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3.0 DESCRIPTION OF AFFECTED ENVIRONMENT

This chapter serves several purposes. It describes the affected environment (the fishery, the gears used, the communities involved, *etc*.), and provides a view of the current condition of the fishery, which serves as a baseline against which to compare impacts of the different alternatives. This chapter also provides a summary of information concerning the biological status of shark stocks; the marine ecosystems in the fishery management unit; the social and economic condition of the fishing interests, fishing communities, and fish processing industries; and, the best available scientific information concerning the past, present, and possible future condition of shark stocks, ecosystems, and fisheries.

3.1 Introduction to Highly Migratory Species Management and Highly Migratory Species Fisheries

Atlantic HMS fisheries are managed directly by the Secretary of Commerce, who designated that responsibility to the NMFS. The HMS Management Division within NMFS is the lead in developing regulations for HMS fisheries, although some actions (*e.g.*, Large Whale Take Reduction Plan) are taken by other NMFS offices if the main legislation (*e.g.*, Marine Mammal Protection Act) driving the action is not the Magnuson-Stevens Act or Atlantic Tunas Convention Act (ATCA). Because of their migratory nature, HMS fisheries require management at the international, national, and state levels. NMFS manages HMS fisheries in federal waters (domestic) and the high seas (international) while individual states establish regulations for some HMS in their own waters. There are exceptions to this generalization. For example, federally-permitted commercial shark fishermen, as a condition of their permit, are required to follow federal regulations in all waters, including state water, unless the state has more restrictive regulations, in which case the state laws prevail. Additionally, in 2005, the Atlantic States Marine Fisheries Commission (ASMFC) agreed to develop an interstate coastal shark FMP. This interstate FMP coordinates management measures among all states along the Atlantic coast (Florida to Maine). NMFS participated in the development of this interstate shark FMP, which was effective in 2009.

Generally, on the domestic level, NMFS implements relevant international agreements and management measures that are required under domestic laws such as the Magnuson-Stevens Act. While NMFS does not generally manage HMS fisheries in state waters, states are invited to send representatives to Advisory Panel (AP) meetings and to participate in stock assessments, public hearings, or other fora. NMFS is working to improve its communication and coordination with state agencies. In 2006, NMFS reviewed the shark regulations of several states and has asked for some states to consider changing their regulations to become more consistent with federal regulations. This request resulted in changes and dialogues with certain states regarding the regulations such as the Commonwealth of Virginia and the State of Florida. Additionally, as a result of ASMFC's decision to develop an interstate FMP, the State of Maine opened a dialogue with NMFS regarding shark regulations. NMFS would share this draft FMP amendment with the states and will work with states, to the extent practicable, to ensure complementary regulations. Please see Section 3.1.4 for more information regarding regulations by state.

On the international level, NMFS participates in the stock assessments conducted by the International Commission for the Conservation of Atlantic Tunas' (ICCAT) Standing Committee on Research and Statistics (SCRS) and in the annual ICCAT meetings. In regard to sharks, ICCAT assesses two pelagic sharks only: the Atlantic blue and the shortfin mako. Stock assessments and management recommendations or resolutions are listed on ICCAT's website at http://www.iccat.es/. ATCA authorizes NMFS to promulgate regulations as may be "necessary and appropriate" to carry out ICCAT recommendations. NMFS also actively participates in other international bodies that could affect U.S. shark fishermen and the shark industry including Convention on International Trade in Endangered Species (CITES) and the Food and Agriculture Organization (FAO). More information on the current status of shark stocks and the dates of the next ICCAT stock assessments are provided in Section 3.2.

3.1.1 History of Domestic Shark Management

Sharks are managed along with other HMS species. Thus, management of the shark fishery is presented in FMPs along with Atlantic billfish, Atlantic tunas, and Atlantic swordfish. This section gives a relatively brief history of shark management of Atlantic sharks. This history is organized by previous FMPs. For more detail regarding the history of management and of other HMS species besides sharks, please see the original documents. Proposed rule, final rules, and other official notices can be found in the Federal Register at http://www.gpoaccess.gov/fr/index.html. Supporting documents can be found on the HMS Management Division's webpage at http://www.nmfs.noaa.gov/sfa/hms. Documents can also be requested by calling the HMS Management Division at (301) 713-2347.

3.1.1.1 Pre-1999 Atlantic Shark Fisheries and Management

Recreational fishing for Atlantic sharks occurs in federal and state waters from New England to the Gulf of Mexico and Caribbean Sea. 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 the marine environment, with even large specimens available in the nearshore areas. Typically, most recreational shark fishing takes place on small to medium-size vessels. Some species such as mako, white, 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 many active shore-based fishermen as well.

In the early 1900s, 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 that time, shark fishing gear included gillnets, hook and line, anchored bottom longlines (BLL), 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).

The U.S. Atlantic shark fishery developed rapidly in the late 1970s due to increased demand for shark 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 conduct some directed fishing. The Secretary of Commerce published the Preliminary Fishery Management Plan for Atlantic Billfish and Sharks in 1978, which noted, among other things, the need for international management regarding sharks. Catches accelerated through the 1980s, with peak commercial landings of large coastal and pelagic sharks reported in 1989.

In 1989, the five Atlantic Fishery Management Councils asked the Secretary of Commerce to develop a Shark 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 NMFS, implemented the FMP for Sharks of the Atlantic Ocean (1993 Shark FMP). At that time, NMFS identified large coastal sharks (LCS) as overfished and pelagic and SCS as fully fished. The quotas were 2,436 mt dressed weight (dw) for LCS and 580 mt dw for pelagic sharks. No quota was established for the SCS complex to limit SCS fishing. Under the rebuilding plan established in the 1993 FMP, the LCS quota was expected to increase every year from 1993 to 1995 up to 3,787 mt dw, which was the maximum sustainable yield estimated in the 1992 stock assessment.

A number of difficulties arose in the initial year of implementation of the 1993 Shark FMP that resulted in a short season and low ex-vessel prices. To address these problems, a commercial trip limit of 4,000 lb dw 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 implementing additional measures authorized by the FMP published on October 18, 1994 (59 FR 52453).

In 1994, under the rebuilding plan implemented in the 1993 Shark FMP, the LCS quota was increased to 2,570 mt dw. However, a new stock assessment was completed in March 1994 that indicated LCS rebuilding could take as long as 30 years and suggested a more cautious approach for pelagic sharks and SCS. A final rule that capped quotas for LCS and pelagic sharks at the 1994 levels was published on May 2, 1995 (60 FR 21468).

In June 1996, NMFS 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 [the] effective fishing mortality rate of 50 [percent] or more." In response to these results, in 1997, NMFS 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 (*Rhizoprinodon terraenovae*) per person per trip (62

FR 16648, April 2, 1997). In this same rule, NMFS established an annual commercial quota for SCS of 1,760 mt dw and prohibited possession of five species (sand tiger, bigeye sand tiger, whale, basking, and white sharks). As a result of litigation, NMFS prepared additional economic analyses on the 1997 LCS quotas and was allowed to maintain those quotas during resolution of the case.

In June 1998, NMFS held another LCS stock assessment. The 1998 stock assessment found that LCS were overfished and would not rebuild under the 1997 harvest levels. Based in part on the results of the 1998 stock assessment, in April 1999, NMFS published the 1999 FMP, which included numerous measures to rebuild or prevent overfishing of Atlantic sharks in commercial and recreational fisheries. The 1999 FMP replaced the 1993 Atlantic Shark FMP. Management measures related to sharks that changed in the 1999 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 to 19 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). However, in July 1999, the District Court for the Middle District of Florida enjoined implementation of the 1999 shark regulations, because of ongoing litigation on the 1997 quotas. A year later, on June 12, 2000, the case was settled and the court issued an order clarifying that NMFS could proceed with implementation and enforcement of the 1999 prohibited species provisions (64 FR 29090, May 28, 1999).

In addition to shark regulations, the 1999 FMP incorporated all existing management measures for Atlantic tuna and north Atlantic swordfish that have been issued previously under the authority of ATCA. It also incorporated all existing management measures for North Atlantic swordfish and Atlantic sharks that had previously been issued under the authority of the Magnuson-Stevens Act. South Atlantic swordfish and South Atlantic albacore tuna continued to be managed only under ATCA.

Some of the non-species specific management measures of the 1999 FMP included vessel monitoring systems for all pelagic longline (PLL) vessels; gear and vessel marking requirements; moving PLL gear after an interaction with a protected species; a requirement for charter/headboats to obtain an annual vessel permit; tournament registration for all HMS tournaments; time limits on completing a vessel logbook; and expanded observer coverage. The 1999 FMP also established the threshold levels for biomass (B) and fishing mortality (F) to determine if a stock is overfished, if overfishing is occurring, or if the stock is rebuilt. Finally, the 1999 FMP identified essential fish habitat (EFH) for all Atlantic tunas, swordfish, and sharks. As part of the 1999 FMP, the regulations for all Atlantic HMS, including billfish, were consolidated into one part of the Code of Federal Regulations, 50 CFR Part 635.

3.1.1.2 1999 Fishery Management Plan for Atlantic Tunas, Swordfish, & Sharks

As described, the 1999 FMP replaced the existing Atlantic Shark and Atlantic Swordfish FMPs, and established the first FMP for Atlantic tunas. NMFS began working on the 1999 FMP shortly after the U.S. Congress reauthorized the Magnuson-Stevens Act in 1996. The 1996 Magnuson-Stevens Act amendments added new fishery management requirements including requiring NMFS to halt overfishing; rebuild overfished fisheries; minimize bycatch and bycatch mortality, to the extent practicable; and identify and protect essential fish habitat (EFH). These provisions were coupled with the recognition that the management of HMS requires international cooperation and that rebuilding programs must reflect traditional participation in the fisheries by U.S. fishermen, relative to foreign fleets.

Development of the 1999 FMP began in September 1997 with the formation of the HMS AP. The HMS AP was established under a requirement of the Magnuson-Stevens Act, and is composed of representatives of the commercial and recreational fishing communities, conservation and academic organizations, the five regional Fishery Management Councils involved in Atlantic HMS management, the Atlantic and Gulf coastal states, and the U.S. ICCAT Advisory Committee. The HMS AP met seven times during development of the 1999 FMP, including once during the public comment period on the draft FMP, and provided extensive comment and advice to NMFS.

In October 1997, NMFS prepared and distributed a scoping document to serve as the starting point for consideration of issues for the 1999 FMP. The scoping document described major issues in the fishery, legal requirements for management, and potential management measures that could be considered for adoption in the FMP and solicited public comment on these issues. The scoping document was the subject of 21 public hearings that were held in October and November 1997 throughout the management area. The scoping meetings allowed NMFS to gather information from participants in the fisheries, and provided a mechanism by which the public could provide input to NMFS early in the FMP development process.

In October 1998, NMFS announced in the Federal Register the availability of the draft FMP. The comment period on the draft FMP lasted from October 25, 1998, to March 12, 1999. The proposed rule that accompanied the draft FMP was published in the Federal Register on January 20, 1999. The supplemental part that related to the bluefin tuna rebuilding program published in the Federal Register on February 25, 1999. The comment period on the proposed rule and its supplement also went until March 12, 1999. Subsequent to the release of the

proposed rule, NMFS held 27 public hearings in communities from Texas to Maine and the Caribbean. During the comment period, NMFS received several thousand comments from commercial and recreational fishermen, scientists, conservationists, and concerned individuals. An HMS AP meeting was held toward the end of the comment period to allow HMS AP members to view most of the comments NMFS had received on the draft FMP and accompanying proposed rule.

The 1999 FMP incorporated all existing management measures for Atlantic tuna and north Atlantic swordfish that have been issued previously under the authority of the ATCA. It also incorporated all existing management measures for north Atlantic swordfish and Atlantic sharks that had previously been issued under the authority of the Magnuson-Stevens Act. Southern Atlantic swordfish and southern Atlantic albacore tuna continue to be managed only under ATCA. In November 2004 and 2006, ICCAT adopted recommendations for Atlantic sharks.

3.1.1.3 Post 1999 FMP

After issuance of the 1999 FMP, a number of constituents (environmental, commercial fishermen, and recreational fishermen) sued the NMFS (the Agency) over aspects of the plan, including the BFT rebuilding program, the use of vessel monitoring systems in the PLL fleet, the time/area closure for the PLL fleet, the pelagic shark quotas, the shark and yellowfin tuna recreational retention limits, the large and SCS quotas, and the bluefin tuna purse seine allocation. The Agency received favorable court rulings, upholding its actions, in most of these cases, and resolved some matters via settlement agreements. All of the briefings and court orders are a matter of the public record.

3.1.1.4 Amendment 1 to the 1999 Fishery Management Plan for Atlantic Tunas, Swordfish, and Sharks

As noted under Section 3.1.1.1, in 1999, a court enjoined the Agency from implementing many of the shark-specific regulations in the 1999 FMP. In 2000, the injunction was lifted when a settlement agreement was entered to resolve the 1997 and 1999 lawsuits. The settlement agreement required, among other things, an independent (*i.e.*, non-NMFS) review of the 1998 LCS stock assessment. 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 1999 FMP were implemented (66 FR 55). Additionally, on March 6, 2001, NMFS 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.

In late 2001, the Agency received the results of the peer review of the 1998 LCS stock assessment. These peer reviews found that the 1998 LCS stock assessment was not the best available science for LCS. Taking into consideration the settlement agreement, the results of the peer reviews of the 1998 LCS stock assessment, current catch rates, and the best available scientific information (not including the 1998 stock assessment projections), NMFS 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, NMFS 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.

On May 8, 2002, NMFS announced the availability of a SCS stock assessment (67 FR 30879) (Cortés, 2002). The Mote Marine Laboratory and the University of Florida provided NMFS with another SCS assessment in August 2002. Both of these stock assessments indicate that overfishing was occurring on finetooth sharks while the three other species in the SCS complex (Atlantic sharpnose, bonnethead, and blacknose) were not overfished and overfishing was not occurring. On October 17, 2002, NMFS announced the availability of the 2002 LCS stock assessment (Cortés *et al*., 2002) and the workshop meeting report (67 FR 64098). The results of this stock assessment indicate that the LCS complex was still overfished and overfishing was occurring. Additionally, the 2002 LCS stock assessment found that sandbar sharks were no longer overfished but that overfishing is still occurring and that blacktip sharks were rebuilt and overfishing was not occurring.

Based on the results of both the 2002 SCS and LCS stock assessments, NMFS 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 established in the 1999 FMP, 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.

In December 2003, NMFS implemented the regulations in Amendment 1 to the Fishery Management Plan for Atlantic Tunas, Swordfish, and Sharks (68 FR 74746) (NMFS, 2003a). These regulations were based on the 2002 SCS and LCS stock assessments. Some of the measures taken in Amendment 1 included revising the rebuilding timeframe for LCS; re-aggregating the LCS complex; establishing a method of changing the quota based on MSY; updating some shark EFH identifications; modifying the quotas, seasons, and regions; adjusting the recreational bag limit; establishing criteria to add or remove species to the prohibited shark list; establishing gear restrictions to reduce bycatch and bycatch mortality; establishing a time/area closure off North Carolina for BLL fishermen; and establishing vessel monitoring system (VMS) requirements for BLL and gillnet fishermen.

3.1.1.5 Other Post-1999 FMP Regulations for Sharks

Since the 1999 FMP, there have been a number of other shark regulatory actions in addition to the rules mentioned above. Below is a short list of some of these actions.

- National Plan of Action for the Conservation and Management of Sharks: On February 15, 2001, NMFS released the final National Plan of Action (NPOA) for the Conservation

and Management of Sharks (66 FR 10484). The NPOA was developed pursuant to the endorsement of the International Plan of Action (IPOA) by the United Nations' FAO Committee on Fisheries Ministerial Meeting in February 1999. The overall objective of the IPOA is to ensure conservation and management of sharks and their long-term sustainable use. The final NPOA, consistent with the Magnuson-Stevens Act, requires NMFS and the Regional Fishery Management Councils to undertake extensive data collection, analysis, and management measures in order to ensure the long-term sustainability of U.S. shark fisheries. The NPOA also encourages Interstate Marine Fisheries Commissions and State agencies to initiate or expand current data collection, analysis, and management measures and to implement regulations consistent with federal regulations, as needed. For additional information on the U.S. NPOA and its implementation, see http://www.nmfs.noaa.gov.

- Shark Finning Prohibition Act: On December 21, 2000, President Clinton signed the Shark Finning Prohibition Act into law (Public Law 106-557). This amended the Magnuson-Stevens Act to prohibit any person under U.S. jurisdiction from (i) engaging in the finning of sharks; (ii) possessing shark fins aboard a fishing vessel without the corresponding carcass; and (iii) landing shark fins without the corresponding carcass. NMFS published final regulations on February 11, 2002 (67 FR 6194). These regulations prohibit the finning of sharks, possession of sharks without the corresponding carcasses, and landings of shark carcasses without the corresponding carcasses in U.S. fisheries in the EEZ and on the high seas.

- Recreational permits and reporting requirements: On December 18, 2002 (67 FR 77434), NMFS published a final rule requiring all vessel owners fishing recreationally (*i.e.*, no sale) for Atlantic HMS, including billfish, to obtain an Atlantic HMS recreational angling category permit. On January 7, 2003 (68 FR 711), a final rule establishing a mandatory reporting system for all non-tournament recreational landings of Atlantic marlins, sailfish, and swordfish was published. These requirements became effective in March 2003.

Other regulatory actions that have been taken including the opening and closing of fisheries and adjustments to quota allocations. All of these actions are not listed here but can be found by searching the Federal Register webpage at http://www.gpoaccess.gov/fr/index.html or by reviewing the annual HMS Stock Assessment and Fishery Evaluation (SAFE) Reports (http://www.nmfs.noaa.gov/sfa/hms).

3.1.1.6 Consolidated HMS FMP and Beyond

As stated in the previous sections, NMFS issued two separate FMPs in April 1999 for the Atlantic HMS fisheries. The 1999 Fishery Management Plan for Atlantic Tunas, Swordfish, and Sharks, combined, amended, and replaced previous management plans for swordfish and sharks, and was the first FMP for tunas. Amendment 1 to the Billfish Management Plan updated and amended the 1988 Billfish FMP.

During the time that these two FMPs had co-existed, there had been a growing recognition by the Agency of the interrelated nature of these fisheries and the need to consolidate

management actions. In addition, the Agency had identified some adverse ramifications stemming from separation of the plans, including unnecessary administrative redundancy and complexity, loss of efficiency, and public confusion over the management process. Therefore, NMFS proposed to improve coordination of the conservation and management of the domestic fisheries for Atlantic swordfish, tunas, sharks and billfish by consolidating all HMS management measures into one FMP. In 2005, NMFS released the draft Consolidated HMS FMP. The final Consolidated HMS FMP was completed in July 2006 and the implementing regulations were published on October 2, 2006 (71 FR 58058).

The 2006 Consolidated HMS FMP changed certain management measures, adjusted regulatory framework measures, and continued the process for updating HMS EFH. Measures that are specific to the shark fisheries include mandatory workshops and certifications for all vessel owners and operators that have PLL or BLL gear on their vessels and that have been issued or are required to be issued any of the HMS limited access permits (LAPs) to participate in HMS longline and gillnet fisheries. The aim of these workshops is to provide information and ensure proficiency with equipment to handle, release, and disentangle sea turtles, smalltooth sawfish, and other non-target species. The Consolidated HMS FMP also requires federally permitted shark dealers to attend Atlantic shark identification workshops to train shark dealers how to properly identify shark carcasses. Additional measures specific to sharks include the differentiation between PLL and BLL gear based upon the species composition of the catch onboard or landed, the requirement that the second dorsal fin and the anal fin remain on all Atlantic sharks through landing, and a new prohibition making it illegal for any person to sell or purchase any HMS that was offloaded from an individual vessel in excess of the retention limits specified in § 635.23 and 635.24. The 2006 Consolidated HMS FMP also implemented complementary HMS management measures in Madison-Swanson and Steamboat Lumps Marine Reserves and established criteria to consider when implementing new time/area closures or making modifications to existing time/area closures.

The 2002 SCS stock assessment found that finetooth sharks were not overfished but that overfishing was occurring. The 2006 Consolidated HMS FMP included a plan for preventing overfishing by expanding observer coverage, collecting more information on where finetooth sharks are being landed, and coordinating with other fisheries management entities that are contributing to finetooth shark fishing mortality. The latest 2007 stock assessment of SCS in the U.S. Atlantic and Gulf of Mexico was recently completed (72 FR 63888, November 13, 2007), and found, among other things, that finetooth sharks were not experiencing overfishing, but blacknose sharks are overfished with overfishing occurring. This peer reviewed assessment, which was conducted according to the SEDAR process, provides an update from the 2002 stock assessment on the status of SCS stocks and projects their future abundance under a variety of catch levels in the U.S. Atlantic Ocean, Gulf of Mexico, and Caribbean Sea. The SEDAR process is a cooperative program designed to improve the quality and reliability of the stock assessments. The SEDAR process emphasizes constituent and stakeholder participation in the assessment development, transparency in the assessment process, and a rigorous and independent scientific review of the completed stock assessment. It consists of three workshops: the Data Workshop, the Assessment Workshop, and the Review Workshop. The Data Workshop for the stock assessment documents, reviews, and compiles the data for conducting the assessment. The Assessment Workshop develops and refines the population analyses and parameter estimates.

Finally, the Review Workshop is where independent scientists review the assessment and data. The 2007 assessment includes updated catch estimates, new biological data, and a number of fishery-independent catch rate series, as well as fishery-dependent catch rate series.

In 2007, NMFS expanded the equipment required for the safe handling, release, and disentanglement of sea turtles caught in the Atlantic shark BLL fishery (72 FR 5633, February 7, 2007). As a result, equipment required for BLL vessels is now consistent with the requirements for the PLL fishery. Furthermore, this action implemented several year-round BLL closures to protect EFH to maintain consistency with the Caribbean Fishery Management Council.

Other actions taken by NMFS affecting the Atlantic shark fishery include a combined emergency and final rule (December 14, 2006, 71 FR 75122) that adjusted the 2007 first season commercial quotas for LCS, SCS, and pelagic sharks based on over- or underharvests from the 2006 fishing season and that announced the season opening and closing dates for the first season of 2007. During the first trimester season of 2007, the South Atlantic region landed 16.0 mt dw LCS, even though there was no quota available (-112.9 mt dw). The South Atlantic region also landed 28.7 mt dw (9.3 percent) of their SCS quota. During this time, the Gulf of Mexico region landed 186.9 mt dw (300 percent) of their LCS quota and 14.7 mt dw (97.4 percent) of their SCS quota, while the North Atlantic region experienced underharvests for both LCS and SCS. In late 2007, NMFS published a final rule (November 29, 2007, 72 FR 67580), which established the 2008 first trimester season commercial quotas for LCS, SCS, and pelagic sharks based on over- or underharvests from the 2007 first trimester fishing season. Specifically, NMFS closed the LCS fishery in all regions for the 2008 first and second trimester seasons. The SCS and pelagic shark fisheries opened January 1, 2008, and remained open during the first trimester season.

3.1.2 Amendment 2 to the Consolidated HMS FMP

On April 10, 2008, NMFS released the Final Environmental Impact Statement for Amendment 2 to the Consolidated HMS FMP based on several stock assessments that were completed in 2005/2006. Assessments for dusky and sandbar sharks indicated that these species are overfished with overfishing occurring and that porbeagle sharks (*Lamna nasus*) are overfished. NMFS implemented management measures consistent with recent stock assessments for sandbar, porbeagle, dusky, blacktip and the LCS complex. The implementing regulations were published on June 24, 2008 (73 FR 35778; corrected version published July 15, 2008; 73 FR 40658). Management measures implemented in Amendment 2 included:

- Initiating rebuilding plans for porbeagle, dusky, and sandbar sharks consistent with stock assessments;
- Implementing commercial quotas and retention limits consistent with stock assessment recommendations to prevent overfishing and rebuild overfished stocks;
- Modifying recreational measures to reduce fishing mortality of overfished/overfishing stocks;
- Modifying reporting requirements;
- Modifying timing of shark stock assessments;

- Clarifying timing of release for annual Stock Assessment and Fishery Evaluation (SAFE) reports;
- Updating dehooking requirements for smalltooth sawfish;
- Requiring that all Atlantic sharks be offloaded with fins naturally attached;
- Collecting shark life history information via the implementation of a shark research program; and,
- Implementing time/area closures recommended by the South Atlantic Fishery Management Council.

3.1.3 International Shark Management

ICCAT is responsible for the conservation of tunas and tuna-like species in the Atlantic Ocean and adjacent seas. Tuna-like species include the following pelagic sharks only: the Atlantic blue shark and the shortfin mako. The organization was established at a Conference of Plenipotentiaries, which prepared and adopted the International Convention for the Conservation of Atlantic Tunas, signed in Rio de Janeiro, Brazil, in 1966. For purposes of clarity, it should be understood that ICCAT recommendations are binding instruments for Contracting Parties while ICCAT resolutions are non-binding and express the will of the Commission. All ICCAT recommendations and resolutions are available on the ICCAT website at http://www.ICCAT.es. Under ATCA, however, NMFS has authority to promulgate regulations as "necessary and appropriate" to implement ICCAT measures.

3.1.3.1 Atlantic Sharks

The first binding measure passed by ICCAT dealing specifically with sharks, *Recommendation 04-10 Concerning the Conservation of Sharks Caught in Association with Fisheries Managed by ICCAT*, includes, among other measures: reporting of shark catch data by Contracting Parties, a ban on shark finning, research on gears and shark nursery areas, a request for Contracting Parties to live-release sharks that are caught incidentally, a review of management alternatives from the 2004 assessment on blue and shortfin mako sharks, and a commitment to conduct another stock assessment of selected pelagic shark species no later than 2007. ICCAT completed stock assessments for shortfin mako and blue sharks in 2004. This work included a review of their biology, a description of the fisheries, analyses of the state of the stocks and outlook, analyses of the effects of current regulations, and recommendations for statistics and research. The Standing Committee on Research and Statistics (SCRS) assessment indicated that the current biomass of North and South Atlantic blue sharks was above MSY ($B>B_{MSY}$), however, these results were conditional and based on assumptions that were made by the committee. These assumptions indicate that blue sharks were not overfished. This conclusion was conditional and based on limited landings data. The North Atlantic shortfin mako population had experienced some level of stock depletion, as suggested by the historical catch-per-unit-effort (CPUE) trend and model outputs. The stock may have been below MSY ($B<B_{MSY}$), suggesting that the species may have been overfished (SCRS, 2004). In 2005, additional measures pertaining to pelagic sharks were added to the 2004 ICCAT recommendation. Measures included a requirement for Contracting Parties that have not yet

implemented the 2004 recommendation, to reduce shortfin mako mortality, and annually report on their efforts to the commission.

The 2006 regular meeting of ICCAT was held November 17 – 26, 2006, in Dubrovnik, Croatia. As such, much of the work at the 2006 Commission meeting dealt with improvement of ICCAT statistics and conservation measures, compliance with existing ICCAT recommendations, and the functioning of the Commission. The 2007 Commission meeting resulted in a recommendation regarding pelagic sharks, as discussed below.

At the 2007 ICCAT annual meeting in Antalya, Turkey, ICCAT adopted a recommendation concerning pelagic sharks (07-06, "Supplemental Recommendation by ICCAT Concerning Sharks"). The new operative paragraphs call for SCRS to conduct stock assessments and recommend management alternatives for porbeagle sharks, take appropriate measures to reduce fishing mortality in porbeagles and North Atlantic shortfin mako sharks, and implement research on pelagic shark species caught in the Convention area in order to identify potential nursery areas. It also requires that Contracting Parties, Cooperating non-Contracting Parties, Entities and Fishing Entities submit Task I and II data for sharks in advance of the next SCRS assessment.

In 2008, an updated stock assessment for blue and shortfin mako sharks was conducted by ICCAT's SCRS. The SCRS determined that while the quantity and quality of the data available for use in the stock assessment had improved since the 2004 assessment, they were still uninformative and did not provide a consistent signal to inform the models used in the 2008 assessment. The SCRS noted that if these data issues could not be resolved in the future, their ability to determine stock status for these and other species will continue to be uncertain. The SCRS assessed blue and shortfin mako sharks as three different stocks, North Atlantic, South Atlantic, and Mediterranean. However, the Mediterranean data was considered insufficient to conduct the quantitative assessments for these species.

3.1.4 Existing State Regulations

Table 3.1 outlines the existing State regulations as of October 15, 2008, with regard to shark species. While the HMS Management Division updates this table periodically throughout the year, persons interested in the current regulations for any state should contact that state directly.

Table 3.1 State Rules and Regulations Pertaining to Atlantic HMS, as of October 15, 2008.

Please note that state regulations are subject to change. Please contact the appropriate state personnel to ensure that the regulations listed below remain current. X = Regulations in Effect; n = Regulation Repealed; FL = Fork Length; CL = Carcass Length; TL = Total Length; LJFL = Lower Jaw Fork Length; CFL = Curved Fork Length; DW = Dressed Weight; and SCS = Small Coastal Sharks; LCS = Large Coastal Sharks.

State	Cite Reference	Regulatory Details	Contact Information
ME	Code ME R. 13-188 ' 50.02	Regulations apply to Spiny dogfish only.	ME Department of Marine Resources George Lapointe Phone: 207/624-6553 Fax: 207/624-6024
NH	FIS 603.19	Regulations apply to Spiny dogfish only	NH Fish and Game Clare McBane Phone: 603/868-1095 Fax: 603/868-3305
MA	322 CMR ' 6.35, 6.37, & 6.41 CMRs available online at http://www.mass.gov/dfwele/dmf/commercialfishing/cmr_index.htm	Regulations apply to Spiny and Smooth dogfish; Prohibition on harvest, catch, take, possession, transportation, selling or offer to sell any basking, dusky, sand tiger, or white sharks	MA Division of Marine Fisheries Melanie Griffin Phone: 617/626-1528 Fax: 617/626-1509
RI	RIMFC Regulations § 7.15	Regulations apply to spiny dogfish only	RI Department of Environment Management Brian Murphy Phone: 401/783-2304
CT	Regulations of Connecticut State Agencies § 26-159a-19	Regulations apply to spiny dogfish only	CT Department of Environmental Protection David Simpson Phone: 860/434-6043 Fax: 860/434-6150
NY	NY Environmental Conservation ' 13-0338; State of New York Codes, Rules and Regulations (Section 40.1)	Shark finning prohibited; Reference to the Federal regulations 50 CFR part 635; Prohibited sharks listed	NY Department of Environmental Conservation Phone: 631/444-0430 Fax: 631/444-0449

State	Cite Reference	Regulatory Details	Contact Information
NJ	NJ Administrative Code, Title 7. Department of Environmental Protection, NJAC 7:25-18.1 and 7:25-18.12(d)	Commercial/Recreational: min size 48" TL or 23" from the origin of the first dorsal fin to pre-caudal pit; possession limit - 2 fish/vessel or 2 fish per person if fishing from shore or a land based structure, must hold federal permit to possess or sell more than 2 sharks; no sale during federal closures; Finning prohibited; Prohibited Species: basking, bigeye sand tiger, sand tiger, whale and white sharks	NJ Fish and Wildlife Hugh Carberry Phone: 609/748-2020 Fax: 609/748-2032
DE	DE Code Regulations 3541	Reference to federal regulations for sharks; Recreational/Commercial: min size – 54" FL; bag limit – 1 shark/vessel/trip; shorebound anglers – 1 shark/person/day; 2 Atlantic sharpnose/vessel/trip with no min size; Prohibited Species: same as federal species. Prohibition against fins without being naturally attached to the body	DE Division of Fish and Wildlife Roy Miller Phone: 302/739-9914
MD	Code of Maryland Regulations tit. 8 ' 02.12.03 and tit. 8, ' 02.05.17	Reference to listing sharks of the order Squaliformes as in need of conservation; In the process of adopting into regulation all measures of the ASMFC Interstate Fishery Management Plan for Atlantic Coastal Sharks (August 2008). It will be effective March 23, 2009.	MD Department of Natural Resources Harley Speir Phone: 410/260-8264
VA	4 VA Administrative Code 20-490	Recreational: bag limit – 1 LCS, SCS, or pelagic shark/vessel/day with a min size of less than 54" FL or 30" CL; 1 Atlantic sharpnose and bonnethead/person/day with no min size; No limits on rec harvest of smooth and spiny dogfish; Commercial: possession limit - 4000 lb dw/day, min size - 58" FL or 31" CL west of the COLREGS line and no min size limit east of the COLREGS line; Prohibitions: fillet at sea, finning, longlining, same prohibited shark species as Federal regulations; and spiny dogfish commercial regulations.	VA Marine Resources Commission Jack Travelstead Phone: 757/247-2247 Fax: 757/247-2020

State	Cite Reference	Regulatory Details	Contact Information
NC	NC Administrative Code tit. 15A, r.3M.0505; Proclamation FF-38-2006	Director may impose restrictions for size, seasons, areas, quantity, *etc*. via proclamation; Commercial: open seasons and species groups same as Federal; 33 non-sandbar LCS retention limit; no retention of sandbar sharks; retain fins with carcass through point of landing; LL shall only be used to harvest LCS during open season, shall not exceed 500 yds or have more than 50 hooks; Recreational: LCS (54" FL min size) - no more than 1 shark/vessel/day or 1 shark/person/day, SCS (no min size) – no more than 1 finetooth or blacknose shark/vessel/day and no more than 1 Atlantic sharpnose and 1 bonnethead/person/day, pelagics (no min size) -1 shark/vessel/day; Same prohibited shark species as Federal regulations	NC Division of Marine Fisheries Randy Gregory Phone: 252/726-7021 Fax: 252/726-0254
SC	SC Code Ann. § 50-5-2725, 50-5-2730	Recreational: 2 Atlantic sharpnose/person/day and 1 Bonnethead/person/day, no min size; All others – 1 shark/boat/trip, min size – 54" FL; Reference to Federal commercial regulations and prohibited species	SC Department of Natural Resources Robert Boyles Phone: 843/953-9304 Fax: 843/953-9159
GA	GA Code Ann. § 27-4-130.1; OCGA §27-4-7(b); GA Comp. R. & Regs. § 391-2-4-.04	Commercial/Recreational: 2 sharks from the Small Shark Composite (bonnethead, sharpnose, and spiny dogfish, daily limit may consist of 2 of the same species (*e.g.*, 2 bonnetheads, 2 sharpnoses) or 2 different species, SCS min size 30" TL; All other sharks - 2 sharks/person or boat, whichever is less, min size 48" TL, may include only 1 greater than 84"; Prohibited Species: sand tiger sharks. All species must be landed head and fins intact. Sharks may not be landed in Georgia if harvested using gill nets.	GA Department of Natural Resources Carolyn Belcher Phone: 912/264-7218 Fax: 912/262-3143
FL	FL Administrative Code Ann. r.68B-44, F.A.C	Commercial/Recreational: min size - none; possession limit – 1 shark/person/day or 2 sharks/vessel on any vessel with 2 or more persons on board; State waters close to commercial harvest when adjacent Federal waters close; Federal permit required for commercial harvest, so Federal regulations apply unless state regulations are more restrictive; Finning & Filleting prohibited; and same prohibited species as Federal regulations, except Caribbean sharpnose is not included	FL Fish and Wildlife Conservation Commission Lisa Gregg Phone: 850/487-0554 Fax: 850/487-4847

State	Cite Reference	Regulatory Details	Contact Information
AL	AL Administrative Code r. 220-2-.46, r.220-3-.30, r.220-3-.37	Recreational & Commercial: bag limit – 2 sharpnose/person/day; no min size; all other sharks – 1/person/day; min size – 54" FL or 30" dressed; state waters close when Federal season closes; Prohibition: Atlantic angel, bigeye thresher, dusky, longfin mako, sand tiger, basking, whale, white, and nurse sharks	AL Department of Conservation and Natural Resources Major Jenkins jjenkins@dcnr.state.al.us Phone: 251 861 2882
LA	LA Administrative Code Title 76, Pt. VII, Ch. 3, § 357	Recreational: min size – 54" FL, except Atlantic sharpnose and bonnethead; bag limit - 1 sharpnose/person/day; all other sharks – 1 fish/person/day; Commercial: 33 per vessel per trip limit, no min size; Com & Rec Harvest Prohibited: 4/1-6/30; Prohibition: same as federal regulations.	LA Department of Wildlife and Fisheries Harry Blanchet 225 765-2889 fax (225) 765-2489 hblanchet@wlf.louisiana.gov
MS	MS Code Title-22 part 7	Recreational: min size - LCS/Pelagics 37" TL; SCS 25" TL; bag limit - LCS/Pelagics 1/person up to 3/vessel; SCS 4/person; Commercial & Prohibited Species - Reference to Federal regulations	MS Department of Marine Resources Kerwin Cuevas Phone: 228/374-5000
TX	TX Administrative Code Title 31, Part 2, Parks and Wildlife Code Title 5, Parks and Wildlife Proclamations 65.3 and 65.72	Commercial/Recreational: bag limit - 1 shark/person/day; Commercial/Recreational possession limit is twice the daily bag limit (*i.e.*, 2 sharks/person/day); min size 24" TL for Atlantic sharpnose, blacktip, and bonnethead sharks and 64" TL for all other lawful sharks. Sandbar and silky sharks are prohibited species.	TX Parks & Wildlife Mark Lingo Phone: 956/350-4490 Fax: 956/350-3470
Puerto Rico	Regulation #6768 Article 8 – General Fishing Limits Article 13 – Limitations Article 17 – Permits for Recreational Fishing (March 2004)	Sharks are covered under the federal regulation known as Highly Migratory Species of the United States Department of Commerce (50 CFR, Part 635); Fishers who capture these species shall comply with said regulation. Nurse Sharks are prohibited in territorial waters.	Puerto Rico Department of Natural and Environmental Resources Craig Lilyestrom Phone: 787-724-8774 x4042 craig@caribe.net

State	Cite Reference	Regulatory Details	Contact Information
U.S. Virgin Islands	US VI Commercial and Recreational Fisher's Information Booklet Revised June 2004	Federal regulations and federal permit requirements apply in territorial waters. Nurse Sharks are prohibited in territorial waters.	www.caribbeanfmc.com http://www.caribbeanfmc.com/usvi%20booklet/fisher%20booklet%20final.pdf

3.2 Status of the Stocks

The thresholds used to determine the status of Atlantic HMS, including sharks, are fully described in Chapter 3 of the 1999 FMP and Amendment 1 to the Billfish FMP, Chapter 3 of the 2006 Consolidated HMS FMP, and are presented in Figure 3.1. These thresholds are based on the thresholds described in a paper describing the technical guidance for implementing National Standard (NS) 1 of the Magnuson-Stevens Act (Restrepo *et al*., 1998).

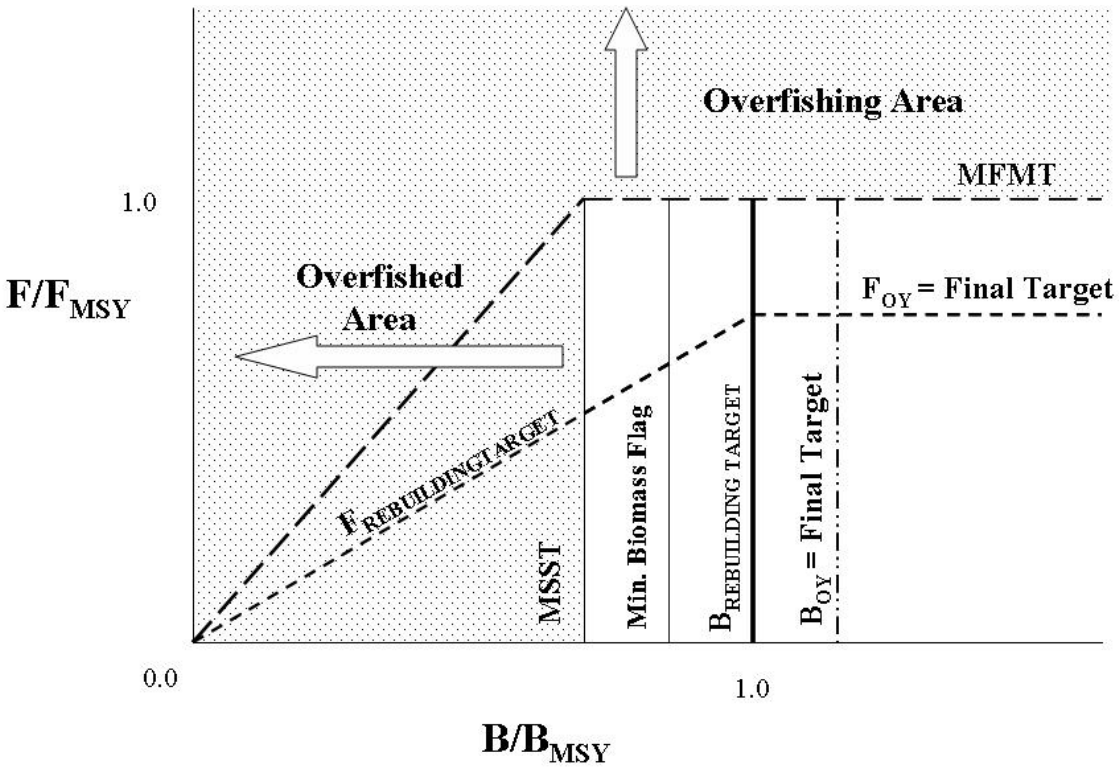

Figure 3.1 Illustration of the status determination and rebuilding terms.

In summary, a species is considered overfished when the current biomass (B) is less than the minimum stock size threshold ($B < B_{MSST}$). The minimum stock size threshold (MSST) is determined based on the natural mortality of the stock and the biomass at MSY (B_{MSY}). MSY is the maximum long-term average yield that can be produced by a stock on a continuing basis. The biomass can be lower than B_{MSY}, and the stock not be declared overfished as long as the biomass is above B_{MSST}.

