banning drift gillnets, therefore, NOAA Fisheries should as well; gillnets should not be allowed because, in addition to unacceptable levels of bycatch of sea turtles, marine mammals, red drum, tarpon, and other game fish, the small shark gillnet fishery in Federal waters off Georgia drains limited law enforcement resources that are needed elsewhere; we support the preferred alternative allowing strikenets only, if observer coverage is maintained to document a reduction in bycatch; if there is no reduction, this gear type should be removed from the list of authorized gear types; there is no reason to close the shark gillnet fishery because bycatch of protected resources is within the

allowance for those species; NOAA Fisheries should not eliminate a viable fishery that has reliable observer science behind it; and, there are only five vessels remaining in the fishery, which is down from the historic twelve vessels that used to participate.

Response: The intent of this alternative (J3) was to allow the commercial shark gillnet fishery to operate while minimizing interactions with protected resources and reducing the bycatch of non-target species. It has been brought to the attention of the Agency that allowing the use of strikenets only would not accomplish this objective. Therefore, the final regulations permit the use of drift gillnets with possible gear modifications or other measures being implemented through a future rulemaking, based upon further study.

Comment 2: The State of Georgia has requested a ban on gillnets since 1992 and continues to request this ban. Because Georgia has banned gillnets, the presence of a gillnet fishery in adjacent Federal waters compromises State management and regulatory statutes and does not meet the standards for consistency required under Georgia's CZMA program. Using GPS technology, it may be possible for NOAA Fisheries to close the EEZ to gillnets adjacent to Georgia to alleviate ongoing consistency and enforcement problems.

Response: The Coastal Zone Management Act (CZMA, 1972, reauthorized 1996) requires that Federal actions be consistent with the enforceable policies of all state coastal zone management programs. NOAA Fisheries has determined that the list of current preferred alternatives which seek to rebuild the LCS complex, prevent overfishing of the LCS complex, and prevent overfishing of other species of sharks will be implemented in a manner consistent to the maximum extent practicable with the enforceable policies of the coastal states in the Atlantic, Gulf of Mexico, and Caribbean that have federally approved coastal zone management programs. NOAA Fisheries asked for states' concurrence with this determination during the proposed rule stage. As of October 31, 10 states had replied affirmatively regarding the consistency determination. NOAA Fisheries presumes that the remaining states that have not yet responded also concur with the determination. One state, Georgia, replied that allowing the use of gillnets, including the strikenet method, is not consistent with the State's CZM program.

The State of Georgia objects to the consistency determination due to the continuing operation of the shark gillnet fishery in Federal waters impacting resources shared by adjacent state waters. NOAA Fisheries shares the State of Georgia's concern regarding the impact of the shark gillnet fishery on protected resources and sport fish. However, data currently available indicate relatively low rates of bycatch and bycatch mortality of protected species and other finfish in this fishery. In the BiOp conducted for this rulemaking, NOAA Fisheries determined that the continued operation of the shark gillnet fishery would not jeopardize any endangered or threatened resources and issued a new incidental take statement for the fishery. Therefore, NOAA Fisheries is not prohibiting the use of this gear in this rulemaking. This finding is consistent with National Standard 2 which requires that management measures be based on the best scientific information available, including the conclusions of the BiOp. In this amendment, NOAA Fisheries is preferring a measure that will require all shark gillnet vessels to install and

activate a VMS during right whale calving season, and is making a commitment to examine gear modifications or other alternatives to reduce bycatch and bycatch mortality in future rulemakings. NOAA Fisheries will also work with existing take reduction teams and relevant Fishery Management Councils to examine methods of reducing bycatch. Thus, NOAA Fisheries finds that the final regulations implemented in Amendment 1 are consistent with Georgia's Coastal Zone Management Program to the maximum extent practicable.

Comment 3: If only strikenetting is allowed, the State of Georgia would continue to ask for 100 percent observer coverage because the reduction of bycatch using strikenet gear in or near Georgia waters has not been adequately investigated. Unlike the waters off Florida, the waters off Georgia are highly turbid. Without adequate observer data, allowing strikenetting for sharks is not a risk-averse strategy to reduce bycatch.

Response: NOAA Fisheries does not prefer an alternative that would limit or remove gillnet gear from the list of authorized gears in this rulemaking. The Agency understands the concerns about the need for adequate observer data documenting gillnet operations and catch near Georgia waters and will continue to monitor catch and bycatch, protected species interactions, and fishery characteristics through continued observer coverage. NOAA Fisheries will consider other alternatives to reduce bycatch and bycatch mortality in a future rulemaking.

Comment 4: Many states ban both longling and gillnetting without adequate data. If longlines are allowed in Federal waters, then gillnets should similarly be allowed.

Response: NOAA Fisheries has banned gear types (e.g., gillnets in the swordfish fishery) and restricted the use of other gear types (e.g., area closures in the pelagic longline fishery) for a variety of reasons including reducing bycatch and bycatch mortality. In this case, NOAA Fisheries is not removing gillnet gear from the list of authorized gears at this time. However, NOAA Fisheries will consider gear modifications or other measures, such as a closure, in a future rulemaking.

Comment 5: Blacktip and Atlantic sharpnose sharks make up the majority of our drift gillnet landings and are not overfished or experiencing overfishing according to the latest stock assessments. Our biggest discard species in the LCS fishery are rays. In the small coastal shark fishery, our biggest discard species is king mackerel and we have petitioned the South Atlantic Fishery Management Council to allow us to retain more of this catch per trip.

Response: NOAA Fisheries agrees that the latest LCS and SCS stock assessments indicate that Atlantic sharpnose and blacktip sharks are not overfished and overfishing is not occurring. In regard to the reduction of bycatch and discards, NOAA Fisheries supports the reduction of bycatch, including regulatory discards, in HMS fisheries.

According to 2002 shark gillnet fishery observer data, king mackerel was observed to be the species most commonly discarded from drift gillnet sets, with approximately 248 fish discarded.

While fishing with strikenet gear, great barracuda (approximately 4 fish) and cownose rays (one fish) were observed to be the most commonly discarded species. Little tunny, king mackerel, and great barracuda were the three non-target species most commonly observed caught in the shark gillnet fishery in 2002.

Comment 6: The preferred alternative allowing strikenet gear only appears as if the Agency is trying to supercede the actions of both the Atlantic Large Whale Take Reduction Plan and the Bottlenose Dolphin Take Reduction Plan. Negotiated actions with members working on these plans are about to become final. If NOAA Fisheries eliminates the use of gillnet gear, it would be wrong and set a dangerous precedent. Instead, NOAA Fisheries should start a buyout program for these vessels and regularly attend take reduction plan meetings. There is no support from either take reduction team to ban drift gillnetting.

Response: As part of this amendment, NOAA Fisheries analyzed the impacts of various bycatch alternatives on bycatch species and protected resources in an attempt to minimize bycatch and bycatch mortality in HMS fisheries to the extent practicable. In this final action, NOAA Fisheries is not implementing measures to limit or remove gillnet gear from the list of authorized gears. A buyout program is beyond the scope of this rulemaking, but could be considered in the future should funding become available.

Comment 7: The only way to fish for small sharpnose sharks is with a drift gillnet in deep water. Strikenet gear will not work because it only catches large coastal sharks.

Response: NOAA Fisheries has reviewed available shark gillnet fishery observer data and agrees that strikenet gear does not appear to be effective at catching Atlantic sharpnose sharks. For this reason, and reasons discussed above, drift gillnet gear will not be banned in this rulemaking.

Comment 8: Enforcement efforts in the EEZ could be complicated due to similarities between drift gillnet and strikenet gear. It is not clear what regulatory parameters will be used to allow clearly enforceable distinctions between the gear types.

Response: NOAA Fisheries agrees that enforcement efforts could be complicated due to similarities between drift gillnet and stikenet gear. For this reason, and reasons discussed above, drift gillnet gear will not be banned in this rulemaking.

Comment 9: The five vessels actively using drift gillnet should be given gillnet endorsements on their directed shark permits to limit entry into the fishery. NOAA Fisheries should consider allowing the five fishing vessels currently in the fishery to continue and prevent any new vessels from entering the fishery.

Response: NOAA Fisheries did not consider specific permit endorsements in this amendment, but may consider options to limit vessel participation in the shark gillnet fishery in the future.

Comment 10: NOAA Fisheries received several comments regarding the modification of shark gillnet gear to reduce protected resources interactions. The comments include: Instead of banning the gear, NOAA Fisheries should reduce the allowable length of the gear; NOAA Fisheries should consider gear modifications to reduce bycatch; my vessel accounted for a large number of interactions between marine mammals and sea turtles until I replaced a large section of my gear, while I still have some interactions with them, they swim away unharmed and are observed to be healthy; I used new gear this past summer with tighter mesh and this increased my sharpnose catch and decreased my interactions with protected species; fishermen who use shark drift gillnet gear have adapted their gear using corks to keep the gear high in the water and allow any entangled turtles to get to the surface and survive; fishermen who do not usually fish in the fishery or who use stab nets are the fishermen who catch dead turtles; and, instead of banning drift gillnets, NOAA Fisheries should consider the use of pingers to reduce interactions with protected species.

Response: Gear modifications have been shown to be effective in other fisheries. As such, NOAA Fisheries agrees that gear modifications could be effective at reducing bycatch in the shark gillnet fishery. However, many gear modification measures are difficult to enforce or can be circumvented by altering fishing patterns, resulting in no bycatch reduction. NOAA Fisheries continues to support research projects regarding effectiveness of gear modifications, to the extent that funding allows, and will consider the possibility gear modifications in a future rulemaking.

Comment 11: NOAA Fisheries received several comments regarding sea turtle interactions in the shark gillnet fishery. The comments include: In terms of actual numbers, relatively few sea turtles have been captured in the shark gillnet fisheries; while this fishery is supposed to have high levels of observer coverage, this is not always the case; as noted in the June 2001 BiOp, this fishery can have a large impact on leatherback sea turtles at a time when reproductive females are in the area; and, I have been fishing 18 years and carried an observer for 10 years. In those 10 years, I have only caught one sea turtle.

Response: The best available information indicates that relatively few sea turtles have been captured in the shark gillnet fishery. This has been substantiated by recent studies performed by NOAA's Southeast Fisheries Science Center and Protected Resources Division. In the October 2003 Biological Opinion, NOAA Fisheries Protected Resources Division estimated that over a five-year period the expected take of sea turtles in the shark gillnet fishery would be 10 total loggerhead sea turtle captures with one mortality, and 22 total leatherback sea turtles captures with three mortalities. The Opinion concluded that the continued operation of the shark fisheries are not likely to jeopardize the continued existence of the endangered Kemp's Ridley, green, hawksbill, and leatherback sea turtles, and the threatened loggerhead sea turtle. The Atlantic Large Whale Take Reduction Plan and the June 14, 2001, Biological Opinion mandate 100 percent observer coverage of the southeast shark gillnet fishery during right whale calving season. An interim final rule published in March 2001 (66 FR 17370) established a level of observer coverage outside of right whale calving season that would attain a sample size needed to provide estimates of sea turtle and marine mammal interactions. This rule was formalized with

the rule that closed the Northeast Distant Statistical Reporting Area (NED) (67 FR 45393, July 9, 2002). Although there were multiple interactions with leatherback turtles during 2001, NOAA Fisheries believes this was an anomalous event, possibly associated with changes in environmental conditions. NOAA Fisheries believes that events such as this can be mitigated through observer coverage, gear modifications, and enforcement.

Comment 12: I can strike at sharks without "striking" as you define it. I do not use the second vessel.

Response: NOAA Fisheries is aware that some vessels have experimented with setting strikenet without using a second vessel. To the extent that these methods are more economical for fishermen, NOAA Fisheries supports these methods. However, the use of shark strikenet gear in a method inconsistent with the current definitions inside the restricted area could constitute a violation. Requirements for strikenet vessels operating in the restricted area are described in the Atlantic Large Whale Take Reduction Plan regulations.

Comment 14: NOAA Fisheries says that only six vessels are in the drift gillnet fishery. There are actually about a dozen that would be affected.

Response: The best available information indicates that there are five vessels that actively target sharks in the shark gillnet fishery. NOAA Fisheries believes that there are a number of fishermen who land sharks incidental to their target species in other gillnet fisheries (e.g, bluefish, croaker, mackerel).

Comment 15: The bycatch of red drum in the shark gillnet fishery is of serious concern, given interstate effort to reduce bycatch of this species. Red drum is an overfished species whose harvest is strictly regulated with slot limits to promote its recovery.

Response: NOAA Fisheries is aware that red drum is caught incidentally in the shark gillnet fishery. However, the limited amounts of observed bycatch of this species in the shark gillnet fishery is not expected to impede recovery of the stock. Observer data indicate that the shark gillnet fishery does not catch large numbers of red drum. In 2002, 28 red drum were observed caught, of which, 50 percent were released alive.

Comment 16: Finetooth sharks are rare in trawl catches off Georgia. However, significant numbers are taken by the shark drift gillnet fishery. Elimination of the shark drift gillnet fishery would contribute towards reducing the overfishing of finetooth sharks.

Response: NOAA Fisheries is aware of observed catches of finetooth sharks in the shark gillnet fishery. However, the shark gillnet fishery has been observed to specifically target Atlantic sharpnose and blacktip sharks. NOAA Fisheries does not believe that the elimination of the shark drift gillnet fishery would significantly reduce overfishing of finetooth sharks, because they are not a target species. In 2002, 21,978 sharks were observed caught in the shark gillnet fishery.

Of those sharks observed caught, 1,615 (7.3 percent) were finetooth sharks.

Comment 17: The Atlantic sharpnose I catch have stomachs full of juvenile sea turtles. NOAA Fisheries should calculate how many sea turtles are saved by allowing the drift gillnet fishery to continue.

Response: NOAA Fisheries is concerned with all sources of mortality for protected resources and realizes that the ecosystem as a whole needs to be considered when rebuilding species. However, NOAA Fisheries' can only influence and mitigate anthropogenic sources of mortality, specifically, those due to interactions with fishing gear within NOAA Fisheries' jurisdiction.

ii. VMS

Comment 1: The use of VMS on bottom longline and gillnet vessels, combined with time/area closures to protect juveniles, may help reduce mortality of vulnerable shark stocks beyond what the quota cuts will achieve.

Response: The preferred time/area closure is designed to reduce bycatch and mortality of neonate and juvenile dusky and sandbar sharks in a known pupping and nursery area. The preferred time/area closure could reduce fishing mortality on the stages that contribute the most to population growth. The use of VMS on shark bottom longline and gillnet vessels will contribute to the enforcement of time/area closures and may enhance the rebuilding of LCS to maximum sustainable yield.

Comment 2: As a gillnet fisherman, I prefer observers over VMS.

Response: While NOAA Fisheries understands that individual fishermen may prefer using observers over VMS, the VMS alternative is preferred as an aid in enforcing time/area closures. Fishery observers are used to monitor catch and bycatch, protected species interactions, and fishery characteristics. They are not used specifically for enforcement purposes.

Comment 3: One commenter was concerned with the utilization of VMS to monitor activities when vessels are engaged in normal fishing operations and not operating illegally.

Response: Currently, VMS is used in many fisheries managed by NOAA Fisheries. VMS is the best technology at this time for monitoring vessel locations. It can be used by NOAA Fisheries to reduce observer program costs, improve the enforcement of time/area closures, to deter illegal fishing, and to increase the efficiency of surveillance patrols. With respect to the shark gillnet and bottom longline time/area closures in particular, the size of the closed areas significantly diminishes the likelihood of detection through conventional means. Traditional methods of surveillance in these areas would be cost prohibitive. Other possible benefits of the VMS include increased safety at sea and dependable and confidential communications.

Comment 4: If VMS is implemented, NOAA Fisheries should hold operators, not vessel owners, responsible for violations because the owner has little control over what the operator does with the vessel once it leaves the dock.

Response: NOAA Fisheries is aware of vessel owners' concerns, however, for enforcement purposes, both vessel owners and operators will continue to be subject to liability for violations. Vessel owners can employ or terminate operators based on their compliance with fishery regulations.

Comment 5: VMS should be phased in to reduce negative economic impacts and blended with a communication adaptation that the U.S. Coast Guard uses as a the homeland security technique for defense.

Response: The VMS requirement will only be required for five shark gillnet vessels and any shark bottom longline vessels operating near the time/area closure (approximately 14 vessels). NOAA Fisheries believes that, because this measure will be required for only a select few vessels, it can be implemented with minimal economic impacts and will not affect the vast majority of the shark fishing fleet. To minimize impacts and to give time to NOAA Fisheries to issue a type approval notice, NOAA Fisheries is delaying the effective date of VMS in the shark fishery. In regards to communications adaptions and uses of VMS for homeland security, NOAA Fisheries supports these uses.