Overfishing may be occurring on a species if the current fishing mortality (F) is greater than the fishing mortality at MSY (F_{MSY}) ($F > F_{MSY}$). In the case of F, the maximum fishing mortality threshold is F_{MSY}. Thus, if F exceeds F_{MSY}, the stock is experiencing overfishing.

If a species is declared overfished or has overfishing occurring, action to rebuild the stock and/or prevent further overfishing is required by law. 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}).

In summary, the thresholds to use to calculate the status of Atlantic HMS, as described in the 1999 FMP and 2006 Consolidated HMS FMP, are:

- Maximum Fishing Mortality Threshold (MFMT) = $F_{limit} = F_{MSY}$;
- Overfishing is occurring when $F_{year} > F_{MSY}$;
- Minimum Stock Size Threshold (MSST) = $B_{limit} = (1\text{-}M)B_{MSY}$ when $M < 0.5 = 0.5B_{MSY}$ when $M >= 0.5$;
- Overfished when $B_{year}/B_{MSY} <$ MSST;
- Biomass target during rebuilding = B_{MSY};
- Fishing mortality during rebuilding < F_{MSY};
- Fishing mortality for healthy stocks = $0.75F_{MSY}$;
- Biomass for healthy stocks = B_{OY} = ~1.25 to $1.30B_{MSY}$;
- Minimum biomass flag = $(1\text{-}M)B_{OY}$; and
- Level of certainty of *at least* 50 percent but depends on species and circumstances; for sharks, a level of certainty of 70 percent is used as a guide.
- For sharks, in some cases, spawning stock fecundity (SSF) or spawning stock number (SSN) was used as a proxy for biomass since biomass does not influence pup production in sharks

3.2.1 Atlantic Sharks

3.2.1.1 Life History/Species Biology

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 from 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. The life span of all shark species in the wild is not known, but it is believed that many species may live 30 to 40 years or longer.

Relative to other marine fish, sharks have a very low reproductive potential. Several important commercial species, including large coastal carcharhinids, such as sandbar (Casey and Hoey, 1985; Sminkey and Musick, 1995; Heist *et al*., 1995), lemon (Brown and Gruber, 1988), and bull sharks (*Carcharhinus leucas)* (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 approximately 350 species of sharks, ranging from tiny pygmy sharks of only 20 cm (7.8 in) in length to the giant whale sharks, over 12 meters (39 feet) in length. There are fast-moving, streamlined species such as mako (*Isurus* spp.*)* and thresher sharks (*Alopias* spp.), and sharks with flattened, ray-like bodies, such as angel sharks (*Squatina dumerili)*. The most commonly known sharks are large apex predators including the white (*Carcharadon carcharias*), mako, tiger (*Galeocerdo cuvier*), bull, and great hammerhead (*Sphyrna mokarran*). Some shark species reproduce by laying eggs, while 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.

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 (eggs hatch outside body), ovoviviparity (eggs hatch inside body), and viviparity (live birth).

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 Atlantic 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 shortfin 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 sharks are examples of a coastal-pelagic species. Deep-dwelling species, *e.g*., most cat sharks (*Apristurus* spp.) and gulper sharks (*Centrophorus* spp.) inhabit the dark, cold waters of the continental slopes and deeper waters of the ocean basins.

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. Thirty-nine species are managed by HMS; spiny dogfish also occur along the U.S. coast, however management for this species is under the authority of the ASMFC as well as the New England and Mid-Atlantic Fishery Management Councils. Deep-water sharks were removed from the management unit in 2003. Based on the ecology and fishery dynamics, the sharks have previously been divided into four species complexes for management: (1) LCS, (2) SCS, (3) pelagic sharks, and (4) prohibited species (Table 3.2). As a result of Amendment 2 to the HMS FMP, sandbar sharks can only be taken commercially within a shark research fishery. In addition, sandbar and silky sharks can not be retained by recreational anglers.

Table 3.2 Common names of shark species included within the four species management units under Amendment 2 to the Consolidated HMS FMP.

Management Unit	Shark Species Included
LCS (11)	Sandbar, silky, tiger, blacktip, bull, spinner, lemon, nurse, smooth hammerhead, scalloped hammerhead, and great hammerhead sharks
SCS (4)	Atlantic sharpnose, blacknose, finetooth, and bonnethead sharks
Pelagic Sharks (5)	Shortfin mako, thresher, oceanic whitetip, porbeagle, and blue sharks
Prohibited Species (19)	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

3.2.1.2 Stock Status and Outlook

NMFS is responsible for conducting stock assessments for the LCS and SCS complexes (Cortés, 2002; Cortés *et al*., 2002). The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has recently conducted assessments of three pelagic shark species. ICCAT's SCRS conducted stocks assessments for blue sharks and shortfin mako in 2008. Ecological risk assessments (ERAs) were also conducted by the SCRS for eight additional priority species of sharks (longfin mako (*Isurus paucus)*; bigeye thresher; common thresher; oceanic whitetip; silky (*Carcharhinus falciformis)*; porbeagle; scalloped hammerhead (*Sphyrna lewini)*; and smooth hammerhead. Stock assessments were conducted for the LCS complex, sandbar sharks, and blacktip sharks in 2006 (NMFS, 2006a), and the SCS stock assessment was finalized during the summer of 2007 (NMFS, 2007a), which also assessed finetooth, Atlantic sharpnose, blacknose, and bonnethead sharks separately. NMFS also recently released a stock assessment for dusky sharks (May 25, 2006, 71 FR 30123) (Cortés *et al*., 2006). Summaries of recent stock assessments and reports on several species of pelagic sharks (blue sharks, shortfin mako sharks, and porbeagle sharks by COSEWIC and ICCAT are also included in this section.

Based on those assessments, NMFS has determined that sandbar, dusky, and porbeagle sharks are overfished; sandbar and dusky sharks have overfishing occurring; the status of the

Atlantic blacktip shark population and the LCS complex is unknown; and the Gulf of Mexico blacktip shark population is not overfished with no overfishing occurring (November 7, 2006, 71 FR 65086). Based on the 2005 and 2006 stock assessments and these stock status determinations, NMFS has developed new management measures to rebuild sandbar, dusky, and porbeagle sharks while providing an opportunity for the sustainable harvest of blacktip and other sharks in the Gulf of Mexico. In addition, based on the 2007 SCS assessment, NMFS has determined that blacknose sharks are overfished with overfishing occurring (May 7, 2008, 73 FR 25665). Based on the latest SCRS assessment, NMFS has determined that shortfin mako sharks are experiencing overfishing. NMFS is proposing in Amendment 3 to develop management measures to rebuild blacknose sharks and end overfishing for blacknose shark and shortfin mako sharks.

3.2.1.3 Large Coastal Sharks

The 2005/2006 stock assessment for LCS follows the SEDAR process. This process is a cooperative program designed to improve the quality and reliability of the stock assessments. The SEDAR process emphasizes constituent and stakeholder participation in the assessment development, transparency in the assessment process, and a rigorous and independent scientific review of the completed stock assessment. The Data Workshop for the stock assessment, which documented, analyzed, reviewed, and compiled the data for conducting the assessment, was held from October 31 to November 4, 2005, in Panama City, FL (September 15, 2005, 70 FR 54537; correction October 5, 2005, 70 FR 58190). The Assessment Workshop, which developed and refined the population analyses and parameter estimates, was held from February 6 to February 10, 2006, in Miami, FL (December 22, 2005, 70 FR 76031). At the Review Workshop held on June 5 to June 9, 2006, in Panama City, FL (March 9, 2006, 71 FR 12185), independent scientists reviewed the assessment and data used in the stock assessment.

The latest 2005/2006 stock assessments for LCS in the Gulf of Mexico and Atlantic Ocean were recently completed (July 24, 2006, 71 FR 41774). Unlike past assessments, the 2005/2006 LCS stock assessment determined that it is inappropriate to assess the LCS complex as a whole due to the variation in life history parameters, different intrinsic rates of increase, and different catch and abundance data for all species included in the LCS complex. Based on these results, NMFS changed the status of the LCS complex from overfished to unknown and is continuing to examine viable options to assess shark populations (November 7, 2006; 71 FR 65086).

Sandbar Sharks

According to 2005/2006 sandbar shark stock assessment, sandbar sharks are overfished ($SSF_{2004}/SSF_{MSY} = 0.72$; SSF is spawning stock fecundity and was used a proxy for biomass), and overfishing is occurring ($F_{2004} / F_{MSY} = 3.72$). The assessment recommends that rebuilding could be achieved with 70 percent probability by 2070 with a total allowable catch across all fisheries of 220 metric tons (mt) whole weight (ww) each year and fishing pressure (F) between 0.0009 and 0.011.

Blacktip Sharks

The 2005/2006 stock assessment assessed blacktip sharks for the first time as two separate populations: a Gulf of Mexico and an Atlantic population. The results indicate that the Gulf of Mexico stock is not overfished and overfishing is not taking place (November 7, 2006, 71 FR 65086), but the assessment Panel did not accept the absolute estimates of the stock status. The three abundance indices believed to be most representative of the stock were consistent with each other, suggesting that stock abundance has been increasing over a period of declining catch during the past 10 years. Based on life history characteristics, blacktip sharks are a relatively productive shark species, and a combination of these characteristics and recent increases in the most representative abundance indices, suggested that the blacktip stock is relatively healthy. There was no scientific basis, however, to consider increasing the catch or quota.

This assessment also indicated that the current status of the blacktip shark population in the South Atlantic region is unknown. The assessment scientists were unable to provide estimates of stock status or reliable population projections, but indicated that current catch levels should not change. NMFS has declared the status of the South Atlantic blacktip shark population to be unknown (November 7, 2006, 71 FR 65086).

Dusky Sharks

The first dusky-specific shark assessment was released on May 25, 2006 (71 FR 30123) (Cortés *et al*., 2006). The 2006 dusky shark stock assessment used data through 2003 and indicates that dusky sharks are overfished (B_{2003}/B_{MSY} = 0.15 – 0.47) with overfishing occurring (F_{2004}/F_{MSY} = 1.68 – 1,810). The assessment recommends that rebuilding for dusky sharks could require 100 to 400 years. Based on these results, NMFS declared the status of dusky sharks as overfished with overfishing occurring (November 7, 2006, 71 FR 65086).

Table 3.3 summarizes stock assessment information and the current status of Atlantic sharks as of October 2008.

Table 3.3 **Stock Assessment Summary Table for Large Coastal Atlantic sharks.**
Sources: SCRS, 2007; Gibson and Campana, 2005; Cortés *et al*., 2006; NMFS, 2006b; NMFS, 2007a.

Species	Current Relative Biomass Level	Minimum Stock Size Threshold	Current Relative Fishing Mortality Rate	Maximum Fishing Mortality Threshold	Outlook
LCS Complex	*Unknown*	*Unknown*	*Unknown*	*Unknown*	*Unknown*
Sandbar	SSF_{04}/SSF_{MSY} = 0.72	4.75-5.35E+05	F_{04}/F_{MSY} = 3.72	0.015	Overfished; overfishing is occurring
Gulf of Mexico Blacktip	SSF_{04}/SSF_{MSY} = 2.54-2.56	0.99-1.07E+07	F_{04}/F_{MSY} = 0.03–0.04	0.20	Not overfished; overfishing not occurring
Atlantic Blacktip	*Unknown*	*Unknown*	*Unknown*	*Unknown*	*Unknown*
Dusky Sharks	B_{03}/B_{MSY} = 0.15-0.47	*Unknown*	F_{03}/F_{MSY} = 1.68-1,810	0.00005-0.0115	Overfished; overfishing is occurring

3.2.1.4 Small Coastal Sharks

On November 13, 2007, NMFS completed a SCS stock assessment following the SEDAR process (72 FR 63888). The SCS Data Workshop was held February 5-9, 2007 (December 7, 2006, 71 FR 70965). The SCS Assessment workshop was held May 7-11, 2007 (April 19, 2007, 72 FR 19701), and the SCS Review workshop was held on August 6-10, 2007 (July 19, 2007, 72 FR 39606). The assessment reviewed data and models for the SCS complex and for each individual species within the SCS complex, per recommendations in previous assessments. This allowed individual analyses, discussions, and stock status determinations for five separate assessments: 1) SCS complex, 2) Atlantic sharpnose shark, 3) bonnethead shark, 4) blacknose shark, and 5) finetooth sharks. These assessments are included in one report as many of the indices, data, and issues overlap among assessments. The Review Panel found that the data and methods used were appropriate and the best available; however, the panel recommended using the individual assessments for each species rather than the assessment on the SCS complex as a whole. The Review Panel also endorsed recommendations for future research contained in the Data Assessment workshop reports, added additional recommendations, and provided comments on the SEDAR process to consider in the future. Based on these assessments, NMFS determined that blacknose sharks are overfished with overfishing occurring; however, Atlantic sharpnose, bonnethead, and finetooth sharks are not overfished and overfishing is not occurring (May 7, 2008, 73 FR 25665)

SCS complex

According to the 2007 the SCS stock assessment, the SCS complex is not overfished and overfishing is not occurring (May 7, 2008, 73 FR 25665). The peer reviewed assessment

provides an update from the 2002 stock assessment on the status of SCS stocks and projects future abundance under a variety of catch levels in the U.S. Atlantic Ocean, Gulf of Mexico, and Caribbean Sea. Because the species were individually assessed, the peer reviewers recommended using species-specific results rather than on the aggregated SCS complex results. As a result of this recommendation, and because the stock assessment covered all SCS species, NMFS will no longer provide status updates or determinations on the SCS complex as a whole.

Atlantic sharpnose

The 2002 SCS stock assessment found that Atlantic sharpnose sharks were not overfished and overfishing was not occurring. The 2007 assessment for Atlantic sharpnose sharks also indicated that the stock is not overfished ($SSF_{2005}/SSF_{MSY} = 1.47$) and that no overfishing is occurring ($F_{2005} / F_{MSY} = 0.74$) (Table 3.4). Based on these results, NMFS has determined that Atlantic sharpnose sharks are not overfished with no overfishing occurring (May 7, 2008, 73 FR 25665). However, because estimates of fishing mortality from the assessment indicate that fishing mortality is close to, but presently below, F_{MSY} (*i.e.*, overfishing is not occurring), the peer reviewers suggest setting a threshold for fishing mortality to keep it below the F_{MSY} threshold to prevent overfishing in the future.

Bonnethead Sharks

Based on the bonnethead stock assessment, the peer reviewers determined that bonnethead sharks are not overfished ($SSF_{2005}/SSF_{MSY} = 1.13$). In addition, the estimate of fishing mortality rate in 2005 was less than F_{MSY}, ($F_{2005} / F_{MSY} = 0.61$) (Table 3.4), thus overfishing was not occurring. As a result, NMFS has determined that bonnethead sharks are not overfished and no overfishing is occurring (May 7, 2008, 73 FR 25665). In addition, the assessment showed that there had been years of overfishing, and the main contributor of population mortality is the recreational fleet and the commercial gillnet fleet.

Blacknose Sharks

The 2002 assessment found blacknose sharks were not overfished and overfishing was not occurring. However, the 2007 assessment for blacknose shark indicates that spawning stock fecundity (SSF; *i.e.*, the number of reproductive-age individuals in a population) in 2005 and during 2001-2005 was smaller than SSF_{MSY} ($SSF_{2005}/SSF_{MSY} = 0.48$). Therefore, NMFS has determined that blacknose sharks are overfished. In addition, the estimate of fishing mortality in 2005 and the average from 2001-2005 was greater than $F_{MSY,}$ and the ratio was substantially greater than 1 in both cases ($F_{2005} / F_{MSY} = 3.77$). Based on these results, NMFS has determined that blacknose sharks are experiencing overfishing (May 7, 2008, 73 FR 25665). The assessment recommended a rebuilding plan with 70 percent probability of recovering to SSF_{MSY} by 2019 if F=0. This recommended rebuilding time is 11 years from 2009. A constant TAC of 19,200 individuals would lead to rebuilding with 70 percent probability by 2027. The constant TAC also allows for rebuilding with 50 percent confidence by 2024. The assessment found that the majority of the mortality for blacknose sharks was occurring as bycatch in the Gulf of Mexico shrimp trawl fishery. In addition, the majority of mortality was occurring on juvenile and neonate blacknose sharks. Blacknose sharks mature around 91 cm total length and around 4.5 years of age.

Finetooth Sharks

According to the 2007 finetooth shark stock assessment, finetooth sharks are not overfished ($N_{2005}/N_{MSY} = 1.80$) and overfishing is not occurring ($F_{2005}/F_{MSY} = 0.17$) (May 7, 2008, 73 FR 25665). This is a change from the 2002 assessment in which finetooth sharks were determined to be experiencing overfishing. However, NMFS also notes that while the peer reviewers agreed that it is reasonable to conclude that the stock is not currently overfished, they also indicated that given the limited data available on the population dynamics for finetooth, management should be cautious. Unlike the other SCS, where the bulk of the mortality occurs in shrimp trawl gear, the majority of the mortality for finetooth sharks occur in gillnets.

Table 3.4 Summary Table of Biomass and Fishing Mortality for Small Coastal Sharks (SCS)
Source: NMFS, 2007a.

Species	Current Relative Biomass Level	Current Biomass N_{2005}	Stock Abundance N_{MSY}	Minimum Stock Size Threshold (MSST)	Current Relative Fishing Mortality Rate (F_{2005}/F_{MSY})	Maximum Fishing Mortality Threshold	Outlook
Small Coastal Sharks (SCS)	1.69 (N_{2005}/N_{MSY})	5.16E+07	2.98E+07	2.1E+07	0.25	0.09	Not overfished; No overfishing is occurring
Bonnethead Sharks	1.13 (SSF_{2005}/SSF_{MSY})	1.59E+06	1.92E+06	1.4E+06	0.61	0.31	Not overfished; No overfishing is occurring
Atlantic Sharpnose Sharks	1.47 (SSF_{2005}/SSF_{MSY})	5.96E+06	4.45E+06	4.09E+06	0.74	0.19	Not overfished; No overfishing is occurring
Blacknose Sharks	0.48 (SSF_{2005}/SSF_{MSY})	3.49E+05	5.7E+05	4.3E+05	3.77	0.07	Overfished; Overfishing is occurring
Finetooth Sharks	1.80 (N_{2005}/N_{MSY})	6.00E+06	3.20E+06	2.4E+06	0.17	0.03	Not overfished; No overfishing is occurring

3.2.1.5 Pelagic Sharks

Pelagic sharks are subject to exploitation by many different nations and exhibit trans-oceanic migration patterns. As a result, ICCAT's 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. 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.

An ERA conducted by the SCRS for eleven priority species of elasmobranchs (including blue shark and shortfin mako) caught in ICCAT fisheries, demonstrated that most Atlantic pelagic sharks have exceptionally limited biological productivity and, as such, can be overfished even at very low levels of fishing mortality. Specifically, the analyses indicated that bigeye threshers, longfin makos, and shortfin makos have the highest vulnerability (and lowest biological productivity) of the shark species examined (with bigeye thresher being substantially less productive than the other species). All species considered in the ERA, particularly smooth hammerhead, longfin mako, bigeye thresher and crocodile sharks (*Pseudocarcharias kamaharai*), are in need of improved biological data to evaluate their biological productivity more accurately and thus specific research projects should be supported to that end. The SCRS recommended that ERAs be updated with improved information on the productivity and susceptibility of these species.

The SCRS decided to conduct an assessment of Atlantic pelagic sharks beginning in 2004. Emphasis was placed on blue sharks and shortfin mako sharks. Several models such as non-equilibrium production and statistical age/length-structured models were considered to analyze the population dynamics of pelagic shark species. The SCRS conducted additional assessments of Atlantic pelagic sharks in 2008. All SCRS stock assessments can be found at http://www.iccat.es/assess.htm.

2008 ICCAT Shark Stock Assessment

In 2008, an updated stock assessment for blue and shortfin mako sharks was conducted by ICCAT's SCRS. The SCRS determined that while the quantity and quality of the data available for use in the stock assessment had improved since the 2004 assessment, they were still uninformative and did not provide a consistent signal to inform the models used in the 2008 assessment. The SCRS noted that if these data issues could not be resolved in the future, their

ability to determine stock status for these and other species will continue to be uncertain. The SCRS assessed blue and shortfin mako sharks as three different stocks, North Atlantic, South Atlantic, and Mediterranean. However, the Mediterranean data was considered insufficient to conduct the quantitative assessments for these species.

Blue Sharks

With regard to North and South Atlantic blue sharks, the stock assessment determined that the biomass is estimated to be above the biomass that would support MSY. Similar to the results of the 2004 assessment, in many of the model runs, stock status appeared to be close to the unfished biomass levels (B_{2007}/B_{msy} = 1.87-2.74) and fishing mortality rates were well below those corresponding to the level at which MSY is reached (F_{msy} = 0.15). Most of the models used in the assessment consistently predicted that blue shark stocks in the Atlantic are not overfished and overfishing is not occurring (SCRS, 2008). Given these results, NMFS is considering blue sharks as not overfished with no overfishing occurring.

Shortfin Mako Sharks

The estimates of stock status for the North Atlantic shortfin mako shark were much more variable than for blue sharks. For the North Atlantic, multiple model outcomes indicated stock depletion to be about 50 percent of virgin biomass (1950s levels) and levels of F above those resulting in MSY, whereas other models estimated considerably lower levels of depletion and no overfishing. The SCRS determined that there is a "non-negligible probability" that the North Atlantic shortfin mako stock could be below the biomass that could support MSY (B_{2007}/B_{msy} = 0.95-1.65) and above the fishing mortality rate associated with MSY (F_{2007}/F_{msy} = 0.48-3.77). Similar outcomes were determined by the SCRS from the 2004 assessment; however, recent biological data show decreased productivity for this species. NMFS believes this to be the best available scientific information with respect to shortfin mako stock status. Therefore, given the results of this assessment, NMFS has determined that North Atlantic shortfin mako is not overfished, but is approaching an overfished status and is experiencing overfishing.

COSEWIC Stock Assessment on Porbeagle

COSEWIC conducted a species report and assessment for porbeagle in 2004 (COSEWIC, 2004). They suggest that significant declines in porbeagle abundance have occurred as a result of overexploitation in fisheries. In May 2004, the COSEWIC recommended to the Canadian Minister of Fisheries that porbeagles be listed as endangered under the Species at Risk Act (SARA). In 2006, the Canadian government decided not to list the porbeagle shark under SARA due to the economic impact of a listing.

The Canadian Department of Fisheries and Oceans has conducted stock assessments on porbeagle sharks in 1999, 2001, 2003, and 2005. Reduced Canadian porbeagle quotas in 2002 brought the 2004 exploitation rate to a sustainable level. According to the 2005 recovery assessment report conducted by Canada (Canadian Science Advisory Secretariat, 2005), the North Atlantic porbeagle stock has a 70 percent probability of recovery in approximately 100 years if F is less than or equal to 0.04. To date, the United States has not conducted a stock assessment on porbeagle sharks. NMFS has reviewed the Canadian stock assessment and deemed it to be the best available science and appropriate to use for U.S. domestic management

purposes (NMFS, 2006c). The Canadian assessment indicates that porbeagle sharks are overfished (SSN_{2004}/SSN_{MSY} = 0.15 – 0.32; SSN is spawning stock number and was used as a proxy for biomass) (Gibson and Campana, 2005). However, the Canadian assessment indicates that overfishing is not occurring (F_{2004}/F_{MSY} = 0.83) (Gibson and Campana, 2005). Based on these results, NMFS declared the status of porbeagle sharks as overfished, but overfishing is not occurring (71 FR 65086).

Table 3.5 Stock Assessment Summary Table for Pelagic sharks.
Sources: SCRS 2008.

Species	Current Relative Biomass Level	Minimum Stock Size Threshold	Current Relative Fishing Mortality Rate	Maximum Fishing Mortality Threshold	Outlook
North Atlantic Blue Sharks	B_{2007}/B_{MSY} = 1.87-2.74	*Unknown*	F_{2007}/F_{MSY} = 0.13-0.17	F_{MSY} =0.15	Not overfished; overfishing is not occurring
Shortfin Mako Sharks	B_{2007}/B_{MSY} = 0.95-1.65	*Unknown*	F_{2007}/F_{MSY} = 0.48-3.77	F_{MSY} = 0.007-0.05	Not overfished (approaching overfished); overfishing is occurring
Porbeagle Sharks	SSN_{2004}/SSF_{MSY}=0.15-0.32	*Unknown*	F_{2004}/F_{MSY} = 0.83	F_{MSY} =0.033-0.065	Overfished; overfishing not occurring

3.2.1.6 Effects of Regulations

International Management

ICCAT may have authority to develop recommendations for shark management associated with its managed fisheries. At the 2004 ICCAT annual meeting in New Orleans, ICCAT adopted *Recommendation 04-10 Concerning the Conservation of Sharks Caught in Association with Fisheries Managed by ICCAT*. This was the first binding measure passed by ICCAT dealing specifically with sharks. This recommendation included, among other measures: reporting of shark catch data by Contracting Parties, a ban on shark finning, a request for Contracting Parties to live-release sharks that are caught incidentally, a review of management alternatives from the 2004 assessment on blue and shortfin mako sharks, and a commitment to conduct another stock assessment of selected pelagic shark species no later than 2007. In 2005, additional measures pertaining to pelagic sharks were added to the 2004 ICCAT recommendation. Measures included a requirement for Contracting Parties that have not yet implemented the 2004 recommendation, to reduce shortfin mako mortality, and annually report on their efforts to the Commission.

At the 2006 ICCAT annual meeting in Dubrovnik, Croatia, ICCAT adopted Recommendation 06-10 which amended Paragraph 7 of *Recommendation 04-10 Concerning the Conservation of Sharks Caught in Association with Fisheries Managed by ICCAT*. The new paragraph called for SCRS to conduct stock assessments and recommended management alternatives for Atlantic blue sharks and shortfin mako sharks in time for consideration at the

2008 annual ICCAT meeting. It also required a data prepatory meeting to be held in 2007 to review all relevant data on biological parameters, catch, effort, discards, trade, and historical data.

At the 2007 ICCAT annual meeting in Antalya, Turkey, ICCAT adopted a recommendation (07-06) concerning pelagic sharks. The new operative paragraphs called for SCRS to conduct stock assessments and recommended management alternatives for porbeagle sharks, to take appropriate measures to reduce fishing mortality in porbeagles and North Atlantic shortfin mako sharks, and to implement research on pelagic shark species caught in the Convention area in order to identify potential nursery areas. It also required that Contracting Parties, Cooperating non-Contracting Parties, Entities and Fishing Entities submit Task I and II data for sharks in advance of the next SCRS assessment.

At the 2008 ICCAT annual meeting in Marrakech, Morocco, ICCAT adopted recommendation (08-07) concerning bigeye thresher sharks and recommendation (08-08) concerning porbeagle sharks. *Recommendation (08-07) by ICCAT on the Conservation of Big Eye Thresher Sharks (Alopias superciliosus) Caught in Association with Fisheries Managed by ICCAT* would require the live release of bigeye thresher sharks, a species that is the most vulnerable of the top 10 species of concern that were evaluated by the international commission's science committee. U.S. fisheries are already subject to this requirement under domestic regulations. In addition, all CPCs would be required to report incidental catches as well as live releases of bigeye thresher sharks in accordance with ICCAT data reporting requirements. *Recommendation (08-08) Resolution by ICCAT on Porbeagle Shark (Lamna nasus)* calls for a joint ICCAT-ICES Inter-sessional meeting in 2009 to further assess porbeagle (Lamna nasus) in accordance with recommendation (07-06).

Domestic Regulations

Domestically, Atlantic sharks have been managed by NMFS since the 1993 FMP for Atlantic Sharks. The 1999 FMP for Atlantic Tunas, Swordfish, and Sharks addressed numerous shark management measures, including: reducing commercial LCS and SCS quotas; establishing a commercial quota for blue sharks and a species-specific quota for porbeagle sharks; expanding the list of prohibited shark species; implementing a LAP system in commercial fisheries; and establishing season-specific over- and underharvest adjustment procedures. The 1999 FMP also partitioned the LCS complex into ridgeback and non-ridgeback categories but did not include regional quota measures. Due to litigation, many management measures in the 1999 FMP were not implemented.

The regulations governing the recreational and commercial shark fisheries allow opportunities for participants to pursue sharks for leisure, subsistence, and/or commercial gain while maintaining compliance with statutes that include, but are not limited to, the MSA, ESA, MMPA, and NEPA. These regulations seek to minimize bycatch of non-target, prohibited shark species, and protected resources by a variety of measures, including, but not limited to: mandating the use of corrodible, non-stainless steel hooks; requiring possession of handling and release equipment for protected resources; conducting gillnet checks every two hours; mandatory observer coverage for commercial fisheries (if selected); limits on the deployment and operation of authorized gears; and, maintaining 19 species of shark on the prohibited species list (possession not authorized). Rebuilding overfished stocks is another objective of shark fishery

regulations, and was accomplished through numerous measures, including, but not limited to: regional fishing quotas based on MSY; regional fishing seasons; commercial trip limits (4,000 lbs dw for LCS); recreational bag limits (1 shark/vessel/day for all authorized species except Atlantic sharpnose and bonnethead sharks (1 shark/person/day); and, recreational minimum size limits (>54" FL for all authorized species except Atlantic sharpnose and bonnethead sharks). Controlling fishing effort was accomplished by the requirement to possess a LAP for commercial shark fisheries and upgrading restrictions for transferred permits. Reducing fishing mortality of prohibited dusky sharks and juvenile sandbar sharks was achieved by the Mid-Atlantic time area closure (January 1 – July 31) and the requirement to use VMS when BLL gear is onboard during this time period.

The final rule implementing Amendment 1 to the 1999 FMP was published in the Federal Register on December 23, 2003. This final rule revised the shark regulations based on the results of the 2002 stock assessments for SCS and LCS. In Amendment 1 to the 1999 FMP, NMFS revised the rebuilding timeframe for LCS to 26 years from 2004, and implemented several new regulatory changes. Management measures enacted in the amendment included, among other things: using MSY as a basis for setting commercial quotas; eliminating the commercial minimum size restrictions; implementing a commercial trip limit for LCS and SCS; imposing gear restrictions to reduce bycatch; and implementing a time/area closure off the coast of North Carolina effective January 1, 2005. Annual quotas established under Amendment 1 to the 1999 FMP were as follows: 1,017 metric tons (mt) dressed weight (dw) (2.24 million lbs dw) for LCS; 454 mt dw per year for SCS; 273 mt dw for blue sharks, 92 mt dw for porbeagle sharks, and 488 mt dw for pelagic sharks other than porbeagle and blue sharks.

An updated LCS stock assessment became available in 2006 and data workshops for an updated SCS stock assessment began in early 2007. Based on the 2006 LCS stock assessment, NMFS implemented Amendment 2 to the 2006 Consolidated HMS FMP to rebuild overfished sandbar, dusky, and porbeagle shark stocks and to end overfishing. The final rule for Amendment 2 published on June 24, 2008 (73 FR 35778) with a correction published on July 15, 2008 (73 FR 40658). The final rule became effective on July 24, 2008. In the final rule, NMFS focused on additional shark management measures. These included, but were not limited to, removing sandbar sharks from the LCS quota and establishing a non-sandbar LCS quota; setting new annual quotas for sandbar sharks (87.9 mt dw), non-sandbar LCS (Atlantic: 187.7 mt dw; Gulf of Mexico: 390.5 mt dw), and porbeagle sharks (1.7 mt dw); maintaining the annual SCS quota (454 mt dw), pelagic sharks quota (273 mt dw for blue sharks), and quota for pelagic sharks other than porbeagle and blue sharks (488 mt dw); establishing a sandbar shark research fishery with prohibition on the retention of sandbar sharks outside the shark research fishery; creating one region for SCS, sandbar, and pelagic sharks and two regions for non-sandbar LCS (Gulf of Mexico and Atlantic regions); creating eight marine protected areas as requested by the South Atlantic Fishery Management Council to prohibit the use of bottom longline gear in those areas; establishing new non-sandbar LCS retention limits for directed and incidental shark permit holders (33 non-sandbar LCS per vessel per trip for directed permit holders and 3 non-sandbar LCS per vessel per trip for incidental permit holders); establishing a fishing year for sharks that begins on January 1 of each year; limiting the carry over of underharvest to 50 percent of the base quota for shark stocks whose status are healthy and prohibiting the carry over of underharvest for shark stocks whose status are overfished, experiencing overfishing, or are

determined to be unknown; deducting overharvests from the following fishing year, or multiple years (up to five year maximum), based on the level of overharvest; requiring HMS dealer reports to be received by NMFS within 10 days of the end of a reporting period; requiring sharks to landed with fins on; and, proportioning unclassified sharks out among each shark species/complex based on observer and dealer reports. Regulations are subject to change based on stock assessments, international obligations, litigation, and public sentiment.

3.2.1.7 Recent and Ongoing Research

Northeast Fisheries Science Center (NEFSC)

Fishery Independent Surveys for Coastal and Pelagic Sharks

Atlantic Surveys for Coastal and Pelagic Shark Species

The bi-annual fishery independent survey of Atlantic large and small coastal sharks in U.S. waters was conducted in the spring of 2007. The goals of this survey are to: 1) monitor the species composition and sizes, distribution, and abundance of sharks in the coastal Atlantic; 2) tag and inject sharks for age validation and migration studies; 3) collect biological samples for age and growth, feeding ecology, and reproductive studies; and 4) collect morphometric data for size conversions. The time series of abundance indices from this survey are critical to the evaluation of coastal Atlantic shark species. Results from this 2007 survey included 457 fish (447 sharks) representing sixteen species. Sharks represented 98% of the total catch of which sandbar sharks were the most common, followed by tiger and dusky sharks. As part of this survey, bottom longline sets were conducted in the closed area off North Carolina. Additional cooperative work included sample collections of blood, heart and other tissues for post-release survivorship and ribosomal DNA species identification marker studies, and the deployment of electronic tags. In conjunction with Monterey Bay Aquarium, UC Long Beach, and Massachusetts Division of Marine Fisheries (MDMF), two smart position or temperature transmitting (SPOT) and three pop-up satellite archival (PSAT) tags were placed on dusky and tiger sharks. Pelagic sets were made subsequent to the coastal survey as a continuation of fishery independent longline surveys for highly migratory swordfish, tunas, and sharks conducted by NMFS and its predecessor agencies periodically since the 1950's. Goals of this research are to conduct a consistent standardized fishery independent pelagic shark survey for research collections and to monitor their abundance and distribution for management and stock assessment.

Juvenile Shark Survey for Monitoring and Assessing Delaware Bay Sandbar Sharks

The juvenile sandbar shark population in Delaware Bay is surveyed by NEFSC staff as part of the Cooperative Atlantic States Shark Pupping and Nursery (COASTSPAN) project. A random stratified longline sampling plan, based on depth and geographic location, was developed in 2001 to assess and monitor the juvenile sandbar shark population during the nursery season (McCandless, 2007). The juvenile index of abundance from this standardized survey has been used as an input into various stock assessment models. In addition, the mark-recapture data from this project are being used to examine the temporal and spatial relative abundance and distribution of sandbar sharks in the Bay (McCandless *et al*. 2007b). In 2007, a total of 263 sandbar sharks were caught, with 251 (95 percent) of the sharks released with tags.

Delaware Bay Sand Tiger Survey

A survey initiated in 2006, targeting the sand tiger for identifying EFH and for future stock assessment purposes, continued in 2007. This study incorporates historical NEFSC sampling stations for comparison to pre-management abundance. Preliminary results indicate that this survey will be a successful monitoring tool for the Delaware Bay sand tiger population and for evaluating long-term changes in abundance and size composition. In 2007, a total of 26 sand tigers were caught, with 25 (96 percent) of the sharks released with conventional tags and one with a PSAT.

NEFSC Historical Longline Surveys

The NEFSC recently recovered the shark species catch per set data from the exploratory shark longline surveys conducted by the Sandy Hook and Narragansett Labs from 1961 to 1991, which provide a valuable historical perspective for evaluating the stock status of Atlantic sharks. This data recovery process is part of a larger, systematic effort to electronically recover and archive historical longline surveys and biological observations of large marine predators (swordfish, sharks, tunas and billfishes) in the North Atlantic. When completed, these efforts will include reconstructing the historic catch, size composition, and biological sampling data into a standardized format for time series analysis of CPUE and size. Standardized indices of abundance for the Atlantic sharpnose shark were developed for the exploratory shark longline surveys and used in the 2007 SCS SEDAR process (McCandless and Hoey, 2007). Work on the recovery of environmental data for this time series, as well as the associated individual shark data, is ongoing to further refine these indices, develop indices of abundance for other shark species, and for future use in shark EFH designations.

NEFSC-UNC Cooperative Study to Archive and Analyze FI Coastal Shark Survey

In addition to the fishery independent surveys conducted by the NEFSC, scientific staff has been working with the University of North Carolina to electronically recover the data from an ongoing coastal shark survey in Onslow Bay that began in 1972. Standardized indices of abundance for the top ten species in numerical abundance were recently developed. The abundance indices created for SCS (SCS complex, Atlantic sharpnose and blacknose sharks) were used in the 2007 SCS SEDAR process (Schwartz *et al.*, 2007) and the indices developed for the LCS species are expected to be useful in future SEDAR processes for LCS. Efforts to recover environmental data are ongoing and will be incorporated into future generalized linear models (GLMs) to further refine the standardized indices of abundance.

SEDAR Process

Staff participated in the SEDAR Data Workshop for the SCS Complex and contributed seven SEDAR working papers. These documents were on small coastal shark mark-recapture data from the Cooperative Shark Tagging Program (Kohler and Turner, 2007), NEFSC historical longline surveys (McCandless and Hoey, 2007), relative abundance trends for small coastal sharks from the COASTSPAN surveys in South Carolina (McCandless *et al*., 2007c) and Georgia (McCandless and Belcher, 2007), catch rate information obtained from the NMFS Northeast longline surveys (McCandless and Natanson, 2007), relative abundance trends for Atlantic sharpnose sharks observed in the NEFSC Observer Program (Mello *et al.*, 2007), and relative abundance trends for small coastal sharks caught during the University of North Carolina shark longline survey (Schwartz *et al.*, 2007).

Essential Fish Habitat

NEFSC staff participated on a working group with other staff from the NMFS HMS Division and SEFSC to update and refine the EFH designations for managed shark species. This process was ongoing in 2007 and entailed providing updated data from the Cooperative Shark Tagging Program (CSTP) and NEFSC surveys for use in delineating EFH, refining the size limits of the life stages for each managed species, and refining the methodology used to determine EFH. NEFSC staff coordinated with Atlantic States Marine Fisheries Commission (ASMFC) coastal shark technical committee members (RI and MA State) to provide EFH and nursery data to begin formulation of ASMFC Draft FMP for Atlantic Coastal Sharks. In addition, NEFSC staff organized and edited a peer-reviewed AFS volume (22 chapters) on shark nursery research in the Gulf of Mexico and U.S. Atlantic coastal waters (McCandless *et al.*, 2007a). Results from the studies detailed in this volume provided critical data needed for updating and refining EFH designations for the juvenile life stages of many coastal shark species (McCandless *et al.*, 2007b; Merson and Pratt, 2007).

Porbeagle Habitat Utilization

A study on the habitat utilization, movement patterns, and post-release survivorship of porbeagles captured on longline in the North Atlantic was funded by the University of New Hampshire Large Pelagics Research Center's External Grants Program. This work is in conjunction with scientists from Massachusetts Department of Marine Fisheries (MDMF) and the University of Massachusetts. The primary objective of this research is to deploy PAT tags to examine the migratory routes, potential nursery areas, swimming behavior, and environmental associations that characterize habitat utilization by porbeagles. In addition, information will be obtained to validate the assessment of the physiological effects of capture stress and post-release recovery in longline-captured porbeagles which will increase our understanding of capture related stress and the potential long-term effects on survival. Moreover, these efforts will potentially allow the quantification of the stress cascade for this shark species captured using commercial gear, thereby providing fishery managers with data showing the minimum standards for capturing (*e.g.* longline soak time) and releasing these fishes ensuring post-release survival. To date, 17 of the 20 PSATs deployed in 2006 released in 2007. Preliminary results were obtained and were presented at the 2008 American Elasmobranch Society meeting as well as at the PI meeting for the funding agency.

Pelagic Nursery Grounds

An investigation into pelagic nursery grounds was initiated with the collection of length-frequency data and biological samples, and the deployment of conventional and electronic tags on pelagic shark species as part of cooperative work with the high seas longline fleet. Sampling took place on board a commercial longline vessel targeting swordfish on the Grand Banks off Newfoundland and the Flemish Cap. In 19 sets, 666 sharks, primarily juvenile blue sharks and shortfin makos, were tagged with conventional tags as well and 2 shortfin makos with SPOT tags. The SPOT tags reported immediately and continued reporting for two weeks. One tag reported several months later. Dissections were accomplished on over 200 sharks.

COASTSPAN Survey

The NEFSC manages and coordinates this project, which surveys Atlantic coastal waters from Florida to Delaware and in the U.S. Virgin Islands, by conducting cooperative, comprehensive, and standardized investigations of coastal shark nursery habitat. Participants in the 2007 COASTSPAN survey included the North Carolina Division of Marine Fisheries, South Carolina Department of Natural Resources, Coastal Carolina University, Georgia Department of Natural Resources, and the Florida Fish and Wildlife Conservation Commission. Researchers from the NEFSC and the University of Rhode Island conducted the survey in Delaware Bay and the U.S. Virgin Islands (USVI). The first objective of the COASTSPAN survey is to determine the location of shark nursery grounds along the U.S. east coast using presence/absence data. The second objective is to determine the relative abundance, distribution and migrations of sharks utilizing these nursery grounds through longline and gillnet sampling and mark-recapture data. The COASTSPAN surveys in Delaware Bay and South Carolina have moved into this second phase, and these data produce standardized indices of abundance (McCandless, 2007; McCandless *et al.*, 2007c). The South Carolina indices of abundance for bonnethead, finetooth, Atlantic sharpnose and blacknose sharks were used in stock assessments for the 2007 Small Coastal Shark SEDAR process (McCandless *et al.*, 2007c). The NEFSC also conducts active and passive acoustic telemetry studies on juvenile blacktip and lemon sharks in Fish Bay, USVI, based on the results of the COASTSPAN survey in that area. This work is being conducted in cooperation with the MDMF and in conjunction with studies on other species by NMFS Galveston Laboratory and NMFS Headquarters. In addition, COASTPAN data from all states and the USVI were recently used to update and refine EFH designations for juvenile life stages of managed coastal shark species.