Comment 6: NOAA Fisheries received several comments regarding the number of vessels required to install and activate a VMS unit. The comments include: VMS is required for all pelagic longline vessels, why would it only be required for a portion of the bottom longline fleet; and, VMS should be expanded to all vessels all-year round.

Response: VMS is required for all pelagic longline vessels to aid in the enforcement of multiple large scale closed areas in a highly mobile fishery. In addition to approximately five shark gillnet vessels, the VMS requirement analyzed in this amendment would require vessels operating near the time/area closure (approximately 14 vessels) to install and activate a VMS unit. Analyses indicate that while vessels in the pelagic longline fleet are highly mobile, vessels in the bottom longline fleet rarely fish far from their reported homeport. Thus, NOAA Fisheries believes that requiring VMS for only that sub-population of the shark fishing fleet that fishes in the vicinity of the time/area closures is appropriate because the intent of the measure is to monitor vessel activity to ensure that time/area closures are effective.

Comment 7: If gillnet gear remains authorized for use in the shark fishery, VMS must be mandatory to ensure compliance during right whale calving season and to facilitate cooperative state/Federal enforcement efforts to monitor this fishery.

Response: NOAA Fisheries is implementing an alternative (J4) that would require shark gillnet vessels to install and activate VMS units during the right whale calving season (November 15 -

March 31). This measure is expected to facilitate enforcement efforts.

iii. Other Gear Restrictions

Comment 1: We support all of the alternatives being considered including limited soak times, reducing the length of the gear, and, especially requiring circle hooks. Reducing soak time and requiring the use of circle hooks could be an effective means of protecting juvenile sharks. These measures could reduce discard mortality of dusky sharks, which remains a candidate for listing under ESA, and other bycatch species.

Response: NOAA Fisheries considered multiple gear restriction alternatives in this amendment. NOAA Fisheries has preferred alternatives J4 and J5 which would require VMS on a sub population of commercial shark fishing vessels as well as require shark bottom longline vessels to use corrodible hooks, possess release equipment, and move one nautical mile after an interaction with a protected species.

Comment 2: It is unclear from the analyses presented in the draft amendment whether the most effective measure to reduce mortality of small sharks would be a series of time/area closures, a minimum size combined with measures to reduce bycatch, or some other plan. Therefore, we express support for measures that seem likely to reduce juvenile shark mortality, especially area closures. However, we encourage NOAA Fisheries to do a more thorough analysis of the effectiveness of each bycatch reduction measure and to develop a comprehensive bycatch reduction plan.

Response: NOAA Fisheries believes that a combination of measures will be most effective in reducing bycatch and bycatch mortality of protected species and small sharks in the shark fishery. Thus, NOAA Fisheries is implementing a number of measures including a time/area closure, a requirement to possess and use release equipment, and a minimum size in the recreational fishery. NOAA Fisheries is also in the process of developing an implementation plan to improve upon, and possibly expand, current bycatch reduction efforts in HMS fisheries under the guidance of the 1998 NOAA Fisheries Report, Managing the Nation's Bycatch. This report contains the Agency's national bycatch goal, which is "to implement conservation and management measures for living marine resources that will minimize, the extent practicable, bycatch and the mortality of bycatch that cannot be avoided." The NOAA Fisheries National Bycatch Strategy and the HMS Bycatch Implementation Plan are discussed in Amendment 1.

Comment 3: The requirement of non-stainless steel corrodible hooks should be readily accepted by the industry and, because most vessels already use these hooks, there will be little or no economic hardships or changes in fishing practices. These hooks corrode in a much shorter period of time and would decrease impairment of feeding and wounding of sea turtles and thus, increase post-release survival.

Response: NOAA Fisheries agrees and is implementing a requirement (alternative J5) for their

use on shark bottom longline vessels.

Comment 4: NOAA Fisheries received several comments regarding the requirement for shark bottom longline vessels to move one nautical mile after an interaction with a marine mammal or sea turtle. The comments include: Requiring vessels to move one nautical mile after an interaction with a sea turtle or marine mammal should not significantly affect normal fishing operations because most vessels already move more than one mile after hauling their gear particularly if the set caught sea turtles or a lot of juvenile sharks; some vessels travel substantially further to dump carcasses from dressed fish in order to prevent contamination of the fishing grounds; requiring a vessel to move after an interaction with a protected species can be difficult to enforce unless enforcement personnel are on the scene when the gear is retrieved; and, if sea turtles are caught in gear, the vessel should move 20 nautical miles away, not one.

Response: NOAA Fisheries believes that the requirement for shark bottom longline vessels to move one nautical mile after an interaction with a protected species is appropriate for the shark bottom longline fishery. This requirement would reduce the probability of another interaction with a protected species because marine mammals, sawfish, and sea turtles often aggregate in clusters. By requiring vessels to move after an interaction, the vessel would increase the likelihood of avoiding additional animals in a cluster when setting subsequent gear. This requirement could increase fuel costs due to increased the time transiting to another fishing area and increase time needed to fish if alternate fishing grounds are not as productive for target species. However, because few marine mammals, sawfish, or sea turtles have been observed caught, NOAA Fisheries does not believe that this requirement would affect more than a few trips for all vessels combined, each year. Moreover, NOAA Fisheries expects that vessels will comply with the requirement because, during normal fishing practices, vessels may already move more than one mile after hauling their gear. Moving more than one mile increases the chance of a vessel encountering another cluster of protected species.

Comment 5: NOAA Fisheries received several comments regarding the possession of release equipment on shark bottom longline vessels. The comments include: The safe removal of hooks and line before release can dramatically increase the chances of survival of the released bycatch and has been endorsed by the U.S. pelagic longline fleet, ICCAT, IATTC, and various NGOs; the SEFSC has developed a line cutter that is safe and effective in removing line from entangled marine mammals and sea turtles in the pelagic longline fishery; vessels that can boat smaller sea turtles should boat them in order to better control their gear removal procedures; and, dehooking devices, line cutters, and dip nets are relatively simple to use and techniques can easily be transferred from fishery to fishery and nation to nation.

Response: NOAA Fisheries agrees that there are benefits of using release equipment and is implementing alternative J5 which will require the possession of release equipment on shark bottom longline vessels.

Comment 6: Requiring workshops to certify that a permit holder has passed a training course on

the proper use of release equipment would aid enforcement and be more cost effective as a whole. These workshops could also serve as an educational forum for fishermen to learn the latest research and regulations, share concepts for their fishery that could be transferred to other fisheries (e.g., recreational to commercial), gain a feeling of stewardship of the environment and their fishery, learn release techniques in a controlled environment, and develop and promote educational video tapes or literature. The workshops would also give fishermen a chance to talk to, and receive answers from, people in NOAA Fisheries about regulations they do not understand. This could lead to a better working relationship over time.

Response: NOAA Fisheries agrees and intends to move forward with this measure (alternative J8) in a future rulemaking in order to assure that all of the aspects of the alternative and implementation are fully analyzed. In the interim, NOAA Fisheries will attempt to make voluntary workshops available to the public.

Comment 7: We remain deeply concerned that NOAA Fisheries has failed to offer options for increasing compliance in the recreational fishery after repeatedly acknowledging that anglers do not adhere to the shark regulations and that this non-compliance may be inhibiting stock rebuilding. We urge NOAA Fisheries to develop programs for angler education in species identification and other efforts to improve compliance. Angler training should be a pre-requisite for obtaining an HMS Angling category permit.

Response: NOAA Fisheries agrees that angler education could significantly improve compliance in the recreational shark fishery. In this amendment NOAA Fisheries analyzed an alternative (J8) that would require commercial and recreational fishermen to attend mandatory workshops discussing shark (and possibly other) species identification, marine mammal, sawfish, and sea turtle release techniques, and current regulations. NOAA Fisheries received public comment in favor of mandatory workshops, and while it appears that mandatory workshops would be beneficial, outstanding implementation and operational issues remain that need to be addressed. Based on these issues, and the fact that NOAA Fisheries would need to delay the implementation of this measure to receive Paperwork Reduction Act (PRA) clearance and work through any implementation difficulties, NOAA Fisheries intends to move forward with this measure in a future rulemaking in order to assure that all of the aspects of the alternative are fully analyzed. In the interim, NOAA Fisheries will attempt to make voluntary workshops available to the public as well as distribute informational pamphlets and identification guides.

Comment 8: At this time, we cannot support mandatory workshops. Rather, increased fiscal and other agency resources need to be expanded to significantly increase the distribution and availability of educational materials such as improved printed materials, electronic media, and more. Specific instructional/training workshops should be developed to focus on commercial fishing fleets/organizations, charter fishermen, tournament organizers, MRFSS/other survey clerks, state/federal enforcement agencies, and more. Partnerships with other federal and state agencies to distribute this material should be explored.

Response: NOAA Fisheries is working to increase outreach and available educational materials. Currently, NOAA Fisheries is distributing Atlantic shark recreational fishery brochures containing information regarding HMS Angling category permits, HMS Charter/Headboat permits, bag limits and minimum sizes, release information, landing restrictions, the no sale provision, HMS tournament registration, tagging information, as well as species that may be retained, and species that must be released. NOAA Fisheries is also currently producing an identification guide for sharks, tunas, and billfishes of the Atlantic and Gulf of Mexico. Further, NOAA Fisheries received public comment in favor of mandatory workshops for anglers and commercial fishermen discussing species identification, release techniques, and regulations. NOAA Fisheries intends to move forward with requiring participation in mandatory workshops in a future rulemaking and will attempt to make voluntary workshops available to the public in the interim.

Comment 9: While the United States is trying to protect sea turtles, fishermen in Florida watch fishermen just outside the U.S. EEZ in Cuba and the Bahamas kill them. I recently watched one vessel in the Bahamas kill 39 sea turtles.

Response: Sea turtles are classified as endangered or threatened species in the United States and NOAA Fisheries has implemented many measures to conserve these species. However, NOAA Fisheries does not have the authority to determine how neighboring countries manage their resources. The Agency continues to pursue improvements in international sea turtle conservation measures.

Comment 10: Amendment 1 does not adequately address the incidental capture of threatened and endangered sea turtles in shark fisheries, especially shark bottom longlines. Reducing the rate of bycatch and reducing the mortality of sea turtles needs to be a primary priority. The impact of shark fisheries on sea turtles appears to be purposefully masked by key omissions in Amendment 1 about the level of sea turtle take and associated past-hooking mortality. The June 2001 BiOp estimates that 207 to 517 loggerheads are caught in the shark bottom longline fishery annually. Many of these animals probably die after release. Significantly more observer coverage is needed to improve confidence intervals. Amendment 1 fails to estimate and discuss the implications of post-hooking mortality of sea turtles. The June 2001 BiOp provides estimates of post-hooking mortality on pelagic longlines. This mortality rate in bottom longlines is expected to be higher because the turtles are trapped on the bottom unable to breathe. Because effort in shark fisheries has increased since 2001, many hundreds of sea turtles are being killed annually in shark longline fisheries.

Response: NOAA Fisheries Protected Resources Division has prepared a new Biological Opinion for Amendment 1 which analyzes the incidental capture of protected resources in the shark fisheries. An estimated 222 loggerhead sea turtles were incidentally caught in the shark bottom longline fishery from 1994 through 2002. Based on observer data and the reported effort in the shark bottom longline fishery, it is estimated that 51 loggerhead turtles will be killed as a result of an interaction with a bottom longline. The highest estimate of post release mortality for sea

turtles interacting with pelagic longlines is 42 percent for turtles ingesting hooks. Being conservative and assuming all loggerhead turtles that ingest a hook are subject to this mortality rate, results in another 72 loggerhead turtles will be killed. This gives a total of 123 loggerhead turtles killed per year as a result of an interaction with a bottom longline. An estimate of 30 leatherback sea turtles were incidentally caught from 1994 through 2002 in the shark bottom longline fishery. Using the same methodology for leatherback sea turtle interactions results in an estimate of 17 leatherback turtles killed each year in this fishery. The leatherback mortality is very conservative because it is known that leatherback turtles rarely ingest or bite hooks, most are usually foul hooked on their flippers or carapaces, reducing the likelihood of post-hooking release mortality. However, leatherback-specific data for this fishery are not available and therefore the most conservative estimate was used. NOAA Fisheries agrees that the precision of the estimates is likely to improve with greater observer coverage. One of the conditions of the Biological Opinion is that NOAA Fisheries must continue to implement an observer program at current or higher levels to monitor incidental takes of protected resources in Atlantic (including Gulf of Mexico) shark fisheries. NOAA Fisheries disagrees that effort in shark fisheries has increased since 2001. Based on reported effort in the logbook data and the observer programs, the total number of hooks set in the shark bottom longline fishery in 2000-2002, ranged from 2.5 to 2.7 million hooks per year. This level of effort is approximately 62 percent less than the reported effort in 1996. In addition, based on current and historical participation, implementation of limited access in the shark fisheries reduced the number of shark permit holders from over 2,200 before limited access to 584 in October of 2003.

Comment 11: Only alternative J5 addresses sea turtle bycatch by recommending that fishing vessels move one nautical mile after an interaction with a sea turtle. Dip nets and line cutters should also be required.

Response: NOAA Fisheries is implementing alternative J5, a preferred alternative, which will require vessels with shark bottom longline gear to use corrodible hooks, possess release equipment (line cutters, dip nets, and when approved, dehooking devices), as well as move one nautical mile after an interaction with a marine mammal or sea turtle. This is expected to be effective at reducing sea turtle mortality.

Comment 12: NOAA Fisheries needs to conduct experiments to determine if circle hooks are effective in reducing the number of turtles caught and the position of the hooks in captured animals.

Response: The June 14, 2001, Biological Opinion included a recommendation that NOAA Fisheries conduct a three-year experimental fishery in the northeast distant statistical reporting area (NED) to attempt to reduce the interactions between pelagic longline gear and sea turtles. In the fall of 2001, NOAA Fisheries conducted the first year of the experimental fishery. The measures that were examined included the use of blue-dyed bait and spacing the gangion lines farther away from the float lines.

In the summer and fall of 2002, NOAA Fisheries conducted the second year of the experimental fishery. The use of circle hooks, mackerel bait, and shortened daylight soak time were tested to examine their usefulness in reducing the capture of sea turtles. Although NOAA Fisheries has not conducted experiments specifically investigating the use of circle hooks to reduce interactions with sea turtles in the shark bottom longline fishery, NOAA Fisheries believes that information gathered from the NED experiments could be transferred to other fisheries.

Comment 13: We support the preferred alternatives of line cutters, dip nets, and dehooking devices and feel they would reduce mortality by recreational fishermen as well.

Response: NOAA Fisheries agrees that the use of release gear may be beneficial in recreational fisheries. However, requiring this equipment for anglers who generally do not use heavy monofilament line and rarely encounter protected species is not practical at this time. NOAA Fisheries does support the voluntary use of release gear in recreational shark fisheries.

Comment 14: NOAA Fisheries should consider a variation of alternative J7 (retention of all sharks, no discards allowed) in order to encourage reducing regulatory discards. This is possible but not practicable in today's marketplace and would be tough to enforce. Other portions of the regulations, such as no filleting at sea or the current trip limit, would need to be changed.

Response: NOAA Fisheries analyzed the no-discard alternative (J7) and determined that it could virtually eliminate the bycatch of sharks in the commercial shark fishery and reduce fishing effort needed to reach trip limits and fill quotas, thereby reducing potential interactions with prohibited species. However, this alternative could also increase the mortality of juvenile sharks, prohibited species, and other sharks not normally retained. Fishermen may also illegally high-grade and discard less marketable species to avoid reaching the trip limit, increasing waste. If no discards were allowed, trip limits and quotas could be reached more quickly, resulting in derby fishing conditions. Derby conditions may result in depressed ex-vessel prices, reduced revenues, market gluts, and concerns for the safety of fishermen at sea. Due to ecological, social, and economic concerns, NOAA Fisheries does not believe this alternative is appropriate for the commercial shark fishery at this time. NOAA Fisheries may consider a variation of this alternative in a future rulemaking.

Comment 15: NOAA Fisheries received several comments regarding bycatch of sharks and non-target species. The comments include: Amendment 1 does not contain a comprehensive strategy to avoid and reduce shark bycatch, as mandated by law; for years NOAA Fisheries has highlighted the shrimp trawl and menhaden purse seine fisheries as problem fisheries for shark bycatch, yet NOAA Fisheries has not offered any suggestion on how to address these bycatch sources; NOAA Fisheries must take action to address these continual problems; and, the non-targeted species and sub-legal bycatch that are routinely discarded as a result of indiscriminate gillnets and longlines is disturbing and a waste of our marine resources.