Habitat Utilization and Essential Fish Habitat of Delaware Bay Sand Tigers

Funding was received through the NOAA Living Marine Resources Cooperative Science Center to support the second year of cooperative research with staff from Delaware State University and the University of Rhode Island on habitat use, depth selection, and the timing of residency for sand tigers in Delaware Bay. Both manual and passive tracking were used to monitor sand tiger habitat utilization patterns during their Delaware Bay residency. Sand tigers were implanted with standard acoustic (n=19) and depth sensing transmitters (n=10) during the summers of 2006 and 2007. Two sand tigers tagged in June of 2006 returned to Delaware Bay during the third week of June 2007, which closely corresponded to the time of first successful captures that year. A total of 72,241 detections of telemetered sand tigers were collected on receivers during the 2006 and 2007 field seasons.

Elasmobranch Life History Studies

NEFSC life history studies are conducted on Atlantic species of elasmobranchs to address identified priority knowledge gaps and focus on species of concern because of declines and management issues. Biological samples are obtained on research surveys and cruises, on commercial vessels, at recreational fishing tournaments, and opportunistically from observers on commercial fishing vessels. In recent years, the shift has been to concentrate on a complete life history for a species to get a total picture for management. This comprehensive life history approach encompasses studies on age and growth rates and validation, diet and trophic ecology, and reproductive biology essential to estimate parameters for demographic, fisheries, and ecosystem models.

Collection of Recreational Shark Fishing Data and Samples

Biological samples for life history studies and catch and morphometric data for more than 300 pelagic sharks were collected at eight recreational fishing tournaments in the U.S. Northeast. This information will enhance ongoing biological studies and will be added to a long-term database of historic landings information for the period 1961–2007.

Atlantic Blue Shark and Shortfin Mako Life History and Assessment Studies

Collaborative programs to examine the biology and population dynamics of the blue shark and shortfin mako in the North Atlantic are ongoing. These studies—critical for use in stock assessment—are being conducted in collaboration with scientists at the University of Washington (blue shark) and University of Rhode Island (shortfin mako) and have resulted in the publication of two manuscripts in 2007. The blue shark research (Aires-da-Silva and Gallucci, 2007) provides fishery-independent demographic and risk analysis results for use in conservation and management with the construction of an age-structured matrix population model in which the vital rates are stochastic. The results of the demographic analyses confirm the importance of juvenile survival for population growth. The risk analysis is proposed as a supplement to the data-limited stock assessment to better evaluate the probability that a given management strategy will put the population at risk of decline. Shortfin mako survival was estimated from NMFS Cooperative Shark Tagging Program mark-recapture data (Wood *et al.*, 2007). Estimates of survival were generated with the computer software MARK, which provided a means for estimating parameters from the 6,309 tagged animals when they were recaptured (n=730). The results of several models are presented with various combinations of constant and time-specific survival and recovery rates and gave a range of survival for the shortfin mako from 0.705–0.873 $year^{-1}$. An estimate of survival is a key variable for stock assessments and subsequent demographic analyses and is crucial when it comes to directly managing exploited or commercially viable species.

Biology of the Thresher Shark

Life history studies of the thresher shark in the western North Atlantic continued with the completion of a manuscript on age. Age and growth estimates were generated using vertebral centra from 173 females, 135 males, and 11 individuals of unknown sex ranging in size from 56 to 264-centimeter fork length. In addition, further collection of food habits and reproductive samples were accomplished primarily at recreational fishing tournaments. Reproductive tissues were processed and sectioned using histological techniques with the results combined with the morphological reproductive data to determine sexual sizes at maturity for this species.

Biology of the Torpedo Ray

A life history study of the torpedo ray (*Torpedo nobiliana*) continued with data collection and sampling on over 150 rays for age and growth, reproduction, and food habits. Reproductive tissues were processed and sectioned using histological techniques, morphological data on organ measurements have been plotted and will be compared to the histological results. Vertebrae were also processed using histology and image analysis and are currently being read. This research is part of a University of Rhode Island graduate student's master's thesis.

Age and Growth of Coastal and Pelagic Sharks

Age and growth estimates for the smooth skate, *Malacoraja senta*, were published (Natanson *et al.*, 2007) and derived from 306 vertebral centra from skates caught in the North Atlantic off the coast of New Hampshire and Massachusetts. Male and female growth diverged at both ends of the data range and the sexes required different growth functions to describe them. Males and females were aged to 15 and 14 years, respectively. A manuscript on the ontogenetic changes in the vertebrae of the basking shark (*Cetorhinus maximus*) was accepted for publication by Marine Ecology Progress Series. In addition, collections of vertebrae took place at tournaments and fish were OTC-injected during fishing operations on board sport, commercial and research vessels.

Basking Shark Isotope Analysis

Researchers at the Woods Hole Oceanographic Institution, MDMF, and the NEFSC are using isotopic analysis on vertebrae to determine the trophic position of the basking shark as well as to learn more about their migratory behavior and ocean connectivity. This type of retrospective trophic-level reconstruction has broad applications in future studies on the ecology of this shark species to determine life-long feeding and migratory patterns and to augment electronic tag data.

Sable Island Seal Predation

An investigation into shark predation on five species of seal on Sable Island, Nova Scotia, Canada, is underway. Flesh wound patterns, tooth fragments, and bone markings are being analyzed to determine the identification of the predator. This work is being completed in conjunction with Sable Island researcher Zoe Lucas.

Diet, Feeding Ecology, and Gastric Evacuation Studies of Delaware Bay Sandbar and Smooth Dogfish Sharks

The diet and feeding ecology of sandbar sharks and smooth dogfish (*Mustelus canis*) are being investigated within Delaware Bay. These species are the two most abundant shark species in the Bay ecosystem, so their role as top predators within the Bay could be substantial. Research indicates that these two species exhibit distinctly different feeding strategies. Smooth dogfish nearly always contained food, which typically consisted of 5 to 10 prey items, but often more, in several states of digestion. The total relative mass of the stomach contents as a percentage body weight was usually around one percent. Sandbar sharks were frequently empty, and those containing food usually contained only one or two prey items. The sandbar sharks contained a smaller total mass of stomach contents (on average 0.5 percent body weight, but larger individual meals were consumed more frequently than in smooth dogfish. Overall, the sandbar shark had an intermittent feeding pattern relative to the rate of digestion but often consuming larger individual meals, whereas smooth dogfish had a continuous pattern with little or no pause between meals of smaller prey items. This may be at least partially linked to the energetic quality of the diet. Reported values in the literature for many of the important prey indicate lower energy content for the invertebrate prey commonly consumed by smooth dogfish than the teleost fish prey most prevalent in the sandbar shark diet; although, metabolic differences and digestive speed and efficiency also likely are not the same for the two species.

Movements and Migrations

CSTP

The CSTP provides information on distribution, movements and essential fish habitat for shark species in U.S. Atlantic and Gulf of Mexico waters. This program involves more than 7,000 volunteer recreational and commercial fishermen, scientists, and fisheries observers since 1962. Through 2007, over 205,000 sharks of more than 50 species were tagged and 12,400 sharks of 33 species were recaptured. To improve the quality of data collected through the CSTP, identification placards for coastal and pelagic shark species were produced and distributed in collaboration with RI Sea Grant. Substantial progress was made on the NEFSC Integrated Mark-Recapture Management System with data modules for tagging and contact information brought online and reports (letters to constituents) finalized including location maps and data. A toll free number was established as well as online reporting to collect information on recaptures for all species. This system creates a centralized tagging infrastructure for the more than 50 species of sharks in the CSTP and other NEFSC teleost tagging programs including cod, black sea bass, yellowtail flounder, and scup.

Electronic Tagging Studies and Movement Patterns

The primary objectives of the new technology tag studies are to examine shark migratory routes, potential nursery areas, swimming behavior, and environmental associations. Secondarily, these studies can assess the physiological effects of capture stress and post-release recovery in commercially- and recreationally-captured sharks. NEFSC electronic tagging studies include 1) acoustic tagging and bottom monitor studies for coastal shark species in Delaware Bay and the USVI as part of COASTSPAN; 2) tracking of porbeagle sharks with acoustic and PSATs in conjunction with the MDMF; 3) placing PSAT and SPOT tags on dusky and tiger sharks in conjunction with Monterey Bay Aquarium, UC Long Beach, and MDMF and 4) placing SPOT tags on shortfin makos on the Flemish Cap. Integration of data from conventional (CSTP) and new-technology tags (28 sharks of 5 species) is necessary to provide a comprehensive picture of the movements and migrations of sharks along with possible reasons for the use of particular migratory routes, swimming behavior, and environmental associations. Additionally, NEFSC staff attended a training session at the University of New Hampshire on the analysis of satellite tagging data using the statistical package KFTrack.

Post-Release Recovery and Survivorship Studies in Sharks—Physiological Effects of Capture Stress

This ongoing cooperative research with the MDMF and the University of Massachusetts, Dartmouth is directed toward coastal and pelagic shark species caught on recreational and commercial fishing gear. These studies use blood and muscle sampling methods coupled with acoustic tracking and PSAT data to quantify the magnitude and impacts of capture stress.

One study utilizing blood samples taken from 62 specimens of eight shark species on the NEFSC coastal and pelagic shark surveys is used to examine their physiological stress response to longline gear. Laboratory analyses for physiological stress indicators, including hematocrit, plasma ion levels, and red blood cell counts, have been partially completed for these samples. PSATs placed on three blood-sampled tiger sharks popped-up after 4 months and showed that these individuals recovered from the stress of longline capture. The combination of these PSAT data and the resulting blood analysis will provide valuable information on post-release

survivorship given the magnitude of capture stress. The results of this research will be critical to evaluate the extensive current catch-and-release management strategies for sharks.

Another ongoing cooperative study is on the post-release survivorship, habitat utilization, and movement patterns of porbeagles captured on longline gear in the North Atlantic using PAT tags. One of the objectives of this research is to quantify and characterize the long-term physiological effects of capture stress and post-release recovery in longline-captured porbeagles. These efforts will potentially allow the quantification of the stress cascade for this shark species captured on commercial gear, thereby providing fishery managers with data showing the minimum standards for capturing (*e.g.* longline soak time) and releasing these fishes while ensuring post-release survival. The second year brought analysis of the heat shock proteins on the sampled individuals. Additionally, 17 of the 20 PSATs released the last 11 months after tagging. All of the tagged individuals have corresponding blood samples currently being analyzed for stress indicators. These data in conjunction with PSAT data will provide important information on post-release survivorship.

Southeast Fisheries Science Center (SEFSC)

Stock Assessments of LCS, SCS, and Prohibited Sharks

The 2005/2006 assessment for the LCS Complex was run according to the SEDAR process. The SEDAR 11 Stock Assessment Report (NMFS, 2006a) compiled the new data used in the assessments, the report from the Assessment Workshop, and the final report by the peer reviewers (the Consensus Summary Report). This Stock Assessment Report constitutes the best available science. The results of the assessment, released on July 24, 2006 (71 FR 41774), showed that the Atlantic stock of sandbar sharks was overfished with overfishing occurring, the status of blacktip sharks in the Atlantic could not be determined due to an absence of reliable estimates of abundance, biomass, and exploitation rates, and the Gulf of Mexico stock of blacktip sharks was not overfished and overfishing was not occurring. A stock assessment of dusky shark, a prohibited species and candidate for listing under the ESA, was completed and released on May 25, 2006 (71 FR 30123). Results indicated that the dusky shark stock off the western North Atlantic had been depleted by 62 to 80 percent of the unfished virgin biomass.

In 2007 a stock assessment for SCS following the SEDAR process was completed on November 13, 2007 (72 FR 63888). Based on these assessments, NMFS determined blacknose sharks to be overfished with overfishing occurring; however, Atlantic sharpnose, bonnethead, and finetooth sharks were found to be not overfished with no overfishing occurring (May 7, 2008, 73 FR 25665). NMFS is currently working on a new amendment to rebuild blacknose sharks and end overfishing.

Update on Catches of Atlantic Sharks

An update on catches of LCS, SCS, and pelagic sharks in U.S. Atlantic, Gulf of Mexico, and Caribbean waters was generated in October 2006 (Cortés and Neer, 2005; SEDAR 11 LCS05/06-DW-16) and formed the basis of the catch scenarios included in the SEDAR Data Workshop report described above. Time series of commercial and recreational landings and discard estimates from several sources were compiled for the LCS complex and sandbar and blacktip sharks. In addition, recent species-specific commercial and recreational landings were provided for sharks in the large coastal, small coastal, and pelagic groups. Species-specific

information on the geographical distribution of commercial landings by gear type and geographical distribution of the recreational catches was also provided. Trends in length-frequency distributions and average weights and lengths of selected species reported from three separate recreational surveys and in the directed shark BLL observer program were also included. Another update on catches of Atlantic sharks was generated in 2007 for the SCS assessment (Cortés and Neer, 2007; SEDAR 13-DW-15). This document presented updated commercial and recreational landings of Atlantic SCS up to 2005. Species-specific information on the geographical distribution of commercial landings and recreational catches was presented along with the different gear types used in the commercial fisheries. Length-frequency information and average weights of the catches in three separate recreational surveys and in the directed shark BLL observer program were also included.

Status evaluation of shark species in the Species of Concern list

Funds from the NMFS Protected Resources Species of Concern Program were provided in 2006 to provide an assessment of the night shark as it pertains to the species of concern criteria. Productivity, abundance trends, and endemism were assessed (Carlson *et al.*, 2008) and based on the analysis of all current available information, night sharks should be removed from the NMFS species of concern list but retained on the prohibited species list as a precautionary approach to management until a more comprehensive assessment of the status of the stock can be conducted (*i.e.*, a stock assessment). A similar study was conducted on the sandtiger shark in 2008 (Carlson *et al*., 2009). While sand tigers shark have one of the lowest productivities among sharks in the Northwest Atlantic Ocean, results from this study indicate sand tigers do not meet all criteria outlined in the species of concern list. Sand tigers are not limited in their distribution and available evidence indicates that relative abundance and size have not declined substantially since pre-exploitation levels or at least lightly exploited levels. However, due to the very high levels of uncertainty in relative abundance trends, removal of this species from the NMFS species of concern list was not recommended and it should be retained as a precautionary approach.

Determination of critical habitat for the conservation of dusky shark using satellite archival tags

Habitat utilization and movement patterns and the utility of the closed area on the conservation and recovery of dusky shark are being examined using satellite archival tags. Information gathered through this study will not only verify the utilization of the closed area by dusky shark but also provide information on daily and seasonal movement patterns, such as migration corridors that could aid in developing additional critical habitat information. Data will also be obtained on preferred depth and habitat, which may help reduce further fishery interactions through bycatch mitigation.

As part of a cooperative study, funded by a NOAA/NMFS CRP grant awarded to the University of Southern Mississippi, dusky sharks have been tagged in the northern Gulf of Mexico to examine habitat utilization and movements of this species in the region. Preliminary results indicate somewhat random dispersion of this species throughout the Gulf of Mexico with at least one individual moving into the southern Gulf of Mexico, off the Yucatan Peninsula, a short time after initial tagging. The final results of this ongoing project, expected to be completed in 2009, will provide information on both short and long term movement patterns of dusky sharks as well as define temperature and depth preferences for the species.

Ecological Risk Assessments for Atlantic sharks

Several Ecological Risk Assessments (ERAs)—also known as Productivity and Susceptibility Analyses (PSA)—for the effect of fishing on Atlantic sharks were undertaken by SEFSC staff in 2008. The analyses included 1) a PSA for 37 species in the Atlantic shark complex as one of six case studies of the NMFS Vulnerability Evaluation Working Group, whose goal was to provide a methodology for determining the vulnerability of a stock to assist in revisions to the National Standard 1 (NS1) Guidelines; 2) an ERA for pelagic shark species as part of a Lenfest Ocean Program Expert Working Group to consider approaches to data-limited shark species and associated management strategies for achieving sustainable fisheries (Simpfendorfer *et al.*, 2008); and 3) a similar ERA for pelagic shark species for the International Commission for the Conservation of Atlantic Tunas (ICCAT) pelagic shark stock assessment meeting (Cortés *et al.*, 2008; SCRS/2008/017). These studies showed differential vulnerabilities of the various species included in the analyses. For pelagic sharks, the bigeye thresher, shortfin mako, longfin mako, and silky sharks tended to have the highest vulnerabilities and, thus, the highest risk of overexploitation.

Observer Programs: Shark Longline Program

From 1994 to 2004, the southeastern United States commercial shark BLL fishery was monitored by the University of Florida Commercial Shark Fishery Observer Program. In 2005, the responsibilities of the program were moved to the NOAA Fisheries Service Panama City Laboratory Shark Population Assessment Group in Panama City, FL. This program is designed to meet the intent of the ESA and the FMP for HMS. It was created to obtain better data on catch, bycatch, and discards in the shark BLL fishery. All observers are required to attend a 1-week safety training and species identification course prior to being dispatched to the fishery. While onboard the vessel, the observer records information on gear characteristics and all species caught, condition of the catch (*e.g.*, alive, dead, damaged, or unknown), and the final disposition of the catch (*e.g.*, kept, released, etc.). As of 2008, the target coverage level is 100 percent for vessels participating in the sandbar shark research fishery and 4-6 percent of the total fishing effort for vessels outside this fishery. This level is estimated to attain a sample size needed to provide estimates of protected resource interaction with an expected coefficient of variation of 0.3.

Observer Programs: Shark Gillnet Program

Since 1993, an observer program has been underway to estimate catch and bycatch in the directed shark gillnet fisheries along the southeastern U.S. Atlantic coast. This program was designed to meet the intent of the MMPA, ESA, and the 1999 revised FMP for HMS. It was also created to obtain better data on catch, bycatch, and discards in the shark fishery. The ALWTRP and the BiOp issued under Section 7 of ESA mandate 100 percent observer coverage during the right whale calving season (15 November - 1 April). Outside the right whale calving season (1 April - 14 November), observer coverage equivalent to 38 percent of all trips is maintained. Based on June 25, 2007 rule (72 FR 34632) shark gillnet vessels fishing between 29° 00' N and 26° 46.5' N have certain requirements as outlined 50 CFR § 229.32 from December 1 through March 31 of each year. These include vessel operators contacting the SEFSC Panama City Laboratory at least 48 hours prior to departure of a fishing trip in order to arrange for an observer. In addition, a recent rule (October 5, 2007, 72 FR 57104) amends restriction in the Southeast U.S.

Monitoring Area from December 1 through March 31. In that area the 100 percent observer coverage has been replaced with VMS requirements found in 50 CFR 635.69. Similar to the shark longline observer program, all observers are required to attend a 1-week safety training and species identification course and while onboard the vessel record information on gear characteristics and all species caught, condition of the catch, and the final disposition of the catch.

Ecosystem Modeling: Reconstructing ecosystem dynamics in the Gulf of Mexico. An assessment of the trophic impacts of fishing and its effects on keystone predator dynamics

Keystone species, such as sharks, can play a central role in the structure and function of marine communities. There are conflicting views surrounding the ecological interactions between sharks and fisheries. One view suggests that removals of keystone species are thought to cause a cascading trophic effect within the remaining community. These effects may involve changes in species composition among the prey or changes in the preferred prey of the predator. An alternate view has been suggested that the high diversity of oceanic systems may oppose strong "top-down" effects. In light of the recent revelations on the reductions of higher trophic levels species and fishing down food webs, an improved understanding of the role of keystone predators in the Gulf of Mexico would be useful in evaluating the impacts of fishing on the marine ecosystem. An Ecopath with Ecosim model has been developed to model the Gulf of Mexico ecosystem dynamics (Carlson, 2007). In addition, hierarchical-Bayesian (HB) statistical models coupled with ecological tracers are being developed to quantify relationships between predators and potential prey.

Shark Depredation Rates on Pelagic Longlines

A suite of modeling approaches was employed to analyze shark depredation rates from the US Atlantic pelagic longline fishery. As depredation events are relatively rare, there are a large number of zeroes in pelagic longline data, and conventional generalized GLMs may be ineffective as tools for statistical inference. GLMs (Poisson and negative-binomial), two-part (delta-lognormal and truncated negative binomial, T-NB), and mixture models (zero-inflated Poisson, ZIP, and zero-inflated negative binomial, ZINB) were used to understand the factors that contributed most to the occurrence of depredation events that included a small proportion of whale damage. Of the six distribution forms used, only the ZIP and T-NB models performed adequately in describing depredation data, and the T-NB and ZINB models outperformed the ZIP models in bootstrap cross-validation estimates of prediction error. Candidate T-NB and ZINB model results showed that encounter probabilities were more strongly related to large-scale covariates (space, season) and that depredation counts were correlated with small-scale characteristics of the fishery (temperature, catch composition). Moreover, there was little evidence of historical trends in depredation rates. The results show that the factors contributing to most depredation events are those already controlled by ships' captains and, beyond novel technologies to repel sharks, there may be little more to do to reduce depredation loss in the fishery within current economic and operational constraints. Results have recently been published in ICES Journal of Marine Science (MacNeil *et al.*, 2009).

Elasmobranch Feeding Ecology and Shark Diet Database

Because there is little quantitative species-specific data on diet, competition, predator-prey interactions, and habitat requirements of sharks, several studies are currently under way describing the diet and foraging ecology, habitat use, and predator–prey interactions of

elasmobranchs in various communities. Atlantic angel sharks (*Squatina dumerili*) have been collected for stomach content analysis from a trawl fishery in northeastern Florida since 2004. Evidence suggests angel sharks consumed mostly teleost fishes, with Atlantic croaker (*Micropogonias undulatus*) being the most common fish species (Baremore *et al.*, 2006). The diet of the roundel skate, *Raja texana*, from the northern Gulf of Mexico is also being examined (Bethea and Hale, 2006). A database containing information on quantitative diet studies of sharks conducted around the world has been in development for several years and presently includes over 200 studies. This fully searchable database will continue to be updated and fine-tuned and is being used as part of a collaborative study with researchers from the University of Washington, University of Wisconsin, and the Inter-American Tropical Tuna Commission, aimed at characterizing intra-guild predation and cannibalism in pelagic predators and evaluate the implications for the dynamics, assessment and management of Pacific tuna populations.

Cooperative Gulf of Mexico States Shark Pupping and Nursery Survey (Gulfspan)

The SEFSC Panama City Shark Population Assessment Group manages and coordinates a survey of coastal bays and estuaries between northwest Florida (Cedar Key-Pensacola) and Texas. Surveys identify the presence/absence of neonate and juvenile sharks and attempt to quantify the relative importance of each area as it pertains to EFH requirements for sharks. The SEFSC Panama City Shark Population Assessment Group also initiated a juvenile shark abundance index survey in 1996. The index is based on random, depth-stratified gillnet sets conducted throughout coastal bays and estuaries in northwest Florida monthly from April to October. The species targeted for the index of abundance are juvenile sharks in the large and small coastal management groups. This index has been utilized as an input to various stock assessment models.

Cooperative SEAMAP Gulf of Mexico Bottom Longline Surveys

A recent SEAMAP initiative (formally began in 2008) is for Gulf of Mexico states to conduct coastal BLL surveys. The SEAMAP surveys are intended to provide a near-coastal index (monthly from March to November as logistics allow) to augment the more offshore Mississippi Laboratories surveys. Similar longline gear and survey designs and tagging protocols are used. At present Texas Parks and Wildlife and Gulf Coast Research Laboratory (Ocean Springs, Mississippi) are participating. The State of Alabama is considering participating in conjunction with current effort by Dauphin Island Sea Lab, University of Southern Alabama, a project that also follows Mississippi Laboratories protocols. The State of Florida has not began SEAMAP longline surveys but did provide a representative to the planning meeting and indications are that provided they can coordinate vessel time they may participate as well. The State of Louisiana is not interested in a SEAMAP BLL effort at present due to a lack of vessel resources.

Development of shark tagging interactive website, NMFS Mississippi Laboratories and NMFS Panama City Laboratory

This cooperative tag tracking effort is based on tagging effort by the Mississippi Laboratories and the Panama City Laboratory, and incorporates tagging information in an accessible format that allows new tagging effort and tag return tracking, coupled with tag specimen specifics (genus, species, morphometrics, sampling, location, release and recapture information). The website is designed to allow researchers access to important tagging vitals.

Essential Fish Habitat

Conventional theory assumes that shark nursery areas are habitats where female sharks give birth to young or lay eggs, or where juvenile sharks spend their first weeks, months, or years of life. The SEFSC Panama City Shark Population Assessment Group is currently testing a number of hypotheses regarding juvenile sharks and EFH that challenge this assumption. There are many bays and inlets along the Gulf of Mexico coastline which may serve as EFH for sharks. These habitats vary from near-oceanic conditions to shallow, enclosed estuarine areas. Following Heupel *et al.* (2007), the SEFSC Panama City Shark Population Assessment Group is determining which habitats provide a greater "nursery value" for a given species. A study using diet and bioenergetics published in 2006 by the Panama City Laboratory (Bethea *et al.*, 2006) concluded that Crooked Island Sound provided a greater "nursery value" than Apalachicola Bay, FL.

Life History Studies of Elasmobranchs

Biological samples are obtained through research surveys and cruises, recreational fishers, and collection by onboard observers on commercial fishing vessels. Age and growth rates and other life history aspects of selected species are processed and data analyzed following standard methodology. This information is vital as input to population models incorporating variation and uncertainty in estimates of life-history traits to predict the productivity of the stocks and ensure they are harvested at sustainable levels. Samples are obtained from commercial fishers and fishery-independent surveys. Samples and preliminary analysis continue on determining life history parameters for skates in the Gulf of Mexico, a group of elasmobranchs often ignored despite being harvested as catch and bycatch in commercial fisheries. In 2006, the age and growth parameters of blacktip sharks (Carlson *et al*., 2006) and scalloped hammerhead shark (Piercy *et al*., 2007) from the Gulf of Mexico and southeast United States were published. In addition, a study was published on the reproductive cycle of blacknose sharks in the Gulf of Mexico, which concluded that not all carcharhinid sharks exhibit a biennial reproductive cycle (Sulikowski *et a*l., 2007). Along this line, new studies began in 2006 on the age and growth of great hammerheads, diet of tiger shark, and reproductive cycle and maturity schedule of blacktip sharks and sandbar sharks in the Atlantic Ocean.

Recent studies have indicated that at least two species of small coastal sharks have divergent reproductive cycles within the western North Atlantic Ocean (Driggers *et al*., 2004). Results of these studies suggest the reproductive biology of many sharks could be spatially and temporally variable. As a result, in depth studies of the reproductive biology of several species, including the Atlantic sharpnose, bonnethead, finetooth, smoothhound (*Mustelus mustelus*), Cuban dogfish (*Squalus cubensis*), and shortspine dogfish (*Squalus mitsukurii*) sharks, are being conducted using samples collected throughout the northern Gulf of Mexico and/or the eastern seaboard. Additionally, the life history of several deepwater sharks, including *Etmopterus* sp. and *Squaliolus laticaudus*, is being examined and results will provide baseline data for those species potentially impacted by developing deepwater fisheries.

The life history of *Mustelus* sp. is being examined in the northern Gulf of Mexico. Historically, there have been at least three putative species of smoothhounds in the area, however,

genetic analysis indicate that only two exist. While *Mustelus* sp. is not a managed species it is frequently encountered as bycatch in several fisheries.

Using molecular techniques, biologists from the Pascagoula laboratory have discovered a new species of hammerhead shark. To date, this new species has only been found in the western North Atlantic Ocean. The formal description of this species, tentatively called *Sphyrna gilberti*, is near completion. Morphologically, the new species is nearly identical to the scalloped hammerhead, therefore, additional work will be needed to examine the relative abundance of both species in U.S. waters.

Elemental chemistry of elasmobranch vertebrae

Although numerous studies have utilized elemental analysis techniques for age determination in bony fishes, little work has been conducted utilizing these procedures to verify age assessments or temporal periodicity of growth band formation in elasmobranchs. A study was completed in 2006 to determine the potential of laser ablation inductively coupled plasma-mass spectrometry (LA-ICP-MS) to provide information on the seasonal deposition of elements in the vertebrae of the round stingray. Spatially resolved time scans for elements across the round stingray vertebrae showed peaks in calcium intensity that aligned with and corresponded to the number of seasonal growth bands identified using standard light microscopy. Higher signals of calcium were associated with the wide opaque bands while lower signals of calcium corresponded to the narrow translucent bands. While a close alignment between the numbers of calcium peaks and annual growth bands was observed in round stingray samples aged five years or younger, this relationship was less well defined in vertebral samples from round stingrays over 11 years old. To the best of our knowledge, this is the first study of its kind to utilize ICP-MS to verify age assessments and seasonal band formation in an elasmobranch. The results of this research were published in 2006 (Hale *et al*., 2006).

Cooperative Research—Brazil-U.S. pelagic shark research project

The main goal of this cooperative project between Brazil (Universidade Federal Rural de Pernambuco) and the United States (SEFSC and the University of Florida's Museum of Natural History) is to conduct simultaneous research on pelagic sharks in the North and South Atlantic Ocean. Central to this project is also the development of fisheries research capacity in Brazil through graduate student training and stronger scientific cooperation between Brazil and the United States. The main research objectives include: 1) development of bycatch reduction and habitat models; 2) investigation of movement and migratory patterns; and 3) ancillary life history studies. Bycatch reduction is being investigated with the placement of hook timers and temperature-depth recorders (TDRs) on fishing gear to gain information on preferential feeding times, fishing depths, and temperatures of pelagic sharks and associated fauna. This information can be used in the future for development of habitat-based models. Movement and migratory patterns are being investigated through the deployment of pop-up satellite tags on pelagic species that are frequently caught in fishing operations or are of special importance to conservation interests in both countries. Information gathered will provide insight into geographical and vertical distribution patterns, which in turn will provide data on catchability that can be used if bycatch reduction measures are implemented in the future. Data obtained from hook timers, TDRs, and archival tags can also be used to estimate the susceptibility of pelagic shark species to surface longline fisheries under ERA approaches. To date, an oceanic whitetip, a longfin mako,

and a bigeye thresher shark have been tagged with satellite tags off U.S. waters, and two blue sharks have been tagged off Brazilian waters as part of this project. The ancillary studies include genetic, age and growth, reproduction and trophic ecology analysis.

Cooperative Research— University of Southern Mississippi-NMFS Mississippi Laboratory shark research project

The movement patterns of whale sharks in the northern Gulf of Mexico are being examined using satellite tags in cooperation with scientists from various institutions, including the University of Southern Mississippi. An area off the Mississippi River Delta has been identified where a large number of whale sharks occur on a predictable cycle (Burks *et al*., 2006. This ongoing project will provide information on habitat utilization, seasonal distribution and large scale horizontal and vertical movements of whale sharks in the northern Gulf of Mexico. Additionally, movements of silky, tiger and scalloped hammerhead sharks are being investigated using satellite tags.

Shark Assessment Research Surveys

The SEFSC Mississippi Laboratories has conducted BLL surveys in the Gulf of Mexico, Caribbean, and Southern North Atlantic since 1995 (21 surveys completed through 2005). The primary objective was assessment of the distribution and abundance of large and SCS across their known ranges to develop a time series for trend analysis. The surveys were designed to satisfy five important assessment principles: stockwide survey, synopticity, well-defined universe, controlling biases, and useful precision. The BLL surveys are the only long-term, nearly stock-wide, fishery-independent surveys of Western North Atlantic Ocean sharks conducted in U.S. and neighboring waters. Ancillary objectives were to collect biological and environmental data and to tag-and-release sharks. Starting in 1997 and under the auspices of the MEXUS Gulf Program, the Mississippi Laboratories have provided logistical and technical support to Mexico's Instituto Nacional de la Pesca to conduct a cooperative research cruise aboard both the NOAA Ship OREGON II (1997 and 1998) and the Mexican research vessel Onjuku (2001 and 2002) in Mexican waters of the Gulf of Mexico. The circumference of Cuba was surveyed with the NOAA Ship OREGON II during 1998. One of the most noteworthy changes in the surveys was a shift from the standard "J" hook used in all the earlier surveys to a circle "C" hook (gear testing surveys conducted in 2000), which is much more efficient for capturing teleosts and slightly more efficient for elasmobranchs. Current surveys continue to address expanding fisheries management requirements for both elasmobranchs and teleosts and annual surveys include the U.S. Atlantic coast from Cape Hatteras to southern Florida and the U.S. Gulf of Mexico.

Shark Research Fishery

Amendment 2 to the Consolidated HMS FMP established a shark research fishery to maintain time series data for stock assessments and to help meet NMFS' shark research objectives. Each year, NMFS determines the research objectives for the upcoming shark research fishery. The research objectives are developed by a shark board, which is comprised of representatives within NMFS including representatives from the SEFSC Panama City Laboratory, NEFSC Narragansett Laboratory, the Southeast Regional Office of Protected Resources Division (SERO\PRD), and the HMS Management Division. The research objectives of the shark research fishery are primarily based on the research needs identified in shark stock assessments.

Many of the research objectives for 2008 and 2009 came from the SEDAR 11, 2005/2006 LCS stock assessment. These objectives were developed with input from non-governmental organizations, industry representatives, fishery managers, and academics present during the stock assessment workshops. In addition, the shark board identified additional needs for tagging studies, collection of genetic material, and controlled BLL experiments to assess the impact of different hook types.

Other Recent Shark Research:

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3.3 Habitat

Section 303(a)(7) of the Magnuson-Stevens Act, 16 U.S.C. §§ 1801 *et seq*., requires FMPs to 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 EFH:

> "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 require that EFH be described and identified within the U.S. EEZ for all life stages of each species in a fishery management unit. FMPs must describe EFH in text, tables, and figures 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. Habitats that satisfy the criteria in the Magnuson-Stevens Act have been identified and described as EFH in the 1999 FMPs and in Amendment 1 to the 1999 Tunas, Swordfish, and Shark FMP and were updated in Amendment 1 to the 2006 Consolidated HMS FMP.

NMFS originally described and identified EFH and related EFH regulatory elements for all HMS in the management unit in the 1999 FMPs, which were updated in Amendment 1 to the 1999 Tunas, Swordfish, and Shark FMP and implemented in 2003. The EFH regulations require NMFS to conduct a comprehensive review of all EFH related information at least once every five years and revise or amend the EFH boundaries if warranted. To that effect, NMFS undertook the comprehensive five-year review of information pertaining to EFH for all HMS in the management unit in the 2006 Consolidated HMS FMP. Based on the findings of this review, NMFS issued a Notice of Intent to amend EFH for HMS through Amendment 1 to the 2006 Consolidate HMS FMP on November 7, 2006 (71 FR 65087). In the Notice of Intent NMFS described its intent to prepare an Environmental Impact Statement (EIS) to examine alternatives for updating existing HMS Essential Fish Habitat (EFH), consider additional Habitat Areas of Particular Concern (HAPCs), analyze fishing gear impacts, and if necessary, identify ways to avoid or minimize, to the extent practicable, adverse fishing impacts on EFH consistent with the Magnuson-Stevens Act and other relevant federal laws. At that time, NMFS requested new information not previously considered in the 2006 Consolidated HMS FMP, comments on potential HAPCs, and information regarding potential fishing and non-fishing impacts that may adversely affect EFH.

On June 12, 2009, NMFS published a Notice of Availability of the Final Environmental Impact Statement for Amendment 1 to the 2006 Consolidated HMS FMP for Essential Fish Habitat (EFH) (74 FR 28018). This amendment updated and revised EFH boundaries for HMS, designated a new HAPC for bluefin tuna in the Gulf of Mexico, and analyzed fishing and non-fishing impacts on EFH. To facilitate public outreach, an internet-based mapping program (HMS EFH Evaluation Tool) was created to show the updated and revised EFH boundaries for HMS. Currently, there is no EFH designated for smooth dogfish and, therefore, no specific management measures exist to mitigate adverse impacts, if any, to such EFH from fishing.

3.3.1.1 Habitat Areas of Particular Concern

To further the conservation and enhancement of EFH, the EFH guidelines encourage FMPs to identify HAPCs. HAPCs are areas within EFH that meet one or more of the following criteria: they are ecologically important, particularly vulnerable to degradation, undergoing stress from development, or are a rare habitat type. HAPCs can be used to focus conservation efforts on specific habitat types that are particularly important to managed species. Currently, HAPC has been designated for two HMS species: sandbar sharks and bluefin tuna. The areas off of North Carolina, Chesapeake Bay, MD, and Great Bay, NJ, have been identified as a HAPC for sandbar sharks (1999 FMP). HAPC for bluefin tuna was designated in Amendment 1 to the 2006 Consolidated HMS FMP and is located across the western, northern, and central Gulf of Mexico.

3.3.2 Habitat Types and Distributions

Sharks may be found in large expanses of the world's oceans, straddling jurisdictional boundaries. Although many of the species frequent other oceans of the world, the Magnuson-Stevens Act only authorizes the description and identification of EFH in federal, state or territorial waters, including areas of the U.S. Caribbean, the Gulf of Mexico, and the Atlantic coast of the United States to the seaward limit of the EEZ. For a detailed description of shark coastal and estuarine habitat, continental shelf and slope area habitat, and pelagic habitat for the Atlantic, Gulf of Mexico, and U.S. Caribbean, please refer to Section 3.3.2 of the 2006 Consolidated HMS FMP.

3.4 Fishery Data Update

In this section, HMS fishery data are analyzed by gear type. While HMS fishermen generally target particular species, the non-selective nature of most fishing gears promote effective analysis and management on a gear-by-gear basis. In addition, issues such as bycatch and safety are generally better addressed by gear type.

The revised list of authorized fisheries (LOF) and fishing gear used in those fisheries became effective December 1, 1999 (64 FR 67511). The rule applies to all U.S. marine fisheries, including Atlantic HMS. As stated in the rule, "no person or vessel may employ fishing gear or participate in a fishery in the EEZ not included in this LOF without giving 90 days' advance notice to the appropriate Fishery Management Council (Council) or, with respect to Atlantic HMS, the Secretary of Commerce (Secretary)." Acceptable HMS fisheries and authorized gear

types for Atlantic tunas, swordfish, and sharks include: swordfish handgear fishery - rod and reel, harpoon, handline, bandit gear, buoy gear; PLL fishery - longline; shark drift gillnet fishery - gillnet; shark BLL fishery - longline; shark recreational fishery - rod and reel, handline; tuna purse seine fishery - purse seine; tuna recreational fishery- rod and reel, handline; and tuna handgear fishery - rod and reel, harpoon, handline, bandit gear. For Atlantic billfish, the only acceptable fishery and authorized gear type is recreational fishery - rod and reel. Species whose life history characteristics may lead to their eventual categorization as highly migratory, but which are not currently under the Secretary or Regional Council management authority, are covered in two broad categories: Recreational Fisheries (Non-FMP) and Commercial Fisheries (Non-FMP). Species that fit this description may be harvested with the gears listed for these catchall categories.

3.4.1 Bottom Longline

3.4.1.1 Domestic History and Current Management

The majority of commercially caught sharks are caught using BLL gear. However, the regulations for the shark fishery as discussed in this section apply to all gear types. In 1993, NMFS implemented the FMP for Sharks of the Atlantic Ocean, which established three management units: LCS, SCS, and pelagic sharks. At that time, NMFS identified LCS as overfished, and implemented commercial quotas for LCS and established recreational harvest limits for all sharks. In 2003, NMFS amended the measures enacted in the 1999 FMP based on the 2002 LCS and SCS stock assessments, litigation, and public comments. Implementing regulations for Amendment 1 to the 1999 FMP were published on December 24, 2003 (68 FR 74746). Management measures enacted in the amendment included: re-aggregating the large coastal shark complex, using MSY as a basis for setting commercial quotas, eliminating the commercial minimum size restrictions, establishing three regional commercial quotas (Gulf of Mexico, South Atlantic, and North Atlantic) for LCS and SCS management units, implementing trimester commercial fishing seasons effective January 1, 2005, imposing gear restrictions to reduce bycatch, and a time/area closure off the coast of North Carolina effective January 1, 2005. As a result of using MSY to establish quotas, and implementing a new rebuilding plan, the overall annual landings quota for LCS in 2004 was established at 1,017 metric tons (mt) dressed weight (dw). The overall annual landings quota for SCS was established at 454 mt dw and the pelagic, blue, and porbeagle shark quotas were established at 488 mt dw, 273 mt dw, and 92 mt dw, respectively.

The regional quotas which were established in Amendment 1 to the 1999 HMS FMP for LCS and SCS were intended to improve overall management of the stocks by tailoring quotas to specific regions based on landings information. These quotas were based upon average historical landings (1999 – 2001) from the canvass and quota monitoring databases. The canvass database provides a near-census of the landings at major dealers in the southeast United States (including state landings) and the quota monitoring database collects information from dealers in the South Atlantic and Gulf of Mexico.

On November 30, 2004, NMFS issued a final rule (69 FR 69537), which established, among other things, new regional quotas based on updated landings information from 1999 – 2003. This final rule did not change the overall quotas for LCS, SCS, and pelagic sharks

established in Amendment 1 to the 1999 HMS FMP, but did revise the percentages allocated to each of the regions. The updated information was based on several different databases, including the canvass and quota monitoring databases, the Northeast Commercial Fisheries Database (CFDBS), and the snapper-grouper logbook. The new regional quotas and trimester seasons for the commercial Atlantic shark fishery became effective January 1, 2005.