Response: NOAA Fisheries agrees that bycatch must be addressed and is working toward this

goal. The bycatch of sharks in trawl, set-net, and hook and line fisheries is discussed in Chapter 3 of Amendment 1. In this amendment, NOAA Fisheries specifically addresses shark bycatch in HMS fisheries by implementing several measures designed to reduce bycatch and bycatch mortality including; a time/area closure, VMS requirements for shark bottom longline and gillnet vessels, requiring the use of corrodible hooks, and requiring the possession of release equipment (line cutters, dipnets, and, when approved, dehooking devices).

NOAA Fisheries is also in the process of developing an implementation plan to improve upon and possibly expand current bycatch reduction efforts in HMS fisheries under the guidance of the 1998 NOAA Fisheries Report, Managing the Nation's Bycatch. This report contains the Agency's national bycatch goal, which is "to implement conservation and management measures for living marine resources that will minimize, the extent practicable, bycatch and the mortality of bycatch that cannot be avoided." The NOAA Fisheries National Bycatch Strategy and the HMS Bycatch Implementation Plan are discussed in Amendment 1.

Comment 16: NOAA Fisheries needs to examine the bycatch of sharks in monk fishing gear.

Response: NOAA Fisheries will investigate the bycatch of sharks in a number of fisheries to determine if measures are needed to minimize shark bycatch and bycatch mortality.

B. Time/Area Closure Comments

Comment 1: Comment: NOAA Fisheries received several comments regarding the use of time/area closures in general. These included: NOAA Fisheries should establish sanctuaries for all fish species. The entire fishery should be closed from January through July to protect pupping females and pups. NOAA Fisheries should implement seasonal closures to longlines and gillnets in coastal nursery grounds to protect all shark species.

Response: The time/area closure is based on specific information from the shark bottom longline observer program that indicates a high proportion of prohibited dusky shark and juvenile sandbar sharks being caught off North Carolina from January through July. NOAA Fisheries does not believe that closing the entire shark fishery from January through July is warranted. The closure will afford some protection to all species that are caught on bottom longline gear during that time of year.

Comment 2: NOAA Fisheries should implement alternative K3, time/area closure for all shark nursing and pupping grounds based on EFH for neonate and juvenile sharks, in order to protect juvenile sharks from indiscriminate commercial gears.

Response: NOAA Fisheries considered this alternative, but believes that it would result in the closure of nearly all coastal waters off the U.S. Atlantic coast and the Gulf of Mexico, and that a targeted time/area closure, for a specific time period such as the one off North Carolina is more appropriate. A closure of all coastal waters would have had a severe economic impact on fishing

communities.

Comment 3: Any delay in implementation of closures may undermine management objectives.

Response: NOAA Fisheries believes that commercial fishermen should be given an opportunity to adjust to the potential economic changes incurred by a time/area closure. Delayed effectiveness of time/area closures has been used in the past, and is believed to be a reasonable approach to allow fishermen to adjust to regulations that effect fishing areas.

Comment 4: NOAA Fisheries should consider time/area closures to protect adult dusky sharks as well as juveniles.

Response: The time/area closure is based on information relating to all life stages of dusky sharks, including adults. The time/area closure is expected to reduce the catch of all dusky sharks by approximately 79 percent and adult dusky sharks by 65 percent.

Comment 5: We cannot support the blanket alternative K3 because each proposal needs to be fully evaluated and based on acceptable understanding of stock status, life histories, and defined EFH for each species.

Response: Alternative K3 proposed closing all EFH identified nursery and pupping areas. The alternative was not selected because of the severe economic impact this alternative would have had, and because there is currently insufficient data to support a closure of all EFH pupping and nursery areas.

Comment 6: Any closure that is considered should be imposed on all commercial and recreational gear that interacts with sharks.

Response: Recreational gears have the capability to release sharks alive, whereas many sharks, and dusky sharks in particular, have low survival rates when caught with commercial gear. This is due in part to the longer soak times required in the commercial fishery. Dusky sharks, for example, have an at-vessel mortality rate of 82 percent. If data in the future indicates adverse impacts from other gears, NOAA Fisheries will consider closures for other gear types, including recreational.

Comment 7: The Environmental Protection Agency recommends marine protected areas (MPAs) for overfished stocks; marine protected areas for sharks that exhibit territorial behavior in breeding would likely benefit.

Response: NOAA Fisheries has selected an alternative that implements a targeted time/area closure to protect prohibited dusky sharks and juvenile sandbar sharks which are currently experiencing overfishing. Ths time/are closure is a type of MPA and is also an effective means to reduce fishing mortality and help rebuild stocks. Based on the best available scientific data,

NOAA Fisheries has taken steps to identify and protect EFH and Habitat Areas of Particular Concern (HAPCs) for both dusky and sandbar sharks. The time/area closure will prevent the catch of both pregnant females and neonates during the critical pupping stage.

Comment 8: Any regulations imposing a closure should have a clear scientific exit strategy to reduce and/or eliminate the closure when scientifically justified.

Response: NOAA Fisheries agrees that closed areas should be re-opened when scientifically justified and will thus be reviewing the status of both dusky and sandbar sharks, the two species most affected by the time/area closure, in the near future. Based on the status of those stock assessments and other information regarding the effectiveness of the closure, NOAA Fisheries may consider revising the size and scope of the closure, the duration of the closure, and potentially elimination of the closure.

Comment 9: NOAA Fisheries received several comments specific to the proposed time/area closure. These comments included: Closing nursery areas has always been seen as one of the most beneficial management measures possible for sharks and has been recommended by nearly every shark stock assessment group assembled; thus we support the proposed time/area closure and NOAA Fisheries efforts to work with the two Fishery Management Councils to protect important state nursery waters. NOAA Fisheries should close the proposed mid-Atlantic region to bottom longline fishing from January through July to protect nursery and pupping areas.

Response: NOAA Fisheries agrees that time/area closures are an important tool in reducing mortality of prohibited species and juvenile life stages of sharks, and that the current time/area closure will help to protect dusky sharks and rebuild sandbars sharks.

Comment 10: NOAA Fisheries should look at the fish being sold; this will show that the fishermen are not selling small sharks. NOAA Fisheries should look at the average carcass weight, not length.

Response: One of the principal reasons for the time/area closure was to protect prohibited dusky sharks, which are illegal to sell. Additionally, because dusky sharks do not mature until approximately 10 feet fork length (FL), even large dusky sharks are considered juveniles. For years, the shark observer program and many other researchers have been collecting length data for sharks because many sharks are released without being landed and weights would be difficult if not impossible to collect. The length-to-weight relationship is used by scientists to determine the life stage and sexual maturity of most fish species, including sharks. Shark bottom longline observer data show high rates of neonate and juvenile sandbar sharks less than 137 cm FL being caught and landed in the winter fishery off of North Carolina. The 137 cm FL corresponds to the recreational minimum size limit for sharks which is 4.5 feet FL. It also corresponds to the female smallest size at maturity. For instance, one data series for the winter fishery off North Carolina in 2001 shows approximately 83 percent of 1188 sandbar sharks observed caught were less than 137 cm, with an average length of approximately 120 cm. Sandbar shark pups are born from

March to early August and measure about 60 cm at birth.

Comment 11: The information used to support the time/area closure is flawed because shark observers are mis-identifying dusky sharks.

Response: The commercial shark bottom longline fishery observers are trained to identify all species of sharks, including dusky sharks. NOAA Fisheries acknowledges that some misidentification of sharks may occur, however, the preponderance of the data, including fishery independent data collected by researchers and trained biologists who participate in tagging efforts indicates that the area off North Carolina is a pupping and nursery area for dusky as well as sandbar sharks. NOAA Fisheries does not rely solely on information from the shark observer program to make its determination for a time/area closure, but relies on many other data sources as well.

Comment 12: Dusky shark catches before 1999 should not be considered because we could not land them then; since 1999, our catch of dusky sharks has decreased.

Response: Since dusky sharks were prohibited in June 2000, the data from that point forward has been analyzed separately from earlier data in the final Amendment. However, it is also important to examine data prior to 2000 because it helps to establish the high rate of historical bycatch and the importance of the area as a pupping and nursery ground for both dusky and sandbar sharks. In analyzing the shorter time period, NOAA Fisheries found that the number of dusky sharks being caught off North Carolina and elsewhere has declined since June 2000, but that a much higher percentage of dusky shark are observed caught in the time/area closure than in other areas, particularly when the relatively small size of the time/area closure is compared to all other open areas of the Atlantic and Gulf of Mexico.

Comment 13: We do not support the time/area closure at this time because of the significant economic and social impacts that would result in the affected fishing communities and the fact that the document does not sufficiently analyze the closure or enforcement of the closure. If done properly, a time/area closure can benefit all concerned; however, the proposed time/area closure is not reasonable. The decision to close the area seems to be driving the science.

Response: The original time/area closure proposed in the draft Amendment would have closed a large area (31,487 square nautical miles) and may have had severe economic and social impacts. Based on public comments, NOAA Fisheries re-analyzed the data and proposed a revised time/area closure of 4,490 square nautical miles in part to mitigate social and economic impacts on fishing communities in North Carolina. The revised time/area closure will still be effective at reducing dusky catch by 79 percent, and neonate and juvenile sandbar catch by 55 percent.

Comment 14: It is not clear if other measures are sufficient to rebuild sandbar and dusky sharks without the addition of time/area closures.

Response: Rebuilding of dusky and sandbar sharks is based on the combination of management measures including the reduction in quota, the time/area closure, gear restrictions that should reduce post-release mortality, and a minimum size on recreationally caught sharks. Without the time/area closure, NOAA Fisheries would need to implement other reductions or restrictions in order to ensure that LCS are rebuilt within the necessary time frame.

Comment 15: NOAA Fisheries received a number of comments regarding the depth of the closures. Comments included: most nursery grounds are in nearshore areas; closing areas 20 fathoms in depth to the shore should be suitable to protect neonates and juveniles. NOAA Fisheries does not need to close areas out to the 200 mile limit unless the desire is to fiercely impact these shark fishing entities. Regions outside of 20 fathoms should remain open. We question any justification for closing anything other than state waters during pupping seasons. We cannot support closures inside of 10, 20, or any other fathom mark at this time.

Response: NOAA Fisheries examined catches based on depth and found that both dusky sharks and juvenile sandbar sharks are caught at depths of up to 50 fathoms. Since large numbers of sharks appear to be caught in a line along the 50 fathom contour, a buffer of approximately two miles was included to extend the seaward boundary of the time/area closure to approximately 60 to 80 fathoms. The time/area closure is one of the few known areas where shark pupping and nursery grounds extend into Federal waters. It is also one of the only areas designated as a Habitat Area of Particular Concern (for sandbar sharks) in Federal waters.

Comment 16: NOAA Fisheries received several comments regarding the proposed time/area closure and the burden being placed on North Carolina fishermen. Comments included: Juvenile sharks are caught all along the coast and North Carolina fishermen are being targeted unfairly. If closures are needed to rebuild sharks, then fishermen in all states need to share the task, not just North Carolina fishermen. The time/area closure is payback for previous lawsuits by the commercial industry.

Response: Juvenile sharks are caught along much of the U.S. Atlantic and Gulf of Mexico coasts; however, the proportion of juvenile and neonate dusky and sandbar sharks being caught off North Carolina is substantially higher than in other areas. This is because the waters off North Carolina are pupping and nursery areas for these two species, and pregnant females, pups and juveniles aggregate in the area. EFH areas for both sandbar and dusky sharks, and HAPC areas for sandbar sharks have been designated off North Carolina. Data indicate that from 1994-2002, 1,099 or 79 percent of all dusky sharks were caught in the time/area closure from January through July. Of these, 1,016 or 92 percent were neonates or juveniles. Of the 12,445 sandbar sharks observed caught in the Atlantic from 1994-2002, 6,755 or 54 percent were caught in the time/area closure between January and July, of which 61 percent were juveniles and neonates. While there may be other nursery and pupping areas in coastal waters, this is one of the only areas where such a high proportion of neonate and juvenile sharks have been documented being caught in Federal waters.

Comment 17: The proposed time/area closure is absurd; the period should be April 1 through June 30 or maybe July 15. NOAA Fisheries should not close the area for the entire time from January through July because most fishermen do not see any pregnant females in the area after mid-July.

Response: Data from the commercial shark observer program indicates that there are substantial numbers of juvenile and neonate sharks being caught in all months from January through July, not just from April through July. This is because in addition to being a primary pupping area from May to August, the area is also a secondary nursery and overwintering ground for young-of-the-year and juvenile sharks.

Comment 18: The five vessels with a history of landing most of the juvenile sandbar sharks should be given some options on how to catch bigger sharks.

Response: NOAA Fisheries has not analyzed specific information regarding which vessels are catching small or large sharks, but has relied instead upon analysis of all data gathered in the time/area closure over various time periods to form the basis for the closure. Even if information were available to indicate that certain vessels were responsible for the majority of juvenile landings, options to remedy the problem would have to be made available to the entire fleet, not just selected vessels. Commercial shark fishery participants who fish in the area are encouraged to share information on fishing gears, methods, and locations that might reduce the catch of juvenile sharks. The intent of the closure is to reduce all interactions between commercial fishing operations and pupping and nursery grounds and hence reduce both the catch and mortality of dusky and juvenile sandbar sharks.

Comment 19: Shrimp nets catch more small sharks than the directed shark fishery in North Carolina.

Response: NOAA Fisheries agrees that the shrimp fishery is responsible for large catches of small coastal sharks. The bycatch of small coastal sharks (SCS) in the shrimp trawl fishery in the Gulf of Mexico has been documented and was taken into account during the latest 2002 SCS stock assessment which indicates that SCS are not overfished and overfishing is not occurring. The time/area closure is intended to reduce the catch of LCS such as the prohibited dusky sharks and juvenile sandbar sharks, and while there may be benefits to the SCS stock as a result of the closure, the intent was to reduce the catch of juvenile sandbar sharks and prohibited dusky sharks.

Comment 20: If an area is closed, landings should not be allowed in states adjacent to the area no matter where the fish are harvested.

Response: NOAA Fisheries does not agree that adjacent states should be closed as well, or that landings should not be allowed in adjacent states. The time/area closure is based on specific information about catches off North Carolina in a known pupping and nursery area. Although

there are pupping and nursery areas in state waters, most notably Chesapeake Bay, MD, and Delaware Bay, DE, fishing effort there has historically been low. Additionally, most other areas adjacent to the closure off North Carolina are not known pupping and nursery areas and have a much higher proportion of adult sandbar sharks, and far fewer dusky sharks. NOAA Fisheries is proposing to implement a Vessel Monitoring System (VMS) to aid in enforcement of the time/area closure. VMS will benefit fishermen by allowing them to traverse the closed area to offload.

Comment 21: The time/area closure will push more vessels into other areas such as the Florida East Coast. This combined with the regional quotas and trimester seasons will mean that all the vessels will be working for one sixth of the normal January opening quota. There is only a small area off of Florida where you can shark fish. If more vessels go to that area, there will not be enough room to set gear.

Response: The original time/area closure proposed in the draft Amendment would have closed all waters off North Carolina, and portions of Virginia and South Carolina to commercial bottom longline fishing. Based on public comments that the catch of dusky sharks has declined in recent years, and that the time/area closure would have severe economic impacts on commercial fishing entities in those states, NOAA Fisheries re-examined the data for the time/area closure, specifically by looking at a shorter time period of catches from 2001-2002. Based on an analysis of the data, NOAA Fisheries revised the time/area closure to close the portion of the original time/area closure which had the highest catch rate of dusky and juvenile sandbar sharks. NOAA Fisheries believes that the revised time/area closure will reduce the catch of dusky and juvenile sandbar sharks, while also mitigating the economic impact of the closure by allowing vessels to continue fishing in waters north and south of the time/area closure off North Carolina from January through July. This should prevent vessels from having to fish in Florida, and will allow the trimester quota to be harvested over a larger area.

Comment 22: NOAA Fisheries received several comments regarding how the proposed boundaries were established. Comments included: NOAA Fisheries needs to improve the transparency in how the time/area boundaries were established and include maps of all observed trips and research cruises, not just observed takes of sandbar and dusky sharks.

Response: The final Amendment provides a more thorough explanation and justification for the boundaries established for the revised time/area closure. The seaward boundary of the revised area follows the 60 to 80 fathom contour, and was selected to include all observed catches of dusky sharks and sandbar sharks. No dusky or sandbar sharks were observed caught east of approximately 50 fathoms. Since large numbers of sharks appear to be caught in a line along the 50 fathom contour, a buffer of approximately two miles was included thus extending the boundary to 60 to 80 fathoms. The northern boundary was selected to include the HAPC for sandbar sharks off Cape Hatteras, and because areas north of Cape Hatteras have historically had low catches of both dusky and sandbar sharks. The southern boundary was selected based on low numbers of dusky sharks that have been observed caught there in recent years, and because the

proportion of juvenile and neonate sandbar sharks is much lower there than in the time/area closure. In summary, the revised time/area closure will reduce the catch of dusky sharks by 79 percent vs. 85 percent under the original proposal, and will reduce the catch of sandbar sharks by 51 percent vs. 66 percent under the original proposal. Detailed maps of the revised time/area closure, all observed trips, and research cruises are provided in the final Amendment.

Comment 23: Why is Virginia closed? The marginal benefit of extending the closed area into Virginia does not appear as great as it would be off of Cape Canaveral, Florida. There appears to be another area of high sandbar and dusky abundance off central Atlantic Florida; NOAA Fisheries should have proposed a similar closed area in that region.

Response: Based on public comments received, NOAA Fisheries re-examined the data and concluded that the waters off Virginia did not warrant being closed at this time. The time/area closure boundary has been revised to include only waters south of the HAPC off Cape Hatteras. For the area near Cape Canaveral, Florida, NOAA Fisheries found that the area accounted for only 8 percent of the observed dusky shark catch from 1994-2002, and less than 14 percent of sandbar sharks, of which a very high proportion were adults. Given the low percentage of catch of prohibited dusky sharks from this area, and the high proportion of adult sandbar sharks, NOAA Fisheries did not feel it was appropriate to close the area at this time.

Comment 24: NOAA Fisheries must adopt alternative K5 which would establish a time/area closure for smalltooth sawfish critical habitat. The smalltooth sawfish is the first marine fish to be listed under ESA, and although critical habitat has not yet been designated, NOAA Fisheries should act immediately.

Response: NOAA Fisheries does not have the basis for implementing a time/area closure for smalltooth sawfish at this time. Without information about smalltooth sawfish critical habitat, NOAA Fisheries does not have sufficient information to identify an appropriate time/area closure. Once a recovery plan is developed and critical habitat identified, NOAA Fisheries will reconsider a closure to protect smalltooth sawfish.

Comment 25: The depths on the maps depicting the time/area closure are incorrect.

Response: NOAA Fisheries agrees that the depths used in the time/area closure maps were incorrect, and has provided updated maps showing the correct bathymetry in the final Amendment.

Comment 26: NOAA Fisheries needs to compare the number of dusky shark takes in the commercial and recreational fisheries. MRFSS data are not credible.

Response: NOAA Fisheries has provided estimates of the number of dusky sharks caught in the commercial and recreational fisheries in the final Amendment. The estimates show that the number of dusky sharks caught in the commercial fishery was considerably higher (18,867) than

in the recreational fishery (5,570) in 1999, but that the recreational fishery may have caught more dusky sharks in 2000-2001 (8,100 vs. 6,063). MRFSS data are not the only data used in calculating recreational catch estimates. Other data are obtained from the NMFS Headboat Survey (HBOAT) and the Texas Parks and Wildlife Recreational Fishing Survey (TXPWD).

Comment 27: The proposed time/area closure splits South Carolina. How will enforcement enforce the regulation?

Response: The revised time area closure is located entirely off the coast of North Carolina and enforcement should no longer be an issue off South Carolina. Other time/area closures have been implemented that did not fully encompass a state's waters, and NOAA Fisheries utilized VMS to ensure the effectiveness and enforcement of the closures. NOAA Fisheries intends to implement VMS for the current time/area closure as well. VMS will have the added benefit of allowing vessels to transit the closed area.

A5.5 Other Management Measures

A. Deepwater and Other Sharks

Comment 1: NOAA Fisheries received a range of comments regarding the alternatives for the deepwater and other species group. The comments include: Deepwater sharks should be protected; because there is little practical effect of leaving or removing them from the management unit, deepwater and other sharks should be left in the management unit; leaving the deepwater and other sharks in the management unit could decrease the time needed to act, if necessary; deepwater and other sharks should remain in the management unit because if any fishery should develop, it could take years to create an FMP following section 305(a) of the Magnuson-Stevens Act in terms of gear evaluation and notification of entry; we support the preferred alternative; NOAA Fisheries should continue to collect data on these species until such a time that they can be assessed or until a potential fishery develops; and, if needed, NOAA Fisheries should move to put them back in the management unit to protect them.

Response: NOAA Fisheries believes that maintaining data collection only on the deepwater and other sharks is sufficient because there are no known significant landings of the species in this group and no known fishermen target these species. If directed fisheries were to start, NOAA Fisheries would evaluate data available at that time to see if an FMP amendment or other regulatory measures would be warranted. NOAA Fisheries believes it can re-establish the deepwater/other species group in the management unit within a short time frame, if necessary.

Comment 2: Fishing for deepwater and other sharks should be prohibited because they are more likely to be overfished than coastal sharks.

Response: At this time, there are no known fishermen targeting deepwater and other sharks. Prohibiting these species would be precautionary, but it may not significantly reduce mortality

because these species are only caught rarely in non-HMS fisheries. Further, prohibiting landings of these species in HMS fisheries could reduce the availability of important data on them.

Comment 3: To the extent that deepwater sharks are a target of fisheries in the Caribbean, the complex should be assessed and managed.

Response: NOAA Fisheries will assess this species group when more biological and fishery information becomes available.

Comment 4: Deepwater and other sharks were added to the management unit not only to ban their finning, but also to preclude possession of species that may be vulnerable to overfishing and to help prevent development of directed fisheries or markets for uncommon or seriously depleted species.

Response: The species added to the prohibited species group in the HMS FMP were added because they were known to be vulnerable to overfishing, uncommon, or seriously depleted. The deepwater and other group was included in the management unit only to prohibit finning of these species. No other regulations were placed on this group (e.g., no permitting or reporting requirements). Presently, the only protection afforded under the HMS FMP, a ban on finning, is now afforded nationally under the Shark Finning Prohibition Act (February 11, 2002, 67 FR 6194). Given the national protection, NOAA Fisheries believes that maintaining data collection only on these species is sufficient.

B. Prohibited Species

Comment 1: Fishermen should be fined $10,000 for every prohibited species they capture.

Response: Currently, the possession and landing of prohibited species is illegal. Penalties and fines vary with the severity of the infraction. At this time, NOAA Fisheries does not believe a $10,000 fine for capturing a prohibited species would be appropriate under all circumstances.

Comment 2: NOAA Fisheries received a range of comments stating that dusky sharks should be removed from the prohibited species list in order to determine where and how many are caught. Alternatively, some commenters stated that NOAA Fisheries should not remove dusky sharks because they have suffered a severe population decline and all measures to reduce mortality should be imposed.

Response: Dusky shark catch rate data indicate large population declines since the early 1970s. Dusky sharks have a high bycatch mortality, approximately 80 percent, and are usually dead when gear is retrieved. Although commercial shark fishery observer data shows that dusky sharks comprise approximately one percent of total catch in recent years, removing dusky sharks from the prohibited species list could result in increased mortality of this overfished species by allowing the retention of individuals that may otherwise be released alive. NOAA Fisheries

determined that removing dusky sharks from the current prohibited species group would likely have significant ecological impacts.

Comment 3: NOAA Fisheries received several comments regarding the addition of the deepwater and other species to the prohibited species group. The comments include: Because they are slow growing and because new fisheries can spring up and deplete populations before action can be taken, deepwater and other sharks should be added to the prohibited species list; removing deepwater and other sharks reduces the chances for conserving slow growing deepwater sharks; and, NOAA Fisheries continues to assert the lack of a fishery for deepwater sharks and yet has failed to reconcile their previous finding in the National Plan of Action for Reducing Fishing Capacity that deepwater sharks are overcapitalized.

Response: NOAA Fisheries determined that adding the deepwater and other species to the prohibited species group would likely have only minor positive ecological impacts. Prohibiting these species takes a precautionary approach, but may not significantly reduce mortality because these species are only caught rarely in non-HMS fisheries. Further, prohibiting the landing of these species in HMS fisheries may limit the availability of data pertaining to them. If directed fisheries started, NOAA Fisheries would evaluate data available at that time to see if an FMP amendment or other regulatory measures would be warranted. NOAA Fisheries believes it can re-establish the deepwater/other species group in the management unit within a short time frame, if necessary. The draft National Plan of Action for Reducing Fishing Capacity stated that deepwater sharks are overcapitalized. NOAA Fisheries believes the deepwater and other species were given this designation because the management group was included along with other shark management groups which are overcapitalized. The Highly Migratory Species Management Division has recommended that this finding for the deepwater and other species be amended because there are no known fishermen who target these species.

Comment 4: We support adding finetooth sharks to the prohibited species list. Possession should be prohibited until effective management measures to stop overfishing are implemented.

Response: NOAA Fisheries agrees that measures need to be taken to prevent overfishing of finetooth sharks. NOAA Fisheries analyzed an alternative (I3) that would add the finetooth shark to the prohibited species group, but determined that this alternative would likely have limited positive ecological impacts as finetooth sharks are common bycatch in non-HMS fisheries and prohibiting them HMS fisheries will not prevent their capture. Additionally, finetooth sharks are not overfished and are commonly caught in HMS fisheries. As such, finetooth sharks do not appear to meet the criteria established in the selected alternative. As described in Amendment 1, NOAA Fisheries will take a long-term approach of identifying where finetooth sharks are caught and work with the appropriate Fishery Management Council to reduce fishing effort, as appropriate.

Comment 5: NOAA Fisheries received several comments regarding the preferred alternative for prohibited species. The comments include: We support the proposed alternative for prohibited

species; we support the proposed alternative but recommend removing the criterion of rarity in LCS catch; If a species is commonly caught in the LCS fishery, but is depleted and warrants protection according to the biological criteria, then the species should be prohibited; we support the proposed mechanism but note that the criteria and procedures in the draft Amendment 1 require further investigation and clarification regarding appropriateness before finalization; and, we support the proposed mechanism but suggest that the criterion for adding and removing species be separated because the action may be contrary.

Response: NOAA Fisheries believes the mechanism for adding and removing species to and from the prohibited species list and the associated criteria are appropriate for addressing the biological needs of individual shark species. In regard to concern over the second criterion, a species may be rarely caught in HMS fisheries (criterion 2) but stock assessments show few signs of depletion (e.g, HMS gear types are not efficient at catching the shark species or the species is caught in areas not fished by HMS fishermen). Before any species is added or removed from the list, NOAA Fisheries would issue a proposed and final rule that fully describes how and if the species meets the criteria. If adjustments to the criteria are found to be needed in the future, NOAA Fisheries can modify the criteria in a future rulemaking.

Comment 6: NOAA Fisheries should finalize alternative I2 (return to the original five species) and the preferred alternative. All LCS should be assessed. If they remain on the prohibited species list, NOAA Fisheries will not have the data they need to assess them. Similarly, we support the proposed mechanism but NOAA Fisheries should also remove any species that are logically not likely to be overfished (e.g., rarely caught species).

Response: The 1997 prohibition on the possession of whale, basking, sand tiger, bigeye sand tiger, and white sharks within Federal waters was a precautionary measure developed to ensure that directed fisheries did not develop for these species. These five species were identified as highly susceptible to over exploitation. In 1999, the HMS FMP prohibited the retention of the remainder of the prohibited species because they were known to be vulnerable to overfishing, uncommon, or seriously depleted. Although the preferred alternative includes a mechanism and lays out criteria for the inclusion and removal of species from the prohibited species group, NOAA Fisheries does not believe any changes to this group are warranted at this time. Each species will be considered on a case by case basis in future rulemakings. In the 2002 LCS stock assessment, there was sufficient information to assess the LCS complex as a whole, and sandbar and blacktip sharks individually. NOAA Fisheries will assess individual species as more biological and fishery information become available.

Comment 7: If the proposed mechanism is finalized, what type of request would we be required for NOAA Fisheries to start rulemaking to remove species?

Response: NOAA Fisheries would require a petition for rulemaking to alter the prohibited species list. A petition for rulemaking should contain sufficient information for NOAA Fisheries to consider the substance of the petition. For a petition regarding changes to the prohibited

species list, the petition should at a minimum:

- Indicate what species are proposed to be added to or removed from the list
- Identify which criteria warrant the addition or removal of the species
- Provide data, information, etc., relevant to those identified criteria
- State the resources necessary to develop the proposed regulations
- Explain the interest of the petitioner in the action requested
- Indicate the size of the population affected (i.e., who is affected by action)
- Indicate the public interest in the proposed regulation
- Explain the importance of the action requested to promoting established NOAA Fisheries' priorities and policies

Comment 8: If the proposed mechanism is finalized, will NOAA Fisheries conduct an annual assessment regarding which species will be placed on the prohibited species list?

Response: NOAA Fisheries will assess individual species as additional data becomes available and not necessarily on an annual basis.

C. Exempted Fishing Permits (EFPs)

Comment 1: We support the preferred alternative as long as NOAA Fisheries maintains some accountability on how the sharks are used, particularly the prohibited species. Any demographic information for age, growth, and offspring that evolves from aquarium use should be provided to NOAA Fisheries annually for use as a comparative database for life history analyses versus wild stocks.

Response: NOAA Fisheries maintains an exempted fishing permit (EFP) database which accounts for each highly migratory species requested, authorized, taken/collected, and/or tagged under an approved EFP. As for data reporting, each permitted individual is required to submit interim reports throughout the calendar as well as submit an annual report documenting the amount, composition, and disposition of the catch as well as information pertaining to fishing activities. Additionally, NOAA Fisheries is in the process of preparing a final rule to amend HMS reporting requirements under Exempted Fishing Permits (EFPs). Any issues or concerns which cannot be addressed in that rulemaking, will be addressed during forthcoming agency actions.

Comment 2: We support a separate display permitting system, apart form research or EFPs. NOAA Fisheries should overhaul the EFP system and establish separate classifications of permits for each specific use (e.g., public display, research, and other exempted activities).

Response: NOAA Fisheries agrees and is establishing display permits in this Amendment. Other purpose classifications of exempted fishing permits may be addressed in future rulemaking.

Comment 3: NOAA Fisheries received several comments regarding the issuance of permits. Comments included: NOAA Fisheries should not issue any more permits for scientific research. Background checks should be made of all permit holders; anyone with previous violations of any kind should be denied a permit. Requests for EFPs and SRPs need to be fully evaluated, taking into consideration past performance and other background, particularly for species that are already critically overfished.

Response: NOAA Fisheries does not believe that the agency should stop issuing scientific research permits. Valuable information is gathered from scientific research that would otherwise be prohibited. For example, the collection of life history, migration, and age and growth information from prohibited shark species would not occur without issuance of scientific research permits. NOAA Fisheries agrees that all permit applications should be carefully evaluated. As such, NOAA Fisheries will be investigating options for improving these evaluation processes (e.g., utilizing background checks as one possible means of permit denial/approval) in a future rulemaking.

Comment 4: Fishermen catching sharks for display purposes should be required to have a purchase order from an aquarium in hand before going out. Annual follow-up investigations to the aquarium should be made to ensure that the shark is cared for properly. If someone is caught without a purchase order, the fine should be $10,000 per shark.

Response: NOAA Fisheries will be investigating these issues further in a future rulemaking.

Comment 5: Several changes are needed to the EFP process including incorporating more public comment into the EFP allocation process and letting the public know what the final decision is and what the environmental impacts are of its decision.

Response: NOAA Fisheries will be investigating alternatives to improve the process in a future rulemaking and notes that information on the types of and number of permits issued are presented in the annual SAFE reports.

Comment 6: Efforts should continue with the Atlantic States Marine Fisheries Commission (ASMFC) regarding coordination between state and federal permits. There often appears to be too many permits and too little oversight.

Response: NOAA Fisheries supports continuing dialogues with the ASMFC regarding coordination between state and federal permits and has been working on improving its own database and collection methods, in part, to improve communication between NOAA Fisheries and state agencies.

Comment 7: While criteria for each EFP may vary, there should be uniform standards of performance, reporting, and accountability that are equally applicable to fishermen, aquariums, researchers, and educational institutions. Implementation of measures to ascertain the

educational need justifying the harvest of these animals and improving reporting should be investigated.

Response: NOAA Fisheries will be investigating these issues further in a future rulemaking.

A5.6 Essential Fish Habitat

Comment 1: EPA recommends including a discussion on whether shark EFH is being affected by other fishery practices. For example, if shark EFH is protected by limiting clamming or trawling in coastal bays, then the fishery may support higher quotas.