The final rule for Amendment 2 to the 2006 Consolidated HMS FMP published on June 24, 2008 (73 FR 35778) with a correction published on July 15, 2008 (73 FR 40658). The final rule became effective on July 24, 2008. In the final rule, NMFS removed sandbar sharks from the LCS quota and established a non-sandbar LCS quota. In addition, NMFS established two regions for the non-sandbar LCS: an Atlantic and Gulf of Mexico region. NMFS also implemented new annual adjusted quotas for sandbar sharks (87.9 mt dw), non-sandbar LCS (Atlantic: 187.7 mt dw; Gulf of Mexico: 390.5 mt dw), and a porbeagle shark commercial quota (1.7 mt dw). The sandbar shark and non-sandbar LCS quotas would increase to their annual base quotas of 116.6 mt dw for sandbar sharks, 188.3 mt dw for non-sandbar LCS in the Atlantic region, and 439.5 mt dw for non-sandbar LCS in the Gulf of Mexico region as of January 1, 2013, depending on overharvests. NMFS maintained the annual SCS quota (454 mt dw), pelagic sharks quota (273 mt dw for blue sharks), and quota for pelagic sharks other than porbeagle and blue sharks (488 mt dw).

Commercial shark fishing effort is generally concentrated in the southeastern United States and Gulf of Mexico (Cortés and Neer, 2005). During 1997 – 2004, 92 – 99 percent of LCS, 37 – 49 percent of pelagic sharks, and nearly all SCS (80 – 100 percent) came from the southeast region (Cortés and Neer, 2005). McHugh and Murray (1997) found in a survey of shark fishery participants that the largest concentration of BLL 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. Consistent with other HMS fisheries, some shark fishery participants move from their homeports to other fishing areas as the seasons change and fish stocks move.

The Atlantic BLL fishery targets both LCS and SCS. BLL is the primary commercial gear employed in the LCS and SCS fisheries in all regions. Gear characteristics vary by region, but in general, an approximately ten-mile long BLL containing about 600 hooks, is fished overnight. Skates, sharks, or various fin fishes are used as bait. 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.

3.4.1.2 Recent Catch and Landings Data

The following section provides information on shark landings as reported in the shark BLL observer program. In January 2002, the observer coverage requirements in the shark BLL fishery changed from voluntary to mandatory participation if selected. Vessels were randomly selected if they have a directed shark LAP, have reported landings from sharks during the previous year, and have not been selected for observer coverage during each of the three previous seasons.

The U.S. Atlantic commercial shark BLL fishery was monitored by the University of Florida and Florida Museum of Natural History, Commercial Shark Fishery Observer Program (CSFOP) from 1994 through the first season of 2005. In June 2005, responsibility for the observer program was transferred to the SEFSC's Panama City Laboratory. The observer program trains and places the observers aboard vessels in the directed shark BLL fishery in the Atlantic and Gulf of Mexico to collect data on the commercial shark fishery, and thus, improve overall management strategies for the fishery. Observers provide baseline characterization information, by region, on catch rates, species composition, catch disposition, relative abundance, and size composition within species for the LCS and SCS BLL fisheries.

During 2003, six observers logged 263 sea days on shark fishing trips aboard 20 vessels in the Atlantic from North Carolina to Florida and in the eastern Gulf of Mexico off Florida. The number of trips taken on each vessel ranged from one to five and the number of sea days each observer logged ranged from nine to 35. Observers documented the catches and fishing effort on approximately 150 longline sets that fished 103,351 hooks. During 2003, LCS comprised 68.4 percent of the total catch, and sandbar sharks were 30.6 percent of total LCS catch.

During 2004, five observers logged 196 sea days on 56 shark fishing trips aboard 11 vessels. Observers documented the catches and fishing effort during 120 longline sets that fished 90,980 hooks. In 2004 LCS comprised 66.7 percent of the total catch, and sandbar sharks were 26.6 percent of catch in 2004. Regional differences in sandbar shark abundance were evident. For example, in the Carolina region, sandbar sharks comprised 67.4 percent of the total catch and 77.2 percent of the LCS 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, whereas in the Florida East Coast region, sandbar sharks comprised only 17.2 percent of the total observed catch, and 37.1 percent of the LCS catch (Burgess and Morgan, 2003). Blacktip sharks comprised 13.9 percent of total observed catch and 20.3 percent of the LCS catch (Burgess and Morgan, 2002). Tiger sharks comprised 7.5 percent of the total observed catch and 11.0 percent of the LCS catch. A majority of tiger sharks (71.7 percent) and nurse sharks (98.8 percent) were tagged and released.

From July 2005 through December 2006, five observers logged 89 trips on 37 vessels with a total of 211 hauls for the second and third seasons in the Atlantic from North Carolina to Florida and in the eastern Gulf of Mexico off Florida (Hale and Carlson, 2007). Observers documented the catches and fishing effort on 34 hauls on four trips targeting grouper/snapper or grouper/shark in the Gulf of Mexico, 82 hauls on 31 trips targeting shark in the Gulf of Mexico, 77 hauls on 50 trips targeting ships in the South Atlantic, and 18 hauls on four trips observed targeting tilefish in the South Atlantic.

From January to November 2007, the shark BLL observer program covered a total of 42 trips on 25 vessels with a total of 264 hauls. Gear characteristics of trips varied by area (Gulf of Mexico or the U.S. Atlantic Ocean) and target species (grouper/snapper or grouper/tilefish, shark or tilefish) (for more details, see Hale *et al*., 2007). There were no grouper/snapper-targeted trips observed in the U.S. Atlantic Ocean. No trips were observed in the northern U.S. Atlantic Ocean. Observers documented the catches and fishing effort on 179 hauls and 10 trips targeting snapper/grouper or grouper/tilefish in the Gulf of Mexico. There were 24 hauls on 7 trips

observed targeting sharks in the Gulf of Mexico. In the U.S. Atlantic Ocean, 39 hauls on 21 trips were observed targeting shark, and 22 hauls on three trips were observed targeting tilefish.

In 2007 on the trips targeting shark in the Gulf of Mexico, 1,302 individual animals were caught. This consisted of 94.9 percent sharks, 4.1 percent teleosts, 0.5 percent invertebrates, and 0.2 percent batoids. LCS comprised the greatest amount of shark catch, at 69.5 percent, and SCS comprised 30.3 percent. The prohibited dusky shark was also caught (0.1 percent). Red grouper was the most caught teleost, while blacktip sharks was the most commonly caught shark (Hale *et al*., 2007).

In 2007 on the trips targeting grouper/snapper or grouper/tilefish in the Gulf of Mexico, 8,980 individual animals were caught. This consisted of 87.3 percent teleosts, 11.6 percent sharks, 0.2 percent batoids, and 0.8 percent invertebrates. LCS species comprised 16.5 percent of the shark catch, while SCS comprised the majority of the shark catch at 73.7 percent. Red grouper was the most caught teleost, and Atlantic sharpnose were the most caught sharks (Hale *et al*., 2007).

On the trips targeting shark in the South Atlantic in 2007, 2,735 individual animals were caught. This consisted of 95.7 percent sharks, 2.5 percent teleosts, 1.2 percent batoids, and 0.4 percent invertebrates. Large coastal shark species comprised 78.7 percent of the shark catch while SCS species comprised 19.2 percent of the shark catch. Sandbar sharks and tiger sharks were the most commonly caught LCS. Other shark species caught were dusky sharks, sand tiger sharks, night sharks, and sixgill sharks. Great amberjack, almaco jack, and great barracuda were the most commonly caught teleosts (Hale *et al.*, 2007).

On the trips targeting tilefish in the South Atlantic in 2007, 1,293 individual animals were caught. This consisted of 97.2 percent teleosts, 2.5 percent sharks, and 0.2 percent invertebrates. LCS comprised 9.4 percent of the shark catch, while no SCS species were caught. Other shark species caught included the sevengill shark, shortfin mako shark, smooth dogfish and spiny dogfish (87.5 percent). Spiny dogfish was the most commonly caught shark species (75 percent) while tilefish was the most caught teleost at 97.5 percent (Hale *et al*., 2007).

BLL for sharks has relatively low observed bycatch rates. For vessels targeting sharks in the Gulf of Mexico in 2007, four loggerhead turtles were observed caught in BLL gear. Of these, two were released alive, and two were released dead. For vessels targeting shark in the Atlantic, no loggerhead turtles were observed caught in BLL gear. However, three smalltooth sawfish were observed caught, with two being released alive and one released dead.

From January to December 2008, the shark BLL observer program covered a total of 50 trips on 17 vessels with a total of 214 hauls. Gear characteristics of trips varied by area (Gulf of Mexico or the U.S. Atlantic Ocean) and target species (grouper/snapper or grouper/tilefish, shark or tilefish) (for more details, see Hale *et al*., 2009). There were no grouper/snapper or grouper/tilefish targeted trips observed in the U.S. Atlantic Ocean. No trips were observed in the northern U.S. Atlantic Ocean. Observers documented the catches and fishing effort on 147 hauls and 7 trips targeting snapper/grouper or grouper/tilefish in the Gulf of Mexico. There were 41

hauls on 27 trips observed targeting sharks in the Gulf of Mexico. In the U.S. Atlantic Ocean, 26 hauls on 16 trips were observed targeting sharks.

In 2008 on the trips targeting shark in the Gulf of Mexico, 2,540 individual animals were caught. This consisted of 90.8 percent sharks, 7.7 percent teleosts, 0.8 percent invertebrates, and 0.6 percent batoids. LCS comprised the greatest amount of shark catch, at 75.3 percent, and SCS comprised 22.3 percent. The prohibited dusky shark, Caribbean reef shark, night shark, and white shark were also caught (1.0 percent). King snake eel was the most caught teleost (55.4 percent), and sandbar shark was the most commonly caught shark (16.6 percent) (Hale *et al*., 2009).

In 2008, on the trips targeting grouper/snapper or grouper/tilefish in the Gulf of Mexico, 10,253 individual animals were caught. This consisted of 86.1 percent teleosts, 12.0 percent sharks, 1.8 percent invertebrates, and 0.04 percent batoids. Deep water shark species comprised the majority of the shark catch at 52.0 percent, followed by small coastal sharks (29.5 percent), large coastal sharks (10.4 percent) and pelagic sharks (0.1 percent). Yellow edge grouper was the most caught teleost, and smooth dogfish was the most caught shark (Hale *et al*., 2009).

On the trips targeting shark in the South Atlantic in 2008, 1,836 individual animals were caught. This consisted of 99.1 percent sharks, 0.4 percent teleosts 0.4 percent batoids, and 0.1 percent invertebrates. Large coastal shark species comprised 83.8 percent of the shark catch while SCS species comprised 16.1 percent and deep water sharks comprised 0.1 percent of the shark catch. Tiger sharks were the most commonly caught shark (50.5 percent) and cobia were the most commonly caught teleost (28.6 percent) (Hale *et al.*, 2009).

BLL for sharks has relatively low observed bycatch rates. For vessels targeting sharks in the Gulf of Mexico in 2008, two smalltooth sawfish were observed caught in BLL gear and both were released alive. No other protected species interactions were observed in the Gulf of Mexico directed shark BLL fishery. For vessels targeting shark in the Atlantic, one loggerhead turtle was observed caught in BLL gear and ultimately released alive. No other protected species interactions were observed in the South Atlantic directed shark BLL fishery (Hale *et al.*, 2009).

3.4.1.3 Bottom Longline Bycatch

Under MMPA (16 U.S.C. 1361 *et seq*.) the Atlantic shark gillnet fishery is classified as Category II (occasional serious injuries and mortalities), and the shark BLL as Category III (remote likelihood or no known serious injuries or mortalities) (June 28, 2007; 72 FR 35393). The Southeast Regional Office of Protected Resources Division prepared a new BiOp regarding the actions implemented under the final rule for Amendment 2 to the Consolidated HMS FMP on May 20, 2008. The BiOp concluded, based on the best available scientific information, that Amendment 2 to the HMS FMP was not likely to jeopardize the continued existence of endangered green, leatherback, and Kemp's ridley sea turtles; the endangered smalltooth sawfish; or the threatened loggerhead sea turtle. The actions implemented under Amendment 2 were not expected to increase endangered species or marine mammal interaction rates. Furthermore, the BiOp concluded that the actions implemented under Amendment 2 were not likely to adversely affect any listed species of marine mammals, invertebrates (*i.e.*, listed species of coral) or other listed species of fishes (*i.e.*, Gulf sturgeon and Atlantic salmon) in the action area.

The BiOp analyzed the effects of the commercial and recreational shark fisheries under Amendment 2 on sea turtles and smalltooth sawfish. These analyses recognized that the actions implemented under Amendment 2 would reduce shark fishing effort as a result of reduced quotas and retention limits (compared to 2004-2007 levels). These measures were expected to reduce the number of participants targeting sharks and should reduce impacts of BLL gear on endangered or threatened sea turtles. It also recognized that smalltooth sawfish interactions with BLL gear may also decline; however, since nearly all individuals are expected to survive interaction with this gear, the BiOp concludes that the actions implemented under Amendment 2 would have little effect on smalltooth sawfish mortality. Furthermore, the BiOp recognized that changes in shark strikenet effort under Amendment 2 were not likely to adversely affect sea turtle or smalltooth sawfish takes because very few takes occur as a result of gillnet practices prior to Amendment 2. The BiOp also stated that drift or sink gillnet sea turtle and smalltooth sawfish takes were more frequent compared to the strikenet fishery, but were still minimal compared to BLL fishing.

The BiOp recognized that implementing 100 percent observer coverage in the shark research fishery would allow observer reports to be used to monitor interactions of directed shark fishing in near real-time, which would improve monitoring and increase the sample size available for evaluating important sea turtle and smalltooth sawfish interaction characteristics (*e.g.*, average life stage and genetic origin data). This would improve data acquisition and monitoring of protected resource interactions in the shark BLL fishery. Maintaining current levels of observer coverage outside the shark research fishery would continue to allow NMFS to observe the non-research BLL and gillnet fishing activities by vessels with directed and incidental shark permits at a level that would allow for statistically reliable monitoring. This would provide a better understanding of the changing dynamics of this fishery and its impacts on all marine resources. Time/area closures being implemented consistent with the South Atlantic Fishery Management Council could provide additional protection for sea turtles and smalltooth sawfish within the marine protected areas; however, they were not likely to reduce the overall interactions between the fishery and protected species given their small size.

The BiOp indicated that the impacts of changes to seasons and regions on sea turtles and smalltooth sawfish interactions were unknown. The research fishery would likely create a more uniform distribution of effort. Thus, shark fishing effort might also occur at different times of the year. The quota and retention limit reductions would likely reduce interactions with protected species, regardless of any anticipated changes in effort patterns. Recreational measures were not expected to have any effect on sea turtles and smalltooth sawfish as there were no documented takes to indicate adverse effects on sea turtles, and only one documented take of a smalltooth sawfish using rod-and-reel to target sharks in federal waters prior to the implementation of Amendment 2.

The BiOp included a revised Incidental Take Statement (ITS) consistent with the modifications to the fishery implemented under Amendment 2. The Atlantic shark fishery had been managed under a 5-year ITS previously, but was modified to three years. A 3-year ITS was provided because the 5-year time period is too long for meaningful monitoring given the frequency of changes in management and the uncertainty of how effort by gear type will shift in

response to the proposed action. The BiOp's 3-year approach would reduce the likelihood of requiring re-initiation unnecessarily because of inherent variability in take levels, but would still allow for an accurate assessment of how the fishery is performing. There were three Reasonable and Prudent Measures (RPMs) that have been implemented to minimize the impacts of the actions implemented under Amendment 2 on protected resources and Terms and Conditions for implementing the RPMs. The Agency has implemented the RPMs and adheres to the terms and conditions of the ITS to ensure compliance with the ESA.

Overall, the BiOp concluded in its evaluation of the effects of the actions implemented under Amendment 2 that the fishery's impacts on both sea turtles and smalltooth sawfish would decrease. Take of these species would continue but at a reduced level in the future because of reductions in fishing effort.

Loggerhead Sea Turtles

In the BLL fishery, a total of 80 sea turtles were observed caught from 1994 through 2008 (Table 3.8 and Table 3.9). Seasonal variation indicates that most of the sea turtles were caught early in the year. Of the 80 observed sea turtles, 65 were loggerhead sea turtles, of which 34 were released alive. Another 14 loggerheads were released in an unknown condition and 17 were released dead. Based on extrapolation of observer data, 784.3 loggerhead interactions with BLL gear occurred between 2004 and 2006. An additional 17.4 unidentified sea turtles were estimated to have been taken for this time period (NMFS, 2007b; Richards, 2007a). No extrapolation has been conducted for 2007 or 2008.

Leatherback Sea Turtles

Of the 80 observed sea turtle interactions in the BLL fishery from 1994 – 2008, six were leatherback sea turtles, of which one was dead and five were released with its condition unknown (Table 3.8 and Table 3.9). Based on extrapolated takes from observer data, it was estimated that 83.2 leatherback sea turtles were taken in the shark BLL fishery from 2004 through 2006 (NMFS, 2007b; Richards, 2007a). Given the large number of turtles released in an unknown condition, these estimated take numbers do not discriminate between live and dead releases. However, leatherback mortality is usually low 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. No extrapolation has been conducted for 2007 or 2008.

Smalltooth Sawfish

As of April 1, 2003, NMFS listed smalltooth sawfish as an endangered species (68 FR 15674) under the ESA. After reviewing the best scientific and commercial information, the status review team determined that the continued existence of the U.S. Distinct Population Segment of smalltooth sawfish was 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; over-utilization for commercial, recreational, scientific, or educational purposes; inadequacy of existing regulatory mechanisms; and other natural or manmade factors affecting its continued existence. NMFS is in the process

of designating critical habitat for smalltooth sawfish. A proposed rule regarding designation of critical habitat published on November 20, 2008 (73 FR 70290).

From 1994 through 2007, 15 smalltooth sawfish interactions have been observed (13 released alive, one released dead, and one released in unknown condition) in shark BLL fisheries (Morgan pers. comm.; Burgess and Morgan, 2004; Hale and Carlson, 2007; Hale *et al*., 2007). In 2008, there were two observed smalltooth sawfish interactions with shark BLL gear (Hale *et al*., 2009). Both interactions occurred in the Gulf of Mexico, and both smalltooth sawfish were released alive. Based on extrapolated takes for 2004 through 2006, 60 smalltooth sawfish have taken in the BLL fisheries (NMFS, 2007b; Richards, 2007a). No mortalities were extrapolated based on the overall extrapolated takes from 2004 to 2006; however, one known mortality occurred in 2007. NMFS has not calculated the extrapolated takes since the mortality occurred in 2007.

Marine Mammals

Four delphinids have been observed caught and released alive between 1994 and 2007, and one bottlenose dolphin was observed dead in 2003 (G. Burgess, pers. comm.; Hale and Carlson, 2007; Hale *et al*., 2007). Based on this one dead encounter in 2003 (no interactions with marine mammals and BLL were observed in 2004 through 2008), NMFS extrapolated that a total of 100 bottlenose dolphin interactions could have occurred with BLL gear during 2003-2007 (Richards, 2007a).

Seabirds

Bycatch of seabirds in the shark BLL fishery is rare with a single pelican observed killed between 1994 and 2007 (G. Burgess, University of Florida, pers. com.). In 2008, observed seabird takes were 2 brown pelicans, one herring gull, and one unidentified seabird (Hale *et al*., 2009). These birds were observed dead during BLL sets targeting grouper/snapper or grouper/shark mix in the Gulf of Mexico. No expanded estimates of seabird bycatch or catch rates are available for the BLL fishery.

Table 3.6 **Species composition of observed BLL catch during 2008 for BLL trips targeting sharks in the South Atlantic.**
Source: Hale *et al*., 2009.

Species	Total Number Caught	% Total Catch	% Kept	% Discarded Dead	% Discarded Alive	% Unknown
Tiger shark	920	50.1	12.2	10.2	76.8	0.8
Sandbar shark	383	20.9	85.9	1.3	11.7	1
Atlantic sharpnose shark	290	15.8	94.1	5.5	0	0.3
Blacktip shark	148	8.1	80.4	15.5	3.4	0.7
Great hammerhead shark	34	1.9	88.2	8.8	0	2.9
Bull shark	23	1.3	73.9	4.3	21.7	0
Nurse shark	13	0.7	0	0	100	0
Clearnose skate	5	0.3	100	0	0	0

Species	Total Number Caught	% Total Catch	% Kept	% Discarded Dead	% Discarded Alive	% Unknown
Blacknose shark	4	0.2	100	0	0	0
Lemon shark	3	0.2	66.7	0	33.3	0
Cobia	2	0.1	0	50	50	0
Remora	2	0.1	0	0	100	0
Southern stingray	2	0.1	0	0	100	0
Coral	1	0.1	0	0	0	100
Goliath grouper	1	0.1	0	0	100	0
Remora family	1	0.1	0	0	100	0
Sharks	1	0.1	0	100	0	0
Smooth dogfish	1	0.1	100	0	0	0
Warsaw grouper	1	0.1	100	0	0	0
Total	1835	100.0				

Table 3.7 **Species composition of observed BLL catch during 2008 for BLL trips targeting sharks in the Gulf of Mexico.**
Source: Hale *et al*., 2009.

Species	Total Number Caught	% Total Catch	% Kept	% Discarded Dead	% Discarded Alive	% Unknown
Sandbar shark	382	15.1	98.4	0.3	1	0.3
Atlantic sharpnose shark	327	12.9	83.2	15	0.6	1.2
Tiger shark	324	12.8	38.6	4.3	55.9	1.2
Bull shark	320	12.6	92.5	0.3	4.7	2.5
Blacktip shark	270	10.6	85.2	11.5	3	0.4
Nurse shark	241	9.5	10	0.8	89.2	0
Blacknose shark	177	7.0	83.1	15.3	1.7	0
King snake eel	108	4.3	100	0	0	0
Great hammerhead shark	69	2.7	94.2	1.4	2.9	1.4
Lemon shark	65	2.6	98.5	0	0	1.5
Scalloped hammerhead shark	38	1.5	92.1	2.6	2.6	2.6
Shortspine dogfish	28	1.1	32.1	17.9	50	0
Cubera snapper	20	0.8	90	0	0	10
Red grouper	19	0.7	78.9	15.8	5.3	0
Silky shark	19	0.7	89.5	5.3	5.3	0
Dusky shark	16	0.6	0	100	0	0
Mutton snapper	16	0.6	75	25	0	0
Southern stingray	13	0.5	7.7	0	92.3	0
Molluscs	8	0.3	0	0	100	0
Yellowedge grouper	8	0.3	87.5	12.5	0	0
Bonnethead shark	7	0.3	57.1	42.9	0	0
Caribbean reef shark	7	0.3	71.4	28.6	0	0
Goliath grouper	7	0.3	0	0	100	0

Species	Total Number Caught	% Total Catch	% Kept	% Discarded Dead	% Discarded Alive	% Unknown
Sponges	6	0.2	0	100	0	0
Gafftopsail catfish	4	0.2	25	75	0	0
Greater amberjack	4	0.2	75	0	25	0
Almaco jack	3	0.1	100	0	0	0
Coral	3	0.1	0	100	0	0
Shortfin mako shark	3	0.1	100	0	0	0
Spinner shark	3	0.1	66.7	0	33.3	0
Eels	2	0.1	50	0	50	0
Night shark	2	0.1	0	50	50	0
Requiem shark family	2	0.1	0	100	0	0
Snowy grouper	2	0.1	100	0	0	0
Bullnose ray	1	0.0	0	0	100	0
Cancer crabs	1	0.0	0	0	100	0
Clearnose skate	1	0.0	0	0	100	0
Finetooth shark	1	0.0	0	100	0	0
Great white shark	1	0.0	0	100	0	0
Octopus	1	0.0	0	0	100	0
Sea stars	1	0.0	0	0	100	0
Sharks	1	0.0	0	0	0	100
Smooth dogfish	1	0.0	0	100	0	0
Smooth hammerhead shark	1	0.0	100	0	0	0
Southern hake	1	0.0	0	100	0	0
Spiny dogfish	1	0.0	0	0	100	0
Spotted eagle ray	1	0.0	0	0	100	0
Warsaw grouper	1	0.0	100	0	0	0
Polychaete Worms	1	0.0	0	0	100	0
Total	2538	100.0				

Table 3.8 Total Number of Observed Sea Turtle Interactions by Species by Month for Years 1994-2008 in the Shark BLL Fishery.
Source: Shark BLL Observer Program

Month	Leatherback Sea Turtle	Loggerhead Sea Turtle	Other Sea Turtles	Total
Jan	1	16	1	18
Feb	3	10	6	19
Mar		7		9
Apr		4		4
May	1			1
Jun				
July		18		18
Aug		4		4
Sept	1	3	1	5
Oct		2	1	3
Nov		1		1
Dec				
Total	6	65	9	80

Table 3.9 Total number of Observed Sea Turtle Interactions by Year for Years 1994-2008 in the Shark BLL Fishery.
Source: Shark BLL Observer Program. Letters in parentheses indicate whether the sea turtle was released alive (A), dead (D), or in an unknown (U) condition.

Year	Leatherback Sea Turtle	Loggerhead Sea Turtle	Other Sea Turtle	Total
1994	1 (1U)	5 (5U)	6 (6U)	12
1995		4 (3A, 1D)		4
1996	1 (1U)	6 (3A, 2D, 1U)		7
1997	1 (1U)	5 (3A, 2U)		6
1998		2 (1A, 1D)	1 (1A)	3
1999		2 (2A)		2
2001	1 (1D)	2 (2A)		3
2002		5 (3A, 1D, 1U)		5
2003		7 (6A, 1D)	1 (1U)	8
2004		5 (3A, 2D)		5
2005	2 (1A, 1D)	4 (1A, 3D)	1 (1U)	7
2006		12 (3A, 4D, 5U),		12
2007		5 (3A, 2D)		5
2008		1 (1A)		1
Total	6	65	9	80

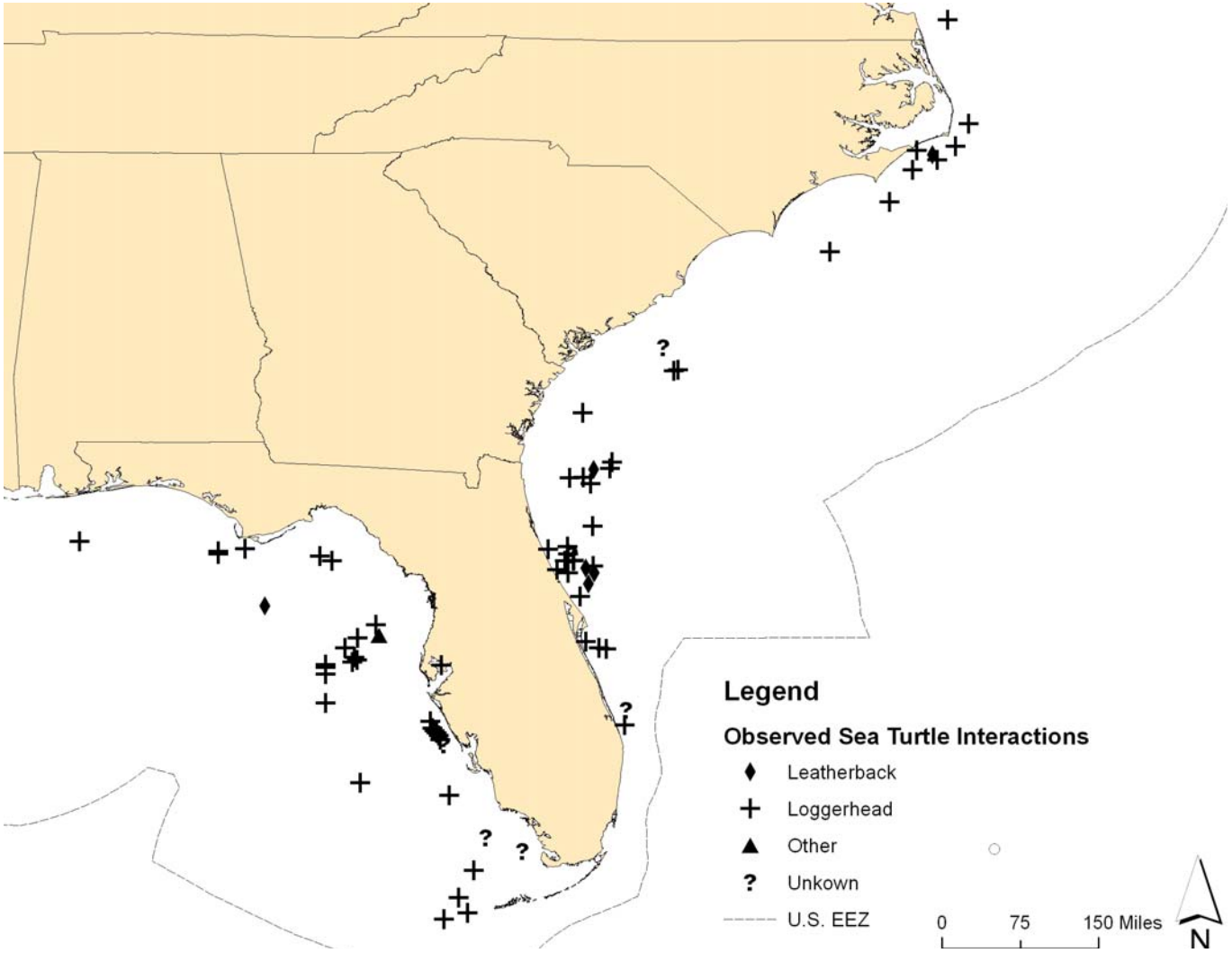

Figure 3.2 **Observed sea turtle interactions in the shark BLL fishery from 1994-2008.**
Source: Commercial Shark Fishery Observer Program data (1994-1st season of 2005) and NMFS' Shark Observer Program data (2nd season 2005-2008).

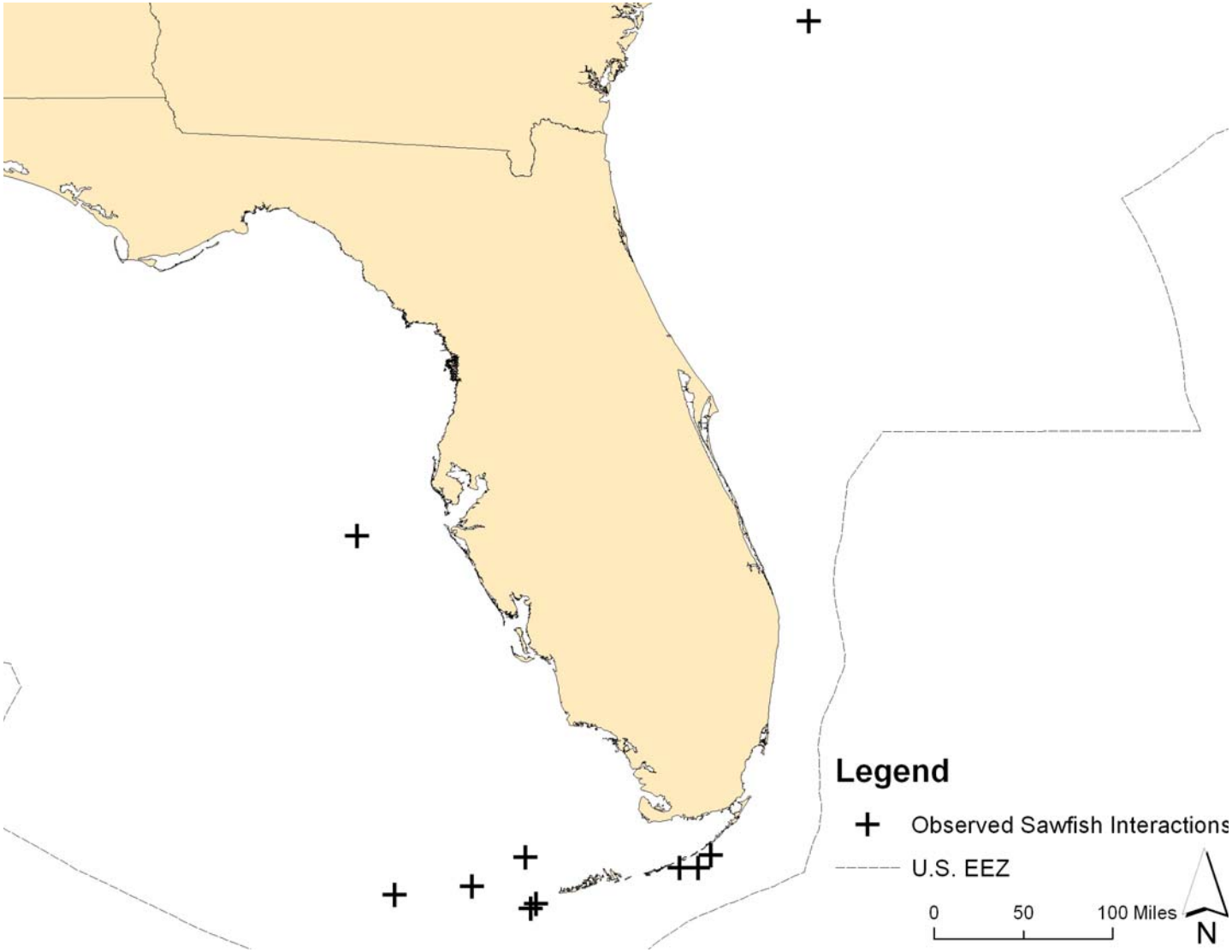

Figure 3.3 **Observed sawfish interactions in the shark BLL fishery from 1994-2008.**
Source: Commercial Shark Fishery Observer Program data (1994-1st season of 2005) and NMFS' Shark Observer Program data (2nd season 2005-2008).

3.4.2 Gillnet Fishery

3.4.2.1 Domestic History and Current Management

The southeast shark gillnet fishery is comprised of several vessels based primarily out of ports in northern Florida (South Atlantic Region). These vessels use drift gillnet, strike gillnet, and sink gillnet gear. The drift gillnet fishery set duration was on average 0.08 hours in depths ranging from 3.1m to 6.1m, and haulback averaged 0.37 hours. The average time from setting the net through completion of haulback was 2.7 hours. Stretched mesh sizes measured from 7.6-15.2 cm. Strikenetters were not observed targeting sharks in 2008, however, in 2006 this gear had the largest mesh size (22.9-30.4 cm) and the set times were 3.2 hours. Sink gillnets used to target sharks generally use 7.0-30.5 cm mesh size and the process lasted for approximately 2.36 hours (Passerotti and Carlson, 2009).

In 2001, NMFS established a requirement to conduct net checks every two hours to look for and remove any protected species. In 2007 the regulations implementing the ALWTRP were amended, thus removing the requirement for 100 percent observer coverage for drift gillnet vessels during the right whale calving season and prohibiting all gillnets in an expanded southeast U.S. restricted area from Cape Canaveral, Florida to the North Carolina/South Carolina border during November 15 – April 15. The rule has limited exemptions, which allows shark strikenet fishing only in waters south of 29° N. latitude during this same period and for Spanish mackerel, *Scomberomorus maculates,* gillnet fishing in the months of December to March. Operations in this area during this time period require VMS and observer coverage, if selected. Based on these regulations, and on current funding levels, the shark gillnet observer program now covers all anchored (sink, stab, set), strike, or drift gillnets fishing by vessels that fish from Florida to North Carolina, year-round.

3.4.2.2 Recent Catch and Landings

The following section provides information on shark landings as reported in the shark gillnet observer program. The "Catch and Bycatch in U.S. Southeast Gillnet Fisheries, 2008" report described the gear and soak time deployed by drift gillnet, strike gillnet, and sink gillnet fishermen (Passerotti and Carlson, 2009).

Gillnet Landings and Bycatch

Strikenets - NMFS published a final rule (72 FR 34632, June 25, 2007) to reduce bycatch of right whales. It prohibits gillnet fishing or gillnet possession during periods associated with the right whale calving season. Limited exemptions to the fishing prohibitions are provided for gillnet fishing for sharks and for Spanish mackerel south of 29°00' N. lat. In this area, only gillnets used in a strikenet fashion can operate during day time when right whales are present. Operation in this area at that time requires VMS and observer coverage, if selected. Vessels fishing in a strikenet fashion used nets 364.8 meters long, 30.4 meters deep, and with mesh size 22.9 cm.

The total observed strike gillnet catch consisted of eight species of sharks from 2005-2006. Finetooth and blacktip sharks made up the greatest percentage of catch in terms of total number caught in strike gillnets from 2005-2006 (Table 3.10). There were no strike gillnet trips observed in 2007, potentially due a first trimester closure of the large coastal shark fishery. This closure was required because of 2006 landings in excess of the quota (Baremore *et al.*, 2007). Similarly, in 2008, no vessels were observed using strikenets to target sharks. This is likely due to the large coastal shark fishery closure in place during the first half of 2008, correcting for overages from the 2007 harvest (Passerotti and Carlson, 2009).

In the strikenet fishery from 2005-2006, 99.7 percent of the observed catch were sharks with only 0.15 percent teleosts, and 0.07 percent non-shark elasmobranchs. Blacktip, finetooth, and spinner shark comprised over 94 percent of the observed shark strike net catch by number and weight. Tarpon and little tunny were the teleosts encountered most frequently (Carlson and Bethea, 2007).

Drift Gillnets – In 2007, a total of five driftnet gillnet vessels were observed making 84 sets on 11 trips. Of those trips, there were 3 vessels observed that targeted sharks for a total of 4 trips and 4 hauls. The total observed catch composition for sets targeting sharks was 86.7 percent shark, 13.3 percent teleosts, zero percent non-shark elasmobranches, and zero percent protected resources. Two species of sharks made up 98.1 percent of the observed shark catch: Atlantic sharpnose shark and blacknose shark. By weight, the shark catch was composed of Atlantic sharpnose, followed by scalloped hammerhead shark, blacknose shark, and blacktip shark. Three species of teleosts made up approximately 97 percent by number of the overall non-shark species. These species were little tunny, king mackerel, and barracudas (Baremore *et al.*, 2007).

In 2008, a total of five driftnet gillnet vessels were observed making 68 sets on 9 trips. The total observed catch composition for sets targeting sharks was 74.9 percent shark, 22.2 percent teleosts, 1.8 percent non-shark elasmobranches, and zero percent protected resources. Two species of sharks made up 99.1 percent of the observed shark catch by number: smooth dogfish (87.2 percent) and spiny dogfish (11.8 percent) (Table 3.11). By weight, the shark catch was composed of smooth dogfish, followed by spiny dogfish, and Atlantic sharpnose. Five species of teleosts made up the majority of the non-shark catch, including: bluefish, Spanish mackerel, butterfish, menhaden and king mackerel (Passerotti and Carlson, 2009).

Sink Gillnets - Sinknet landings and bycatch vary by target species. A total of 29 trips making 112 sink net sets on six vessels were observed in 2007. Of those, 17 trips making 60 sets targeted sharks, 3 trips making 27 sets targeted Spanish mackerel, and 4 trips making 9 sets targeted Atlantic croaker, and 6 trips making 16 sets targeted other teleosts. Sink gillnets that targeted sharks caught 97.8 percent shark, 1.4 percent teleosts, 0.7 percent non-shark elasmobranches, and 0.1 percent protected resources. By number, the shark catch was primarily bonnethead shark, finetooth shark, Atlantic sharpnose shark, and blacknose shark. By weight the shark catch was made up of mostly finetooth shark, followed by bonnethead shark, blacknose shark, and spinner shark. Cobia made up 25.8 percent of the teleost catch, followed by Gulf kingfish and banded drum. Cownose ray and Atlantic guitarfish and other stingrays made up 100 percent of the non-shark elasmobranch catch (Baremore *et al*., 2007).

Catch of vessels targeting Spanish mackerel was 99.4 teleosts and 0.6 percent shark. Shark catches were mostly Atlantic sharpnose by number, and blacktip and bonnethead sharks. By weight, spiny dogfish were the predominant catch, followed by smooth dogfish, blacktip shark, and bonnethead shark. Spanish mackerel, butterfish, and bluefish made up the majority of the catch (Baremore *et al*., 2007).

Sink gillnet vessels targeting croaker caught 3.2 percent sharks, 96.7 percent teleosts, an 0.01 percent non-shark elasmobranches. Sink gillnet vessels that targeted other species other than sharks, Spanish mackerel, and Atlantic croaker caught mostly bluefish and Atlantic croaker (Baremore *et al*., 2007).

A total of 41 trips making 134 sink net sets on 14 vessels were observed in 2008. Target species included shark, Spanish mackerel, Southern kingfish, and goosefish (monkfish). Specific proportion breakdown of target species by trip was not possible in the 2008 data due to vessel confidentiality restrictions. Sink gillnets, regardless of target species, caught 86.0 percent teleosts, 12.0 percent sharks, 1.7 percent non-shark elasmobranchs and zero percent protected resources. By number, the shark catch was primarily Atlantic sharpnose shark (45.3 percent), bonnethead shark (34.0 percent), blacknose shark (8.0 percent) and spinner shark (6.7 percent) (Table 3.12). By weight the shark catch was made up of mostly Atlantic sharpnose shark, followed by bonnethead shark, blacknose shark and spinner shark, finetooth shark. Spanish mackerel made up 45.7 percent of the teleost catch, followed by bluefish, blue runner, Atlantic bumper, and spot. Winter skate and Cownose ray made up the majority of the non-shark elasmobranch catch (Passerotti and Carlson, 2009).

Loggerhead Sea Turtles

Loggerhead sea turtles are rarely caught in the shark gillnet fishery. No loggerheads 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 were observed caught with drift gillnets during right whale calving season, one each year from 2000 to 2002 (Carlson, 2000; Carlson and Baremore, 2001; Carlson and Baremore, 2002a; Garrison, 2003a).

No loggerhead sea turtles were caught outside of the right whale calving season in 2002 (Carlson and Baremore, 2002b), and no loggerhead turtles were observed caught during or after the right whale calving season in 2003 or 2004 in the directed shark gillnet fishery (Carlson and Baremore, 2003; Carlson, pers. comm). In 2005, five loggerheads were observed caught, and in 2006, three loggerheads were observed caught (Table 3.13). In 2007, 4 loggerhead sea turtles were observed, three were released alive, and one was released in an unknown condition (Baremore *et al*., 2007). There were no observed loggerhead sea turtle interactions in 2008 (Passerotti and Carlson, 2009).