Response: Because sharks use both estuarine and coastal inshore habitats, their EFH may be negatively impacted by fisheries that target species other than sharks. These fisheries may be either state or Federally managed. In particular, shark pupping and nursery habitats may be subjected to fishing impacts from gears of other fisheries, e.g., shrimp trawling, but the degree of overlap between the various trawl fisheries and shark EFH, the extent to which habitat is altered by these gears, and the resulting impact on EFH are currently not known. Further research would be required to determine habitat-related production rates for sharks (the highest, most refined level of information available with which to identify EFH, and which is currently not available for sharks) and the potential impact of other fisheries on these production rates. Even if clamming or trawling were limited in some way to reduce impacts on shark EFH, the decision to raise quotas would only be made after appropriate stock assessments were conducted to determine whether the status of the stock had improved as a result of the conservation and enhancement actions.

Comment 2: NOAA Fisheries should identify EFH based on the entire geographic range of the species (alternative L2).

Response: The EFH final rule recommends distinguishing EFH from all habitats potentially used by a species (50 CFR 600.815(a)(1)(iv)(A)). NOAA Fisheries considered alternative L2, to identify EFH based on the entire geographic range of the species, but decided instead to use alternative L4 because specific information from scientists, observers, and tagging programs was available to identify EFH more precisely based on observed distributions and knowledge about habitat requirements of individual species. Alternative L4 identifies EFH based on an initial analysis of 100 percent of the observed distribution (alternative L3) which may then either be expanded or reduced based on the status of the stock. If new information is not available, the existing EFH identifications would be maintained. The basis for this alternative is to provide flexibility to increase or decrease the extent of EFH based on the status of the stock. Since overfished resources are considered to be at greater risk, the percentage of habitat identified as EFH for overfished species would be greater than that of fully fished or not overfished species. Alternative L2 could potentially have resulted in inclusion of the entire EEZ for certain species, which would include more than the range of areas necessary for spawning, feeding, breeding and growth to maturity as defined in the EFH regulations. NOAA Fisheries believes that the areas

currently identified as EFH are based upon the best available science and represent the most accurate identification of EFH.

Comment 3: We support the use of alternatives J3 and J4 to identify EFH as specifically as possible and the use of data to increase or decrease the identifications for each species.

Response: Alternative L4 is preferred because it provides an objective way of identifying EFH, and because it allows for the expansion or contraction of EFH based on the status of a particular species or life stage. For example, for overfished species, 90 percent of the range of distribution could hypothetically be identified as EFH, and for a species that is not overfished, 75 percent of the range of distribution might be identified as EFH.

Comment 4: Sandbar shark EFH should include areas in the northern Gulf of Mexico.

Response: Current sandbar shark EFH for all life stages includes areas in the northeastern Gulf of Mexico from Key West, Florida, as far west as Cape San Blas, Florida, on the Florida Gulf coast at 80^0 15' North, including Apalachicola Bay, Florida. NOAA Fisheries did not have sufficient information to include areas farther west at this time.

Comment 5: NOAA Fisheries should work with Mexico and Cuba to include their waters as EFH. Twenty percent of all dusky shark tags are returned from Mexico after having been tagged in the mid-Atlantic region. Expanding EFH would help present all information possible about EFH throughout the immediate range.

Response: Habitats that satisfy the criteria in the Magnuson-Stevens Act and the EFH regulations have been identified and described as EFH; some additional habitats may lie outside the U.S. Exclusive Economic Zone (EEZ), and therefore cannot be identified as EFH under the Magnuson-Stevens Act. Instead, these areas may be highlighted as particularly important habitats and actions that may adversely affect the habitat may be addressed through international agreements as recommended in the EFH regulations (50 CFR 600.805(b)(2)). The U.S. has engaged in discussions with Mexico regarding fisheries issues in the past, and met again October 22-24, 2003, for U.S. Mexico Bilateral Consultations in Mazatlan, Mexico. NOAA Fisheries is not aware whether shark habitat was on the list of topics that were discussed. Currently the U.S. does not have diplomatic relations with Cuba, and working cooperatively to determine shark habitat in Cuban waters would be difficult.

Comment 6: The Amendment discusses changes to EFH based on human impacts but does not discuss natural impacts such as red tide or rising temperatures.

Response: Both red tide and rising temperatures may influence EFH. Red tides may have a short term impact by altering distribution of organisms, and temperature rise may have a long term influence by changing the distribution and abundance of predators and prey, benthic and water column habitat characteristics, and a host of other related issues. Red tides and rising

temperatures have been linked to human activities, and as such, the final Amendment includes conservation recommendations aimed at reducing the runoff of coastal pollution which may influence or exacerbate red tides, and discusses many other influencing factors that are land-based and may have an impact on coastal waters and EFH.

A5.7 The Stock Assessment and the Status of the Sharks

Comment 1: NOAA Fisheries received a range of comments regarding the current abundance of sharks. One commenter noted that a research scientist told him that there are plenty of sharks and that the scientist has seen more in his research this year than in other years. Another commenter noted that he no longer sees as many large coastal sharks as he used to and that shark harvesting should be stopped.

Response: Because of a number of factors including, but not limited to, environmental changes, the gear used, the random sampling scheme used, and past experience of the fisherman, the number of sharks seen by one person or in one year of a time series compared to other years or other people can vary. The models used in the large and small coastal shark stock assessments take this variation into account when examining the data provided by fishermen and scientists. Thus, the measures of abundance determined by the stock assessment are deemed to be the best available science and an appropriate basis for management action.

Comment 2: How could blacktip sharks be overfished in 1998 and now be rebuilt?

Response: As a result of a settlement agreement with commercial fishermen, NOAA Fisheries had the 1998 LCS stock assessment peer reviewed. Those reviews found that the scientific conclusions and recommendations in the 1998 stock assessment were not based on scientifically reasonable uses of appropriate stock assessment techniques. As a result of these peer reviews, NOAA Fisheries went back to the 1998 stock assessment and conducted a number of sensitivity analyses on the data and the models used at that time. These analyses found that the data and models used for blacktip sharks were particularly sensitive to a number of factors and that changing some of the factors could lead to results that indicated the stock was either rebuilt or was well below sustainable levels. The sensitivity of the results (to computational issues) was largely attributed to the CPUE series within the analyses, which showed contradictory trends. As a result of these sensitivity analyses, before the actual 2002 stock assessment was conducted, scientists and other stakeholders examined each time series and model available and determined which ones were the most appropriate for use. Given these decisions on data inputs and modeling approaches, the condition of blacktip sharks was determined to be rebuilt. The peer review of the 2002 LCS stock assessment found that the models and data used were appropriate.

Comment 3: Given the short period of shark management and the long time required for sandbars to attain maturity, the assertion that sandbar sharks are restored is something of a scientific miracle. Sandbar sharks used to be so common in the mid-Atlantic that they could be counted upon to save almost every summer shark trip. After a few years of intense commercial shark

fishing, that species was practically wiped out. We still do not see them.

Response: The latest LCS stock assessment was conducted by some of the most respected shark and stock assessment scientists in the United States and, as is attested by the results of the peer review, used state-of-the-art models. Additionally, the data and models used in the stock assessment were examined and debated by scientists, environmentalists, and fishermen in a stock evaluation workshop before the stock assessment itself. Thus, based on the best scientific data available at this time, NOAA Fisheries believes that the latest LCS stock assessment is one of the most accurate shark stock assessments produced by the agency. This assessment found that sandbar sharks are no longer overfished but are experiencing overfishing. It is important to note that a change in status from overfished to rebuilt does not mean that the population is restored to levels of an unexploited or lightly exploited population. In general, a fish population that is capable of producing MSY on a continuous level (i.e., a population that is not overfished) is roughly half that of an unexploited population. Thus, NOAA Fisheries would not expect sandbar shark catch rates to return to the catch rates that occurred at the start-up phases of either the recreational or commercial fisheries.

Comment 4: How can a species have overfishing occurring but not be overfished?

Response: Overfishing relates to the rate of fishing mortality and indicates that the standing stock is being reduced because removals exceed the capacity of the stock to replace itself. Fishing pressure or fishing mortality needs to be reduced on a species that is experiencing overfishing or the species will become overfished. A species is overfished if the biomass or the number of fish in the population is too low to produce the desired level of harvest on a continuing basis. In the case of an overfished species, fishing mortality must be reduced in order to keep more individuals in the population and contributing to reproduction. An overfished population cannot rebuild unless overfishing is stopped.

Comment 5: NOAA Fisheries received several comments regarding the accuracy of species identification and its impact on data quality and the accuracy of stock assessments. Comments included: NOAA Fisheries needs to improve species identification and reporting by shark dealers. The data you are using is wrong because fishermen have normally listed everything as a "sandbar shark." NOAA Fisheries should work within the Atlantic Coastal Cooperative Statistics Program (ACCSP) to better standardize fishery-dependent survey data collection and address the tendency of dealers to simply categorize shark landings as "sharks."

Response: Since 1993, species-specific reporting has been required. However, some fishermen and dealers still report sharks as "shark" or as "large coastal." Both the small and large coastal shark stock assessments use a variety of data including fishery-dependent (e.g., self-reported data such as logbooks) and fishery-independent data (e.g., research cruises with a set sampling scheme). While some fishermen or dealers may report the incorrect species on logbooks, other fishermen and dealers do report the correct species, as is required by the regulations, and observers or scientists trained in species-identification report the correct species level data. Both

stock assessments conducted numerous sensitivity analyses to examine what happens to the results of the models if only relative abundance data reported by fishermen or only data reported by scientists are used. The overall results of the stock assessments consider these sensitivity analyses. Recognizing that the accuracy of stock assessments and management can be improved with correct species-identification, NOAA Fisheries will be releasing a species-identification guide shortly and will be examining, in a future rulemaking, methods of requiring mandatory workshops for both commercial and recreational fishermen in order to improve, among other things, species-identification. NOAA Fisheries continues to work within the ACCSP and other relevant forums to improve the reporting process of shark data.

Comment 6: How independent were the peer reviews?

Response: For the 1998 and 2002 LCS stock assessments, Natural Resources Consultants, Inc. (NRC) hired several non-NOAA Fisheries scientists to conduct the peer review. These non-NOAA Fisheries scientists provided information to show they had no conflict of interest. NOAA Fisheries provided NRC with all the supporting documentation the scientists required such as copies of the stock assessment and the related documents. However, pursuant to a court-approved settlement agreement, NRC did not disclose the identities of the peer reviewers to fisheries management staff at NOAA Fisheries until after the reviews were complete. No one in NOAA Fisheries knew who the peer reviewers were or had contact with them until after both the agency's and Plaintiffs' counsel determined that the peer review documents were complete.

Comment 7: All shark fishing should be stopped. The PEW Report and other reports by independent, unbiased scientists indicate that overfishing is occurring. NOAA Fisheries is not accurate when it says "sandbar sharks are no longer overfished."

Response: The latest LCS stock assessment was conducted by some of the most respected shark and stock assessment scientists in the United States and the methods and data used were examined by both industry and environmental representatives before the stock assessment was conducted. Independent (i.e., non-NOAA Fisheries) peer reviews of the stock assessment indicate that the models and data used were appropriate. The current LCS stock assessment is the best available science on the status of the stocks.

Comment 8: NOAA Fisheries received a range of comments regarding the menhaden fishery and shark bycatch. These comments included: The menhaden fishery catches a lot of sharks. Does NOAA Fisheries incorporate bycatch information from the mendhaden fishery in the stock assessment? NOAA Fisheries should monitor and control the bycatch in the menhaden fishery.

Response: The Gulf of Mexico menhaden purse seine fishery does have some bycatch of sharks. It is estimated that approximately 75 percent of the sharks encountered in the fishery die, and 97 percent of the sharks encountered are LCS while 3 percent are SCS. The 2002 LCS stock assessment included these discard estimates for LCS, blacktip, and sandbar in the Gulf of Mexico menhaden purse seine fishery from 1981 to 2001. Additionally, different sensitivity analyses

were conducted to determine how much the results would change if data extended back to1964. Results from those sensitivity analyses indicated that extending the series of menhaden discard estimates back in time had almost no effect. NOAA Fisheries will continue to work with the Gulf States Marine Fisheries Commission and the Gulf of Mexico Fishery Management Council to monitor the situation and, as needed, examine methods of reducing bycatch of sharks in this fishery.

Comment 9: The two species that have been assessed outside the LCS complex have been shown to be not overfished; NOAA Fisheries needs to assess the other 20 LCS species to find out what their status is. All LCS, except sandbar and blacktip sharks, are considered overfished. Some of these species are rare event animals in the ecosystem; they have never, nor will ever be, overfished because they cannot be targeted in U.S. waters. These species should not be considered overfished. Despite 10 years of management, NOAA Fisheries has failed to conduct species-specific assessments for all LCS. Similarly, some of the prohibited LCS are listed as overfished but should not be. For example the bigeye sand tiger and narrowtooth sharks. These animals are rarely caught or found in U.S. waters.

Response: NOAA Fisheries continues to collect species-specific data in support of species-specific stock assessments. To date, NOAA Fisheries has conducted individual stock assessments for sandbar, blacktip, Atlantic sharpnose, finetooth, blacknose, and bonnethead sharks. As additional biological and fishery-related data become available, NOAA Fisheries will conduct other species-specific stock assessments. As noted in the 2002 LCS stock assessment, NOAA Fisheries plans to conduct a dusky shark stock assessment in the near future. Until that time, NOAA Fisheries must use the best available data to conduct stock assessments. For many species of sharks, this means conducting group stock assessments of the entire complex. These results indicate that some species in the LCS complex are in apparent decline while other species are not. Until stock assessments can be conducted on individual shark species, NOAA Fisheries is implementing a mechanism that uses a number of criteria to determine if the species should be on the prohibited species list. If a species, such as narrowtooth sharks, is rarely caught but do not meet the other criteria, such as sufficient biological data to indicate a decline, then the species can be removed. However, if the species is rarely caught because its stock is depleted, the species would be added to, or maintained on, the prohibited species list.

Comment 10: NOAA Fisheries' dusky data is incorrect and is not a true indicator of what is being caught. Juvenile dusky sharks are not caught off the east coast of Florida. Only giant dusky sharks were reported in logbooks in the past.

Response: The data collected on dusky sharks is from a variety of sources including fishermen, dealers, observers, and scientists. While there may be some problems with species identification on the part of those individuals not trained to do so, observers and scientists who have been trained to identify sharks do provide species level data. These data indicate that juvenile dusky sharks (dusky sharks do not mature until they are approximately 9.5 feet fork length) are caught off the east coast of Florida.

Comment 11: NOAA Fisheries received several comments regarding the assessment results for finetooth sharks. Comments include: The data on finetooth sharks is flawed; I only land a few and there is only a small area where they are caught. Assessments for finetooth sharks can be improved with better landings and bycatch information. NOAA Fisheries states that overfishing is occurring for finetooth sharks because of excessive bycatch, yet according to the SCS stock assessment, no bycatch numbers were used in the model; NOAA Fisheries should improve the data on finetooth sharks.

Response: NOAA Fisheries agrees that results for finetooth sharks are uncertain and believes this is due to limited catch and CPUE series, lack of bycatch estimates, and no catches reported in some years. NOAA Fisheries is also examining which fisheries are actually landing the majority of the finetooth sharks. The majority of finetooth shark landings come from gillnets in the South Atlantic fishery; however, observer data indicate that the six gillnet vessels that are known to be targeting small coastal sharks, including finetooth sharks, do not land as many finetooth sharks as are reported. Given the uncertainty of the results of the models and the need to collect information on these non-HMS fisheries that are landing finetooth sharks, NOAA Fisheries intends prevent overfishing of finetooth sharks by improving species-identification, particularly with recreational fishermen, and working with the Fishery Management Councils to identify and improve monitoring of fisheries that land finetooth sharks.

Comment 12: NOAA Fisheries received several comments regarding future assessments. Comments included: NOAA Fisheries should use an assessment protocol similar to the South Atlantic Fishery Management Council's Southeast Data and Assessment Review (SEDAR) process for future stock assessments. Species level assessments for several of the primary LCS species need to be developed as soon as possible. NOAA Fisheries needs to schedule LCS and SCS stock assessments for 2004 to prepare plans for future shark issues of importance. An assessment for the pelagic shark group needs to be completed as soon as possible.

Response: The process for conducting shark stock assessments continues to evolve and improve over time. As new data and techniques become available, NOAA Fisheries makes every effort to examine the possibility of using those data and techniques for assessing the status of sharks. Additionally, NOAA Fisheries considers and will continue to consider the process of other fisheries stock assessments and the needs of the fishing communities to improve the overall stock assessment process. Under the HMS FMP, NOAA Fisheries committed to holding stock assessments for each complex every two to three years. At this time, NOAA Fisheries has not yet decided when the next SCS or LCS stock assessments will be conducted. However, NOAA Fisheries will make every effort to ensure interested parties can attend the shark evaluation workshop. As for pelagic sharks, because of their migratory nature, NOAA Fisheries is working with ICCAT to collect data and conduct an international stock assessment of several species of pelagic sharks. That stock assessment should occur in 2004.

Comment 13: NOAA Fisheries should make efforts to document fully landings in Mexican waters and to work with that country in coordinating shark management.

Response: NOAA Fisheries agrees and is working through international means and with Mexican scientists to improve communication and facilitate the exchange of data.

A5.7 The Stock Assessment and the Status of the Sharks

Comment 1: NOAA Fisheries received a range of comments regarding the current abundance of sharks. One commenter noted that a research scientist told him that there are plenty of sharks and that the scientist has seen more in his research this year than in other years. Another commenter noted that he no longer sees as many large coastal sharks as he used to and that shark harvesting should be stopped.

Response: Because of a number of factors including, but not limited to, environmental changes, the gear used, the random sampling scheme used, and past experience of the fisherman, the number of sharks seen by one person or in one year of a time series compared to other years or other people can vary. The models used in the large and small coastal shark stock assessments take this variation into account when examining the data provided by fishermen and scientists. Thus, the measures of abundance determined by the stock assessment are deemed to be the best available science and an appropriate basis for management action.

Comment 2: How could blacktip sharks be overfished in 1998 and now be rebuilt?

Response: As a result of a settlement agreement with commercial fishermen, NOAA Fisheries had the 1998 LCS stock assessment peer reviewed. Those reviews found that the scientific conclusions and recommendations in the 1998 stock assessment were not based on scientifically reasonable uses of appropriate stock assessment techniques. As a result of these peer reviews, NOAA Fisheries went back to the 1998 stock assessment and conducted a number of sensitivity analyses on the data and the models used at that time. These analyses found that the data and models used for blacktip sharks were particularly sensitive to a number of factors and that changing some of the factors could lead to results that indicated the stock was either rebuilt or was well below sustainable levels. The sensitivity of the results (to computational issues) was largely attributed to the CPUE series within the analyses, which showed contradictory trends. As a result of these sensitivity analyses, before the actual 2002 stock assessment was conducted, scientists and other stakeholders examined each time series and model available and determined which ones were the most appropriate for use. Given these decisions on data inputs and modeling approaches, the condition of blacktip sharks was determined to be rebuilt. The peer review of the 2002 LCS stock assessment found that the models and data used were appropriate.

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Response: The latest LCS stock assessment was conducted by some of the most respected shark and stock assessment scientists in the United States and, as is attested by the results of the peer review, used state-of-the-art models. Additionally, the data and models used in the stock assessment were examined and debated by scientists, environmentalists, and fishermen in a stock evaluation workshop before the stock assessment itself. Thus, based on the best scientific data available at this time, NOAA Fisheries believes that the latest LCS stock assessment is one of the most accurate shark stock assessments produced by the agency. This assessment found that sandbar sharks are no longer overfished but are experiencing overfishing. It is important to note that a change in status from overfished to rebuilt does not mean that the population is restored to levels of an unexploited or lightly exploited population. In general, a fish population that is capable of producing MSY on a continuous level (i.e., a population that is not overfished) is roughly half that of an unexploited population. Thus, NOAA Fisheries would not expect sandbar shark catch rates to return to the catch rates that occurred at the start-up phases of either the recreational or commercial fisheries.

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Response: Since 1993, species-specific reporting has been required. However, some fishermen and dealers still report sharks as "shark" or as "large coastal." Both the small and large coastal shark stock assessments use a variety of data including fishery-dependent (e.g., self-reported data such as logbooks) and fishery-independent data (e.g., research cruises with a set sampling scheme). While some fishermen or dealers may report the incorrect species on logbooks, other fishermen and dealers do report the correct species, as is required by the regulations, and observers or scientists trained in species-identification report the correct species level data. Both stock assessments conducted numerous sensitivity analyses to examine what happens to the results of the models if only relative abundance data reported by fishermen or only data reported

by scientists are used. The overall results of the stock assessments consider these sensitivity analyses. Recognizing that the accuracy of stock assessments and management can be improved with correct species-identification, NOAA Fisheries will be releasing a species-identification guide shortly and will be examining, in a future rulemaking, methods of requiring mandatory workshops for both commercial and recreational fishermen in order to improve, among other things, species-identification. NOAA Fisheries continues to work within the ACCSP and other relevant forums to improve the reporting process of shark data.

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Response: The Gulf of Mexico menhaden purse seine fishery does have some bycatch of sharks. It is estimated that approximately 75 percent of the sharks encountered in the fishery die, and 97 percent of the sharks encountered are LCS while 3 percent are SCS. The 2002 LCS stock assessment included these discard estimates for LCS, blacktip, and sandbar in the Gulf of Mexico menhaden purse seine fishery from 1981 to 2001. Additionally, different sensitivity analyses were conducted to determine how much the results would change if data extended back to1964. Results from those sensitivity analyses indicated that extending the series of menhaden discard

estimates back in time had almost no effect. NOAA Fisheries will continue to work with the Gulf States Marine Fisheries Commission and the Gulf of Mexico Fishery Management Council to monitor the situation and, as needed, examine methods of reducing bycatch of sharks in this fishery.

Comment 9: The two species that have been assessed outside the LCS complex have been shown to be not overfished; NOAA Fisheries needs to assess the other 20 LCS species to find out what their status is. All LCS, except sandbar and blacktip sharks, are considered overfished. Some of these species are rare event animals in the ecosystem; they have never, nor will ever be, overfished because they cannot be targeted in U.S. waters. These species should not be considered overfished. Despite 10 years of management, NOAA Fisheries has failed to conduct species-specific assessments for all LCS. Similarly, some of the prohibited LCS are listed as overfished but should not be. For example the bigeye sand tiger and narrowtooth sharks. These animals are rarely caught or found in U.S. waters.

Response: NOAA Fisheries continues to collect species-specific data in support of species-specific stock assessments. To date, NOAA Fisheries has conducted individual stock assessments for sandbar, blacktip, Atlantic sharpnose, finetooth, blacknose, and bonnethead sharks. As additional biological and fishery-related data become available, NOAA Fisheries will conduct other species-specific stock assessments. As noted in the 2002 LCS stock assessment, NOAA Fisheries plans to conduct a dusky shark stock assessment in the near future. Until that time, NOAA Fisheries must use the best available data to conduct stock assessments. For many species of sharks, this means conducting group stock assessments of the entire complex. These results indicate that some species in the LCS complex are in apparent decline while other species are not. Until stock assessments can be conducted on individual shark species, NOAA Fisheries is implementing a mechanism that uses a number of criteria to determine if the species should be on the prohibited species list. If a species, such as narrowtooth sharks, is rarely caught but do not meet the other criteria, such as sufficient biological data to indicate a decline, then the species can be removed. However, if the species is rarely caught because its stock is depleted, the species would be added to, or maintained on, the prohibited species list.

Comment 10: NOAA Fisheries' dusky data is incorrect and is not a true indicator of what is being caught. Juvenile dusky sharks are not caught off the east coast of Florida. Only giant dusky sharks were reported in logbooks in the past.

Response: The data collected on dusky sharks is from a variety of sources including fishermen, dealers, observers, and scientists. While there may be some problems with species identification on the part of those individuals not trained to do so, observers and scientists who have been trained to identify sharks do provide species level data. These data indicate that juvenile dusky sharks (dusky sharks do not mature until they are approximately 9.5 feet fork length) are caught off the east coast of Florida.

Comment 11: NOAA Fisheries received several comments regarding the assessment results for

finetooth sharks. Comments include: The data on finetooth sharks is flawed; I only land a few and there is only a small area where they are caught. Assessments for finetooth sharks can be improved with better landings and bycatch information. NOAA Fisheries states that overfishing is occurring for finetooth sharks because of excessive bycatch, yet according to the SCS stock assessment, no bycatch numbers were used in the model; NOAA Fisheries should improve the data on finetooth sharks.

Response: NOAA Fisheries agrees that results for finetooth sharks are uncertain and believes this is due to limited catch and CPUE series, lack of bycatch estimates, and no catches reported in some years. NOAA Fisheries is also examining which fisheries are actually landing the majority of the finetooth sharks. The majority of finetooth shark landings come from gillnets in the South Atlantic fishery; however, observer data indicate that the six gillnet vessels that are known to be targeting small coastal sharks, including finetooth sharks, do not land as many finetooth sharks as are reported. Given the uncertainty of the results of the models and the need to collect information on these non-HMS fisheries that are landing finetooth sharks, NOAA Fisheries intends prevent overfishing of finetooth sharks by improving species-identification, particularly with recreational fishermen, and working with the Fishery Management Councils to identify and improve monitoring of fisheries that land finetooth sharks.

Comment 12: NOAA Fisheries received several comments regarding future assessments. Comments included: NOAA Fisheries should use an assessment protocol similar to the South Atlantic Fishery Management Council's Southeast Data and Assessment Review (SEDAR) process for future stock assessments. Species level assessments for several of the primary LCS species need to be developed as soon as possible. NOAA Fisheries needs to schedule LCS and SCS stock assessments for 2004 to prepare plans for future shark issues of importance. An assessment for the pelagic shark group needs to be completed as soon as possible.

Response: The process for conducting shark stock assessments continues to evolve and improve over time. As new data and techniques become available, NOAA Fisheries makes every effort to examine the possibility of using those data and techniques for assessing the status of sharks. Additionally, NOAA Fisheries considers and will continue to consider the process of other fisheries stock assessments and the needs of the fishing communities to improve the overall stock assessment process. Under the HMS FMP, NOAA Fisheries committed to holding stock assessments for each complex every two to three years. At this time, NOAA Fisheries has not yet decided when the next SCS or LCS stock assessments will be conducted. However, NOAA Fisheries will make every effort to ensure interested parties can attend the shark evaluation workshop. As for pelagic sharks, because of their migratory nature, NOAA Fisheries is working with ICCAT to collect data and conduct an international stock assessment of several species of pelagic sharks. That stock assessment should occur in 2004.

Comment 13: NOAA Fisheries should make efforts to document fully landings in Mexican waters and to work with that country in coordinating shark management.

Response: NOAA Fisheries agrees and is working through international means and with Mexican scientists to improve communication and facilitate the exchange of data.

A5.8 Economic Impacts

Comment 1: NOAA Fisheries received several comments regarding the range of economic impacts that should be analyzed. Comments included: NOAA Fisheries should focus on the probability of extinction of sharks instead of the economic impacts on commercial fishermen. NOAA Fisheries should not focus on the economic impacts on commercial fishermen but on U.S. citizens as a whole.

Response: NOAA Fisheries conducts economic analyses pursuant to the National Environmental Policy Act, 1969 (42 U.S.C. 4321 et seq.), Regulatory Flexibility Act, 1980 (5 U.S.C. 601 et seq.), Small Business Regulatory Enforcement Fairness Act, 1996 (5 U.S.C. 801 et seq.), Regulatory Planning and Review, 1993 (Executive Order 12866), and Proper Consideration of Small Entities in Agency Rulemaking, 2002 (Executive Order 13272). As such, NOAA Fisheries conducted economic analyses via completion of a Environmental Impact Statement, Initial Regulatory Flexibility Analysis (IRFA), Final Regulatory Flexibility Analysis (FRFA), and a Regulatory Impact Review (RIR), which document economic impacts on the affected fishery, small entities, and the nation as a whole.

Comment 2: The revised quotas will put fishermen out of business. The current quotas are good and the overall fishery is improving. NOAA Fisheries should leave well enough alone.

Response: According to the 2002 LCS stock assessment, the LCS complex is overfished and overfishing is occurring (Cortes, 2002). As such, the 2002 stock assessment recommends that adjustments to quotas be made in the form of percent reductions in catch. Economic analyses indicate that the LCS quota was worth $2,895,521 in 2001 under the baseline for comparison (i.e., 1285 mt dw). According to economic analyses, implementation of the preferred alternatives will result in a 21-percent reduction in total gross revenues for both the fishery as a whole as well as small entities. If NOAA Fisheries, did not act, the quotas from the 1999 HMS FMP would go into place. These quotas are lower than the quotas selected in Amendment 1 and would put additional fishermen out of business.

Comment 3: The combination of alternatives A4 and C2 would stabilize some of the economic impacts that have unfolded upon the directed shark participants since 1997 due to regulations and inadequate science.

Response: While the combination of alternatives A4 and C2 would increase total gross revenues by 33 percent to both the fishery as a whole as well as small entities, this economic benefit may be short-lived if the fishery continues to decline as a result of substantial increases of regulatory discards that are anticipated with multiple closures in a mixed LCS fishery. Fishermen would likely need to increase effort in order to make up for lost catches during partial closures. This

increase in effort may result in increased protected resource interactions and mortality on non-targeted species. Moreover, longer sorting times per set are likely to increase opportunity costs to fishery participants. Additionally, lengthening of trips may occur in order for fishermen to compensate for lost catches during a partial closure. Increased time at sea reduces the profits fishermen gain due to increased costs for fuel, bait and ice. Safety at sea concerns are also of interest, given that fishermen must fish longer or harder to counteract for lost revenues.

Comment 4: The regional quotas and estimates of catches by region are flawed and will put North Atlantic fishermen out of business. This regional quota and a trimester approach will give the North Atlantic 1.3 percent of the quota or 14.4 mt dw for each season. This is not sufficient to maintain a crew.

Response: NOAA Fisheries combined information from two separate databases containing regional landings information as reported by dealers and states to NOAA Fisheries. NOAA Fisheries believes that the landings reported by dealers and states represents the best available information pertaining to regional data. Given that regional quotas seek to maintain historical landings, as opposed to reducing landings, NOAA Fisheries does not expect that regional quotas would change previous fishing practices or result in any significant economic impact. To the extent that the quota itself is being reduced, fishermen in all regions will likely have reduced landings. However, NOAA Fisheries believes that having more open seasons (i.e., three as opposed to two) and spreading the open seasons out more evenly, will result in greater economic stability for fishery participants, including crew members. Additionally, over time, regional quotas may allow NOAA Fisheries the flexibility to manage quotas to each region's maximum economic advantage.

Comment 5: NOAA Fisheries received a range of comments regarding the economic impact of a trimester approach. Comments include: We cannot support the trimester season approach because it would hurt the market and because it could have economic costs for fishermen who would need to switch their gear types three times a year instead of two times. Grocers need at least a month to develop their advertising and know their potential supply and price; a trimester approach would not give enough time for grocers to advertise. I like the trimester approach because it would allow for more advertising and therefore a higher price. I do not need to switch my gear because I use the same gear for grouper, sharks, and tuna. NOAA Fisheries, as part of the Department of Commerce, should be more sensitive to seafood markets and should know that changing the seasons from biannual to trimesters will cause extreme harm to the established market routine for sharks.

Response: NOAA Fisheries recognizes that trimesters may take time for fishermen and associated communities (e.g., dealers, processors, retail agents) to adapt to, given that new markets will need to be established at different times of the year. Fishery participants will need time (i.e., between two weeks and a month) to work with grocers to advertise shark products and under trimester seasons the time available for such advertisements may be further limited, as compared with the no action alternative. Additionally, since fishermen may be able to land

sharks at the same time as other fish, there could be fluctuations in markets for other fisheries. Spreading open seasons out more evenly over the calendar year could, in the long-term, result in greater economic stability for fishermen and associated communities because the amount of time between open and closed seasons would be reduced and sharks would be available in the market more frequently throughout the year. In order to reduce the economic impacts associated with trimesters, NOAA Fisheries will implement a delay in effectiveness to give fishery participants an opportunity to work with dealers and grocers to enhance markets and advertising solutions in advance of season openings. NOAA Fisheries also recognizes that variation in open seasons could result in short-term social and economic burdens, given that fishermen will need to adjust fishing practices, including but not limited to, re-rigging gear more often to fish for shark, as opposed to other species, during what would otherwise be a closed season. Social and economic costs associated with switching gear more often may be minimized, if shark fishery participants use the same gear in other fisheries (e.g. similar gear is used to fish for shark, grouper, and tuna). Trimester seasons are preferred to quarterly seasons because trimesters will minimize the costs of switching gear (i.e., only three times as opposed to four per year) and give a higher percentage of the quota to each open season than would occur under a quarterly season approach.

Comment 6: I want a buyout if you are going to set the regional quotas and trimester seasons. My vessel is worth more than $200,000 to me.

Response: NOAA Fisheries has the authority to reduce capacity under the Magnuson-Stevens Act (Section 312(b)-(e)) and may investigate options to reduce capacity during a future rulemaking.