Leatherback Sea Turtles

In the shark gillnet fishery, leatherback sea turtles are sporadically caught. 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 14 in 2001 and 2 in 2002 (Carlson, 2000; Carlson and Baremore, 2001; Carlson and Baremore, 2002a; Garrison, 2003a). NMFS 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).

From 2003 – 2004, no leatherback sea turtles were observed caught in gillnets fished in strikenet or driftnet methods (Carlson and Baremore, 2003; Carlson, pers. comm.). In 2005, one leatherback turtle was caught and released alive (Table 3.13). In 2006 and 2007, no leatherbacks were observed caught in gillnets (Carlson and Bethea, 2007; Baremore *et al*., 2007; Table 3.13). There were no observed leatherback sea turtle interactions in 2008 (Passerotti and Carlson, 2009).

Smalltooth Sawfish

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 off the west coast of Florida and was released alive (Carlson and Baremore, 2003). The 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. 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. From 2004-2008, there were no observed catches of smalltooth sawfish in shark gillnet fisheries.

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.

Given the high rate of observer coverage in the shark gillnet fishery, NMFS 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 an annual basis. Based on this information, the 2008 BiOp permitted one incidental take of smalltooth sawfish (released alive) from 2008 through 2011 as a result of the use of all gillnets in this fishery (NMFS, 2008b).

Marine Mammals

Observed takes of marine mammals in the Southeast Atlantic shark gillnet fishery during 1999 – 2007 totaled 12 bottlenose dolphins and four spotted dolphins. Extrapolated observations from 2004-2006 suggest 1.4 interactions with bottlenose dolphin and zero Atlantic spotted dolphin outside the right whale season. During the right whale season, there was one interaction

with bottlenose dolphins and zero interactions with Atlantic spotted dolphins in the shark gillnet fishery from 2004 through 2006 (Garrison, 2007).

On January 22, 2006, a dead right whale was spotted offshore of Jacksonville Beach, Florida. The survey team identified the whale as a right whale calf, and photos indicated the calf as having one large wound along the midline and smaller lesions around the base of its tail. The right whale calf was located at 30°14.4' N. Lat., 81° 4.2'′ W. Long., which was approximately 1 nautical mile outside of the designated right whale critical habitat, but within the Southeast U.S. Restricted Area. NMFS determined that both the entanglement and death of the whale occurred within the Southeast U.S. Restricted Area, and all available evidence suggested the entanglement and injury of the whale by gillnet gear ultimately led to the death of the animal.

On February 16, 2006, NMFS published a temporary rule (71 FR 8223) to prohibit, through March 31, 2006, any vessel from fishing with any gillnet gear in the Atlantic Ocean waters between 32°00' N. Lat. (near Savannah, GA) and 27°51' N. Lat. (near Sebastian Inlet, FL) and extending from the shore eastward out to 80°00' W. long under the authority of the ALWTRP (50 CFR 229.32 (g)) and ESA. NMFS took this action based on its determination that a right whale mortality was the result of an entanglement by gillnet gear within the Southeast U.S. Restricted Area.

NMFS implemented the final rule on June 25, 2007 (72 FR 34632), that prohibits gillnet fishing, including shark gillnet fishing, from November 15 to April 15, between the NC/SC border and 29° 00' N. The action was taken to prevent the significant risk to the wellbeing of endangered right whales from entanglement in gillnet gear in the core right whale calving area during calving season. Limited exemptions to the fishing prohibitions are provided for gillnet fishing for sharks and for Spanish mackerel south of 29°00' N. lat. Shark gillnet vessels fishing between 29° 00' N and 26° 46.5' N have certain requirements as outlined 50 CFR § 229.32 from December 1 through March 31 of each year. These include vessel operators contacting the SEFSC Panama City Laboratory at least 48 hours prior to departure of a fishing trip in order to arrange for an observer.

In addition, a recent rule (October 5, 2007, 72 FR 57104) amends restriction in the Southeast U.S. Monitoring Area from December 1 through March 31. In that area no person may fish with or possess gillnet gear for sharks with webbing of 5" or greater stretched mesh unless the operator of the vessel is in compliance with the VMS requirements found in 50 CFR 635.69. The Southeast U.S. Monitoring Area is from 27°51' N. (near Sebastian Inlet, FL) south to 26°46.5' N. (near West Palm Beach, FL), extending from the shoreline or exemption line eastward to 80°00' W. In addition, NMFS may select any shark gillnet vessel regulated under the ALWTRP to carry an observer. When selected, the vessels are required to take observers on a mandatory basis in compliance with the requirements for at-sea observer coverage found in 50 CFR 229.7. Any vessel that fails to carry an observer once selected is prohibited from fishing pursuant to 50 CFR § 635. There are additional gear marking requirements that can be found at 50 CFR § 229.32.

Table 3.10 Total Strike gillnet Shark Catch and Bycatch by Species in order of Decreasing Abundance for all Observed Trips, 2005-2006.
Source: Carlson and Bethea, 2007.

Species	Total Number Caught	Kept (%)	Discarded Alive (%)	Discarded Dead (%)
Blacktip shark	9,831	89.5	0.2	10.3
Finetooth	1,687	100	0	0
Spinner Shark	1,108	100	0	0
Blacknose shark	541	100	0	0
Dusky shark	20	0	25	75
Atlantic sharpnose	7	100	0	0
Scalloped Hammerhead	7	71.4	0	28.6
Tarpon	5	0	0	100
Blackfin tuna	5	100	0	0
Manta ray	4	0	100	0
Bonnethead shark	3	100	0	0
Cobia	3	100	0	0
Cownose ray	3	0	33.3	66.7
Red drum	2	0	50	50
Bull shark	2	100	0	0
Spotted eagle ray	2	0	100	0
Nurse shark	1	100	0	0
Crevalle jack	1	100	0	0
Southern flounder	1	100	0	0
Barracudas	1	0	0	100
Remoras	1	100	0	0
Ocellated flounder	1	0	0	100
Total	**13,236**			

Table 3.11 Total Shark Catch and bycatch by Species and Species Disposition in Order of Decreasing Abundance for all Observed Drift gillnet Sets 2008.
Source: Passerotti and Carlson, 2009

Species	Total Number Caught	Kept (%)	Discarded Alive (%)	Discarded Dead (%)
Smooth dogfish	2331	79.1	20.9	0.0
Bluefish	340	74.1	11.5	14.4
Spiny dogfish	316	0.0	100.0	0.0
Spanish mackerel	268	93.3	0.0	6.7
Butterfish	59	98.3	0.0	1.7
Clearnose skate	56	0.0	100.0	0.0
Menhaden	39	0.0	7.7	92.3
King mackerel	34	97.1	0.0	2.9
Jellyfishes	34	0.0	100.0	0.0
Atlantic croaker	22	0.0	31.8	68.2
Blue crab	8	0.0	100.0	0.0
Flounders	8	0.0	100.0	0.0
Cobia	7	42.9	28.6	28.6
Atlantic sharpnose shark	7	28.6	71.4	0.0
Thresher shark	6	100.0	0.0	0.0
Stingrays	5	0.0	100.0	0.0
Remora	4	0.0	100.0	0.0
Cownose ray	3	0.0	100.0	0.0
Lookdown	3	0.0	66.7	33.3
Sand tiger shark	3	0.0	100.0	0.0
Lady fish	2	0.0	0.0	100.0
Blacktip shark	2	50.0	50.0	0.0
Sandbar shark	2	0.0	100.0	0.0
Angel shark	2	0.0	100.0	0.0
Flounders	2	100.0	0.0	0.0
Spadefish	1	0.0	100.0	0.0
Atlantic bonito	1	100.0	0.0	0.0
Red drum	1	0.0	100.0	0.0
Blacknose shark	1	0.0	0.0	100.0
Spinner shark	1	0.0	100.0	0.0
Great hammerhead shark	1	0.0	100.0	0.0
Total	**3569**			

Table 3.12 Total Sink gillnet Shark Catch and Bycatch by Species in order of Decreasing Abundance for all Observed Trips, 2008.
Source: Passerotti and Carlson, 2009.

Species	Total Number Caught	Kept (%)	Discarded Alive (%)	Discarded Dead (%)
Spanish mackerel	5875	98.3	0.0	1.7
Bluefish	1969	97.1	1.2	1.7
Blue runner	1105	99.3	0.0	0.7
Atlantic bumper	1040	86.8	6.6	6.5
Atlantic sharpnose shark	853	73.4	11.4	15.2
Spot	657	87.5	5.9	6.5
Bonnethead	609	86.4	3.9	9.7
Goosefish family	414	76.6	1.2	22.2
Yellowfin menhaden	393	60.8	5.1	34.1
Sand drum	340	0.0	25.0	75.0
Southern kingfish	281	98.2	0.0	1.8
Winter skate	238	50.0	6.3	43.7
Blacknose shark	143	98.6	1.4	0.0
Spinner shark	120	55.0	10.8	34.2
Atlantic moonfish	115	59.1	18.3	22.6
King mackerel	115	21.7	2.6	75.7
Atlantic croaker	79	78.5	2.5	19.0
Banded drum	79	16.5	13.9	69.6
Blacktip shark	73	24.7	63.0	12.3
Butterfish	57	96.5	3.5	0.0
Flounder family	49	85.7	8.2	6.1
Crevalle jack	34	100.0	0.0	0.0
Florida pompano	25	68.0	32.0	0.0
Cobia	25	28.0	32.0	40.0
Weakfish	25	84.0	0.0	16.0
Horseshoe crab	19	0.0	100.0	0.0
Atlantic cutlassfish	18	94.4	0.0	5.6
Silver perch	18	77.8	0.0	22.2
Gafftopsail catfish	17	0.0	11.8	88.2
Scalloped hammerhead shark	16	12.5	75.0	12.5
Seatrout family	15	93.3	0.0	6.7
Jellyfish family	14	0.0	0.0	100.0
Gulf kingfish	14	100.0	0.0	0.0
Gulf butterfish	12	83.3	0.0	16.7

Species	Total Number Caught	Kept (%)	Discarded Alive (%)	Discarded Dead (%)
Menhaden	10	0.0	0.0	100.0
Cownose ray	9	0.0	100.0	0.0
Sea robins	9	0.0	88.9	11.1
Herring	9	0.0	22.2	77.8
Spiny dogfish	9	0.0	22.2	77.8
Pomfrets	7	0.0	0.0	100.0
Atlantic thread herring	6	16.7	33.3	50.0
Spadefish	6	0.0	16.7	83.3
Unknown teleost-eaten/damaged	6	0.0	0.0	100.0
Lookdown	5	0.0	0.0	100.0
Ladyfish	5	80.0	20.0	0.0
Remoras	6	0.0	100.0	0.0
Finetooth shark	4	25.0	75.0	0.0
Rays	3	0.0	100.0	0.0
Little tunny	3	100.0	0.0	0.0
Dusky shark	3	0.0	0.0	100.0
Houndfish	2	100.0	0.0	0.0
Inshore lizardfish	2	0.0	0.0	100.0
Swimming crabs	2	0.0	50.0	50.0
Devil ray	2	0.0	50.0	50.0
Spotted eagle ray	2	0.0	100.0	0.0
Smooth dogfish	2	0.0	100.0	0.0
Sand tiger shark	2	0.0	100.0	0.0
Atlantic guitarfish	1	0.0	100.0	0.0
Southern flounder	1	100.0	0.0	0.0
Pigfish	1	100.0	0.0	0.0
Bullnose ray	1	0.0	100.0	0.0
Manta ray	1	0.0	100.0	0.0
Silver seatrout	1	0.0	0.0	100.0
Barred grunt	1	0.0	100.0	0.0
Unicorn filefish	1	100.0	0.0	0.0

Table 3.13 **Total number of Observed Sea Turtle Interactions by Year from 2000-2008 in the Shark Gillnet Fishery.**

Source: Directed Shark Gillnet Observer Program. Letters in parentheses indicate whether the sea turtle was released alive (A), dead (D), or unknown (U).

Year	Leatherback Sea Turtle	Loggerhead Sea Turtle	Total
2000		1 (U)	1
2001		1 (U)	1
2002		1 (U)	1
2003			0
2004			0
2005	1(A)	5 (4A, 1D)	6
2006		3 (2A, 1D)	3
2007		4 (3A, 1U)	4
2008			0
Total	1	15	16

Table 3.14 Observed Interactions of Sea Turtles in the PLL Fishery and Directed Shark BLL and Gillnet Fishery by Year and Gear Type (LGH = Loggerhead, LTRB = Leatherback).

Source: Directed Shark Gillnet Observer Program, BLL Observer Program, PLL Observer Program.

		2004			2005			2006			2007			2008		
		LGH	LTRB	Other	LGH	LTRB	Other	LGH	LTRB	Other	LGH	LTRB	Other	LGH	LTRB	Other
Gillnet	Drift Gillnet	0	0	0	4	1	0	0	0	0	1	0	0	0	0	0
	Strikenet	0	0	0	1	0	0	3	0	0	0	0	0	0	0	0
	Sink Gillnet	0	0	0	1	0	0	0	0	0	3	0	0	0	0	0
Pelagic Longline		733	1,362	0	282	368	0	558	415	11	542	500	1	Data not available		
Bottom Longline		5	0	0	4	2	0	12	0	0	5	0	0	1	0	0
Total		2,100			662			999			1,052					

3.4.3 Pelagic Longline Fishery

3.4.3.1 Domestic History and Current Management

The U.S. PLL fishery for Atlantic HMS primarily targets swordfish, yellowfin tuna, and bigeye tuna in various areas and seasons. Secondary target species include dolphin, albacore tuna, and to a lesser degree sharks. Although this gear can be modified (*e.g.*, depth of set, hook type, *etc*.) to target swordfish, tunas, or sharks, it is generally a multi-species fishery. These vessel operators are opportunistic, switching gear style and making subtle changes to target the best available economic opportunity of each individual trip. PLL gear sometimes attracts and hooks non-target finfish with little or no commercial value as well as species that cannot be retained by commercial fishermen due to regulations, such as billfish. Pelagic longlines may also interact with protected species, such as marine mammals, sea turtles, and seabirds. Thus, this gear has been classified as a Category I fishery with respect to MMPA. Any species (or undersized catch of permitted species) that cannot be landed due to fishery regulations is required to be released, whether dead or alive.

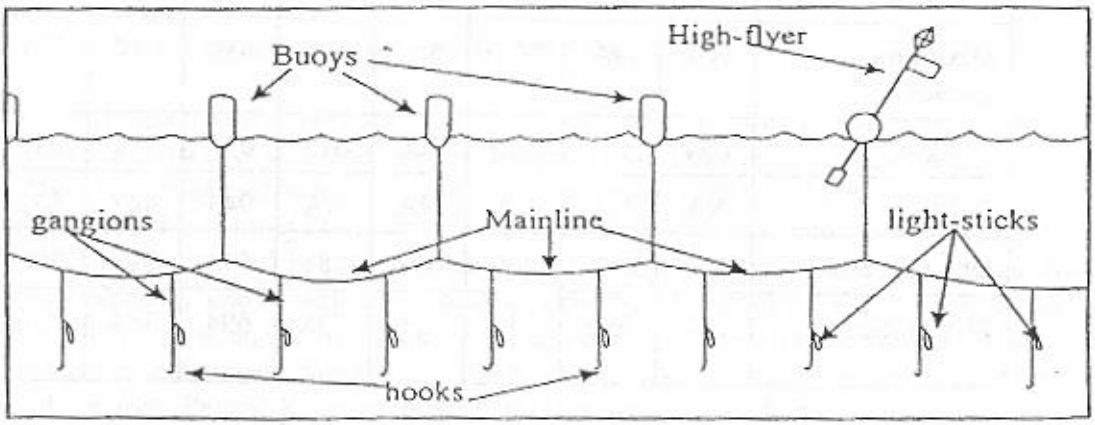

Figure 3.4 Typical U.S. PLL Gear.
Source: Arocha, 1996

PLL gear is composed of several parts (see Figure 3.4[1]) (NMFS, 1999). The primary fishing line, or mainline of the longline system, 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 which can have radar reflectors or radio beacons attached. Each individual hook is connected by a leader, or gangion, to the mainline. Lightsticks, which contain chemicals that emit a glowing light, are often used, particularly when targeting swordfish. When attached to the hook and suspended at a certain depth, lightsticks attract baitfish, which may, in turn, attract pelagic predators (NMFS, 1999).

When targeting swordfish, PLL gear is generally deployed at sunset and hauled at sunrise to take advantage of swordfish nocturnal near-surface feeding habits (NMFS, 1999). In general, longlines targeting tunas are set in the morning, deeper in the water column, and hauled in the

[1] As of April 1, 2001, (66 FR 17370) a vessel is considered to have pelagic longline gear on board when a power-operated longline hauler, a mainline, floats capable of supporting the mainline, and leaders (gangions) with hooks are on board.

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. The number of hooks per set varies with line configuration and target species (Table 3.15) (NMFS, 1999). The PLL gear components may also be deployed as a trolling gear to target surface feeding tunas. Under this configuration, the mainline and gangions are elevated and actively trolled so that the baits fish on or above the water's surface. This style of fishing is often referred to as "green-stick fishing," and reports indicate that it can be extremely efficient compared to conventional fishing techniques. For more information on green-stick fishing gear and the configurations allowed under current regulations, please refer to section 4.8 of the 2008 SAFE Report for Highly Migratory Species.

Table 3.15 Average Number of Hooks per PLL Set, 1999-2006.
Source: PLL logbook data.

Target Species	1999	2000	2001	2002	2003	2004	2005	2006	2007
Swordfish	521	550	625	695	711	701	747	742	672
Bigeye Tuna	768	454	671	755	967	400	634	754	773
Yellowfin Tuna	741	772	731	715	720	696	691	704	672
Mix of tuna species	NA	638	719	767	765	779	692	676	640
Shark	613	621	571	640	696	717	542	509	494
Dolphin	NA	943	447	542	692	1,033	734	988	789
Other species	781	504	318	300	865	270	889	236	NA
Mix of species	738	694	754	756	747	777	786	777	757

Regional U.S. Pelagic Longline Fisheries Description

The U.S. PLL fishery sector has historically been comprised of five relatively distinct segments with different fishing practices and strategies, including the Gulf of Mexico yellowfin tuna fishery, the South Atlantic-Florida east coast to Cape Hatteras swordfish fishery, the Mid-Atlantic and New England swordfish and bigeye tuna fishery, the U.S. distant water swordfish fishery, and the Caribbean Islands tuna and swordfish fishery. Each vessel type has different range capabilities due to fuel capacity, hold capacity, size, and construction. In addition to geographical area, these segments have historically differed by percentage of various target and non-target species, gear characteristics, and deployment techniques. Some vessels fish in more than one fishery segment during the course of the year (NMFS, 1999). Due to the various changes in the fishery, *i.e.*, regulations, operating costs, market conditions, availability, etc., the fishing practices and strategies of these different segments may change over time.

Management of the U.S. Pelagic Longline Fishery

The U.S. Atlantic PLL fishery is restricted by a swordfish quota, divided between the North and South Atlantic (separated at 5°N. Lat.). Other regulations include minimum sizes for swordfish, yellowfin, bigeye, and bluefin tuna; bluefin tuna target catch requirements; shark quotas; protected species incidental take limits; reporting requirements (including logbooks);

gear and bait requirements; limited access vessel permits, and mandatory workshop requirements. Current billfish regulations prohibit the retention of billfish by commercial vessels, or the sale of billfish from the Atlantic Ocean. As a result, all billfish hooked on PLL gear must be discarded, and are considered bycatch. PLL is a heavily managed gear type and, as such, is strictly monitored. Because it is difficult for PLL fishermen to avoid undersized or prohibited fish in some areas, NMFS has closed areas in the Gulf of Mexico and along the east coast. The intent of these closures is to decrease bycatch in the PLL fishery by closing those areas with the highest rates of bycatch. There are also time/area closures for PLL fishermen designed to reduce the incidental catch of bluefin tuna and sea turtles. In order to enforce time/area closures and to monitor the fishery, NMFS requires all PLL vessels to report positions on an approved VMS.

In addition to the regulations mentioned above, vessels with PLL gear onboard, at all times, in all areas open to PLL fishing, excluding the NED, must possess onboard and/or use only 16/0 or larger non-offset circle hooks and/or 18/0 or larger circle hooks with an offset not to exceed ten degrees. Only whole finfish and squid baits may be possessed and/or utilized with allowable hooks. All PLL vessels must possess and use sea turtle handling and release gear in compliance with NMFS careful release protocols. Additionally, all PLL vessel owners and operators must be certified in the use of the protected species handling and release gear. Certification must be renewed every three years and can be obtained by attending a workshop.

Permits

The 1999 FMP established six different LAP types: (1) directed swordfish, (2) incidental swordfish, (3) swordfish handgear, (4) directed shark, (5) incidental shark, and (6) tuna longline. To reduce bycatch in the PLL fishery, these permits were designed so that the swordfish directed and incidental permits are valid only if the permit holder also holds both a tuna longline and a shark permit. Similarly, the tuna longline permit is valid only if the permit holder also holds both a swordfish (directed or incidental, not handgear) and a shark permit. This allows limited retention of species that might otherwise have been discarded.

As of May 1, 2008, approximately 241 tuna longline limited access permits had been issued. In addition, approximately 181 directed swordfish limited access permits, 76 incidental swordfish limited access permits, 214 directed shark limited access permits, and 285 incidental shark limited access permits had been issued. Vessels with limited access swordfish and shark permits do not necessarily use pelagic longline gear, but these are the only permits that allow for the use of pelagic longline gear in HMS fisheries.

Monitoring and Reporting

PLL fishermen and the dealers who purchase HMS from them are subject to reporting requirements. NMFS has extended dealer reporting requirements to all swordfish importers as well as dealers who buy domestic swordfish from the Atlantic. These data are used to evaluate the impacts of harvesting on the stock and the impacts of regulations on affected entities.

Commercial HMS fisheries are monitored through a combination of vessel logbooks, dealer reports, port sampling, cooperative agreements with states, and scientific observer coverage. 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. In some cases, social and economic data such as volume and cost of fishing inputs are also required.

Pelagic Longline Observer Program

During 2007, NMFS observers recorded 944 PLL sets for an overall fishery coverage of 10.8 percent. (Fairfield and Garrison, 2008) Table 3.16 details the amount of observer coverage in past years for this fleet. Generally, due to logistical problems, it has not always been possible to place observers on all selected trips. NMFS is working towards improving compliance with observer requirements and facilitating communication between vessel operators and observer program coordinators. In addition, fishermen are reminded of the safety requirements for the placement of observers specified at 50 CFR 600.746, and the need to have all safety equipment on board required by the U.S. Coast Guard.

Table 3.16 Observer Coverage of the PLL Fishery.
Source: Yeung, 2001; Garrison, 2003b; Garrison and Richards, 2004; Garrison, 2005; Walsh and Garrison, 2006, 2007.

Year	**Number of Sets Observed**			**Percentage of Total Number of Sets**		
1999	420			3.8		
2000	464			4.2		
2001*	Total	Non-NED	NED	Total	Non-NED	NED
	584	398	186	5.4	3.7	100.0
2002*	856	353	503	8.9	3.9	100.0
2003*	1088	552	536	11.5	6.2	100.0
	Total	Non-EXP	EXP	Total	Non-EXP	EXP
2004**	702	642	60	7.3	6.7	100.0
2005**	796	549	247	10.1	7.2	100.0
2006	568	-	-	7.5	-	-
2007	944	-	-	10.8	-	-

*In 2001, 2002, and 2003, 100 percent observer coverage was required in the NED research experiment.
** In 2004 and 2005 there was 100 percent observer coverage in experimental fishing (EXP).

3.4.3.2 Recent Catch and Landings

U.S. PLL catch (including bycatch, incidental catch, and target catch) is largely related to vessel and gear characteristics, but is summarized for the whole fishery in Table 3.17.

From May 1992 through December 2000, the Pelagic Observer Program (POP) recorded a total of 4,612 elasmobranchs (15 percent of the total catch) caught off the southeastern U.S. coast in fisheries targeting tunas and swordfish (Beerkircher *et al.*, 2004). Of the 22 elasmobranch species observed, silky sharks were numerically dominant (31.4 percent of the

elasmobranch catch), with silky, dusky, night, blue, tiger, scalloped hammerhead, and unidentified sharks making up the majority (84.6 percent) (Beerkircher *et al.*, 2004).

Table 3.17 Reported Catch of Species Caught by U.S. Atlantic PLLs, in Number of Fish, for 2000-2007. Source: PLL Logbook Data.

Species	2000	2001	2002	2003	2004	2005	2006	2007
Swordfish Kept	62,978	47,560	49,320	51,835	46,440	41,139	38,241	45,933
Swordfish Discarded	17,074	13,993	13,035	11,829	10,675	11,134	8,900	11,823
Blue Marlin Discarded	1,443	635	1,175	595	712	567	439	611
White Marlin Discarded	1,261	848	1,438	809	1,053	989	557	744
Sailfish Discarded	1,091	356	379	277	424	367	277	321
Spearfish Discarded	78	137	148	108	172	150	142	147
Bluefin Tuna Kept	235	177	178	273	475	375	261	337
Bluefin Tuna Discarded	737	348	585	881	1,031	765	833	1,345
Bigeye, Albacore, Yellowfin, Skipjack Tunas Kept	94,136	80,466	79,917	63,321	76,962	57,132	73,058	70,390
Pelagic Sharks Kept	3,065	3,460	2,987	3,037	3,440	3,149	2,098	3,504
Pelagic Sharks Discarded	28,046	23,813	22,828	21,705	25,355	21,550	24,113	27,478
Large Coastal Sharks Kept	7,896	6,478	4,077	5,326	2,292	3,362	1,768	546
Large Coastal Sharks Discarded	6,973	4,836	3,815	4,813	5,230	5,877	5,326	7,133
Dolphin Kept	29,125	27,586	30,384	29,372	38,769	25,707	25,658	68,124
Wahoo Kept	4,193	3,068	4,188	3,919	4,633	3,348	3,608	3,073
Turtle Interactions	271	424	465	399	369	152	128	300
Number of Hooks (x 1,000)	*7,976*	*7,564*	*7,150*	*7,008*	*7,276*	*5,911*	*5,662*	*6,291*

Incidental bycatch

Other species including marine mammals, turtles, seabirds, and finfish are occasionally hooked by pelagic longling vessels. For detailed descriptions of interactions with these species, please refer to section 3.4.1.2 of the 2006 Consolidated HMS FMP.

3.4.3.3 Safety Issues

Like all offshore fisheries, pelagic longlining can be dangerous. Trips are often long, the work is arduous, and the nature of setting and hauling longline gear may result in injury or death. Like all other HMS fisheries, longline fishermen are exposed to unpredictable weather. NMFS does not wish to exacerbate unsafe conditions through the implementation of regulations. Therefore, NMFS considers safety factors when implementing management measures in the PLL

fishery. For example, all time/area closures are expected to be closed to fishing, not transiting, in order to allow fishermen to make a direct route to and from fishing grounds. NMFS seeks comments from fishermen on any safety concerns they may have. Fishermen have pointed out that, due to decreasing profit margins, they may fish with less crew or less experienced crew or may not have the time or money to complete necessary maintenance tasks. NMFS encourages fishermen to be responsible in fishing and maintenance activities.

3.4.3.4 International Issues and Catch

PLL fisheries for Atlantic HMS primarily target swordfish and tunas. Directed PLL fisheries in the Atlantic have been operated by Spain, the United States, and Canada since the late 1950s or early 1960s. The Japanese PLL tuna fishery started in 1956 and has operated throughout the Atlantic since then (NMFS, 1999). Most of the 46 other ICCAT nations now also operate PLL vessels.

ICCAT generally establishes management recommendations on a species (*e.g.*, swordfish) or issue basis (*e.g.*, data collection) rather than by gear type. For example, ICCAT typically establishes quotas or landing limits by species, not gear type. In terms of data collection, ICCAT may require use of specific collection protocols or specific observer coverage levels in certain fisheries or on vessels of a certain size, but these are usually applicable to all gears, and not specific to any one gear type. However, there are a handful of management recommendations that are specifically applicable to the international PLL fishery. These include, a prohibition on longlining in the Mediterranean Sea in June and July by vessels over 24 meters in length, a prohibition on PLL fishing for bluefin tuna in the Gulf of Mexico, and mandated reductions in Atlantic white and blue marlin landings for PLL and purse seine vessels from specified levels, among others.

Because most ICCAT management recommendations pertain to individual species or issues, as discussed above, it is often difficult to obtain information specific to the international PLL fishery. For example, a discussion of the authorized TAC for specific species in this section of the document would be of limited utility because it is not possible to identify what percentage of quotas are allocated to PLL. Division of quota, by gear type, is typically done by individual countries.

Nevertheless, ICCAT does report landings by gear type. Available data indicate that longline effort produces the second highest volume of catch and effort, and is the most broadly distributed (longitudinally and latitudinally) of the gears used to target ICCAT managed species (SCRS, 2004). Purse seines produce the highest volume of catch of ICCAT managed species from the Atlantic (SCRS, 2004). Figure 3.5 shows the aggregate distribution of hooks from all fishing fleets from 2000-2006. In 2007, international longline landings of HMS in fisheries in which the U.S. participated totaled 102,876 mt, which represented a continuation of the generally decreasing trend since 1999.

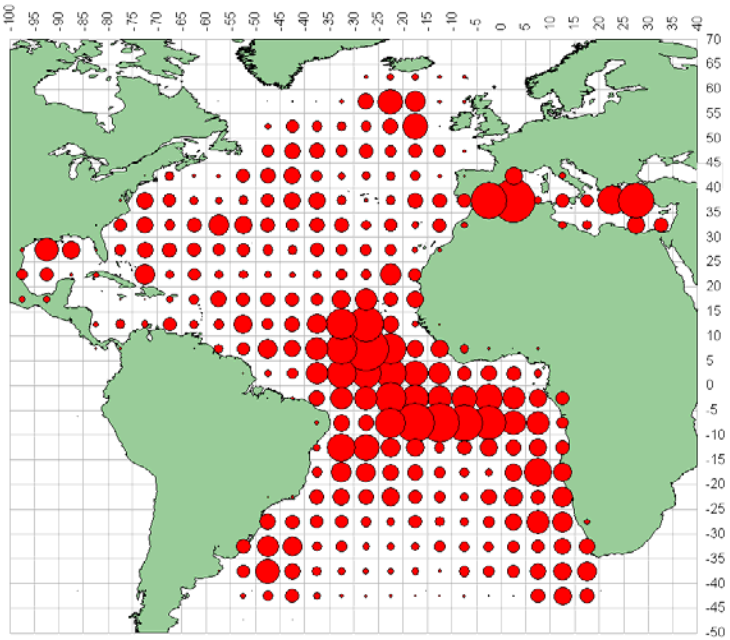

Figure 3.5 **Aggregate Distribution of Hooks Deployed by All ICCAT Parties 2000-2006.** Source: SCRS, 2008.

Scientific observer data are being collected on a range of PLL fleets in the Atlantic and will be increasingly useful in better quantifying total catch, catch composition, and disposition of catch as these observer programs mature. Previous ICCAT observer coverage requirements of five percent for non-purse seine vessels that participated in the bigeye and yellowfin tuna fishery, including PLL (per ICCAT Recommendation 96-01), are no longer in force. There is currently no ICCAT required minimum level of observer coverage specific to PLL fishing. Nevertheless, the United States has implemented a mandatory observer program in the U.S. PLL fishery. Japan is required to have eight percent observer coverage of its vessels fishing for swordfish in the North Atlantic, which are primarily PLL vessels, however, the recommendation is not specific to vessel or gear type. ICCAT recommendation 04-01, a conservation and management recommendation for the bigeye tuna fishery, requires at least five percent observer coverage of PLL vessels over 24 meters participating in that particular fishery.

ICCAT has also developed a running tabulation of the diversity of species caught by the various gears used to target tunas and tuna-like species in the Atlantic and Mediterranean (Table 3.18). For all fish species, longline gear shows the highest documented diversity of catch, followed by gillnets and purse seine. For seabirds, longline gear again shows the highest diversity of catch, while for sea turtles and marine mammals, purse seine and gillnet have a higher documented diversity of species for Atlantic tuna fleets (SCRS, 2004).

Table 3.18 ICCAT Bycatch Table (LL, longline; GILL, gillnets; PS, purse-seine; BB, baitboat; HARP, harpoon; TRAP, traps).
Source: SCRS, 2004.

ICCAT Bycatch Table (www.iccat.es)

Count	Group	LL	GILL	PS	BB	HARP	TRAP	OTHER
214	*All Groups*	149	110	78	12	33	20	43
		69.6%	51.4%	36.4%	5.6%	15.4%	9.3%	20.1%
12	*Skates and Rays*	10	6	6	0	2	0	1
		83.3%	50.0%	50.0%	0.0%	16.7%	0.0%	8.3%
46	*Coastal Sharks*	45	19	6	1	7	2	9
		97.8%	41.3%	13.0%	2.2%	15.2%	4.3%	19.6%
11	*Pelagic Sharks*	10	7	5	0	5	2	4
		90.9%	63.6%	45.5%	0.0%	45.5%	18.2%	36.4%
23	*Teleosts (ICCAT Species)*	23	18	16	9	6	7	11
		100.0%	78.3%	69.6%	39.1%	26.1%	30.4%	47.8%
82	*Teleosts (excluding Scombridae and billfishes)*	44	37	25	2	5	4	17
		53.7%	45.1%	30.5%	2.4%	6.1%	4.9%	20.7%
5	*Sea Turtles*	3	4	5	0	2	1	1
		60.0%	80.0%	100.0%	0.0%	40.0%	20.0%	20.0%
9	*Sea Birds*	8	2	0	0	0	0	0
		88.9%	22.2%	0.0%	0.0%	0.0%	0.0%	0.0%
26	*Marine Mammals*	6	17	15	0	6	4	0
		23.1%	65.4%	57.7%	0.0%	23.1%	15.4%	0.0%

U.S. Pelagic Longline Catch in Relation to International Catch

Highly Migratory Species

The U.S. PLL fleet represents a small fraction of the international PLL fleet that competes on the high seas for catches of tunas and swordfish. In recent years, the proportion of U.S. PLL landings of HMS, for the fisheries in which the United States participates, has remained relatively stable in proportion to international landings. The U.S. fleet accounts for less than 0.5 percent of the landings of swordfish and tuna from the Atlantic Ocean south of 5°N. Latitude and does not operate at all in the Mediterranean Sea. Tuna and swordfish landings by foreign fleets operating in the tropical Atlantic and Mediterranean are greater than the catches from the north Atlantic area where the U.S. fleet operates. Within the area where the U.S. longline fleet operates, U.S. longline landings still represent a limited fraction of total landings. In recent years (1999-2007), the U.S. longline landings have averaged 4.9 percent of total Atlantic longline landings, ranging from a high of 5.5 percent in 1999 to a low of 4.2 percent in 2002.

Atlantic Sharks

Data collection from international fisheries for Atlantic sharks has improved in recent years due to increasing reporting requirements adopted by ICCAT. At its annual meeting in New Orleans in 2004, ICCAT adopted *Recommendation 04-10 Concerning the Conservation of Sharks Caught in Association with Fisheries Managed by ICCAT.* Recommendation 04-10 required ICCAT Contracting Parties to report Task I and Task II data for catches of sharks in accordance with ICCAT data reporting procedures to allow for assessment of stocks.

Recommendation 04-01 also banned shark finning, requires vessels to fully utilize their entire catches of sharks, and encourages the release of live sharks that are caught incidentally and are not used for food.

At the 2006 ICCAT annual meeting in Dubrovnik, Croatia, ICCAT adopted Recommendation 06-10 which amended Paragraph 7 of *Recommendation 04-10 Concerning the Conservation of Sharks Caught in Association with Fisheries Managed by ICCAT*. The new paragraph called for SCRS to conduct stock assessments and recommend management alternatives for Atlantic blue sharks and shortfin mako sharks in time for consideration at the 2008 annual ICCAT meeting. It also required a data preparatory meeting to be held in 2007 to review all relevant data on biological parameters, catch, effort, discards, trade, and historical data.

At the 2007 ICCAT annual meeting in Antalya, Turkey, ICCAT adopted a recommendation (07-06) concerning pelagic sharks. That recommendation called for the SCRS to conduct stock assessments and recommend management alternatives for porbeagle sharks, for Contracting Parties to take appropriate measures to reduce fishing mortality in porbeagles and North Atlantic shortfin mako sharks, and implement research on pelagic shark species caught in the Convention area in order to identify potential nursery areas. It also required that Contracting Parties, Cooperating non-Contracting Parties, Entities and Fishing Entities submit Task I and II data for sharks in advance of the next SCRS assessment.

In 2008, the SCRS assessed blue sharks, and shortfin mako sharks. SCRS concluded that blue sharks were not overfished or experiencing overfishing. SCRS concluded that shortfin mako sharks were at or slightly below levels that could support MSY and produced widely varying estimates of fishing mortality (0.48 to 3.77). At the 2008 ICCAT annual meeting in Marrakech, Morocco, ICCAT adopted a recommendation requiring the live release of bigeye thresher sharks that are brought to the boat alive as well as reporting bycatch and live releases of bigeye thresher sharks. The most recent catch totals for blue and shortfin mako sharks are presented in Tables 3.19 and 3.20.

Table 3.19 Nominal Catches of Blue Shark Reported to ICCAT (landings and discards) by Major Gear and Flag between 1991 and 2007 (NLD=No Landing Data).

Source: SCRS, 2008.

		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Atlantic Total		3,533	2,343	7,879	8,310	8,422	9,036	36,895	33,211	34,208	38,512	33,859	31,867	35,301	35,359	20,596	13,066	44,623
LANDINGS	BELIZE	0	0	0	0	0	0	0	0	0	0	0	0	0	37	259	0	236
	BENIN	0	0	0	0	0	0	6	4	27	0	0	0	0	0	0	0	NLD
	BRAZIL	0	0	0	0	0	743	1,103	0	179	1,683	2,173	1,971	2,166	1,667	2,523	2,591	2,258
	CANADA	0	0	0	0	276	12	11	5	54	18	0	5	6	0	11	4	
	CAPE VERDE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NLD
	CHINA P.R.	0	0	0	0	0	0	0	0	0	0	750	420	600	0	0	0	952
	CHINESE TAIPEI	0	0	0	0	0	0	0	0	0	0	0	0	692	1,006	1,106	2,383	2,339
	EC DENMARK	1	1	0	1	2	3	1	1	0	2	1	13	5	1	0	0	NLD
	EC ESPANA	0	0	0	0	0	0	29,769	28,078	28,984	31,063	25,105	21,034	22,601	24,680	21,416	24,188	25,980
	EC FRANCE	187	276	322	350	266	278	213	163	399	395	207	221	57	106	120	99	167
	EC IRELAND	0	0	0	0	0	0	0	0	66	31	66	11	2	0	0	0	NLD
	EC PORTUGAL	2,257	1,583	5,726	4,669	5,569	5,710	3,966	3,316	3,337	4,215	4,672	4,589	7,484	3,888	7,211	7,089	9,776
	EC UNITED KINGDOM	0	0	0	0	12	0	0	1	0	12	9	6	4	6	5	242	6
	JAPAN	0	0	0	2,116	1,078	906	963	1090	771	553	578	718	893	1,308	1,739	2,813	2,433
	MEXICO	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0
	NAMIBIA	0	0	0	0	0	0	0	0	0	0	0	2,213	0	1,906	6,616	0	NLD
	PANAMA	0	0	0	0	0	0	0	0	177	22	0	0	0	0	0	254	NLD
	SOUTH AFRICA	0	0	0	0	0	0	0	23	21	0	83	63	232	128	154	90	82
	TRINIDAD & TOBAGO	0	0	0	0	0	0	0	0	0	0	0	6	3	2	1	1	0
	USA	308	215	680	29	23	283	211	255	217	291	42	0	1	7	2	2	1
	UK BERMUDA	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0
	URUGUAY	8	107	10	84	57	259	180	248	118	81	66	85	480	462	376	232	337
	VENEZUELA	0	0	0	0	0	0	0	0	0	0	0	0	0	9	26	10	18
	BRAZIL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60
	CANADA	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0	0	NLD
DISCARDS	JAPAN	0	0	0	7,571	5,379	6,881	6,164	5,998	4,442	4,150	3,318	2,184	4,753	3,784	2,827	3,921	NLD
	USA	772	184	1,136	572	618	711	185	196	101	137	106	68	0	65	66	45	38
	UK BERMUDA	0	0	0	0	3	1	0	0	8	0	0	0	0	0	0	0	NLD

Table 3.20 Nominal Catches of Shortfin Mako Shark Reported to ICCAT (landings and discards) by Major Gear and Flag between 1991 and 2007 (NLD=No Landing Data).

Source: SCRS, 2008.

		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Atlantic Total		1,210	1,302	2,957	2,952	4,866	2,771	5,577	5,275	4,002	4,858	4,683	5,380	7,370	7,510	3,801	3,346	6,425
LANDINGS	BRAZIL	0	0	0	0	0	83	190	0	27	219	409	226	283	238	426	210	36
	CANADA	0	0	0	0	111	67	110	69	70	78	69	78	73	80	91	71	72
	CHINA P.R.	0	0	34	45	23	27	19	74	126	305	22	208	260	0	0	0	158
	CHINESE TAIPEI	0	0	0	0	0	0	0	0	0	0	0	0	710	178	147	172	226
	CÔTE D'IVOIRE	9	13	10	20	13	15	23	10	10	9	15	15	30	15	14	16	25
	EC ESPAÑA	0	0	0	0	0	0	3,772	3,340	2,912	2,766	2,919	2,858	3,226	4,107	2,335	2,582	2,470
	EC PORTUGAL	314	220	796	649	749	785	519	423	446	706	518	471	1,874	486	1,351	1,444	1,915
	EC UNITED KINGDOM	0	0	0	0	0	0	0	0	2	3	2	1	1	1	0	5	0
	JAPAN	663	778	2	1,583	2,209	1,304	502	1,159	271	402	161	571	385	970	0	0	
	MEXICO	0	0	0	0	10	0	0	0	0	10	16	0	9	6	9	5	8
	NAMIBIA	0	0	0	0	0	0	0	0	1	0	0	459	0	509	1,415	1,243	1002
	PANAMA	0	0	0	0	0	0	0	0	25	1	0	0	0	0	0	0	2
	SOUTH AFRICA	0	0	0	0	0	0	0	19	13	0	79	19	138	126	125	99	208
	ST VINCENT AND THE GRENADINES	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	NLD
	TRINIDAD & TOBAGO	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	NLD
	USA	315	376	948	642	1,710	469	409	348	159	456	395	415	142	411	187	130	215
	UK BERMUDA	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0
	URUGUAY	13	20	28	12	17	26	20	23	21	35	40	38	188	249	146	68	36
	VANUATU	0	0	0	0	0	0	0	0	0	0	0	0	0	52	12	13	NLD
	VENEZUELA	0	0	0	0	0	0	0	0	0	0	0	0	0	58	20	6	11
	MEXICO	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
DISCARDS	USA	11	38	24	21	28	1	0	0	0	0	0	0	0	0	0	0	41
	UK BERMUDA	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	NLD
	JAPAN	0	0	0	429	194	142	29	134	74	68	48	71	153	297	102	122	NLD

3.4.4 Recreational Handgear

The following section describes the recreational portion of the handgear fishery, and is primarily focused upon rod and reel fishing. The HMS Handgear (rod and reel, handline, buoy gear, and harpoon) fishery includes both commercial and recreational fisheries and is described fully in Section 2.5.8 of the 1999 FMP and 2006 Consolidated HMS FMP. Handgear components may also be deployed as a specialized trolling gear to target surface-feeding tunas. Under this configuration, the line and leaders are elevated and actively trolled so that the baits fish on or above the water's surface. This style of fishing is often referred to as "green-stick fishing," and reports indicate that it can be extremely efficient compared to conventional fishing techniques. For more information on green-stick fishing gear and the configurations allowed under current regulations, please refer the 2008 SAFE Report.

3.4.4.1 Overview of History and Current Management

Atlantic tunas, swordfish, and sharks are managed under the 2006 Consolidated FMP and Amendment 1 to the 1999 FMP. Summaries of the Atlantic shark fishery are found in Sections 2.4.3 of the 1999 FMP.

Atlantic tunas, sharks, swordfish, and billfish are all targeted by domestic recreational fishermen using rod and reel gear. The recreational swordfish fishery had declined dramatically over the past twenty years, but recent information indicates that the recreational swordfish fishery is rebuilding in the Mid-Atlantic Bight and off the east coast of Florida. Effective March 1, 2003, an HMS Angling category permit has been required to fish recreationally for any HMS-managed species (Atlantic tunas, sharks, swordfish, and billfish) (67 FR 77434, December 18, 2002). Prior to March 1, 2003, the regulations only required vessels fishing recreationally for Atlantic tunas to possess an Atlantic Tunas Angling category permit.

Recreational fishing for Atlantic HMS is managed primarily through the use of minimum size limits and bag limits. The recreational shark fishery is managed using an authorized shark species list, bag limits, minimum size requirements, and landing requirements (sharks must be landed with head and fins attached). Additionally, the possession of 19 species of sharks is prohibited.

3.4.4.2 Most Recent Catch and Landings Data

The recreational landings database for HMS consists of information obtained through surveys including the Marine Recreational Fishery Statistics Survey (MRFSS), Large Pelagic Survey (LPS), Southeast Headboat Survey (HBS), Texas Headboat Survey, and Recreational Billfish Survey Tournament Data (RBS). Descriptions of these surveys, the geographic areas they include, and their limitations, are discussed in Section 2.6.2 of the 1999 FMP.

Shark Recreational Fishery

Recreational landings of sharks are an important component of HMS fisheries. Recreational shark fishing with rod and reel is a popular sport at all social and economic levels, largely because the resource is accessible. Sharks can be caught virtually anywhere in salt water, depending upon the species.

Recreational shark fisheries often occur in nearshore waters by private vessels and charter/headboats. However, there is also some shore-based fishing and some offshore fishing. The following tables provide a summary of landings for each of the three species groups. Since 2003, the recreational fishery has been limited to rod and reel and handline gear only. Similar state regulations along the Atlantic seaboard were implemented through an ASMFC interstate fishery management plan in 2009.

Table 3.21 Estimates of Total Recreational Harvest of Atlantic Sharks: 1999-2007 (numbers of fish in thousands).
Source: Cortés and Neer 2005, Cortés, pers. comm. Estimates include prohibited species.

Species Group	1999	2000	2001	2002	2003	2004	2005	2006	2007
LCS	92.3	140.0	137.2	82.8	88.8	66.6	86.2	59.5	68.7
Pelagic	11.1	13.3	3.8	4.7	4.3	5.0	5.4	18.1	9.0
SCS	125.7	199.9	212.5	153.8	133.7	126.0	119.1	121.7	172.4
Unclassified	6.9	10.9	24.5	5.4	18.1	27.9	47.4	7.3	23.8

Table 3.22 Recreational Harvest of Atlantic LCS by Species, in number of fish: 1999-2007.
Sources: Cortés and Neer 2005, Cortés, pers. comm.

LCS Species	1999	2000	2001	2002	2003	2004	2005	2006	2007
Basking**	0	0	0	0	0	0	0	0	0
Bignose*	0	0	0	0	0	17	0	0	55
Bigeye sand tiger**	0	0	0	0	0	0	0	0	0
Blacktip	31,778	73,998	49,488	39,756	40,402	30,872	44,831	31,724	28,883
Bull	2,775	6,075	4,117	1,823	3,455	4,883	1,377	4,284	5,983
Caribbean Reef*	3	59	268	741	0	652	5	47	0
Dusky*	5,337	3,116	5,993	1,047	2,806	142	3,050	191	130
Galapagos*	0	0	0	0	0	0	0	0	0
Hammerhead, Great	555	925	3,446	4	47	9	162	139	813
Hammerhead, Scalloped	614	3,781	1,494	1,358	2,956	930	5,212	537	1,840
Hammerhead, Smooth	1	2	703	2	1	0	0	2	0
Hammerhead, Unclassified	0	3,691	0	5,247	0	0	2,676	1,099	807
Lemon	122	5,434	5,884	4,921	4,876	5,578	506	1,145	3
Night*	50	24	0	0	0	0	15	1	2
Nurse	1,429	2,214	4,934	2,562	563	3,463	2,341	1,553	334
Sandbar	20,228	10,965	36,094	8,530	5,151	3,853	2,795	848	7,110
Sand tiger**	0	0	604	0	0	0	0	1,040	0
Silky	361	6,233	3,928	1,741	1,943	399	3,589	2,042	1,980
Spinner	6,075	4,810	3,384	3,732	4,483	3,435	3,055	2,022	6,217
Tiger	7	1,480	732	126	110	1	1,321	1,309	1,815
Whale**	0	0	0	0	0	0	0	0	0
White**	0	0	0	0	0	0	0	0	0
Requiem shark unclassified	12,813	17,164	16,136	11,173	21,990	12,388	15,319	11,511	12,730
Total:	82,148	139,971	137,205	82,763	88,783	66,622	86,254	59,494	68,702

*indicates species that were prohibited in the recreational fishery as of July 1, 1999.
** indicates species that were prohibited as of April 1997.

Table 3.23 Recreational Harvest of Atlantic Pelagic Sharks by Species, in number of fish: 1999-2007.
Sources: Cortés and Neer 2005, Cortés, pers. comm.

Pelagic Shark Species	1999	2000	2001	2002	2003	2004	2005	2006	2007
Bigeye thresher*	0	0	0	65	0	0	0	42	0
Bigeye sixgill*	0	0	0	0	0	0	0	0	0
Blue Shark	5,218	7,011	950	0	376	0	31	980	1,622
Mako, Longfin*	0	0	0	0	0	0	0	0	0
Mako, Shortfin	1,383	5,813	2,827	3,206	3,922	4,964	3,857	3,363	2,556
Mako, Unclassified	9	0	0	0	0	0	0	0	0
Oceanic whitetip	0	0	0	0	0	0	0	0	0
Porbeagle	0	0	0	0	0	0	0	0	0
Sevengill*	0	0	0	0	0	0	0	0	0
Sixgill*	0	0	0	0	0	0	0	0	0
Thresher	4,512	529	0	1,467	0	0	1,504	13,747	4,813
Total:	11,122	13,353	3,777	4,738	4,298	4,964	5,392	18,132	8,991

* indicates species that were prohibited in the recreational fishery as of July 1, 1999.

Table 3.24 Recreational Harvest of Atlantic SCS by Species, in number of fish: 1999-2007.
Sources: Cortés and Neer 2005, Cortés, pers. comm.

SCS Species	1999	2000	2001	2002	2003	2004	2005	2006	2007
Atlantic Angel*	0	0	0	0	0	0	0	0	0
Blacknose	6,139	10,410	14,885	11,438	6,615	15,215	7,110	9,947	9,168
Bonnethead	37,341	56,436	59,017	51,048	40,066	42,050	31,369	24,302	43,006
Finetooth	78	1,390	6,628	3,027	1,758	286	2,847	268	3,935
Sharpnose, Atlantic	69,153	130,727	131,912	88,297	85,299	68,421	77,712	87,180	116,263
Sharpnose, Caribbean*	0	0	0	0	0	0	0	0	0
Smalltail*	4	973	70	0	0	71	35	0	0
Total:	112,715	199,936	212,512	153,810	133,738	126,043	119,073	121,697	172,372

*indicates species that were prohibited in the recreational fishery as of July 1, 1999.

3.4.4.3 Bycatch Issues and Data Associated with the Fishery

Bycatch in the recreational rod and reel fishery is difficult to quantify because many fishermen value the experience of fishing and may not be targeting a particular pelagic species. Recreational "marlin" or "tuna" trips may yield dolphin, tunas, wahoo, and other species, both undersized and legal sized. Bluefin tuna trips may yield undersized bluefin, or a seasonal closure may prevent landing of a bluefin tuna above a minimum or maximum size. Sharks may be discarded because they are a prohibited species. In some cases, therefore, rod and reel catch may be discarded. The Magnuson-Stevens Act (16 USC 1802 (2)) stipulates that bycatch does not include fish under recreational catch-and-release.

Bycatch can result in death or injury to discarded fish. Therefore, bycatch mortality is incorporated into fish stock assessments and into the evaluation of management measures. Rod and reel discard estimates from Virginia to Maine during June – October could be monitored

through the expansion of survey data derived from the LPS (dockside and telephone surveys). However, the actual numbers of fish discarded for many species are so low that presenting the data by area could be misleading, particularly if the estimates are expanded for unreported effort in the future. The number of kept and released sharks reported or observed through the LPS dockside intercepts for 1997 – 2007 is presented in Table 3.25.

An outreach program to address bycatch and to educate anglers on the benefits of circle hooks has been implemented by NMFS. One of the key elements of the outreach program is to provide information that leads to an improvement in post-release survival from recreational gear by encouraging recreational anglers to use circle hooks. The initial implementation of this outreach program began in 2007 with the distribution of DVDs to tournament operators showing the proper rigging and deployment of circle hooks with natural baits. This outreach program is anticipated to be expanded by NMFS in future years. Also, a final rule to require the mandatory use of circle hooks when fishing with natural baits in billfish tournaments was published in May 2007 (72 FR 26735, May 11, 2007) and became effective on January 1, 2008.

Table 3.25 **Observed or reported number of Atlantic Shark kept and released in the rod and reel fishery, Maine through Virginia, 2000 -2007.**
Source: Large Pelagic Survey (LPS) Preliminary Data.

	Number of Fish Kept [1]								Number of Fish Released Alive							
Species	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Thresher Shark	2	5	20	24	58	45	34	62	1	0	5	8	27	9	15	24
Mako Shark	49	27	72	141	216	99	111	143	114	65	120	208	350	142	177	190
Sandbar Shark	1	2	0	9	7	1	1	9	4	10	17	26	68	37	158	168
Dusky Shark	0	0	1	1	0	0	3	6	32	8	9	44	60	49	73	87
Tiger Shark	0	1	1	0	0	1	0	1	3	2	3	12	0	6	7	11
Porbeagle	0	0	1	0	1	1	1	0	0	0	14	3	1	6	8	2
Blacktip Shark	0	1	0	1	0	1	1	0	0	0	6	0	1	19	9	31
Atlantic Sharpnose Shark	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0
Blue Shark	12	2	36	65	74	67	61	109	374	141	505	2,060	2,242	920	884	1,978
Hammerhead Shark	1	2	0	0	1	0	0	0	0	1	6	38	2	5	0	0

[1] NMFS typically expands these "raw" data to report discards of bluefin tuna by the rod and reel fishery to ICCAT. If sample sizes are large enough to make reasonable estimates for other species, NMFS may produce estimates for other species in future SAFE reports.

3.4.5 Fishery Data: Landings by Shark Species

The purpose of this section is to provide a summary of recent landings of sharks on a species by species basis, including sharks caught under special permits (such as EFPs), which are not recorded in commercial logbooks. Landings for sharks were compiled from the most recent stock assessment documents.

Table 3.26 Commercial landings of LCS in lb dw: 1999-2007.
Sources: Cortés 2003; Cortés and Neer 2002, 2005; Cortés pers. comm.

Large Coastal Sharks	1999	2000	2001	2002	2003	2004	2005	2006	2007
Basking**	0	0	0	0	0	0	0	0	0
Bignose*	9,050	672	1,442	0	318	0	98	61	0
Bigeye sand tiger**	0	0	0	0	0	0	0	0	0
Blacktip	1,259,016	1,633,919	1,135,199	1,099,194	1,474,362	1,092,600	993,380	1,311,257	1,089,199
Bull	28,603	24,980	27,037	40,463	93,816	49,556	133,265	173,125	157,890
Caribbean Reef*	0	0	1	0	0	0	0	0	0
Dusky*	110,942	205,746	1,973	8,779	23,288	1,025	874	4,209	1,907
Galapagos*	0	0	0	0	0	0	0	0	0
Hammerhead, Great	0	0	0	0	0	0	0	0	0
Hammerhead, Scalloped	0	0	0	0	0	0	0	0	0
Hammerhead, Smooth	0	0	0	0	0	92	54	150	0
Hammerhead, Unclassified	53,393	35,060	69,356	108,160	150,368	116,546	197,067	153,854	65,255
Large Coastal, Unclassified	67,197	16,575	172,494	147,359	51,433	0	0	0	0
Lemon	25,298	45,269	24,453	56,921	80,688	67,810	71,805	62,738	72,583
Narrowtooth*	0	0	0	0	0	0	0	0	0
Night*	4,287	0	0	0	20	0	0	0	0
Nurse	1,176	429	387	69	70	317	97	2,258	15
Sandbar	1,320,239	1,491,908	1,407,550	1,863,420	1,425,628	1,223,241	1,282,477	1,580,142	669,525
Sand Tiger**	6,401	6,554	1,248	409	624	1,832	5,167	4,321	210

Large Coastal Sharks	1999	2000	2001	2002	2003	2004	2005	2006	2007
Silky	9,961	31,959	14,197	30,731	51,588	11,808	17,646	16,173	16,496
Spinner	629	14,473	6,970	8,447	12,133	14,806	44,150	96,259	17,888
Tiger	30,779	24,443	26,973	16,115	18,536	30,976	33,477	53,706	17,500
Whale**	0	0	0	0	0	0	0	0	0
White**	82	1,201	26	0	1,454	58	0	122	88
Unclassified, assigned to large coastal	821,648	92,117	525,661	771,450	908,077	603,229	527,026	393,749	199,550
Unclassified, fins	116,570	87,820	23,988	142,565	181,431	137,375	110,613	146,037	102,615
Total (excluding fins)	**3,865,271 (1,753 mt dw)**	**3,713,125 (1,684 mt dw)**	**3,414,967 (1,549 mt dw)**	**4,151,594 (1,883 mt dw)**	**4,292,403 (1,947 mt dw)**	**3,213,896 (1,458 mt dw)**	**3,306,583 (1,500 mt dw)**	**3,852,124 (1,747 mt dw)**	**2,308,018 (1,047 mt dw)**

* indicates species that were prohibited in the commercial fishery as of June 21, 2000.
** indicates species that were prohibited as of April 1997.

Table 3.27 **Commercial landings of small coastal sharks in lb dw: 1999-2007.**
Source: Cortés and Neer, 2002, 2005; Cortés, 2003; Cortés pers. comm.

Small coastal sharks	1999	2000	2001	2002	2003	2004	2005	2006	2007
Atlantic Angel*	0	97	0	495	1,397	818	3,587	500	29
Blacknose	137,619	178,083	160,990	144,615	131,511	68,108	120,320	187,907	91,438
Bonnethead	58,150	69,411	63,461	36,553	38,614	29,402	33,295	33,911	53,638
Finetooth	285,230	202,572	303,184	185,120	163,407	121,036	107,327	80,536	171,099
Sharpnose, Atlantic	244,356	142,511	196,441	213,301	190,960	230,880	375,881	520,028	334,421
Sharpnose, Atlantic, fins	0	0	209	0	0	0	0	0	0
Sharpnose, Caribbean*	2,039	353	205	0	0	0	0	0	0
Unclassified Small Coastal	336	0	51	35,831	8,634	1,407	9,792	471	3,474
Total (excluding fins)	**727,730 (330 mt dw)**	**593,027 (269 mt dw)**	**724,332 (329 mt dw)**	**615,915 (279 mt dw)**	**534,523 (242 mt dw)**	**451,651 (205 mt dw)**	**650,202 (295 mt dw)**	**823,353 (373 mt dw)**	**654,099 (297 mt dw)**

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

Table 3.28 Commercial landings of pelagic sharks in lb dw: 1999-2007.
Sources: Cortés and Neer 2002, 2005; Cortés 2003; Cortés pers. comm.

Pelagic Sharks	1999	2000	2001	2002	2003	2004	2005	2006	2007
Bigeye thresher*	18,683	4,376	330	0	0	719	267	68	0
Bigeye sixgill*	0	0	0	0	0	0	0	0	0
Blue shark	886	3,508	65	137	6,324	423	0	588	0
Mako, longfin*	3,394	6,560	9,453	3,008	1,831	1,827	403	2,198	2,039
Mako, shortfin	150,073	129,088	171,888	159,840	151,428	217,171	154,187	102,901	165,120
Mako, Unclassified	56,625	74,690	73,556	58,392	33,203	50,978	35,241	28,557	38,170
Oceanic whitetip	1,480	657	922	1,590	2,559	1,082	713	338	787
Porbeagle	5,650	5,272	1,152	2,690	1,738	5,832	2,452	3,810	3,370
Sevengill*	0	0	0	0	0	0	0	0	0
Sixgill*	0	0	0	0	0	0	0	0	0
Thresher	96,266	81,624	56,893	53,077	46,502	44,915	24,280	33,299	49,257
Unclassified, pelagic	0	233	0	5,965	79,439	0	0	571	0
Unclassified, assigned to pelagic	41,006	40,951	31,636	182,983	314,300	356,522	18,057	12,936	5,022
Unclassified, pelagic, fins	2,408	3,746	12,239	0	0	41	0	0	0
Total (excluding fins)	**376,471 (171 mt dw)**	**350,705 (159 mt dw)**	**345,895 (157 mt dw)**	**467,682 (212 mt dw)**	**637,324 (289 mt dw)**	**679,469 (308 mt dw)**	**235,600 (107 mt dw)**	**185,266 (84 mt dw)**	**263,765 (120 mt dw)**

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

Table 3.29 **The number of sharks and non-shark species that were discarded alive, discarded dead, and kept under the exempted fishing program during 2008, including exempted fishing permits, display permits, scientific research permits, and letters of acknowledgement. These numbers do not include fish that were reported in commercial logbooks.**

Species	Number Discarded Alive	Number Discarded Dead	Number Kept	Total Number of Interactions
Shark Species				
Angel Shark	1			1
Atlantic Sharpnose Shark	535	402	1	938
Bignose	1			1
Blacknose Shark	39		8	47
Blacktip Shark	41	1	12	54
Bonnethead Shark	182	92	14	288
Bull Shark	5			5
Dusky Shark	12			12
Finetooth Shark	2			2
Florida Smoothhound Shark	36	2	1	39
Great Hammerhead Shark	2		1	3
Mako Shark			1	1
Night Shark	17	19		36
Nurse Shark	21		4	25
Sand Tiger Shark	9		2	11
Sandbar Shark	10			10
Scalloped Hammerhead Shark	7	4		11
Silky Shark	15	49		64
Spinner Shark	5			5
Thresher Shark	1			1
Tiger Shark	21			21
Unidentified Shark	4			4
Non-Shark Species				
Barracuda	1			1
Bigeye Tuna		2		2
Bluefin Tuna	47	29	3	79
Eagle Ray			2	2
Cobia	1			1
Humpback Whale	1			1
Little Tunny	2		5	7
Longbill Spearfish		6		6
Mahi Mahi		1	8	9
Manta Ray	2			2
Oilfish		1		1
Red Drum	2			2
Roundscale Spearfish		20	1	21
Southern Stingray	1			1
Swordfish	8	9	29	46
White Marlin		58		58
Yellowfin Tuna			2	2

Table 3.30 Estimates of total landings and dead discards for LCS from 1981 through 2007 (numbers of fish in thousands).
Sources: Modified from Table 2.2 in SEDAR 11 LCS Data Workshop Report (NMFS, 2006b) and Cortés, pers. comm.

Year	Commercial Landings	Pelagic Longline Discards	Recreational Catches	Unreported Catches	Bottom Longline Discards	Mexican Catches	Menhaden Fishery Bycatch	Confiscated Mexican catches in U.S.	Total
1981	16.2	0.9	285.1		0.5	120.0	37.5		460.2
1982	16.2	0.9	539.3		0.5	81.9	38.5		677.3
1983	17.5	0.9	812.7		0.6	85.4	38.0		955.1
1984	23.9	1.3	273.3		0.8	120.7	38.0		458.0
1985	22.2	1.2	407.8		0.7	87.7	34.2		553.9
1986	54.0	2.9	426.7	24.9	1.7	81.8	33.8		625.8
1987	104.7	9.7	298.3	70.3	3.3	80.2	35.2		601.7
1988	274.6	11.4	317.2	113.3	8.7	89.3	34.2		848.6
1989	351.0	10.5	224.8	96.3	11.1	105.6	36.1		835.3
1990	267.5	8.0	219.2	52.1	8.5	122.2	35.2		712.7
1991	200.2	7.5	306.2	11.3	6.3	95.7	27.2		654.4
1992	215.2	20.9	218.0		6.8	103.4	23.9		588.2
1993	169.4	7.3	189.2		5.4	119.8	24.4		515.5
1994	228.0	8.8	155.2		3.7	110.7	26.1		532.6
1995	222.4	5.2	186.0		5.2	96.0	24.0		538.8
1996	161.0	5.7	196.6		4.8	106.1	23.9		498.0
1997	130.6	5.6	167.6		6.7	83.1	24.4		418.0
1998	174.9	4.3	161.4		6.6	74.1	23.5		444.8

Year	Commercial Landings	Pelagic Longline Discards	Recreational Catches	Unreported Catches	Bottom Longline Discards	Mexican Catches	Menhaden Fishery Bycatch	Confiscated Mexican catches in U.S.	Total
1999	111.5	9.0	82.1		2.9	57.1	25.8		288.4
2000	111.2	9.4	140.0		4.1	52.1	22.1	1.0	339.9
2001	95.8	5.6	137.2		5.5	52.1	20.6	1.5	318.2
2002	123.7	1.8	82.8		4.8	52.1	20.2	1.4	286.7
2003	128.0	2.9	89.3		7.1	52.1	19.7	1.3	300.4
2004	103.4	4.9	67.2		4.7	52.1	20.2	2.1	254.5
2005	107.4	4.3	86.3		8.1	52.1	20.2	2.1	280.4
2006	132.2	1.9	59.4		7.7	52.1	20.2	2.1	275.6
2007	74.8	3.2	68.7		6.0	52.1	20.2	2.1	227.0

Table 3.31 **Catch history for the Small Coastal Shark complex (numbers of fish). 2007 recreational catches are preliminary (TXPWD Survey catches assumed equal to those in 2006); 2006 and 2007 values for shrimp bycatch (GOM and SA) and EFP assumed equal to those in 2005**.
Sources: Modified from Table 2.2 in SEDAR 13 (NMFS, 2007b) and Cortés, pers. comm.

	Commercial				Recreational Catches	Bottom Longline Discards	Shrimp Bycatch (GOM)	Shrimp Bycatch (SA)	EFP	Total
Year	Total	Longline Discards	Nets	Lines						
1972							840,633	105,680		946,313
1973							233,634	29,371		263,005
1974							411,643	51,749		463,392
1975							872,930	109,740		982,670
1976							292,878	36,819		329,697
1977							946,230	118,955		1,065,185
1978							635,527	79,895		715,422
1979							933,737	117,384		1,051,121
1980							1,738,982	218,615		1,957,597
1981					82,759		1,736,376	218,287		2,037,422
1982					67,647		409,794	51,517		528,958
1983					87,399		674,421	84,784		846,604
1984					57,342		377,532	47,461		482,335
1985					62,885		476,828	59,944		599,657
1986					111,425		485,197	60,996		657,618
1987					98,947		1,040,738	130,836		1,270,521

	Commercial				Recreational Catches	Bottom Longline Discards	Shrimp Bycatch (GOM)	Shrimp Bycatch (SA)	EFP	Total
Year	Total	Longline Discards	Nets	Lines						
1988					172,684		580,306	72,953		825,943
1989					104,757		603,506	75,869		784,132
1990					96,977		614,590	77,263		788,830
1991					143,845		891,723	112,102		1,147,670
1992					111,829		1,172,572	147,409		1,431,810
1993	262				93,562		509,360	64,034		667,219
1994	3,308				140,473		443,215	55,718		642,714
1995	139,569	57,819	80,791	627	164,884	22,607	1,051,681	132,211		1,510,952
1996	118,425	39,967	75,317	3,134	114,007	12,230	920,627	115,736		1,281,026
1997	214,221	29,527	181,922	1,723	99,382	12,106	703,350	88,421		1,117,481
1998	187,931	22,044	163,396	2,397	123,593	17,547	806,300	101,363		1,236,734
1999	222,715	18,064	198,804	4,601	112,715	16,239	641,017	80,585		1,073,271
2000	168,544	24,689	141,425	2,377	199,043	24,220	796,602	100,144	11	1,288,565
2001	219,962	14,643	201,777	1,535	212,442	14,511	641,786	80,682		1,169,384
2002	173,847	25,133	146,719	1,949	153,810	18,171	1,104,353	138,833		1,589,015
2003	147,313	36,678	90,411	20,120	135,644	30,956	544,058	68,396	5	926,372
2004	133,937	35,741	97,080	1,374	128,468	29,665	797,000	101,330	1,872	1,192,273
2005	156,679	43,583	111,084	1,466	119,073	21,573	530,943	66,893	484	895,646

	Commercial				Recreational Catches	Bottom Longline Discards	Shrimp Bycatch (GOM)	Shrimp Bycatch (SA)	EFP	Total
Year	Total	Longline Discards	Nets	Lines						
2006	183,714	63,987	117,404	2,234	119,504	47,056	530,943	66,893	484	948,594
2007	174,326	20,442	150,120	3,295	172,372	15,418	530,943	66,893	484	960,436

3.5 HMS Permits and Tournaments

This section provides updates for the number of permits that were issued in conjunction with HMS fishing activities. These are current through 2008 and, in some cases, March 2009, depending on the table in which the data appears. Furthermore, Section 3.5.6 provides a comprehensive synthesis of recreational fishing tournaments and their role in the context of HMS management.

NMFS' HMS Management Division continues to monitor capacity in HMS fisheries. Updated permit numbers for HMS and non-HMS fisheries as of March 18, 2009 are included in Table 3.32. The overall number of HMS permits for Atlantic swordfish and sharks (directed and incidental) decreased between 2005 and 2008 (Table 3.32), however, these numbers are subject to change based upon on-going permit renewal or expiration.

Table 3.32 Distribution of Shark Directed and Incidental Permits and Other held in other Fisheries by State as of March 18, 2009.

State	SHK-Directed	SHK Incidental	SWO Directed	SWO Incidental/ Handgear	GOM Reef Fish	Dolphin Wahoo	Mackerel:		Spiny Lobster	Snapper-Grouper	Non-HMS Charter Head Boat General*
							King	Spanish			
ME	1	1	1	0	0	1	0	0	0	0	0
NH	1	2	1	0	0	0	0	0	0	0	0
MA	5	13	11	3	0	11	1	5	2	0	0
RI	0	4	0	3	0	1	0	0	0	0	0
CT	1	1	0	0	1	0	0	0	0	0	0
NY	9	10	12	4	1	15	0	4	0	0	5
NJ	25	31	32	12	0	35	12	18	1	1	3
DE	0	1	1	0	0	1	0	0	0	0	0
MD	5	2	6	0	1	6	0	1	0	0	6
VA	2	2	1	2	0	3	1	1	0	1	0
NC	18	14	10	7	0	29	20	20	2	14	10
SC	7	12	4	1	0	12	8	2	0	13	3
GA	2	1	0	0	0	3	3	3	2	3	0
FL	138	136	69	37	97	165	115	153	14	71	99
AL	5	1	0	0	3	0	1	1	0	0	0
MS	0	5	0	0	2	0	4	3	0	0	0
LA	3	36	33	3	4	6	6	3	0	0	0
TX	1	7	1	3	6	2	5	2	0	0	3

State	SHK-Directed	SHK Incidental	SWO Directed	SWO Incidental/ Handgear	GOM Reef Fish	Dolphin Wahoo	Mackerel:		Spiny Lobster	Snapper-Grouper	Non-HMS Charter Head Boat General*
							King	Spanish			
Total 2009	**223**	**279**	**182**	**75**	**115**	**290**	**176**	**216**	**21**	**103**	**129**
Total 2008	**214**	**285**	**181**	**76**	**	**	**	**	**	**	**
Total 2007	**231**	**296**	**180**	**160**	**134**	**316**	**444** (King / Spanish Combined)		**54**	**119**	**193**
Total 2006 ***	**240**	**312**	**191**	**86**	***	***	***	***	***	***	***
Total 2005 ***	**235**	**320**	**190**	**91**	***	***	***	***	***	***	***

* Non-HMS Charter Headboat (CHB) General includes: Atlantic CHB for dolphin/wahoo, South Atlantic (SA) CHB for pelagic fish, SA CHB for snapper/grouper, Gulf of Mexico (GOM) CHB for pelagic fish, and GOM CHB for reef fish.
** 2008 numbers taken from 2008 SAFE Report. Not all permit totals are available.
*** Numbers for 2005 and 2006 were taken from the Consolidated HMS FMP. Non-HMS permits were not calculated at that time.

3.5.1 Upgrading and Safety Issues

When the limited access program was implemented, NMFS included upgrading restrictions that were the same as those implemented by the NEFMC and MAFMC in order to help minimize the number of regulations for fishermen in those areas. These regulations restrict vessels from any increase over ten percent length overall (LOA), ten percent gross or net tonnage, and 20 percent horsepower. NMFS continued to receive comments that these vessel upgrading restrictions are not appropriate for longline fisheries, may inhibit full utilization of the domestic swordfish quota, are not the preferred vessel characteristics to limit overcapitalization, and have caused safety at sea concerns. In developing the current upgrading restrictions, hold capacity was identified by constituents as a vessel characteristic that would not impact safety at sea and would meet the objective of addressing overcapitalization in HMS commercial fisheries. NMFS did not implement hold capacity as a measure to limit vessel upgrading in 1999 due to the lack of standard measurements of vessel hold capacity as well as the lack of consistent collection of this information for HMS commercial vessels as part of existing vessel registration systems. NMFS considered other possible options including: eliminating upgrading restrictions; limiting hold capacity instead of, or in addition to, the current restrictions; allowing a greater percentage increase; and creating vessel categories. NMFS heard similar comments as those listed above from the HMS AP in March of 2007.

On June 7, 2007, NMFS published a final rule which modified HMS limited access vessel upgrading restrictions for vessels concurrently issued certain HMS permits (72 FR 31688). According to this rule, effective August 6, 2007, HMS limited access vessel upgrading restrictions are modified, but only for vessels that concurrently possess, or are eligible to renew, on August 6, 2007, incidental or directed swordfish and shark permits, as well as an Atlantic Tunas Longline category permit. These vessels may be upgraded, or permits transferred, so long as the upgrade or permit transfer does not result in an increase in vessel size (LOA, gross registered tonnage (GRT), and net tonnage (NT)) of more than 35 percent, relative to the vessel first issued the HMS LAP. Also, all horsepower upgrading restrictions for these vessels are removed by the rule. In addition, effective July 9, 2007, restrictions specifying that a vessel may be upgraded only once were removed for all HMS LAPs. NMFS provided additional information to LAP holders regarding eligibility for the modified vessel upgrading restrictions in a subsequent notice.

3.5.2 HMS CHB Permits

In 2002, NMFS published a final rule (67 FR 77434, December 18, 2002) expanding the HMS recreational permit from tuna only to include all HMS and define CHB operations. This established a requirement that owners of charterboats or headboats that are used to fish for, take, retain, or possess Atlantic tunas, sharks, swordfish, or billfish must obtain a HMS CHB permit. This permit replaced the Atlantic Tunas CHB permit. A vessel issued a HMS CHB permit for a fishing year will not be issued an HMS Angling permit or any Atlantic Tunas permit in any category for that same fishing year, regardless of a change in the vessel's ownership. The total number of CHB increased between 2006 and 2008 (Table 3.33).

Table 3.33 CHB Permits by State in 2008.

State	CHB permits	State	CHB Permits
AL	78	NJ	644
CT	112	NV	1
DE	156	NY	394
FL	819	OH	2
GA	31	PA	53
LA	108	PR	27
MA	748	RI	199
MD	174	SC	180
ME	107	TN	--
MI	3	TX	202
MS	32	VA	143
NC	509	VI	23
NH	66	Other	26
Total (2008)			**4,837**
Total (2007)			**3,899**
Total (2006)			**4,173**

3.5.3 HMS Angling Permits

Effective March 2003 (67 FR 77434, December 18, 2002), the HMS Angling category permit allows all recreational 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. These species include: sharks, swordfish, white and blue marlin, sailfish, spearfish, and federally regulated Atlantic tunas (bluefin, yellowfin, bigeye, skipjack, and albacore). Atlantic HMS caught, retained, possessed, or landed by persons on board vessels with an HMS Angling permit may not be sold or transferred to any person for a commercial purpose. By definition, recreational landings of Atlantic HMS are those that cannot be marketed through commercial channels, therefore it is not possible to monitor anglers' catches through ex-vessel transactions as in the commercial fishery. Instead, NMFS conducts statistical sampling surveys of the recreational fisheries. These survey programs have been used for over a decade and include the MRFSS and the LPS. A vessel issued an HMS Angling permit for a fishing year shall not be issued an HMS Charter/Headboat permit or an Atlantic Tunas permit in any category for that same fishing year, regardless of a change in the vessel's ownership.

Table 3.34 HMS Angling Permits by State in 2008.

State	CHB permits	State	CHB Permits
AL	584	NJ	4634
CT	949	NV	6
DE	1363	NY	2328
FL	5534	OH	24
GA	179	PA	326
LA	830	PR	1036
MA	4601	RI	905
MD	1814	SC	1214
ME	628	TN	30
MI	25	TX	945
MS	273	VA	1449
NC	2556	VI	92
NH	456	Other	153
Total (2008)			**32,934**
Total (2007)			**24,220**
Total (2006)			**25,238**

3.5.4 Dealer Permits

Dealer permits are required for commercial receipt of Atlantic tuna, swordfish, and sharks, and are described in further detail in the 1999 FMP for Atlantic Tunas, Swordfish, and Sharks. Shark dealers are also required to attend shark identification workshops as of December 31, 2007. Dealer permits are not limited access. Fishermen caught selling HMS to unpermitted dealers and persons without a dealer permit buying HMS from fishermen could be subject to enforcement action. Similarly, persons caught buying HMS from non-commercial fishermen could also be subject to enforcement action. All dealer permit holders are required to submit reports detailing the nature of their business. For swordfish and shark permit holders (including those who *only* import swordfish), dealers must submit bi-weekly dealer reports on all HMS they purchase. Tuna dealers must submit, within 24 hours of the receipt of a bluefin tuna, a landing report for each bluefin purchased from U.S. fishermen. Dealers must also submit bi-weekly reports that include additional information on tunas that they purchase. To facilitate quota monitoring "negative reports" for shark and swordfish are also required from dealers when no purchases are made (*i.e.*, NMFS can determine who has not purchased fish versus who has neglected to report). As of March 18, 2009, there were 100 permitted shark dealers (Table 3.35). NMFS continues to automate and improve its permitting and dealer reporting systems and plans to make additional permit applications and renewals available online in the near future.

Table 3.35 Number of shark dealer permits and other permits held by shark dealers by state or country as of March 18, 2009.

State	Sharks	Domestic Swordfish	Dolphin/ Wahoo	Reef Fish	Rock Shrimp	Snapper/ Grouper	Golden Crab	Wreckfish	Total # of Permits
AL	3	1	2	3	0	1	0	0	10
FL	39	24	20	24	9	24	8	6	154
GA	1	1	1	0	1	1	0	1	6
LA	7	6	5	6	0	5	0	0	29
MA	6	6	6	1	1	1	1	2	24
MD	2	2	2	0	0	0	0	0	6
ME	2	2	2	0	0	1	0	0	7
NC	7	6	7	0	2	7	0	2	31
NJ	8	8	6	1	1	1	0	1	26
NY	4	4	2	1	1	2	1	2	17
RI	3	3	3	0	0	0	0	0	9
SC	11	4	6	0	0	7	0	1	29
TX	3	2	1	3	0	1	0	0	10
VA	4	4	4	0	0	3	0	2	17
Totals (2008)	**100**	**73**	**67**	**39**	**15**	**54**	**10**	**17**	**375**

3.5.5 Exempted Fishing Permits (EFPs), Display Permits, Chartering Permits, and Scientific Research Permits (SRPs)

EFPs, display permits, and SRPs are requested and issued under the authority of the Magnuson-Stevens Act (16 U.S.C. 1801 *et seq*.) and/or the ATCA (16 U.S.C. 971 *et seq*.). EFPs are issued to individuals interested in being exempted from regulations for the purpose of conducting research or other fishing activities using private (non-NOAA) vessels, whereas an SRP would be issued to agency scientists who are using NOAA vessels as their research platform. Display permits are issued to individuals who are fishing for, catching, and then transporting HMS to certified aquariums for public display. Regulations at 50 CFR 600.745 and 50 CFR 635.32 govern scientific research activity, exempted fishing, and exempted educational activity with respect to Atlantic HMS. Amendment 1 to the 1999 FMP for Atlantic Tunas, Swordfish, and Sharks implemented and created a separate display permitting system, which operates apart from the exempted fishing activities that are focusing on scientific research. However, the application process for display permits is similar to that required for EFPs and SRPs. The quota is 60 mt ww for all sharks collected under EFPs, display permits, and SRPs.

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

In order to implement the chartering recommendations of ICCAT, NMFS published a rule on December 6, 2004 (69 FR 70396), requiring U.S. vessel owners with HMS permits to apply for and obtain a chartering permit before fishing under a chartering arrangement outside U.S. waters. These permits are issued in a similar manner as other EFPs. Under this final rule and consistent with the ICCAT recommendations, vessels issued a chartering permit are not authorized to use the quota or entitlement of the United States until the chartering permit expires or is terminated. This is because of the fact that under a chartering arrangement, it is assumed that vessels have attained temporary authorization to harvest another ICCAT Contracting Parties' quota. Having a chartering permit does not obviate the need to obtain a fishing license, permits, or other authorizations issued by the chartering nation in order to fish in foreign waters, or obtain other authorizations such as a High Seas Fishing Compliance Act Permit, 50 CFR 300.10 *et seq*. Additionally, incidental takes of, or interactions with, protected resources are included against the Incidental Take Statement specified in any relevant BiOps. A U.S. vessel shall not be authorized to fish under more than one chartering arrangement at the same time. NMFS will issue chartering permits only if it determines that the chartering arrangement is in conformance with ICCAT's conservation and management programs. The number of EFPs, display permits, and SRPs issued from 2003 – 2008 by category and species are listed in Table 3.36.

Table 3.36 Number of Exempted Fishing Permits (EFPs), Display Permits, Scientific Research Permits (SRPs), Letters of Acknowledgement (LOAs) issued between 2003 and 2008.

Permit type		2003	2004	2005	2006	2007	2008
EFPs	Sharks for display	8	8	6	7	6	5
	HMS for display	1	1	1	1	2	1
	Tunas for display	0	1	0	--	--	0
	Shark research on a non-scientific vessel	9	6	5	7	4	4
	Tuna research on a non-scientific vessel	5	11	7	5	4	5
	HMS research on a non-scientific vessel	18	5	3	4	7	7
	Billfish research on a non-scientific vessel	0	1	2	3	2	3
	Shark Fishing	1	0	0	--	--	0
	HMS Chartering	0	1	0	--	--	0
	Tuna Fishing	7	2	0	5	--	0
	TOTAL	**49**	**36**	**24**	**32**	**25**	**25**
SRPs	Shark research	1	3	4	2	2	0
	Tuna research	0	0	0	--	1	0
	Billfish research	0	0	0	1	--	0
	HMS (multi-species) research	1	1	4	4	1	1
	TOTAL	**2**	**4**	**8**	**7**	**4**	**1**
LOAs	Shark research	3	2	4	5	7	6
	TOTAL	**3**	**2**	**4**	**5**	**7**	**6**

3.5.6 Atlantic HMS Tournaments

Fishing tournaments are an important component of HMS recreational fisheries. A tournament is defined in the HMS regulations as any fishing competition involving Atlantic HMS in which participants must register or otherwise enter or in which a prize or award is offered for catching or landing HMS. Since 1999, Federal regulations have required that each HMS tournament operator register their tournament with NMFS at least four weeks prior to the commencement of tournament fishing activities. Tournament operators may be selected for reporting and, if selected, must submit tournament results to NMFS within seven days of the conclusion of the tournament.