Comment 7: If NOAA Fisheries bans drift gillnet, all shark gillnet fishermen, including those already using strikenet gear, will go out of business because you can only use strikenet from January through April when the LCS are schooling and the season is open. You cannot use strikenet to target SCS which is what shark gillnet fishermen rely on when the LCS season is closed. You also cannot use strikenet gear in the summer because the sharks in this area are not schooling. Shark gillnet fishermen cannot fish for Mackerel due to the Florida net ban; therefore, most of their money comes from shark fishing. Strikenet fishing requires two large vessels to retrieve the gear, two small vessels to deploy the gear, and an airplane. Buying new gear itself costs at least $70 K. That is a large amount of capital investment and because it captures a large amount of blacktip sharks at a time, the gear can only support two vessels.

Response: NOAA Fisheries no longer prefers the alternative, which would allow only strikenet method in the shark gillnet fishery. Public comment received by NOAA Fisheries indicates that allowing the use of strikenets only would not accomplish the objective of allowing the gillnet fishery to continue while minimizing interactions with protected resources as well as reducing bycatch of non-target species. Therefore, the final regulations will permit the use of drift gillnets with possible gear modifications or other measures designed to reduce interactions and mortality of bycatch being implemented through a future rulemaking, based upon further study.

Comment 8: The complete prohibition of a gear in a fishery is not unusual in fisheries management, especially in regards to entanglement gear. Gillnets have been disallowed in other fisheries that are considerably larger and with more socioeconomic impact than the six to eight gillnet vessels in this fishery. Beside protected species, gillnets kill gamefish species such as tarpon and large red drum that support recreational and charter fisheries that contribute over $500 million to Georgia's economy. The kill of these premier gamefish in this gear presents a clear threat to Georgia's growing recreational and charter fishing fleets, with distinct economic implications to the State.

Response: While it may be true that prohibitions of gear types exist in other fisheries and that those actions may have resulted in economic impact to the concerned fishery as well as small entities, it is likely that the decision-making associated with why those prohibitions were originally considered and ultimately approved differs. In this instance, NOAA Fisheries proposed allowances for strikenet method only in the shark gillnet fishery in order to allow the commercial shark gillnet fishery to continue while minimizing interactions with protected resources as well as reducing bycatch of non-target species. Through public comment it has been brought to the attention of NOAA Fisheries that allowing the use of strikenets only would not accomplish this objective. Therefore, the final regulations will permit the use of drift gillnets with possible gear modifications or other measures being implemented through a future rulemaking.

Comment 9: I use small mesh monofilament stab nets to fish for whiting, bluefish, Spanish mackerel, and croakers. I normally land more than the incidental limit of sharks. If you allow only strikenets, I will go out of business.

Response: NOAA Fisheries originally proposed allowing the strikenet method only in the shark gillnet fishery in order to reduce bycatch of protected species. This alternative would have allowed incidental shark landings from vessels participating in other gillnet fisheries, such as those mentioned in the comment above. However, based upon public comment received during the comment period for draft Amendment 1, NOAA Fisheries has decided not to implement this alternative at this time.

Comment 10: The time/area closure off of North Carolina will put many fishermen out of business.

Response: NOAA Fisheries acknowledges that some fishermen may go out of business as a result of the time/area closure. Original economic analyses in the DEIS indicated that the time/area closure offshore of South Carolina, North Carolina, and Virginia could have a direct economic impact on a total of 34 vessels (out of 251 total directed permits issued in 2002 ~ 14%) with directed shark permits. Economic analyses, based on revisions to the time/area closure, indicate that 23 vessels (out of 256 total directed permits issued in 2003 ~ 9%) with directed shark permits may experience direct economic impacts. Additionally, original analyses pointed toward a total of 13 vessels with home ports located in South Carolina, North Carolina, and

Virginia as having reported shark landings during 2001. These vessels reported gross revenues totaling $351,600 during that year. Revised economic analyses indicate that only 8 vessels with home ports located in North Carolina reported shark landings during 2001. This revised analysis indicates that the time/area closure off of North Carolina will result in a 15-percent reduction in total gross revenues for the fishery as a whole and in a three-percent reduction of revenues for the small entities directly affected by the proposed closure. As such, the revised time/area closure mitigates the economic impacts by $17,956 in total gross revenues for the small entities directly affected by the closure as compared with the original preferred alternative as outlined in the DEIS.

Comment 11: NOAA Fisheries received several comments regarding VMS. Comments included statements that the proposed VMS is not as expensive as the program run out of the Northeast; therefore, we encourage your program. VMS is expensive and a violation of privacy. A VMS requirement would put bottom longline fishermen out of business.

Response: Economic analyses of the impacts associated with the VMS requirements indicate that only five percent of the fleet would be affected and that this will result in a eight-percent reduction in total gross revenues for the fishery as a whole and a 26-percent reduction in total gross revenues for the 12 vessels directly affected by this proposed requirement during the first year of implementation. For every year thereafter, economic analyses indicate that annual costs will result in a seven-percent reduction in total gross revenues for the fishery as a whole and a seven-percent reduction in total gross revenues for the 12 vessels directly affected by this proposed requirement.

Comment 12: Will the agency pay for VMS for this fishery?

Response: Implementation of the VMS requirement in this final rule will result in five gillnet vessel owners and seven bottom long-line vessel owners having to pay for VMS units and all associated costs. Specifically, the costs associated with implementing a VMS program in the Atlantic shark gillnet fishery include an initial average cost per vessel of approximately $2,275 (not including postage costs for returning certification statement), an average annual maintenance cost of approximately $500/year, and approximately $197.28/year for communications during the right whale calving season. Costs associated with implementing a VMS program in the directed shark bottom longline fishery include an initial average cost per vessel of approximately $2,275 (not including postage costs for returning certification statement), an average annual maintenance cost of approximately $500/year, and approximately $305.28/year for communications during the proposed 212 day shark bottom longline time/area closure.

Comment 13: The fuel that it takes to move one nautical mile after an interaction with a protected species is not significant and should not have a large economic impact.

Response: NOAA Fisheries believes that most fishing vessels will move at least one nautical mile during the course of normal operations. As such, fuel costs associated with a requirement to

move one nautical mile after an interaction with a protected species are insignificant and would have minimal, if any, economic impacts.

Comment 14: The retrieval of fishing gear (i.e., hooks, leaders, and crimps) saves the fisherman money replacing the lost gear and time and effort. Dehooking and disentanglement techniques would speed up, in most cases, their fishing operation and reduce CPUE. Additionally, line cutters and dehooking devices are relatively inexpensive and are a one-time cost that could be paid back with the savings from retrieved hooks from one or two trips.

Response: NOAA Fisheries agrees that costs associated with purchasing release equipment are minimal and that retrieval of fishing gear will reduce some of the costs associated with replacement of lost gear.

Comment 15: If HMS fishermen properly use release equipment, they would have the ability to call their target species "sea turtle friendly" at the marketplace. This would allow for a market edge for US-caught fish over imports.

Response: NOAA Fisheries agrees that economic costs associated with purchase of release equipment could be minimized if consumers perceive the shark fishery as conservation minded and correspondingly begin to support the sale of shark products in the market place. Examples of eco-labeling programs, such as those supported by the Marine Stewardship Council, illustrate this effect.

Comment 16: Private sector gear technologists, NGOs, educational grants, and other interested parties may be willing to help pay for educational workshops. Trainers could donate their time. Fishermen and anglers could absorb the costs of travel and time and contribute assistance in funding if necessary.

Response: NOAA Fisheries will pursue the requirement of mandatory workshops during a future rulemaking and intends to fully investigate these funding options at that time.

Comment 17: NOAA Fisheries is proposing a number of measures that may change the allocation methodology of potential future quotas and cause expensive and unnecessary negative impacts to the current commercial shark fleet. NOAA Fisheries should be patient with the shark fishing community and minimize the potential for socioeconomic impacts until further efforts to stabilize the fleet through better analysis, sufficient quotas, buyback program, etc., become more progressed. NOAA Fisheries should not be in a hurry to put fishermen out of business.

Response: The 2002 stock assessment for LCS documents that the complex is overfished and that overfishing is occurring. Under the Magnuson-Stevens Act, NOAA Fisheries must take action to prevent overfishing and rebuild overfished stocks. However, to the extent practicable, NOAA Fisheries is delaying implementation of certain measures such as VMS and the time/area

closure to give fishermen time to adjust and will implement relief restrictions such as the quota and commercial minimum size immediately. This delay in implementation is aimed at minimizing some of the economic impacts associated with VMS and the time/area closure.

Comment 18: NOAA Fisheries should consider some type of individual quota evolved from the current directed shark limited access permit holders. These quotas could reduce derby effects and seasonal market gluts.

Response: NOAA Fisheries agrees that ITQs may be a viable alternative to address those issues and may investigate those types of alternatives further in a future rulemaking.

Comment 19: NOAA Fisheries should consider restricting imports of shark products to help boost the domestic market.

Response: The Magnuson-Stevens Act authorizes use of import prohibitions under certain circumstances, most notably where another country is not complying with an applicable international fishery agreement. To date, no such agreement has been reached with regard to Atlantic sharks. As such, NOAA Fisheries cannot impose importation restrictions on other countries. However, NOAA Fisheries is supportive of continuing dialogues with international fishery management organizations such as ICCAT, FAO, and others as appropriate for developing international fishery agreements aimed at shark management.

Comment 20: The Sever Acute Respiratory Syndrome (SARS) epidemic has hurt fin prices.

Response: NOAA Fisheries is unaware of any link between the SARS epidemic and a decline in shark fin prices. However, NOAA Fisheries is aware of a dramatic increase (i.e., twice as much) in average shark fin prices between calendar years 2000 and 2001.

Comment 21: NOAA Fisheries shark management has been both an ecological disaster and a knife in the back of recreational shark fishermen. While NOAA Fisheries spends millions of taxpayer's money to buy out commercial fishermen who destroyed the stocks with overfishing, there is no offer to compensate those in the recreational fishing business who have been bankrupted by NOAA Fisheries policies.

Response: There are a variety of Federal programs, which provide economic relief to fishermen and other businesses affected by fishery management measures. A summary of these programs can be found in Chapter 8 of the FEIS. As such, NOAA Fisheries believes that equal opportunities are given to all members of the affected environment, where fishing regulations and economic relief are concerned.

A5.9 General

Comment 1: The EPA stated that in some cases it is unclear how the No Action alternative is

assessed for impacts and recommended that NOAA Fisheries substantiate claims of no impact. As an example, EPA refers back to the statement on page 4-10 of the draft environmental impact statement that semi-annual seasons would not have any ecological impacts because the fishery had been managed that way since 1993. EPA believes that the impacts of a continued course of action, such as continuing a semi-annual season, may have caused the fishery to decline to an unsustainable level.

Response: Based on this comment, NOAA Fisheries has tried to improve, in the final environmental impact statement, the description of No Action alternatives and the assessment of any impacts of continuing a particular course of action. In the case of the specific example cited by EPA, NOAA Fisheries does not agree that semi-annual seasons have caused the fishery to become overfished. Semi-annual seasons can have some ecological impacts if they extend into pupping seasons; however, it is unlikely that providing fishermen two fishing seasons caused the decline of the stock. Rather, it is likely that the overall level of fishing mortality, combined with environmental factors, led to the decline of the stock.

Comment 2: The EPA states that it would be useful for a baseline comparison if NOAA Fisheries could explain why a No Fishing alternative would be reasonable or unreasonable.

Response: In the case of Atlantic sharks, NOAA Fisheries does not believe that a No Fishing alternative is reasonable nor would such an alternative be consistent with the Magnuson-Stevens Act. The latest stock assessments indicate that the SCS complex is not overfished and overfishing is not occurring and that while the LCS complex is overfished, the two primary LCS species are not. Given the status of the SCS complex, there is no reason why NOAA Fisheries would consider a No Fishing alternative. For the LCS complex, alternatives are available that would allow fishing to continue while still allowing the stock to rebuild. As described in Chapters 1 and 4 in the Amendment, NOAA Fisheries feels a No Fishing alternative is not consistent with the Magnuson-Stevens Act in that it would not minimize social and economic impacts, to the extent practicable, nor would it be based on the best available science.

Comment 3: EPA notes that summary tables that provide clear and relevant background information and recommends including a glossary of terms, a list of acronyms, and other visual diagrams such as pie charts.

Response: In the final environmental impact statement, NOAA Fisheries has included a list of acronyms and several more diagrams and figures. Many of the tables presented in Amendment 1 come straight from the stock assessments or other supporting documents, and NOAA Fisheries feels it would be best to rely on the information as it was first presented rather than to convert it to an unfamiliar format. Regarding a glossary of terms, NOAA Fisheries did not include a glossary but did try to ensure that any fishing-related terms, such as maximum sustainable yield, are defined in context throughout the text.

Comment 4: EPA comments that NOAA Fisheries should clarify the effects of other fisheries on

the stocks of sharks and clearly connect relevant information throughout the document. As an example, EPA refers to a quote regarding the amount of commercial landings of SCS compared to bycatch (page 3-13 of DEIS) and compares this quote to other quotes regarding the amount of LCS bycatch in the menhaden fishery (page 3-75 of DEIS). Another example given by EPA is the need to clarify and expand upon the discussion of collection of sharks for public display.

Response: NOAA Fisheries has tried to clarify and connect relevant information throughout the final environmental impact statement in order to provide a context for any related analyses. Regarding the specific example given by EPA, NOAA Fisheries notes that the SCS and LCS fisheries are two different fisheries with different species of sharks and that bycatch of SCS is not necessarily related to bycatch of LCS. For example, while the menhaden fishery catch both SCS and LCS, 97 percent of the catch of sharks are LCS and only 3 percent are SCS. Regarding the example of public display, NOAA Fisheries has added details regarding the number of sharks taken for public display each year and the impact on the stocks.

Comment 5: EPA comments that NOAA Fisheries should clarify the impact of other fishery practices on sharks. If sharks are being significantly diminished by other fishery practices, the FEIS should contain a short discussion of what other FMPs are doing to minimize impacts on sharks and provide a webpage link to that other FMP.

Response: NOAA Fisheries agrees that knowledge regarding the relationship between shark catches in other fisheries and their impact on shark stocks needs to be examined and improved. For several years, NOAA Fisheries has been working on including this type of information in the stock assessments. For example, the 1998 LCS stock assessment included Mexican catches for the first time and the 2002 LCS stock assessment expanded upon the Mexican catches and included information regarding shark bycatch in the menhaden fishery. However, while the total number of sharks taken as bycatch in other fisheries might be large, most fishery managers consider the bycatch in individual fisheries under their purview to be a low priority, particularly compared to the target catch and bycatch of other managed or protected species. Thus, many FMPs do not analyze in detail the impacts of the specific target fisheries on sharks. However, NOAA Fisheries is in the process of developing and implementing a National Bycatch Strategy. Several of the draft implementation plans for other fisheries outline recommendations for improving monitoring of bycatch in these fisheries. The final bycatch implementation plans should be available to the public by the end of 2003. As information on shark bycatch in these fisheries becomes available, it will be incorporated in future stock assessments.

Comment 6: Draft Amendment 1 was too large. The document needs to be condensed to be easily understood.

Response: While the legal requirements dictate the content of fishery management plans and plan amendments, the analyses that are required, and the need to respond to public comments, NOAA Fisheries has provided an executive summary in the final Amendment. NOAA Fisheries will also be providing an updated one-page chart in the executive summary that outlines the all the

regulations and highlights major changes from the draft Amendment. NOAA Fisheries has also tried to provide summary and explanatory tables and figures throughout the document. Per the Regulatory Flexibility Act, NOAA Fisheries will also be providing a small entity compliance guide for the final rule. Additionally, NOAA Fisheries will be updating and revising the current recreational and commercial brochures based on the changes to the regulations.

Comment 7: NOAA Fisheries should accept comments via email.

Response: NOAA Fisheries is working towards a system that would allow the public to submit comments electronically over the web. In 2001, NOAA Fisheries issued the first "e-comment" pilot program for a proposed rule regarding issues in HMS charter/headboat fisheries. Based on the results from this pilot, NOAA Fisheries made a number of improvements and continues to test the program on other rules and fisheries in order to ensure that the final e-comment program is user-friendly and provides an adequate method of providing comments. A link to regulations that are accepting comments via the web can be found off the main NOAA Fisheries webpage at: http://www.nmfs.noaa.gov.

Comment 8: NOAA Fisheries received a range of comments on the rule and Amendment as a whole. Comments included: NOAA Fisheries should be commended for adhering to the scientific recommendations from recent stock assessments and proposing conservation measures that have a reasonable chance to protect all shark species. This proposed rule is an encouraging step forward in the long process of rebuilding; management is on the correct path to rebuilding and sustaining this fishery. The continued communication and cooperation between various stakeholders and the inclusion of interested parties and user groups from the inception of the process has helped to ensure the success of these management measures. NOAA Fisheries has proposed a rule that walks down the middle to allow for a viable commercial fishery while protecting the most vulnerable species; all the alternatives are linked to account for the 50-percent reduction that is needed. The proposed measures will not be enough catalyst to regain a healthy population across the whole spectrum of the shark species; the "collective impact of humanity" on the total population has to be addressed as well as the simplistic concept of the population being overfished. The stock assessments show that the current system is working; NOAA Fisheries should leave well enough alone.