Tournament registration and reporting is necessary because it provides an important source of information used to assess HMS fish stocks and to estimate the annual catch of Atlantic HMS. The information may be used by NMFS to plan for the assignment of tournament observers to assist in catch/effort data compilation and to obtain biological data and samples from landed fish (length/weight, stomach contents, injuries, parasites, hard and soft tissue samples for age determination, genetic and microconstituent analysis, spawning condition, fecundity, *etc*.). Additionally, with an accurate tournament database, NMFS may better assess the practicality of using tournaments for angler educational outreach efforts including distribution of written informational materials, notification of public hearings, and explanation of HMS regulations. HMS tournament registration and reporting information further allows NMFS, in the course of developing fishery management plans, to evaluate the social and economic impact of tournament angling in relation to other types of angling (*e.g*., commercial, non-tournament recreational, *etc*.) and the relative effect of tournament angling on populations of various regulated HMS. Finally, the information is essential for the U.S. to meet its reporting obligations to ICCAT.

When registering an HMS tournament, the following information is required to be submitted to the HMS Management Division in St. Petersburg, FL: (1) Tournament name; (2) tournament location; (3) name, address, phone number, fax number, and e-mail address of tournament operator; (4) fishing dates; and (5) HMS species for which points or prizes are awarded. If selected for reporting, operators must submit the following information to the SEFSC: (1) Tournament name; (2) tournament dates; (3) tournament location; (4) number of boats fishing; (5) hours fished; 6) recorder's name, phone number, and e-mail address; (7) the number of each species kept; (8) the number of each species lost; (9) the number of each species tagged and released; (10) the number of each species released without a tag; (11) the number of each species released dead; and, (12) the weight and length of all fish boated. This information is routinely collected during tournament operations to award prizes. Generally, 100 percent of all billfish tournaments are selected for reporting, as this information is critical to determining billfish landings. Tournament registration forms are available at: http://www.nmfs.noaa.gov/sfa/hms/linkpages/reporting_forms.htm.

NMFS estimates that fewer than 300 HMS fishing tournaments occur annually along the U.S. Atlantic coast, including the Gulf of Mexico and Caribbean (NMFS Atlantic HMS Tournament Registration Database). These tournaments range from smaller, club member-only events with as few as ten participating boats (40 - 60 anglers) to larger, statewide tournaments with 250 or more participating vessels (1,000 – 1,500 anglers). For the larger tournaments, corporate sponsorship from tackle manufactures, marinas, boat dealers, beverage distributors, resorts, publications, chambers of commerce, restaurants, and others are often involved. Also, some tournaments are components of larger series, including state Governors Cups (North Carolina, South Carolina), the World Billfish Series, and the MTU (Detroit Diesel) Legend Series, among others.

Many HMS fishing tournaments promote strict conservation principles in their rules. For example, minimum sizes for fish that are landed are often larger than state and federal requirements. Also, some tournaments prohibit treble hooks and may require circle hooks on certain baits. Because tournament participants are often well-respected anglers (*i.e*. highliners),

these conservation trends and ethics likely influence the general angling population in a positive manner. Many HMS fishing tournaments support charitable organizations.

Table 3.37 presents the total number of registered HMS tournaments, by state, between 2001 and 2008. This table indicates that, in 2008, HMS fishing tournaments were conducted most frequently in Florida, Louisiana, Texas, New Jersey, Puerto Rico, North Carolina, South Carolina, New York, and Maryland. By far, the largest number of registered HMS tournaments has consistently occurred in the State of Florida.

Table 3.37 Number of Registered HMS Tournaments by State between 2001 and 2008.
Source: NMFS Atlantic HMS Tournament Registration Database.

STATE	2001	2002	2003	2004	2005	2006	2007	2008
ME	2	3	3	5	3	5	5	4
NH	0	0	0	0	0	0	0	0
MA	7	1	7	10	4	7	10	10
RI	2	2	3	3	2	2	2	2
CT	1	0	0	0	1	1	0	1
NY	5	4	14	14	10	12	13	13
NJ	11	5	18	17	16	19	17	20
DE	2	0	0	1	0	0	1	1
MD	4	2	14	14	14	13	11	13
VA	5	1	5	4	5	4	6	5
NC	11	5	15	16	18	17	17	16
SC	6	3	13	9	9	12	13	16
GA	6	1	12	3	13	11	11	10
FL	46	26	66	57	74	83	97	80
AL	7	7	9	8	7	8	10	8
MS	3	2	7	2	2	1	1	1
LA	19	0	20	22	26	20	24	24
TX	14	1	17	10	17	17	33	21
PR	16	4	13	17	22	19	20	19
USVI	9	0	6	1	10	7	7	2
Bahamas[1]	3	2	1	2	2	1	1	1
Bermuda[1]	0	0	0	0	1	0	0	0
Mexico[1]	1	0	0	0	0	0	0	0
Turks/Caicos[1]	0	0	1	0	0	0	0	0
TOTAL	**181**	**68**	**244**	**215**	**256**	**259**	**299**	**267**

[1]Some foreign tournaments voluntarily registered because the participants were mostly U.S. citizens.

Table 3.38 shows the number and percentage of HMS tournaments awarding points or awards for a particular HMS, based upon 2006 and 2008 tournament registrations. Blue marlin, white marlin, sailfish, and yellowfin tuna have consistently been the predominant target species

in HMS fishing tournaments. Bluefin tuna, swordfish, and pelagic sharks are also frequently targeted in HMS tournaments.

From 2006 – 2008, the overall number of registered tournaments peaked in 2007. The drop in the number of tournaments in 2008 is likely due to a variety of economic factors including the rise in fuel costs. The large percentage drop is quite evident in the billfish tournaments.

Table 3.38 Number and Percent of All HMS Tournaments Awarding Points or Prizes for a HMS, 2006-2008.
Source: NMFS Atlantic HMS Tournament Registration Database

Species	Number of Tournaments			Percent of Tournaments*		
	2006	2007	2008	2006	2007	2008
Blue Marlin	173	201	153	67%	67%	57%
Sailfish	164	186	148	63%	62%	55%
White Marlin	163	184	136	63%	62%	51%
Yellowfin Tuna	144	168	152	56%	56%	57%
Bluefin Tuna	78	93	90	30%	31%	34%
Swordfish	74	83	90	29%	28%	34%
Pelagic Sharks	67	59	60	26%	20%	23%
Bigeye Tuna	42	53	56	16%	18%	21%
Albacore Tuna	20	29	28	8%	10%	11%
Ridgeback Sharks	13	21	14	5%	7%	5%
Non-Ridgeback Sharks	10	21	10	4%	7%	4%
Skipjack Tuna	7	11	24	3%	4%	9%
Small Coastal Sharks	6	10	7	2%	3%	3%

*Species targeted by tournaments are not mutually exclusive categories; therefore, a sum of percentages by year will not equal 100%.

Table 3.39, Table 3.40, and Table 3.41 indicate the percentage and number of 2008 HMS registered tournaments, by state, for pelagic, LCS (ridgeback and non-ridgeback), and SCS, respectively. These tables indicate that the Louisiana/Texas, Florida, New York/New Jersey, and Massachusetts/Maine areas are the primary areas for pelagic shark fishing tournaments. LCS and SCS fishing tournaments are conducted less frequently.

Table 3.39 Registered Pelagic Shark Tournaments, 2008.
Source: NMFS Atlantic HMS Tournament Registration Database.

State	Number of 2008 Tournaments Awarding Points or Prizes for Pelagic Sharks	Percent of Total 2008 Tournaments Awarding Points or Prizes for Pelagic Sharks
Louisiana	18	30%
New York	11	18%
New Jersey	10	17%
Massachusetts	4	7%
Maine	4	7%
Florida	4	7%
Maryland	3	5%
Rhode Island	2	3%
Connecticut	1	2%
North Carolina	1	2%
South Carolina	1	2%
Texas	1	2%
TOTAL	**60**	**100%***

*Detail may not sum to total because of rounding.

Table 3.40 Registered Large Coastal Shark (ridgeback and non-ridgeback) Tournaments, 2008.
Source: NMFS Atlantic HMS Tournament Registration Database.

State	Number of 2008 Tournaments Awarding Points or Prizes for Large Coastal Sharks	% of Total 2008 Tournaments Awarding Points or Prizes for Large Coastal Sharks
Florida	5	33%
Texas	3	20%
Maryland	2	13%
New York	2	13%
New Jersey	1	7%
North Carolina	1	7%
South Carolina	1	7%
TOTAL	**15**	**100%**

Table 3.41 Registered Small Coastal Shark Tournaments, 2008.
Source: NMFS Atlantic HMS Tournament Registration Database.

State	Number of 2008 Tournaments Awarding Points or Prizes for Small Coastal Sharks	% of Total 2008 Tournaments Awarding Points or Prizes for Small Coastal Sharks
Florida	2	29%
New Jersey	2	29%
North Carolina	1	14%
South Carolina	1	14%
Texas	1	14%
TOTAL	**7**	**100%**

3.6 Economic Status of HMS Shark Fisheries

The review of each rule, and of HMS fisheries as a whole, is facilitated when there is an economic baseline against which the rule or fishery may be evaluated. In this analysis, NMFS used the past eight years of data to facilitate the analysis of trends. It also should be noted that all dollar figures are reported in nominal dollars (*i.e.*, current dollars). If analysis of real dollar (*i.e.*, constant dollar) trends controlled for inflation is desired, price indexes for 2000 to 2007 are provided in Table 3.42. To determine the real price in base year dollars, divide the base year price index by the current year price index, and then multiply this result by the price that is being adjusted for inflation. From 1996 to 2004, the Consumer Price Index (CPI-U) indicates that prices have risen by 20.4 percent, the Gross Domestic Product (GDP) Implicit Price Deflator indicates that prices have risen 16.3 percent, and the Producer Price Index (PPI) for unprocessed finfish indicates a 20.8 percent rise in prices. From 2004 to 2005, the CPI, GDP Deflator, and the PPI for unprocessed finfish indicate prices rose by 3.4 percent, 3.2 percent, and 12.9 percent respectively. From 2005 to 2006, the CPI, GDP Deflator, and the PPI for unprocessed finfish indicate prices rose by 3.2 percent, 3.2 percent, and 32.2 percent respectively. From 2006 to 2007, the CPI, GDP Deflator, and the PPI for unprocessed finfish indicate prices rose by 2.6 percent, 2.7 percent, and -4.9 percent.

Table 3.42 **Inflation Price Indexes. The CPI-U is the standard Consumer Price Index for all urban consumers (1982-1984=100) produced by U.S. Department of Labor Bureau of Labor Statistics.**
The source of the Producer Price Index (PPI) for unprocessed finfish (1982=100) is also the Bureau of Labor Statistics. The Gross Domestic Product Implicit Price Deflator (2000=100) is produced by the U.S. Department of Commerce Bureau of Economic Analysis and obtained from the Federal Reserve Bank of St. Louis (http://www.stlouisfed.org/).

Year	CPI-U	GDP Deflator	PPI Unprocessed Finfish
1996	156.9	93.8	185.5
1997	160.5	95.4	165.7
1998	163	96.5	170.7
1999	166.6	97.9	191.7
2000	172.2	100.0	182.4
2001	177.1	102.4	176.1
2002	179.9	104.2	201.5
2003	184	106.4	195.8
2004	188.9	109.4	224.1
2005	195.3	113.0	253.1
2006	201.6	116.0	334.6
2007	207.3	119.8	318.1

3.6.1 Commercial Fisheries[2]

In 2006, the total commercial shark landings at ports in the 50 states by U.S. fishermen were valued at $8.6 million. In 2007, the total commercial shark landings at ports in the 50 states by U.S. fishermen were valued at $4.3 million. The 2007 ex-vessel price indicated that prices for shark fins dropped by about 25%, while the weight of fins dropped by a third. Furthermore, landings by weight for LCS and SCS dropped 40% and 20% respectively, all contributing to a significant drop in shark fishery revenue. For a summary of all pricing, see Table 3.43.

3.6.1.1 Ex-Vessel Prices

The average ex-vessel prices per pound dw for 2000-2007 by shark species complex and area are summarized in Table 3.43. In this table, prices are reported in nominal dollars. The ex-vessel price depends on a number of factors including the quality of the fish (*e.g.*, freshness, fat content, method of storage), the weight of the fish, the supply of fish, and consumer demand.

[2] All the information and data presented in this section were obtained from NMFS, 1997a and NMFS, 2005b.

Table 3.43 Average ex-vessel prices per lb (in U.S. dollars) for shark by area.

Species	Area	1996	1999	2000	2001	2002	2003	2004	2005	2006	2007
LCS	Gulf of Mexico	0.21	0.56	0.43	0.44	0.36	0.38	0.37	0.46	0.43	0.51
	S. Atlantic	1.02	1.10	0.78	1.12	1.27	0.39	0.44	0.50	0.40	0.45
	Mid-Atlantic	0.55	0.59	0.53	1.09	1.56	1.62	1.93	1.75	1.71	0.64
	N. Atlantic	0.88	0.77	1.01	1.02	0.77	0.72	0.70	0.74	1.02	0.70
Pelagic sharks	Gulf of Mexico	-	1.36	1.31	1.42	1.11	1.13	1.08	1.12	1.21	1.17
	S. Atlantic	0.62	0.83	0.76	0.68	0.67	0.71	0.65	0.73	0.72	0.86
	Mid-Atlantic	1.21	1.23	1.20	1.09	1.17	1.21	1.29	1.39	1.38	1.39
	N. Atlantic	1.31	0.81	1.10	1.23	1.00	1.12	1.46	1.40	1.26	0.97
Small coastal sharks	Gulf of Mexico	-	0.55	0.52	0.58	0.48	0.40	0.45	0.55	0.53	0.51
	S. Atlantic	0.25	0.50	0.48	0.52	0.53	0.51	0.61	0.62	0.55	0.63
	Mid-Atlantic	0.25	0.47	0.38	0.55	0.48	0.38	0.44	0.42	0.45	0.73
	N. Atlantic	-	-	-	1.51	0.58	-	-	0.50	-	-
Shark fins	Gulf of Mexico	-	14.01	15.99	20.90	22.64	18.12	17.93	20.24	20.76	15.12
	S. Atlantic	10.74	11.10	14.16	18.43	17.10	15.85	14.57	16.12	16.30	12.55
	Mid-Atlantic	4.60	3.41	4.90	-	-	-	-	-	-	-
	N. Atlantic	2.69	1.19	6.83	-	-	-	-	-	-	-

The average ex-vessel price for SCS decreased slightly in the Gulf of Mexico in 2007, however, there was a large increase in both the South Atlantic and Mid-Atlantic regions. Prices for pelagic sharks increased in all the regions except the Gulf of Mexico (Table 3.43). The average ex-vessel prices for LCS decreased significantly in the Mid-Atlantic and North Atlantic regions, while slightly increasing in the other regions (Table 3.43).

3.6.1.2 Revenues

Table 3.44 summarizes the average annual revenues of the shark fisheries based on average ex-vessel prices and the weight reported landed as per the U.S. National Report (NMFS, 2004a, 2008c), the Shark Evaluation Reports (NMFS, 1997b), and information given to ICCAT (Cortés and Neer, 2005). These values indicate that the estimated total annual revenue of shark fisheries between 2000 and 2007 peaked in 2002, and then steadily decreased until 2007, excluding the small peak in 2006. Prices did not follow a similar trend, however, weight of LCS and shark fins did, likely contributing to the overall fishery valuation results.

Table 3.44 Estimates of the total ex-vessel annual revenues of Atlantic shark fisheries.
Sources: NMFS, 1997b; NMFS 2008c; Cortés, 2003; Cortés and Neer, 2002, 2005; Cortés, pers.comm.

Species		2000	2001	2002	2003	2004	2005	2006	2007
Large coastal sharks	Ex-vessel $/lb dw	$0.68	$0.91	$0.99	$0.78	$0.86	$0.86	$0.89	$0.58
	Weight lb dw	3,713,125	3,414,967	4,151,594	4,292,403	3,213,896	3,306,583	3,852,124	2,308,018
	Fishery Revenue	$2,524,925	$3,107,620	$4,110,078	$3,348,074	$2,763,951	$2,843,661	$3,428,390	$1,338,650
Pelagic sharks	Ex-vessel $/lb dw	$1.09	$1.11	$0.99	$1.04	$1.12	$1.16	$1.14	$1.10
	Weight lb dw	350,705	345,895	467,682	637,324	679,469	235,600	185,266	263,765
	Fishery Revenue	$382,268	$383,943	$463,005	$662,817	$761,005	$273,296	$211,203	$290,142
Small coastal sharks	Ex-vessel $/lb dw	$0.46	$0.79	$0.52	$0.43	$0.50	$0.52	$0.51	$0.63
	Weight lb dw	593,027	724,332	615,915	534,523	451,651	650,202	823,353	654,099
	Fishery Revenue	$272,792	$572,222	$320,276	$229,845	$225,826	$338,105	$419,910	$412,082
Shark fins (weight = 5% of all sharks landed)	Ex-vessel $/lb dw	$10.47	$19.67	$19.87	$17.09	$16.25	$18.18	$18.53	$13.84
	Weight lb dw	232,843	224,260	261,760	273,213	217,251	209,619	243,037	161,294
	Fishery Revenue	$2,437,865	$4,411,188	$5,201,162	$4,669,202	$3,530,326	$3,810,878	$4,503,478	$2,232,310
Total sharks	**Fishery Revenue**	**$5,617,851**	**$8,474,974**	**$10,094,521**	**$8,909,938**	**$7,281,107**	**$7,265,940**	**$8,562,982**	**$4,273,185**

Note: Average ex-vessel prices may have some weighting errors.

3.6.1.3 Wholesale Market

Currently, NMFS does not collect wholesale price information from dealers. However, the wholesale price of some fish species is available off the web (http://www.st.nmfs.gov/st1/market_news/index.html). The wholesale prices presented in Table 3.45 are from the annual reports of the Fulton Fish Market. As with ex-vessel prices, wholesale prices depend on a number of factors including the quality of the fish, the weight of the fish, the supply of fish, and consumer demand.

As reported by the Fulton Fish Market, Table 3.45 indicates that the average wholesale price of shark sold in Atlantic and Gulf of Mexico states decreased from 1996 to 2004 for the mako shark. Prices for other shark species have appeared to have rebounded in 2004, when compared to 1996.

Table 3.45 The overall average wholesale price per lb of fresh HMS sold in Atlantic and Gulf of Mexico states as reported by the Fulton Fish Market.
Source: NMFS, 2004c.

Species	1996 Price/lb	1999 Price/lb	2000 Price/lb	2001 Price/lb	2002 Price/lb	2003 Price/lb	2004 Price/lb
Blacktip	$1.05	$1.04	$1.04	$1.05	$1.00	$1.33	$1.08
Mako	$2.77	$2.74	$3.18	$3.00	$2.00	$2.37	$2.24
Thresher	$1.00	$0.91	$0.82	$1.25	$1.25	$0.78	$1.24

3.6.2 Recreational Fisheries

Although NMFS believes that recreational fisheries have a large influence on the economies of coastal communities, NMFS has only recently been able to gather additional information on the costs and expenditures of anglers or the businesses that rely on them.

An economic survey done by the U.S. Fish and Wildlife Service in 2006 found that for the entire United States 7.7 million saltwater anglers (including anglers in state waters) went on approximately 67 million fishing trips and spent approximately $8.9 billion (USFWS, 2006). These participation rates are down from the 2001 survey which found 9.1 million saltwater anglers (including anglers in state waters) went on approximately 72 million fishing trips and spent approximately $8.4 billion (USFWS, 2001). The 2006 survey found saltwater anglers spent $5.3 billion on trip-related costs and $3.6 billion on equipment (USFWS, 2006). Expenditure on trip-related costs increased 17 percent from 2001, but equipment expenditures have declined 7 percent. These 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. Approximately 79 percent of the saltwater anglers surveyed fished in their home state in 2006, compared to 76 percent in 2001 (USFWS, 2001).

Specific information regarding angler expenditures for trips targeting HMS species was extracted from the recreational fishing expenditure survey add-on (1998 in the Northeast, 1999 – 2000 in the Southeast) to the MRFSS. These angler expenditure data were analyzed on a per

person per trip-day level and reported in 2003 dollars. The expenditure data include the costs of tackle, food, lodging, bait, ice, boat fuel, processing, transportation, party/charter fees, access/boat launching, and equipment rental. The overall average expenditure on HMS related trips is estimated to be $122 per person per day. Specifically, expenditures are estimated to be $85 per person per day on pelagic shark directed trips, $95 on LCS directed trips, and $81 on SCS.

The American Sportfishing Association (ASA) also has a report listing the 2006 economic impact of sportfishing on specific states. This report states that all sportfishing (in both federal and state waters) has an overall economic importance of $125 billion dollars. ASA estimates 8,528,000 anglers participate in saltwater fishing. These saltwater anglers spent $11 billion in retail sales, resulting in 263,000 jobs, and $9 billion in salaries, wages, and business earnings in 2006. Saltwater fishing contributed $30 billion of the overall economic impact estimated. Florida, Texas, South Carolina, and North Carolina are among the top ten states in terms of overall economic expenditures for both saltwater and freshwater fishing. Florida is also one of the top states in terms of economic impact of saltwater fishing with $3.0 billion in angler expenditures, $5.1 billion in overall economic impact, $1.6 billion in salaries and wages related to fishing, and 51,588 fishing related jobs (ASA, 2008).

At the end of 2004, NMFS began collecting market information regarding advertised charterboat rates. This analysis of the data collected focused observations of advertised rates on the internet for full day charters. Full day charters vary from six to 14 hours long with a typical trip being 10 hours. Most vessels can accommodate six passengers, but this also varies from two to 12 passengers. Table 3.46 summarizes the average charterboat rate for full day trips on vessels with HMS Charter/Headboat permits. The average price for a full day boat charter was $1,053 in 2004. Sutton *et al.,* (1999) surveyed charterboats throughout Alabama, Mississippi, Louisiana, and Texas in 1998 and found the average charterboat base fee to be $762 for a full day trip. Holland *et al.* (1999) conducted a similar study on charterboats in Florida, Georgia, South Carolina, and North Carolina and found the average fee for full day trips to be $554, $562, $661, and $701, respectively. Comparing these two studies conducted in the late 1990s to the average advertised daily HMS charterboat rate in 2004, it is apparent that there has been a significant gain in charterboat rates.

Table 3.46 **Average Atlantic HMS charterboat rates for day trips.**
Source: NMFS searches for advertised daily charter rates of HMS Charter/Headboat permit holders. (Observations=99)

State	2004 Average Daily Charter Rate
AL	$1,783
CT	$1,500
DE	$1,060
FL	$894
LA	$1,050
MA	$777
MD	$1,167

State	2004 Average Daily Charter Rate
ME	$900
NC	$1,130
NJ	$1,298
NY	$1,113
RI	$917
SC	$1,300
TX	$767
VA	$825
Overall Average	**$1,053**

Generally, HMS tournaments last from three to seven days, but lengths can range from one day to an entire fishing season. Similarly, average entry fees can range from approximately $0 to $5,000 per boat (average approximately $500/boat – $1,000/boat), depending largely upon the magnitude of the prize money that is being awarded. The entry fee would pay for a maximum of two to six anglers per team during the course of the tournament. Additional anglers can, in some tournaments, join the team at a reduced rate of between $50 and $450. The team entry fee is not directly proportional to the number of anglers per team, but rather is proportional with the amount of money available for prizes and, possibly, the species being targeted. Prizes may include citations, T-shirts, trophies, fishing tackle, automobiles, boats, or other similar items, but most often consists of cash awards. In general, it appears that billfish and tuna tournaments charge higher entry fees and award more prize money than shark and swordfish tournaments, although all species have a wide range.

Several tournaments target sharks. Many shark tournaments occur in New England, New York, and New Jersey, although other regions hold shark tournaments as well. In 2004, the 24th Annual South Jersey Shark Tournament hosted over 200 boats and awarded over $220,000 in prize money, with an entry fee of $450 per boat. The "Mako Fever" tournament, sponsored by the Jersey Coast Shark Anglers, in 2004 awarded over $55,000 in prizes, with the first place vessel receiving $25,000. In 2004, the 18th Annual Monster Shark Tournament in Martha's Vineyard, Massachusetts was broadcast on ESPN, and featured a new fishing boat valued at over $130,000 awarded to the winner.

In addition to official prize money, many fishing tournaments may also conduct a "calcutta" whereby anglers pay from $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 upon 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 tournament websites, 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.

Fishing tournaments can sometimes generate a substantial amount of money for surrounding communities and local businesses. Besides the entry fee to the tournament and possibly the calcutta, anglers may 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. Less direct, but equally important, fishing tournaments may serve to generally promote the local tourist industry in coastal communities. In a survey of participants in the 1999 Pirates Cove Billfish Tournament, Ditton, *et al*. (2000) found that almost 80 percent of tournament anglers were from outside of the tournament's county. For this reason, tourism bureaus, chambers of commerce, resorts, and state and local governments often sponsor fishing tournaments.

3.7 Community and Social Update

According to NS 8, conservation and management measures should, consistent with conservation requirements, "take into account the importance of fishery resources to fishing communities by utilizing economic and social data [based on the best available information] in order to (A) provide for the sustained participation of such communities, (B) to the extent practicable, minimize adverse economic impacts on such communities." The information presented here addresses new data concerning the social and economic well-being of participants in the fishery and considers the impact of significant regulatory measures enacted in the past year.

3.7.1 Overview of Current Information and Rationale

The Magnuson-Stevens Act requires, among other things, that all FMPs include a fishery impact statement intended to assess, specify, and describe the likely effects of the measures on fishermen and fishing communities (§303(a)(9)).

NEPA also 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" (§102(2)(A)). Moreover, agencies need to address the aesthetic, historic, cultural, economic, social, or health effects, which may be direct, indirect, or cumulative. Consideration of social impacts is a growing concern as fisheries experience increased participation and/or declines in stocks. The consequences of management actions need to be examined to better ascertain and, if necessary and possible, mitigate regulatory impacts on affected constituents.

Social impacts are generally the consequences to human populations resulting from some type of public or private action. Those consequences may include alterations to the ways in which people live, work or play, relate to one another, and organize to meet their needs. In addition, cultural impacts, which may involve changes in values and beliefs that affect people's way of identifying themselves within their occupation, communities, and society in general are included under this interpretation. Social impact analyses help determine the consequences of policy action in advance by comparing the status quo with the projected impacts. Community

profiles are an initial step in the social impact assessment process. Although public hearings and scoping meetings provide input from those concerned with a particular action, they do not constitute a full overview of the fishery.

The Magnuson-Stevens Act outlines a set of NSs that apply to all fishery management plans and the implementation of regulations. Specifically, NS 8 notes that:

> "Conservation and management measures, 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 by utilizing economic and social data that meet the requirements of paragraph (2), in order to: (A) provide for the sustained participation of such communities; and, (B) to the extent practicable, minimize adverse economic impacts on such communities." (§301(a)(8)). See also 50 CFR §600.345 for NS 8 Guidelines.

"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))

NMFS (2001) guidelines for social impact assessments specify that the following elements are utilized in the development of FMPs and FMP amendments:

1. The size and demographic characteristics of the fishery-related work force residing in the area; these determine demographic, income, and employment effects in relation to the work force as a whole, by community and region.

2. The cultural issues of attitudes, beliefs, and values of fishermen, fishery-related workers, other stakeholders, and their communities.

3. The effects of proposed actions on social structure and organization; that is, on the ability to provide necessary social support and services to families and communities.

4. The non-economic social aspects of the proposed action or policy; these include life-style issues, health and safety issues, and the non-consumptive and recreational use of living marine resources and their habitats.

5. The historical dependence on and participation in the fishery by fishermen and communities, reflected in the structure of fishing practices, income distribution and rights.

The 2006 Consolidated HMS FMP used information from the Wilson *et al*. (1998) study for the 1999 FMP for Atlantic Tunas, Swordfish and Sharks that investigated the social and cultural characteristics of fishing communities in five states and one U.S. territory: Massachusetts, New Jersey, North Carolina, Florida, Louisiana, and Puerto Rico. These areas were selected because they each had important fishing communities that could be affected by the 1999 FMP and Atlantic Billfish Amendment, and because they are fairly evenly spread along the Atlantic and Gulf coasts and the Caribbean. In addition, the 2006 Consolidated HMS FMP used information gathered under the contract with the Virginia Institute of Marine Science (VIMS) at the College of William and Mary to re-evaluate several of the baseline communities (Kirkley, 2005). The VIMS study gathered a profile of basic sociological information for the principal states involved with the Atlantic shark fishery. From the 255 communities identified as involved in the 2001 commercial fishery, Amendment 1 to the 1999 FMP for Atlantic Tunas, Swordfish and Sharks 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 shark fishery, participation and landings were not documented in a manner that allowed community identification. Wilson, *et al*. (1998), selected only the recreational fisheries found within the commercial fishing communities for a profile due to the lack of community-based data for the sport fishery. As of 2009, 80 percent of directed shark permit holders are located in Florida, New Jersey and North Carolina. Communities in these states are expected to be the most affected by the measures in Amendment 3. A detailed description of additional information used in the community profiles analysis can be found in Section 9.2.2 of the 2006 Consolidated HMS FMP. Several other chapters in this document include information that addresses the requirements described in section 9.1. In addition to the community profile information found in the Consolidated HMS FMP, a recent report was completed by MRAG Americas, Inc. and Jepson (2008) titled "Updated Profiles for HMS Dependent Fishing Communities" can be found in Appendix E of Amendment 2 to the 2006 Consolidated HMS FMP (NMFS, 2008a) and in chapter 6 of the 2008 SAFE Report (NMFS, 2008b). This report includes updated community profiles and new social impacts assessments for HMS fishing communities along the Atlantic and Gulf of Mexico coasts. Please also refer to the Economic Evaluation in Chapter 6, the Regulatory Impact Review (RIR) in Chapter 7, and the Initial Regulatory Flexibility Analysis (IRFA) in Chapter 8. Furthermore, each of the management alternatives in Chapter 4 includes an assessment of the potential social and economic impacts associated with the proposed alternatives.

3.7.2 Summary of New Social and Economic Data Available

3.7.2.1 2008-2009 Social Science Publications

Abbott, J., Maharaj, V., and Wilen, J.E. 2009. Designing ITQ programs for commercial recreational fishing. Marine Policy 33:766–774.

Barnes, C. and McFadden, K.W. 2008. Marine ecosystem approaches to management: challenges and lessons in the United States. Marine Policy 32:387–392.

Claesson, S. 2009. An ecosystem-based framework for governance and management of maritime cultural heritage in the USA. Marine Policy 33: 698–706.

Gilman, E., Clarke, S., Brothers, N., Alfaro-Shigueto, J., Mandelman, J., Mangel, J., Petersen, S., Piovano, S., Thomson, N., Dalzell, P., Donoso, M., Goren, M., and Werner, T. 2008. Shark interactions in pelagic longline fisheries. Marine Policy 32(1):1-18.

Hernandez-Milian, G., Goetz, S., Varela-Dopico, C., Rodriguez-Gutierrez, J., Romon-Olea, J., Fuertes-Gamundi, J., Ulloa-Alonso, E., Tregenza, N., Smerdon, A., Otero, M., Tato, V., Wang, J., Santos, M., Lopez, A., Lago, R., Portela, J., and Pierce, G. 2008. Results of a short study of interactions of cetaceans and longline fisheries in Atlantic waters: environmental correlates of catches and depredation events. Hydrobiologia 612(1): 251-268.

Jeon, Y., C. Reid, and D. Squires. 2008. Is there a global market for tuna? Policy implications for tropical tuna fisheries. Ocean development and international Law 39(1):32-50.

Pinkerton, E. and Edwards, D.N. 2009. The elephant in the room: The hidden costs of leasing individual transferable fishing quotas. Marine Policy 33: 707–713.

3.7.2.2 Summary of Social Data and Information

The 2006 Consolidated HMS FMP provides a thorough analysis, by state, of HMS fisheries including the shark fishery for in the Atlantic and Gulf of Mexico states and will not be duplicated here. The MRAG Americas Report, "Updated Profiles for HMS Dependent Fisheries," can be found in Appendix E of Amendment 2 to the 2006 Consolidated HMS FMP and chapter 6 of the 2008 SAFE Report and provides social impact analysis by state of HMS dependent fishing communities.

3.8 International Trade and Fish Processing

Regional fishery management organizations (RFMOs) including ICCAT have taken steps to improve collection of international trade data to further international conservation policy for management of some shark species. While RFMOs cannot re-create information about stock production based on trade data, this information can be used provisionally to estimate landings related to these fisheries, and to identify potential compliance problems with certain ICCAT management measures. In addition, it is important to keep in mind that the ICCAT RFMO collects information only on the pelagic sharks: the shortfin mako and the blue shark, and has also produced some numbers on the porbeagle shark. United States participation in shark and all HMS related international trade programs, as well as a review of trade activity, is discussed in this section. This section also includes a review of the available information on the processing industry for shark species.

3.8.1 Overview of International Trade for Atlantic HMS

3.8.1.1 Trade Monitoring

The United States collects general trade monitoring data through the U.S. Bureau of Customs and Border Protection (CBP; imports) and the U.S. Bureau of the Census (Census Bureau; exports and imports). These programs collect data on the amount and value of imports and exports categorized under the Harmonized Tariff Schedule (HTS). Many HMS have distinct HTS codes, and some species are further subdivided by product (*e.g.*, fresh or frozen, fillets, steaks, *etc*.). NMFS provides Census Bureau trade data for all marine fish products online for the public at http://www.st.nmfs.gov/st1/trade/index.html. Shark species are grouped together, which can limit the value of these data for fisheries management when species-specific information is needed. These data are further limited since the ocean area of origin for each product is not distinguished.

Trade data for Atlantic HMS, including shark species, are of more use as a conservation tool when they indicate the flag of the harvesting vessel, the ocean of origin, and the species for each transaction. Under the authority of ATCA and the Magnuson-Stevens Act, NMFS collects this information while monitoring international trade of bluefin tuna, swordfish, southern bluefin tuna, and frozen bigeye tuna. These programs implement ICCAT recommendations and support rebuilding efforts by collecting data necessary to identify nations and individuals that may be fishing in a manner that diminishes the effectiveness of ICCAT fishery conservation and management measures. Copies of all trade monitoring documents associated with these programs may be found on the NMFS HMS Management Division webpage at http://www.nmfs.noaa.gov/sfa/hms/. These and several other trade monitoring programs established by NMFS for HMS, including sharks, are described in further detail below.

3.8.2 U.S. Exports of HMS

"Exports" may include merchandise of both domestic and foreign origin. The Census Bureau 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.

3.8.2.1 Shark Exports

Export data for sharks is gathered by the Census Bureau, and includes trade data for sharks from any ocean area of origin. Shark exports are not categorized down to the species level with the exception of dogfish, and are not identified by specific product code other than fresh or frozen meat and fins. Due to the popular trade in shark fins and their high relative value compared to shark meat, a specific HTS code was assigned to shark fins in 1998. It should be

noted that there is no tracking of other shark products besides meat and fins. Therefore, NMFS cannot track trade in shark leather, oil, or shark cartilage products.

Table 3.47 indicates the magnitude and value of shark exports by the United States from 1999 – 2007. The reduction in shark fin exports from 2002 to 2007 is of particular note, as is the increase in the unit value of shark fins during this time period. Decreases in shark fin trade were expected as the result of the Shark Finning Prohibition Act, which was enacted in December of 2000 and implemented by final rule (67 FR 6194, February 11, 2002).

Table 3.47 Amount and Value of U.S. Shark Product Exports From 1999-2007.
Source: Census Bureau.

Yr	Shark Fins Dried			Non-specified Fresh Shark			Non-specified Frozen Shark			Total for all Exports	
	MT	US$ (million)	$/KG	MT	US$ (million)	$/KG	MT	US$ (million)	$/KG	MT	US$ (million)
1999	106	.91	8.54	270	.48	1.80	155	.46	2.97	532	1.86
2000	365	3.51	9.62	430	.78	1.82	345	.81	2.35	1140	5.10
2001	335	3.16	9.44	332	.54	1.64	634	2.34	3.69	1301	6.04
2002	123	3.46	28.00	968	1.47	1.52	982	2.34	2.38	2075	7.28
2003	45	4.03	87.79	837	1.31	1.57	592	1.34	2.28	1476	6.70
2004	63	3.02	47.53	536	1.18	2.21	472	.98	2.09	1071	5.18
2005	31	2.37	76.93	377	1.03	2.73	494	1.06	2.15	902	4.46
2006	34	3.17	94.66	816	1.62	1.99	747	1.38	1.85	1597	6.17
2007	19	1.78	93.68	502	1.05	2.09	695	1.35	1.94	1216	4.18

Note: Exports may be in whole (ww) or product weight (dw); data are preliminary and subject to change.

3.8.3 U.S. Imports of Atlantic HMS

All import shipments must be reported to the U.S. Bureau of Customs and Border Protection. “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 CBP bonded warehouses. “Consumption” import data reflect the actual entry of commodities originating outside the United States into U.S. channels of consumption. As discussed previously, CBP data for certain products are provided to NMFS for use in implementing statistical document programs. U.S. Census Bureau import data are used by NMFS as well.

3.8.3.1 Shark Imports

For shark imports, NMFS does not require importers to collect and submit information regarding the ocean area of catch. Shark imports are also not categorized by species, and lack specific product information on imported shark meat such as the proportion of fillets, steaks, or loins. The condition of shark fin imports; *e.g.*, wet, dried, or further processed products such as canned shark fin soup, is also not collected. There is no longer a separate tariff code for shark leather, so its trade is not tracked by CBP or Census Bureau data.

The United States may be an important transshipment port for shark fins, which may be imported wet, processed, and then exported dried. It is also probable that U.S.-caught shark fins are exported to Hong Kong or Singapore for processing, and then imported back into the United States for consumption by urban-dwelling Asian Americans (Rose, 1996).

Table 3.48 summarizes Census Bureau data on shark imports for 1999 through 2007. Imports of fresh shark products and shark fins have decreased significantly since 1999. As of July 2, 2008, shark importers, exporters, and re-exporters are required to be permitted under NMFS' HMS International Trade Permit regulations (73 FR 31380). Permitting of shark fin traders was implemented to assist in enforcement and monitoring trade of this valuable commodity.

From 1999 to 2007, the overall annual amount and value of shark imports has fluctuated. Imports of dried shark fins has been increasing gradually since 2003.

Table 3.48 U.S. Imports of Shark Products From All Ocean Areas Combined: 1999-2007.
Source: Census Bureau data.

Year	Shark Fins Dried		Non-specified Fresh Shark		Non-specified Frozen Shark		Total For All Imports	
	MT	US$ (million)	MT	US$ (million)	MT	US$ (million)	MT	US$ (million)
1999	59	2.10	1,095	2.03	105	.62	1,260	4.76
2000	66	2.35	1,066	1.85	90	.57	1,222	4.79
2001	50	1.08	913	1.38	123	1.78	1,087	4.25
2002	39	1.02	797	1.24	91	1.09	928	3.35
2003	11	0.01	515	0.72	100	0.99	626	1.82
2004	14	0.34	650	1.00	156	2.35	821	3.70
2005	27	0.75	537	1.02	147	2.27	711	4.04
2006	28	1.38	338	0.68	93	1.35	459	3.41
2007	29	1.68	548	1.03	174	1.04	751	3.75

NOTE: Imports may be whole weight (ww) or product weight (dw); data are preliminary and subject to change.

3.9 Bycatch, Incidental Catch, and Protected Species

Bycatch in commercial and recreational fisheries has become an important issue for the fishing industry, resource managers, scientists, and the public. Bycatch can result in death or injury to the discarded fish, and it is essential that this component of total fishing-related mortality be incorporated into fish stock assessments and evaluation of management measures. Bycatch precludes other more productive uses of fishery resources and decreases the efficiency of fishing operations. Although not all discarded fish die, bycatch can become a large source of mortality, which can slow the rebuilding of overfished stocks. Bycatch imposes direct and indirect costs on fishing operations by increasing sorting time and decreasing the amount of gear available to catch target species. Incidental catch concerns also apply to populations of marine mammals, sea turtles, seabirds, and other components of ecosystems which may be protected

under other applicable laws and for which there are no commercial or recreational uses but for which existence values may be high.

In 1998, NMFS developed a national bycatch plan, *Managing the Nation's Bycatch* (NMFS, 1998b), which includes programs, activities, and recommendations for federally managed fisheries. The national goal of the Agency's bycatch plan activities is 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. Inherent in this goal is the need to avoid bycatch, rather than create new ways to utilize bycatch. The plan also established a definition of bycatch as fishery discards, retained incidental catch, and unobserved mortalities resulting from a direct encounter with fishing gear.

3.9.1 Bycatch Reduction and the Magnuson-Stevens Act

The Magnuson-Stevens Act defines bycatch as fish are harvested in a fishery, but are not sold or kept for personal use, and includes economic and regulatory discards. Fish is defined as finfish, mollusks, crustaceans, and all other forms of marine animal and plant life other than marine mammals and birds. Birds and marine mammals are therefore not considered bycatch under the MSA but are examined as incidental catch. Bycatch does not include fish released alive under a recreational catch-and-release fishery management program.

NS 9 of the Magnuson-Stevens Act requires that fishery conservation and management measures shall, to the extent practicable, minimize bycatch and minimize the mortality of bycatch that cannot be avoided. In many fisheries, it is not practicable to eliminate all bycatch and bycatch mortality. Some relevant examples of fish caught in Atlantic HMS fisheries that are included as bycatch or incidental catch are marlin, undersized swordfish, and bluefin tuna caught and released by commercial fishing gear; undersized swordfish and tunas in recreational hook and line fisheries; species for which there is little or no market such as blue sharks; and species caught and released in excess of a bag limit.