Response: NOAA Fisheries agrees that implementation of the management measures in this document will be a step forward towards rebuilding and that the management measures are a result of the participation and cooperation of various stakeholders and user groups. NOAA Fisheries believes that the management measures in this document, consistent with the Magnuson-Stevens Act, are based on the best available science, will rebuild the LCS complex, prevent overfishing of Atlantic sharks, provide for commercial and recreational fisheries, and will clarify other shark-related management measures. Without these management measures, some management measures that are not based on the best available science, such as the 1999 commercial quotas, will go in place, contrary to the Magnuson-Stevens Act. NOAA Fisheries will continue to work with stakeholders on issues not addressed in this rulemaking during a

future rulemaking process.

Comment 9: NOAA Fisheries received a range of comments regarding who is influencing agency decisions. One commenter noted that NOAA Fisheries settled with the commercial fishing industry but is fighting the environmental groups tooth and nail in order to protect commercial fish profits. Another commenter was concerned that NOAA Fisheries is being overly influenced by environmentalists.

Response: Environmental groups, recreational fishermen, and commercial fishermen all had the chance to participate in the process and submit comments on the scoping documents and the Draft Amendment 1 and proposed rule. While NOAA Fisheries considers these comments in selecting the alternatives, the agency follows the mandates of the Magnuson-Stevens Act and other domestic law when finalizing actions, not the mandates of any particular stakeholder.

Comment 10: The purpose of the regulations should be to reduce the number of shark deaths. All other purposes are secondary.

Response: The Magnuson-Stevens Act and other domestic laws such as the Regulatory Flexibility Act requires NOAA Fisheries to consider not only the status of the stocks but also any social and economic impacts on fishermen and communities and any impacts on other species such as protected species or other fisheries.

Comment 11: While state waters are outside of NOAA Fisheries' jurisdiction, ensuring rebuilding of overfished sharks is not. NOAA Fisheries must develop a strategy for working with states and state commissions to implement cooperative shark management in nearshore waters.

Response: NOAA Fisheries will continue to work with states and the Fishery Management Councils with a goal of consistent management in mind. At the time of finalization of the HMS FMP, several states indicated their intent to develop more consistent regulations but decided to postpone their efforts due to the unstable legal environment for Federal shark management. Upon completion of this Amendment and during the scoping processes for future rulemakings, NOAA Fisheries hopes to work with those and other states, possibly through the implementation of Memorandum of Understandings, to ensure that, at the minimum, NOAA Fisheries can have access to all state shark landings and catches from all fisheries for use in future stock assessments.

Comment 12: NOAA Fisheries must reduce bycatch and mortality of sharks in both directed and non-directed fisheries; establish a standardized bycatch reporting methodology; account for all sources of mortality when determining shark quotas and closures; and allocate levels of observer coverage that are adequate to provide statistically significant estimates of catch and bycatch.

Response: NOAA Fisheries is in the process of developing a National Bycatch Strategy which

contains the Agency's national bycatch goal, "to implement conservation and management measures for living marine resources that will minimize, to the extent practicable, bycatch and the mortality of bycatch that cannot be avoided." As part of this effort, NOAA Fisheries' HMS Management Division is developing a Bycatch Implementation Plan to improve upon and possibly expand current bycatch reduction efforts in HMS fisheries, which includes shark fisheries, under this guidance. Sources of shark mortality other than the directed fishery landings are included as part of the stock assessments from which the quotas were developed. Levels of observer coverage are generally set at five percent of the total effort in each fishery unless there is a concern that more coverage would be beneficial. Such is the case for the shark gillnet fishery where 100 percent observer coverage is required during the right whale calving season.

Comment 13: NOAA Fisheries should identify and quantify the potential impacts of any HMS fisheries on seabirds so that appropriate protocols can be developed to alleviate potential chronic mortalities associated with the fishery or gear. This will be especially important in future actions associated with pelagic sharks and other components with the HMS FMP.

Response: NOAA Fisheries agrees that the potential impacts to seabird populations should continue to be monitored and where appropriate, protocols developed to alleviate bycatch problems. NOAA Fisheries notes that relatively few seabird interactions have been identified in shark fisheries addressed by Amendment 1. If a potential problem is identified with the pelagic longline fishery this can be addressed in a future rulemaking.

Comment 14: Draft documents need to ensure that detailed effort data is incorporated into the text and tables, especially regarding the bycatch of sea turtles, marine mammals, and sea birds. For example, draft Amendment 1 does not properly quantify the level of observer effort involved in documenting seabird bycatch in the Atlantic pelagic longline fishery (Table 3.38). Therefore, the conclusion that seabird interactions are relatively low holds little merit.

Response: NOAA Fisheries agrees that detailed effort data regarding observer programs is important to understanding the level of interaction with various bycatch species. The Final Amendment 1 provides an overview of the types of seabird interactions in the shark fishery. The conclusion regarding the level of seabird interactions in Amendment 1 is based on the take of a single seabird in nine years of observer data from the shark bottom longline fishery.

Comment 15: NOAA Fisheries should increase boat and catch monitoring efforts.

Response: NOAA Fisheries already requires 100 percent observer coverage for shark gillnet vessels operating during the right whale calving season and approximately 50 percent outside of the calving season. Observer coverage in the shark bottom longline fishery is targeted as five percent while pelagic longline vessels operating in the NED experimental area are required to carry an observer at all times. A target of five percent observer coverage for pelagic longline vessels fishing outside of the NED is in place. Additional resources would need to be identified in order to increase observer coverage.

Comment 16: I need time to prepare for other fisheries and hire crew between notice of the final rule and implementation.

Response: NOAA Fisheries is aware that for a number of regulations, such as implementation of the time/area closure and VMS requirement, fishermen will require time to adjust and prepare for any changes. In those cases, NOAA Fisheries will give sufficient time to adjust. However, in some cases, such as the commercial quota or the commercial minimum size, any delay in implementation would allow more restrictive management measures to go into place. Thus, commercial quotas, elimination of the commercial minimum size, and certain other measures will be effective at the start of the 2004 fishing year. NOAA Fisheries is providing the approximate dates of effectiveness for the requirements in the Executive Summary of Amendment 1.

Comment 17: Are you leaving the 4,000 lb LCS trip limit alone? NOAA Fisheries should consider some type of trip limit tolerance because the trip limit is not working well now that sandbar and blacktip sharks are not overfished.

Response: This Amendment and its rule will not change the 4,000 lb LCS directed trip limit. In the Issues and Options paper released during the public scoping phase of this Amendment, NOAA Fisheries indicated that changing the 4,000 lb LCS directed trip limit could be one of the management measures addressed in this Amendment. However, given the possible changes in this Amendment, NOAA Fisheries felt some of the items in the Issues and Options paper, including the 4,000 lb LCS trip limit were beyond the scope of this rulemaking. NOAA Fisheries may consider those issues in a future rule.

Comment 18: NOAA Fisheries should allow fishermen to fish until the quota is caught instead of scheduling closure dates. I am afraid that if we have a couple of years where we do not catch the quota because of weather, that the quota will be taken away from us. NOAA Fisheries should monitor landings and allow the season to remain open until the quota is filled.

Response: Before the HMS FMP, NOAA Fisheries monitored the landings and gave five days notice before closing the fishery. This technique led to the quota being exceeded, derby fishing, and to unreliable markets because no one knew when the fishery would be closing. Additionally, NOAA Fisheries knows of some dealers and fishermen that would delay sending in their reports in an effort to keep the fishery open longer. To address these concerns, in the HMS FMP, NOAA Fisheries decided to announce, based on previous catch rates, the closing date of the fishery before the fishery opened. Additionally, any over- or underharvest would come off of or be added to the same season's quota of the following year (e.g., first semi-annual season to first semi-annual season). This technique appears to be working (e.g., fewer seasonal quotas have been exceeded and fishing seasons have lengthened) and during scoping few fishermen wanted to change the current system. With the transition to trimester and regional quotas, there may be some adjustment needed in terms of calculating catch rates and estimating the length of the seasons in each region, however, NOAA Fisheries does not intend to "take quota away" because

of underharvests. In the future, NOAA Fisheries might adjust the percent of quota available in each fishing season (e.g., if one season is always exceeded while another season always has quota left, some of the quota may be moved to the first season from the second) or might adjust the percent of quota available to each region (e.g., if one region always exceeds its quota while another region does not land its full portion, some of the quota from the second region might be transferred to the first region). However, any such adjustment would require a rulemaking and would not change the overall total quota available.

Comment 19: NOAA Fisheries should be relying on an observer report from 1994 through 2002, not a report from recent years.

Response: NOAA Fisheries has requested such a report from the contractor who manages the observer program. However, until such a report is available, NOAA Fisheries must use the best available science which includes several observer reports that cover only one or two years each.

Comment 20: NOAA Fisheries should re-examine the five percent fin ratio rule. The legal percentage does not work accurately unless the sandbar shark catch is blended down by other LCS with smaller fins.

Response: NOAA Fisheries first implemented the five percent fin ratio in the 1993 Shark FMP. This ratio was based on research that indicated that the average ratio of fin weight (including first dorsal, pectorals, and lower caudal fins) to dressed weight of the carcass was 3.6 percent and the sandbar fin ratio was 5.1 percent. Observer data indicate that, except for a couple of years, the fin ratio for all observed sharks has been under five percent. In December 2000, the Shark Finning Prohibition Act was signed. This Act, which implements the five percent finning ratio for all shark fisheries in the United States, was fully implemented through a final rule released in February 2002. Thus, any changes to the five percent fin ratio would have to be the result of Congress modifying the Shark Finning Prohibition Act.

Comment 21: Because porbeagle sharks are often caught while pursuing cod, mackerel, and other New England finfish, northeast groundfish commercial fishermen should be allowed to keep one porbeagle shark per day per trip without a commercial shark fishing permit.

Response: Since 1993, fishermen who have caught and sold sharks in Federal waters have been required to have a Federal shark permit. In 1999, NOAA Fisheries implemented a limited access program for the Atlantic shark fisheries. Under this program, any fisherman who had a Federal shark permit and reported landing a limited number of sharks could qualify for either a directed or incidental Federal shark limited access permit. This program was implemented to reduce latent effort in the shark fishery and reduce overcapitalization in order to rebuild the LCS complex and prevent overfishing on other shark species. From past experience, NOAA Fisheries knows that porbeagle sharks are highly susceptible to overfishing. Until a stock assessment on porbeagle sharks indicates that the porbeagle shark is not overfished and is not experiencing overfishing, NOAA Fisheries does not want to re-open that sector of the shark fishery. However,

those fishermen wishing to land porbeagle sharks can either obtain a commercial permit from someone leaving the fishery or obtain a recreational permit. Any porbeagle sharks that are landed would have to be caught with an authorized gear type.

Comment 22: NOAA Fisheries should report weight in pounds not metric tons because commercial fishermen sell fish by the pound.

Response: In the future, NOAA Fisheries will report weight in pounds and metric tons on reports that are transmitted to fishermen or will provide the conversion factor to allow fishermen to convert numbers in metric tons to pounds.

Comment 23: NOAA Fisheries has not done one iota to protect mako sharks except limit recreational fishermen. While the proposed rule does have some positive proposals that limit commercial fishing, conservation of the most important recreational sharks left, pelagic sharks, continues to be ignored.

Response: NOAA Fisheries is not ignoring pelagic sharks. Rather, NOAA Fisheries is working with ICCAT to collect data in order to conduct an international stock assessment of pelagic sharks. Because pelagic sharks traverse the Atlantic Ocean, NOAA Fisheries is not able to conduct an accurate stock assessment without data from other countries. The international stock assessment is expected to occur in 2004. Once the international stock assessment is complete, NOAA Fisheries will consider the results and will modify the management measures for pelagic sharks, as appropriate.

Comment 24: NOAA Fisheries should consider converting directed shark permits that have been inactive since July 1999 to incidental permits. This could help reduce latent effort from becoming active during the rebuilding period.

Response: NOAA Fisheries is considering several options to could lead to changes in the current limited access program in a future rule. NOAA Fisheries will consider comments such as this one at that time.

Comment 25: The number of shark permits should be reduced to 10.

Response: In 1999, NOAA Fisheries implemented a limited access program in the commercial shark fishery to reduce latent effort and capitalization in the fishery. This program established two types of commercial shark permits: directed and incidental. The directed permits allow fishermen to target sharks while the incidental permits were designed to allow fishermen who target other species to land a limited number of sharks, thus reducing regulatory discards. At this time, NOAA Fisheries recently approved a Saltonstall-Kennedy Grant to researchers who are examining the feasibility of a buyout program for commercial shark fishermen. Additionally, NOAA Fisheries will consider other options, such as conversion of directed to incidental permits or individual transferable quotas, to revise and refine the current limited access program in a

future rule.

Comment 26: Enforcement personnel should be hired and trained to catch fishermen who illegally take and kill any fish species. The budget for enforcement is too small and should be increased by 800 percent.

Response: Enforcement personnel are trained to catch fishermen who illegally take and kill any fish species. If their budget were increased, more enforcement personnel could be hired and additional resources could be obtained that would allow them to more effectively enforce the regulations throughout their jurisdiction in the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea.

Comment 27: The more information NOAA Fisheries has, the more money fishermen lose.

Response: While it sometimes feels as though the more information fishermen report, the more regulations are placed on them, this is not always the case. For example, in the 1999 HMS FMP, NOAA Fisheries finalized commercial shark quotas that are much lower than those quotas selected in Amendment 1. However, based on additional information and new analyses, the latest stock assessment indicates that two species of LCS are no longer overfished. Thus, NOAA Fisheries is able to select the slightly higher quotas in Amendment 1 than those finalized in 1999. Ideally, as the status of LCS improves, the commercial quota should be able to increase. However, without data from the fishermen, NOAA Fisheries will not know if the status is improving and therefore would not be able to increase the quota. Indeed, with less data, NOAA Fisheries may decided that the best, most risk-averse, course of action would be to lower the quotas.

Comment 29: NOAA Fisheries should integrate the Large Pelagic Survey (LPS) within the Marine Recreational Fisheries Statistics Survey (MRFSS) in order to expand and improve the acquisition of recreational landings data for sharks and other HMS.

Response: NOAA Fisheries continues to explore improvements to the design of the LPS and has implemented some of these for the 2003 fishing year. The biggest change was integrating the charterboat and headboat sectors of the LPS and MRFSS into a single For-Hire Survey for the Atlantic Coast. A separate For-Hire Survey was implemented in 2001 for the Gulf of Mexico. Both of these efforts should provide improved estimates of recreational catch and landings of HMS as well as non-HMS. Evaluation of other modifications already implemented for the LPS are ongoing and may lead to additional changes to survey design and estimation procedures.

Comment 31: NOAA Fisheries received several comments regarding where public hearings should have been held because there are a lot of fishermen who could be affected by the proposed regulations. These areas included New Jersey, Virginia, and Fort Pierce, Florida. NOAA Fisheries also heard that Montauk, New York should not have had a public hearing because there are no fishermen in the area and it is too far to drive.

Response: NOAA Fisheries tries to schedule a number of public hearings along the Atlantic and Gulf of Mexico coasts in areas where there are a number of fishermen but understands that some areas with many fishermen will likely be unintentionally missed. For Amendment 1, NOAA Fisheries tried to coordinate public hearings with Fishery Management Council meetings in order to reduce travel for stakeholders who were interested in attending both meetings. In other cases, NOAA Fisheries scheduled hearings at areas where attendance at previous hearings has been large. People who are unable to attend a public hearing are always welcome to submit written comments or to call NOAA Fisheries and speak to someone directly. Comments provided over the phone during the comment period are considered part of the public record.

Comment 32: NOAA Fisheries needs to mail fishermen information about public hearings to notify permit holders. While we were mailed information about the hearings for the proposed rule, we did not hear about the scoping meetings.

Response: NOAA Fisheries announces its intentions in a variety of methods including automated infolines, the HMS Fax network, the HMS web page, the weekly electronic newsletter FishNews, and through mailings. Because some permit holders have told NOAA Fisheries that they feel many of the mailings sent are equivalent to junk mail, in this case NOAA Fisheries limited the mailing to information regarding the actual proposed rule and not the scoping meetings. However, for both the scoping and proposed rules, NOAA Fisheries used all other methods to announce relevant information. If you would like to be included on any of these automatic distributions (e.g., the HMS Fax network or FishNews) please call the HMS Management Division at (301) 713-2347 or visit the NOAA Fisheries home page at http://www.nmfs.noaa.gov for more information.