There are benefits associated with the reduction of bycatch, including the reduction of uncertainty concerning total fishing-related mortality, which improves the ability to assess the status of stocks, to determine the appropriate relevant controls, and to ensure that overfishing levels are not exceeded. It is also important to consider the bycatch of HMS in fisheries that target other species as a source of mortality for HMS and to work with fishery constituents and resource manager partners on an effective bycatch strategy to maintain sustainable fisheries. This strategy may include a combination of management measures in the domestic fishery, and if appropriate, multi-lateral measures recommended by international bodies such as ICCAT or coordination with Regional Fishery Management Councils or States. The bycatch in each fishery is summarized annually in the SAFE report for Atlantic HMS fisheries. The effectiveness of the bycatch reduction measures is evaluated based on this summary.

A number of options are currently employed (*) or available for bycatch reduction in Atlantic HMS fisheries. These include but are not limited to:

Commercial

1. *Gear Modifications (including hook and bait types)
2. *Circle Hooks
3. *Time/Area Closures
4. Performance Standards
5. *Education/Outreach
6. *Effort Reductions (*i.e.*, Limited Access)
7. Full Retention of Catch
8. *Use of De-hooking Devices (mortality reduction only)

Recreational

1. Use of Circle Hooks (mortality reduction only)
2. Use of De-hooking Devices (mortality reduction only)
3. Full Retention of Catch
4. *Formal Voluntary or Mandatory Catch-and-Release Program for all Fish or Certain Species
5. Time/Area Closures

There are probably no fisheries in which there is zero bycatch because none of the currently legal fishing gears are perfectly selective for the target of each fishing operation (with the possible exception of the swordfish/tuna harpoon fishery and speargun fishery). Therefore, to totally eliminate bycatch of all non-target species in Atlantic HMS fisheries would be impractical. The goal then is to minimize the amount of bycatch to the extent practicable and minimize the mortality of species caught as bycatch.

3.9.2 Standardized Reporting of Bycatch

Section 303(a)(11) of the Magnuson-Stevens Act requires that a FMP establish a standardized reporting methodology to assess the amount and type of bycatch occurring in the fishery. In 2004, NMFS published a report entitled *"Evaluating Bycatch: A National Approach to Standardized Bycatch Monitoring Programs,"* which described the current status of and guidelines for bycatch monitoring programs (NMFS, 2004d). The data collection and analyses that are used to estimate bycatch in a fishery constitute the "standardized bycatch reporting methodology" (SBRM) for that fishery (NMFS, 2004d). Appendix 5 of the report specifies the protocols for SBRMs established by NMFS throughout the country.

As part of the Agency's National Bycatch Strategy, NMFS established a National Working Group on Bycatch (NWGB) to develop a national approach to standardized bycatch reporting methodologies and monitoring programs. This work is to be the basis for regional teams, established in the National Bycatch Strategy, to make fishery-specific recommendations.

The NWGB reviewed regional issues related to fisheries and bycatch and discussed advantages and disadvantages of various methods for estimating bycatch including: (1) fishery-independent surveys; (2) self-reporting through logbooks, trip reports, dealer reports, port sampling, and recreational surveys; (3) at-sea observation, including observers, digital video cameras, digital observers, and alternative platform and remote monitoring; and (4) stranding networks. All of the methods may contribute to useful bycatch estimation programs, but at-sea observation (observers or electronic monitoring) provides the best mechanism to obtain reliable and accurate bycatch estimates for many fisheries. Often, observer programs also will be the most cost-effective of these alternatives. However, observers are not always the most cost-effective or practicable method for assessing bycatch (NMFS, 2004d).

The effectiveness of any SBRM depends on its ability to generate estimates of the type and quantity of bycatch that are both precise and accurate enough to meet the conservation and management needs of a fishery. The National Bycatch Report (NMFS, 2004d) contains an in-depth examination of the issues of precision and accuracy in estimating bycatch. Accuracy refers to the closeness between the estimated value and the (unknown) true value that the statistic was intended to measure. Precision refers to how closely multiple measurements of the same statistic are to one another when obtained under the same protocol. The precision of an estimate depends on how consistent independent measurements are to one another; the tighter the cluster, or the greater the consistency in independent measurements, the more precise the estimate. The precision of an estimate is often expressed in terms of the coefficient of variation (CV) defined as the standard error of the estimator divided by the estimate. The lower the CV, the more precise the estimate is considered to be. A precise estimate is not necessarily an accurate estimate. The National Bycatch Report (NMFS, 2004d) contains an extensive discussion of how precision relates to sampling and to assessments.

The other important aspect of obtaining bycatch estimates that are useful for management purposes is accuracy. Accuracy is the difference in the mean of the sample and the true value of that property in the sampled universe (NMFS, 2004d). In other words, accuracy refers to how correct the estimate is. Efficient allocation of sampling effort within a stratified survey design improves the precision of the estimate of overall discard rates (Rago *et al.*, 2005). Accuracy of sample estimates can be evaluated by comparing performance measures (*e.g.*, landings, trip duration) between vessels with and without observers present. While there are differences between the terms accuracy and bias they have been used interchangeably. A "biased" estimate is inaccurate while an "accurate" estimate is unbiased (Rago *et al*., 2005).

The NWGB recommended that at-sea sampling designs should be formulated to achieve precision goals for the least amount of observation effort, while also striving to increase accuracy (NMFS, 2004d). This can be accomplished through random sample selection, developing appropriate sampling strata and sampling allocation procedures, and by implementing appropriate tests for bias. Sampling programs will be driven by the precision and accuracy required by managers to address management needs for estimating management quantities such as allowable catches through a stock assessment, for evaluating bycatch relative to a management standard such as allowable take, and for developing mitigation mechanisms.

The recommended precision goals for estimates of bycatch are defined in terms of the CV of each estimate. For marine mammals and other protected species, including seabirds and sea turtles, the recommended precision goal is a 20 to 30 percent CV for estimates of interactions for each species/stock taken by a fishery. For fishery resources, excluding protected species, caught as bycatch in a fishery, the recommended precision goal is a 20 to 30 percent CV for estimates of total discards (aggregated over all species) for the fishery; or if total catch cannot be divided into discards and retained catch, then the goal is a 20 to 30 percent CV for estimates of total catch (NMFS, 2004d). The report also states that attainment of these goals may not be possible or practical in all fisheries and should be evaluated on a case-by-case basis.

The CV of an estimate can be reduced and the precision increased by increasing sample size. In the case of observer programs, this would entail increasing the number of trips or gear deployments observed. Increasing the number of trips observed increases both the cost in terms of funding, but also the logistical complexities and safety concerns. However, the improvements in precision will decline at a decreasing rate as sample size is increased to a point where it will not be cost-effective to increase sample size any further. This concept is illustrated in Figure 1 of the National Bycatch Report (NMFS, 2004d). As a result of this statistical relationship, fishery managers select observer coverage levels that should achieve the desired or required balance between precision of bycatch estimates and cost.

While the relationship between precision and sample size is relatively well known (NMFS, 2004d), the relationship between sample size and accuracy is not reliable. Observer programs strive to achieve samples that are representative of both fishing effort and catches. Representativeness of the sample is critical not only for obtaining accurate (*i.e.*, unbiased) estimates of bycatch, but also for collecting information about factors that may be important for mitigating bycatch. Bias may be introduced at several levels: when vessels are selected for coverage, when hauls are selected for sampling, or when only a portion of the haul can be sampled (NMFS, 2004d).

Rago *et al.* (2005) examined potential sources of bias in commercial fisheries of the Northeast Atlantic by comparing measures of performance for vessels with and without observers. Bias can arise if the vessels with observers onboard consistently catch more or less than other vessels, if trip durations change, or if vessels fish in different areas. Average catches (pounds landed) for observed and total trips compared favorably and the expected differences of the stratum specific means and standard deviations for both kept weight and trip duration was near zero (Rago *et al.*, 2005). Although mean trip duration was slightly longer on observed trips, the difference was not significantly different from zero. The spatial distribution of trips matched well based on a comparison of VMS data with observed trips (Murawski, 2005). The authors concluded that the level of precision in discard ratios as a whole was high and that there was little evidence of bias. The results of this study indicate that bias may not be as large an issue in self-reported data as has been suggested by Babcock *et al.* (2003), but additional analyses would need to be conducted to determine the applicability to HMS fisheries.

A simplistic approach in trying to get more accurate bycatch estimates is to increase observer coverage. A report by Babcock *et al.* (2003) suggests that relatively high percentages of observer coverage are necessary to adequately address potential bias in bycatch estimates

from observer programs. However, the examples cited by Babcock *et al.* (2003) as successful in reducing bias through high observer coverage levels are fisheries comprised of relatively few vessels compared to many other fisheries, including the Atlantic HMS fisheries. Their examples are not representative of the issues facing most observer programs and fishery managers, who must work with limited resources to cover large and diverse fisheries. It is also incorrect to assume that simply increasing observer coverage ensures accuracy of the estimates (Rago *et al.*, 2005). Bias due to unrepresentative sampling may not be reduced by increasing sample size due to logistical constraints, such as if certain classes of vessels cannot accommodate observers. Increasing sample size may only result in a larger, but still biased, sample.

Although the precision goals for estimating bycatch are important factors in determining observer coverage levels, other factors are also considered when determining actual coverage levels. These may result in lower or higher levels of coverage than that required to achieve the precision goals for bycatch estimates. In general, factors that may justify lower coverage levels include lack of adequate funding; incremental coverage costs that are disproportionately high compared to benefits; and logistical consideration such as lack of adequate accommodations on a vessel, unsafe conditions, and lack of cooperation by fishermen (NMFS, 2004d).

Factors that may justify higher coverage levels include incremental coverage benefits that are disproportionately high compared to costs and other management focused objectives for observer programs. The latter include total catch monitoring, in-season management of total catch or bycatch, monitoring bycatch by species, monitoring compliance with fishing regulations, monitoring requirements associated with the granting of Experimental Fishery Permits, or monitoring the effectiveness of gear modifications or fishing strategies to reduce bycatch. In some cases, management may require one or even two observers to be deployed on every fishing trip. Increased levels of coverage may also be desirable to minimize bias associated with monitoring "rare" events with particularly significant consequences (such as takes of protected species), or to encourage the introduction of new "standard operating procedures" for the industry that decrease bycatch or increase the ease with which bias can be monitored (NMFS, 2004d).

NMFS utilizes self-reported logbook data (Fisheries Logbook System or FLS, and the supplemental discard report form in the reef fish/snapper-grouper/king and Spanish mackerel/shark logbook program), at-sea observer data, and survey data (recreational fishery dockside intercept and telephone surveys) to produce bycatch estimates in HMS fisheries. The number and location of discarded fish are recorded, as is the disposition of the fish (*i.e.*, released alive vs. released dead). Post-release mortality of HMS can be accounted for in stock assessments to the extent that the data allow.

The fishery logbook systems in place are mandatory programs, and it is expected that the reporting rates are generally high (Garrison, 2005). Due to the management focus on HMS fisheries, there has been close monitoring of reporting rates, and observed trips can be directly linked to reported effort. In general, the gear characteristics and amount of observed effort is consistent with reported effort. However, under-reporting is possible, which can lead to a negative bias in bycatch estimates. Cramer (2000) compared dead discards of undersized swordfish, sailfish, white and blue marlin, and pelagic sharks from HMS logbook and POP data

in the U.S. Atlantic PLL fishery. Cramer (2000) provided the ratio of catch estimated from the POP data divided by the reported catch in the HMS logbooks. The ratio indicated the amount of underreporting for each species in a given area. However, the data analyzed by Cramer (2000), was based on J-hook data from 1997 – 1999 and that gear is now illegal. In some instances, logbooks are used to provide effort information against which bycatch rates obtained from observers are multiplied to estimate bycatch. In other sectors/fisheries, self-reporting provides the primary method of reporting bycatch because of limited funding, priorities, *etc*.

The following section provides a review of the bycatch reporting methodologies for all shark fisheries: the U.S. PLL fishery, the shark BLL fishery, the shark gillnet fishery, and the recreational handgear fishery. Future adjustments may be implemented based on evaluation of the results of studies developed as part of the HMS Bycatch Reduction Implementation Plan, or as needed due to changing conditions in the fisheries. In addition, NMFS is in the process of developing a National Bycatch Report which may provide additional insight and guidance on areas to be addressed for each fishery. Further analyses of bycatch in the various HMS fisheries may be conducted as time, resources, and priorities allow.

3.9.2.1 U.S. Atlantic Pelagic Longline Fishery

NMFS utilizes both self-reported data (mandatory logbooks for all vessels) and observer data to monitor bycatch in the PLL fishery. The observer program has been in place since 1992 to document finfish bycatch, characterize fishery behavior, and quantify interactions with protected species (Beerkircher *et al.*, 2002). The program is mandatory for those vessels selected, and all vessels with directed and indirect swordfish permits are selected. The program had a target coverage level of five percent of the U.S. fleet within the North Atlantic (waters north of 5^{o} N. latitude), as was agreed to by the United States at ICCAT. Actual coverage levels achieved from 1992 – 2003 ranged from two to nine percent depending on quarter and year. Observer coverage was 100 percent for vessels participating in the NED experimental fishery during 2001 – 2003. Overall observer coverage in 2003 was 11.5 percent of the total sets made, including the NED experiment. The program began requiring an eight percent coverage rate due to the requirements of the 2004 BiOp for Atlantic PLL Fishery for HMS (NMFS, 2004f). Observer coverage in 2005-07 ranged from 7.5 – 10.8 percent. Since 1992, data collection priorities have been to collect catch and effort data of the U.S. Atlantic PLL fleet on highly migratory fish species, although information is also collected on bycatch of protected species.

Fishery observer effort is allocated among eleven large geographic areas and calendar quarter based upon the historical fishing range of the fleet (Walsh and Garrison, 2006). The target annual coverage is eight percent of the total reported sets, and observer coverage is randomly allocated based upon reported fishing effort during the previous fishing year/quarter/statistical reporting area (Beerkircher *et al.*, 2002). Bycatch rates of protected species (catch per 1,000 hooks) are quantified based upon observer data by year, fishing area, and quarter (Garrison, 2005). The estimated bycatch rate is then multiplied by the fishing effort (number of hooks) in each area and quarter reported to the FLS program to obtain estimates of total interactions for each species of marine mammal and sea turtle (Garrison, 2005).

3.9.2.2 Shark Bottom Longline Fishery

Vessels participating in the BLL fishery for sharks are required to submit Gulf of Mexico reef fish, South Atlantic snapper-grouper, king and Spanish mackerel, and shark fisheries logbooks to report their catch and effort, including bycatch species. All vessels having shark LAPs are required to report. The CSFOP has monitored the shark BLL fishery since 1994. Since 2005, the program has been administered through the SEFSC out of the Panama City, Florida Laboratory. The program has been mandatory for vessels selected to carry observers beginning in 2002. Prior to that, it was a voluntary program relying on cooperating vessels/captains to take observers. From 2002 – 2005, the objective of the vessel selection was to achieve a representative five percent level of coverage of the total fishing effort in each fishing area (North Atlantic, South Atlantic, and Gulf of Mexico) and during each fishing season of that year (Smith *et al*., 2006). In 2006, target coverage level has been 3.9 percent of the total fishing effort. In 2007, target coverage level of 4-6 percent of the total fishing effort. This level was estimated to attain a sample size needed to provide estimates of sea turtle, smalltooth sawfish, or marine mammal interactions with an expected CV of 0.3 (Carlson, unpubl., as cited in Smith *et al*., 2006).

Effective August 1, 2001, selected Federal permit holders that report in the Coastal Fisheries logbook (Gulf of Mexico reef fish, South Atlantic snapper-grouper, king and Spanish mackerel, and shark fisheries) must report all species and quantities of discarded (alive and dead) sea turtles, marine mammals, birds, and finfish on a supplemental discard form. A randomly selected sample of 20 percent of the vessels with active permits in the above fisheries is selected each year. The selection process is stratified across geographic area (Gulf of Mexico and South Atlantic), gear (handline, longline, troll, gillnet, and trap), and number of fishing trips (ten or less trips and more than 11 trips). Of the 3,498 vessels with Federal permits in these fisheries in 2006, a total of 512 vessels were selected to report. Of the 3,491 vessels with Federal permits in these fisheries in 2007, 449 were selected to report. Shark fishermen can use the PLL logbook or the northeast vessel trip reports (VTR) depending on the permits held by the vessel. If they use either the PLL logbook or VTR, they need to report all of the catch and effort, as well as all the bycatch or incidental catch.

The final rule for Amendment 2 to the Consolidated Highly Migratory Species (HMS) Fishery Management Plan (FMP) (73 FR 35778, June 24, 2008, corrected at 73 FR 40658, July 15, 2008) established, among other things, a shark research fishery to maintain time series data for stock assessments and to meet NMFS' research objectives. The shark research fishery permits authorize participation in the shark research fishery and the collection of sandbar and non-sandbar LCS from federal waters in the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea for the purposes of scientific data collection subject to 100 percent observer coverage. The commercial vessels selected to participate in the shark research fishery are the only vessels authorized to land/harvest sandbars subject to the sandbar quota available for each year. The base quota is 87.9 mt dw/year through December 31, 2012, although this number may be reduced in the event of overharvests, if any, and 116.6 mt dw/year starting on January 1, 2013. The selected vessels would also have access to the non-sandbar LCS, SCS, and pelagic shark quotas. Commercial vessels not participating in the shark research fishery may only land non-sandbar LCS, SCS, and pelagic sharks subject to the retention limits and quotas per 50 CFR 635.24 and 635.27, respectively.

3.9.2.3 Shark Gillnet Fishery

Vessels participating in the gillnet fishery for sharks are required to submit logbooks to report their catch and effort, including bycatch species. An observer program for the directed shark gillnet fishery has been in place from 1993 – 1995 and from 1998 to the present. The objectives of this program are to obtain estimates of catch and bycatch and bycatch mortality rates of protected species, juvenile sharks, and other fish species. Catch and bycatch estimates are produced to meet the mandates of the ALWTRP and the May 2008 BiOp. During right whale calving season (15 November to 15 April), 100 percent observer coverage is required for shark gillnet vessels operating from West Palm Beach, FL, to Sebastian Inlet, FL. Outside right whale calving season, observer coverage is equal to that which would obtain a sample size needed to provide estimates of sea turtle or marine mammal interactions with an expected CV of 0.3 (Carlson and Baremore, 2002a).

NMFS implemented the final rule on June 25, 2007 (72 FR 34632), that prohibits gillnet fishing, including shark gillnet fishing, from November 15 to April 15, between the NC/SC border and 29° 00' N. The action was taken to prevent the significant risk to the wellbeing of endangered right whales from entanglement in gillnet gear in the core right whale calving area during calving season. Limited exemptions to the fishing prohibitions are provided for gillnet fishing for sharks and for Spanish mackerel south of 29°00' N. lat. Shark gillnet vessels fishing between 29° 00' N and 26° 46.5' N have certain requirements as outlined 50 CFR § 229.32 from December 1 through March 31 of each year. These include vessel operators contacting the SEFSC Panama City Laboratory at least 48 hours prior to departure of a fishing trip in order to arrange for an observer.

In addition, a recent rule (October 5, 2007, 72 FR 57104) amends restrictions in the Southeast U.S. Monitoring Area from December 1 through March 31. In that area no person may fish with or possess gillnet gear for sharks with webbing of 5" or greater stretched mesh unless the operator of the vessel is in compliance with the VMS requirements found in 50 CFR 635.69. The Southeast U.S. Monitoring Area is from 27°51' N. (near Sebastian Inlet, FL) south to 26°46.5' N. (near West Palm Beach, FL), extending from the shoreline or exemption line eastward to 80°00' W. In addition, NMFS may select any shark gillnet vessel regulated under the ALWTRP to carry an observer. When selected, the vessels are required to take observers on a mandatory basis in compliance with the requirements for at-sea observer coverage found in 50 CFR 229.7. Any vessel that fails to carry an observer once selected is prohibited from fishing pursuant to 50 CFR § 635. There are additional gear marking requirements that can be found at 50 CFR § 229.32.

Starting in 2005, a pilot observer program began to include all vessels that have an active directed shark permit and fish with sink gillnet gear (Carlson and Bethea, 2006). These vessels were not subject to observer coverage because they were either targeting non-HMS or were not fishing gillnets in a drift or strike fashion. These vessels were selected for observer coverage in an effort to determine their impact on finetooth shark landings and their overall impact on shark resources when not targeting sharks.

3.9.2.4 Recreational Handgear Fishery

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

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

The National Academy of Sciences (NAS) assembled a committee to review current marine recreational fishing surveys at the request of NMFS (NAS, 2006). The committee was tasked with developing recommendations for improvements to current surveys and to recommend the implementation of possible alternative approaches. The committee's final report was published in April 2006. Based on recommendations made by the National Research Council, a new, nationwide system to standardize recreational data collection has begun. This has been termed the Marine Recreational Information Program (MRIP), and the program focuses on integrating state and federal level recreational permit information to create a resource for targeted surveys of anglers' catch and effort.

3.9.3 Bycatch Reduction in HMS Fisheries

The NMFS HMS bycatch reduction program includes an evaluation of current data collection programs, implementation of bycatch reduction measures such as gear modifications and time/area closures, and continued support of data collection and research relating to bycatch. Additional details on bycatch and bycatch reduction measures can be found in Section 3.5 of the 1999 FMP for Atlantic Tunas, Swordfish and Sharks (NMFS, 1999), in Regulatory Amendment 1 to the 1999 FMP for Atlantic Tunas, Swordfish and Sharks (NMFS, 2000), in Regulatory Adjustment 2 to the 1999 FMP for Atlantic Tunas, Swordfish and Sharks (NMFS, 2002), in Amendment 1 to the 1999 FMP for Atlantic Tunas, Swordfish and Sharks (NMFS, 2003a), the June 2004 Final Rule for Reduction of Sea Turtle Bycatch and Bycatch Mortality in the Atlantic PLL Fishery (69 FR 40734), the 2006 Consolidated HMS FMP (NMFS, 2006a), Amendment 2 to the 2006 Consolidated HMS FMP (NMFS, 2008a), and Section 3.9 of this chapter. In addition, an HMS Bycatch Reduction Implementation Plan was developed in late 2003 which identify priority issues to be addressed in the following areas: 1) monitoring, 2) research, 3)

management, and 4) education/outreach. Individual activities in each of these areas were identified and new activities may be added or removed as they are addressed or identified.

3.10 Evaluation and Monitoring of Bycatch

The identification of bycatch in Atlantic HMS fisheries is the first step in reducing bycatch and bycatch mortality. The Magnuson-Stevens Act requires the amount and type of bycatch to be summarized in the annual SAFE reports.

PLL dead discards of LCS and pelagic sharks are estimated using data from NMFS observer reports and pelagic logbook reports. Shark BLL and shark gillnet discards can be estimated using logbook data and observer reports as well. Shark gillnet discards have also been estimated using logbook data when observer coverage is equal to 100 percent.

3.10.1 Bycatch Mortality

3.10.1.1 Introduction

The reduction of bycatch mortality is an important component of NS 9. Physical injuries may not be apparent to the fisherman who is quickly releasing a fish because there may be injuries associated with the stress of being hooked or caught in a net. Little is known about the mortality rates of many shark species but there are some data for certain species. Information on bycatch mortality should continue to be collected, and in the future, could be used to estimate bycatch mortality in stock assessments. For a summary of bycatch species in BLL and gillnet fisheries, please refer to Table 3.49. For all other fisheries, please refer to Table 3.107 in the Consolidated HMS FMP.

NMFS submits annual data (Task II) to ICCAT on mortality estimates (dead discards). These data are included in the SAFE Reports and National Reports to ICCAT to evaluate bycatch trends in HMS fisheries.

Table 3.49 Summary of bycatch species in HMS fisheries, Marine Mammal Protection Act (MMPA) category, Endangered Species Act (ESA) requirements, data collection, and management measures by fishery/gear type.
(Excerpted from HMS Bycatch Priorities and Implementation Plan and updated through September 2008)

Fishery/Gear Type	Bycatch Species	MMPA Category	ESA Requirements	Bycatch Data Collection	Management Measures
Shark Bottom Longline	Prohibited shark species Target species after closure Sea turtles Smalltooth sawfish Non-target finfish	Category III	ITS, Terms & Conditions, RPMs	Permit requirement (1993); logbook requirement (1993); observer coverage (1994)	Quotas (1993); trip limit (1994); gear marking (1999); handling & release guidelines (2001); line clippers, dipnets, corrodible hooks, de-hooking devices, move 1 nm after an interaction (2004); South Atlantic closure, VMS (2005); shark identification workshops for dealers (2007); sea turtle control device (2008)
Shark Gillnet	Prohibited shark species Sea turtles Marine mammals Non-target finfish Smalltooth sawfish	Category II	ITS, Terms & Conditions, RPMs	Permit requirement (1993); logbook requirement (1993); observer coverage (1994)	Quotas (1993); trip limit (1994); gear marking (1999); deployment restrictions (1999); 30-day closure for leatherbacks (2001); handling & release guidelines (2001); net checks (2002); whale sighting (2002); VMS (2004); closure for right whale mortality (2006); shark identification workshops for dealers (2007)
Pelagic Longline	Bluefin tuna Billfish Undersize target species Marine mammals Sea turtles Seabirds Non-target finfish Prohibited shark species Large Coastal Shark species after closure	Category I	Jeopardy findings in 2000 & 2004; Reasonable and Prudent Alternative implemented 2001-04; ITS, Terms & Conditions, RPMs	Permit requirement (1985); logbook requirement (SWO-1985; SHK - 1993); observer requirement (1992), EFPs (2001-present)	BFT target catch requirements (1981); quotas (SWO - 1985; SHK - 1993); prohibit possession of billfish (1988); minimum size (1995); gear marking (1999); line clippers, dipnets (2000); MAB closure (1999); limited access (1999); limit the length of mainline (1996-1997 only); move 1 nm after an interaction (1999); voluntary vessel operator workshops (1999); GOM closure (2000); FL, Charleston Bump, NED closures (2001); gangion length, corrodible hooks, de-hooking devices, handling & release guidelines (2001); NED experiment (2001-03); VMS (2003); circle hooks and bait requirements (2004); mandatory safe handling and release workshops (2006); sea turtle control device (2008); closed area research (2008)

3.10.1.2 Mortality by Fishery

Bottom Longline Fishery

The shark BLL fishery has relatively low observed bycatch rates. Historically, finfish bycatch has averaged approximately 6.4 percent in the Gulf of Mexico region and 2.3 percent in the Atlantic region for the BLL fishery. Observed protected species bycatch (sea turtles) has typically been much lower, less than 0.01 percent of the total observed catch. See Section 3.4.1.3 for more information. Disposition of discards is recorded by observers and can be used to estimate discard mortality.

Shark Gillnet Fishery

The shark gillnet fishery has relatively low observed bycatch rates. Finfish bycatch during the 2007 fishery ranged from 1.4 to 13.3 percent of the total catch from directed shark sets. Observed protected species bycatch (sea turtles and marine mammals) was very low, less than 0.1 percent. See Section 3.4.2.2 for more information. Disposition of discards is recorded by observers and can be used to estimate discard mortality.

For PLL and recreational handgear mortality summaries, please refer to Section 3.9.8.2 of the 2006 Consolidated HMS FMP.

3.10.1.3 Code of Angling Ethics

NMFS developed a Code of Angling Ethics as part of implementing Executive Order 12962 – Recreational Fisheries. NMFS implemented a national plan to support, develop, and implement programs that were designed to enhance public awareness and understanding of marine conservation issues relevant to the wellbeing of fishery resources in the context of marine recreational fishing. This code is consistent with NS 9, minimizing bycatch and bycatch mortality. These guidelines are discretionary, not mandatory, and are intended to inform the angling public of NMFS views regarding what constitutes ethical angling behavior. Part of the code covers catch-and-release fishing and is directed towards minimizing bycatch mortality. For a detailed description of the code, please refer to Section 3.9.8.3 of the 2006 Consolidated HMS FMP.

3.10.2 HMS Fishing Gears with Protected Species

This section examines the interaction between protected species and Atlantic HMS fisheries managed under this FMP. As a point of clarification, interactions are different than bycatch. Interactions take place between fishing gears and marine mammals, and seabirds while bycatch consists of the incidental take and discards of non-targeted finfish, shellfish, mollusks, crustaceans, sea turtles, and any other marine life other than marine mammals and seabirds. Following a brief review of the three acts (Marine Mammal Protection Act, Endangered Species Act, and Migratory Bird Treaty Act) affecting protected species, the interactions between HMS gears and each species is examined. Additionally, the interaction of seabirds and longline fisheries are considered under the auspices of the United States "National Plan of Action for Reducing the Incidental Catch of Seabirds in Longline Fisheries" (NPOA – Seabirds).

3.10.2.1 Interactions and the MMPA

The MMPA of 1972 as amended is one of the principal Federal statutes that guides marine mammal species protection and conservation policy. In the 1994 amendments, section 118 established the goal that the incidental mortality or serious injury of marine mammals occurring during the course of commercial fishing operations be reduced to insignificant levels approaching a zero mortality rate goal (ZMRG) and serious injury rate within seven years of enactment (*i.e*,. April 30, 2001). In addition, the amendments established a three-part strategy to govern interactions between marine mammals and commercial fishing operations. These include the preparation of marine mammal stock assessment reports, a registration and marine mammal mortality monitoring program for certain commercial fisheries (Category I and II), and the preparation and implementation of take reduction plans (TRP).

NMFS relies on both fishery-dependent and fishery-independent data to produce stock assessments for marine mammals in the Atlantic Ocean, Gulf of Mexico, and the Caribbean Sea. Draft stock assessment reports are typically published in January and final reports are typically published in the fall. Stock assessment reports are available and can be obtained on the web at: http://www.nmfs.noaa.gov/prot_res/PR2/Stock_Assessment_Program/sars.html

The following list of species outlines the marine mammal species that occur off the Atlantic and Gulf Coasts that are or could be of concern with respect to potential interactions with HMS fisheries.

Common Name	**Scientific Name**
Atlantic spotted dolphin	*Stenella frontalis*
Blue whale	*Balaenoptera musculus*
Bottlenose dolphin	*Tursiops truncatus*
Common dolphin	*Delphinis delphis*
Fin whale	*Balaenoptera physalus*
Harbor porpoise	*Phocoena phocoena*
Humpback whale	*Megaptera novaeangliae*
Killer whale	*Orcinus orca*
Long-finned pilot whale	*Globicephela melas*
Minke whale	*Balaenoptera acutorostrata*
Northern bottlenose whale	*Hyperoodon ampullatus*
Northern right whale	*Eubalaena glacialis*
Pantropical spotted dolphin	*Stenella attenuata*
Pygmy sperm whale	*Kogia breviceps*
Risso's dolphin	*Grampus griseus*
Sei whale	*Balaenoptera borealis*
Short-beaked spinner dolphin	*Stenella clymene*
Short-finned pilot whale	*Globicephela macrorhynchus*
Sperm whale	*Physeter macrocephalus*
Spinner dolphin	*Stenella longirostris*
Striped dolphin	*Stenella coeruleoalba*
White-sided dolphin	*Lagenorhynchus acutus*

Under MMPA requirements, NMFS produces an annual list of fisheries (LOF) that classifies domestic commercial fisheries, by gear type, relative to their rates of incidental mortality or serious injury of marine mammals. The LOF includes three classifications:

1. Category I fisheries are those with frequent serious injury or incidental mortality to marine mammals;
2. Category II fisheries are those with occasional serious injury or incidental mortality; and
3. Category III fisheries are those with remote likelihood of serious injury or known incidental mortality to marine mammals.

The final 2008 MMPA LOF was published on November 27, 2007 (72 FR 66048) and the final 2009 MMPA LOF was published on December 1, 2008 (73 FR 73032). The Atlantic Ocean, Caribbean, and Gulf of Mexico large pelagic longline fishery is classified as Category I (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 following Atlantic HMS fisheries are classified as Category III (remote likelihood or no known serious injuries or mortalities): Atlantic tuna purse seine; Gulf of Maine and Mid-Atlantic tuna, shark and swordfish, 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. Commercial passenger fishing vessel (charter/headboat) fisheries are subject to Section 118 and are listed as a Category III fishery. Recreational vessels are not categorized since they are not considered commercial fishing vessels. Beginning with the 2009 LOF, high seas fisheries are included in the LOF. Many fisheries operate in both U.S. waters and on the high seas thereby making the high seas component an extension of a fishery already on the LOF. NMFS categorizes the majority of high seas fisheries on the LOF as Category II based on the lack of marine mammal stock abundance information from the high seas. Exceptions to this are high seas fisheries that also operate in U.S. waters that have already been categorized as I, II, or III. For additional information on the fisheries categories and how fisheries are classified, see http://www.nmfs.noaa.gov/pr/interactions/lof/.

Fishermen participating in Category I or II fisheries are required to register under the MMPA and to accommodate an observer aboard their vessels if requested. Vessel owners or operators, or fishermen, in Category I, II, or III fisheries must report all incidental mortalities and serious injuries of marine mammals during the course of commercial fishing operations to NMFS. There are currently no regulations requiring recreational fishermen to report takes, nor are they authorized to have incidental takes (*i.e.*, they are illegal).

NMFS continues to investigate serious injuries to marine mammals as they are released from fishing gear. In April 1999, NMFS held a joint meeting of the three regional scientific review groups to further discuss the issue. NMFS is continuing to develop marine mammal serious injury guidelines and until these are published, NMFS will apply the criteria listed by the review groups to make determinations for specific fisheries. The current BiOps for Atlantic HMS fisheries have resulted in a conclusion of no jeopardy for marine mammals. The 1999 HMS FMP implemented several of the recommendations of the Atlantic Offshore Cetacean Take Reduction Team (AOCTRT) including: 1) a requirement that vessels fishing for HMS move one

nautical mile (nm) after an entanglement with protected species; 2) limiting the length of the mainline to 24 nm in the MAB from August 1, 1999 through November 30, 2000; 3) voluntary vessel operator education workshops for HMS pelagic longline vessels; 4) handling and release guidelines; and 5) limited access for swordfish, shark and tuna longline permits.

More recently, a Pelagic Longline Take Reduction Team (PLTRT) was formed which replaced the disbanded AOCTRT. The PLTRT developed a draft Take Reduction Plan (TRP) and was published along with a proposed rule to implement it on June 24, 2008 (73 FR35623). The PLTRT recommended a suite of management strategies to reduce mortality and serious injury of pilot whales and Risso's dolphins in the Atlantic pelagic longline fishery. NMFS proposed the following three regulatory measures: (1) Establish a Cape Hatteras Special Research Area (CHSRA), with specific observer and research participation requirements for fishermen operating in that area; (2) set a 20–nm (37.02–km) upper limit on mainline length for all pelagic longline sets within the MAB; and (3) develop and publish an informational placard that must be displayed in the wheelhouse and the working deck of all active pelagic longline vessels in the Atlantic fishery. The final rule for this action published May 19th, 2009 (74 FR 23349).

3.10.2.2 Interactions and the ESA

The ESA of 1973 as amended (16 U.S.C. 1531 *et seq*.) provides for the listing of species determined by the USFWS or NOAA to be threatened or endangered throughout all or a portion of their range and the designation of critical habitat for such species, prohibition on unauthorized or unpermitted take, and for avoiding jeopardy and ultimately conserving and recovering listed species of fish, wildlife, and plants. The listing of a species is based on the status of the species throughout its range or in a specific portion of its range in some instances. Threatened species are those likely to become endangered in the foreseeable future [16 U.S.C. §1532(20)] if no action is taken to stop the decline of the species. Endangered species are those in danger of becoming extinct throughout all or a significant portion of their range [16 U.S.C. §1532(20)]. Species can be listed as endangered without first being listed as threatened. The Secretary of Commerce, acting through NMFS, is authorized to list marine and anadromous fish species, marine mammals (except for walrus and sea otter), marine reptiles (such as sea turtles), and marine plants. The Secretary of the Interior, acting through the USFWS, is authorized to list walrus and sea otter, seabirds, terrestrial plants and wildlife, and freshwater fish and plant species, among other species.

In addition to listing species under the ESA, the service agency (NMFS or USFWS) generally must designate critical habitat for listed species concurrently with the listing decision to the "maximum extent prudent and determinable" [16 U.S.C. §1533(a)(3)]. The ESA defines critical habitat as those specific areas that are occupied by the species at the time it is listed that are essential to the conservation of a listed species and that may be in need of special consideration, as well as those specific areas that are not occupied by the species that are essential to their conservation. Federal agencies are prohibited from undertaking actions that are likely to result in jeopardy to a listed species or destroy or adversely modify designated critical habitat or taking species in the absence of an incidental take statement included in a Biological Opinion (BiOp). Federal agencies carry out their duties under the ESA to avoid jeopardy, receive authorization for incidental take, and provide for conservation and recovery of species

through formally consulting with either NMFS or the USFWS depending on the species at issue under Section 7 of the ESA. Formal Section 7 consultation concludes with the USFWS or NMFS issuing a BiOp evaluating the effects of the proposed action to listed species, determining whether there is a likelihood of jeopardy, including an incidental take statement authorizing a specific level of take, requiring terms and conditions and implementing reasonable and prudent measures for incidental take, and recommendations for conservation measures. If the BiOp concludes that the action is likely to jeopardize a listed species, USFWS or NMFS must suggest reasonable and prudent alternatives to implement the proposed action without jeopardizing the species. The following is a list of endangered or threatened species that have critical habitat listed within the proposed action area.

Marine Mammals	**Status**
Blue whale *(Balaenoptera musculus)*	Endangered
Fin whale *(Balaenoptera physalus)*	Endangered
Humpback whale *(Megaptera novaeangliae)*	Endangered
Northern right whale *(Eubalaena glacialis)*	Endangered
Sei whale *(Balaenoptera borealis)*	Endangered
Sperm whale *(Physeter macrocephalus)*	Endangered
Sea Turtles	
Green turtle *(Chelonia mydas)*	*Endangered/Threatened
Hawksbill sea turtle *(Eretmochelys imbricata)*	Endangered
Kemp's ridley sea turtle *(Lepidochelys kempii)*	Endangered
Leatherback sea turtle *(Dermochelys coriacea)*	Endangered
Loggerhead sea turtle *(Caretta caretta)*	Threatened
Olive ridley sea turtle *(Lepidochelys olivacea)*	Threatened
Critical Habitat	
Northern right whale	Endangered
Finfish	
Smalltooth sawfish *(Pristis pectinata)*†	Endangered

*Green sea turtles in U.S. waters are listed as threatened except for the Florida breeding population, which is listed as endangered. Due to the inability to distinguish between the populations away from the nesting beaches, green sea turtles are considered endangered wherever they occur in U.S. waters.

†U.S. Distinct Population Segment

Sea Turtles

NMFS has taken several steps in the past few years to reduce sea turtle bycatch and bycatch mortality in domestic longline fisheries. On March 30, 2001, NMFS implemented via interim final rule requirements for U.S. flagged vessels with PLL gear on board to have line clippers and dipnets to remove gear on incidentally captured sea turtles (66 FR 17370). Specific handling and release guidelines designed to minimize injury to sea turtles were also implemented. NMFS published a final report which provides the detailed guidelines and protocols (NMFS,

2008d) and a copy can be found at http://www.nmfs.noaa.gov/sfa/hms/Protected%20Resources/TM580_color_standard_1_7_09.pdf.

A BiOp completed on June 14, 2001, found that the actions of the PLL fishery jeopardized the continued existence of loggerhead and leatherback sea turtles. This document reported that the PLL fishery interacted with an estimated 991 loggerhead and 1,012 leatherback sea turtles in 1999. The estimated take levels for 2000 were 1,256 loggerhead and 769 leatherback sea turtles (Yeung, 2001).

On July 13, 2001 (66 FR 36711), NMFS published an emergency rule that closed the NED area to PLL fishing (effective July 15, 2001), modified how PLL gear may be deployed effective August 1, 2001, and required that all longline vessels (pelagic and bottom) post safe handling guidelines for sea turtles in the wheelhouse. On December 13, 2001 (66 FR 64378), NMFS extended the emergency rule for 180 days through July 8, 2002. On July 9, 2002, NMFS published a final rule (67 FR 45393) that closed the NED to PLL fishing. As part of the Reasonable and Prudent Alternative, the BiOp required NMFS to conduct an experiment with commercial fishing vessels to test fishery-specific gear modifications to reduce sea turtle bycatch and mortality. This rule also required the length of any gangions to be 10 percent longer than the length of any floatline on vessels where the length of both is less than 100 meters; prohibited stainless steel hooks; and required gillnet vessel operators and observers to report any whale sightings and required gillnets to be checked every 0.5 to 2 hours.

The experimental program required in the BiOp was initiated in the NED area in 2001 in cooperation with the U.S. PLL fleet that historically fished on the Grand Banks fishing grounds. The goal of the experiment was to test and develop gear modifications that might prove useful in reducing the incidental catch and post-release mortality of sea turtles captured by PLL gear while striving to minimize the loss of target catch. The experimental fishery had a three-year duration and utilized 100 percent observer coverage to assess the effectiveness of the measures. The gear modifications tested in 2001 included blue-dyed squid and moving gangions away from floatlines. In 2002, the NED experimental fishery examined the effectiveness of whole mackerel bait, squid bait, circle and "J" hooks, and reduced daylight soak time in reducing the capture of sea turtles. The experiment tested various hook and bait type combinations in 2003 to verify the results of the 2002 experiment.

On November 28, 2003, based on the conclusion of the three-year NED experiment, and preliminary data that indicated that the Atlantic PLL fishery may have exceeded the Incidental Take Statement in the June 14, 2001 BiOp, NMFS published a Notice of Intent to prepare an SEIS to assess the potential effects on the human environment of proposed alternatives and actions under a proposed rule to reduce sea turtle bycatch (68 FR 66783). A new BiOp for the Atlantic PLL fishery was completed on June 1, 2004 (NMFS, 2004f). The BiOp concluded that long-term continued operation of the Atlantic PLL fishery, authorized under the 1999 FMP, was not likely to jeopardize the continued existence of loggerhead, green, hawksbill, Kemp's ridley, or olive ridley sea turtles; and was likely to jeopardize the continued existence of leatherback sea turtles.

On July 6, 2004, NMFS implemented additional regulations for the Atlantic PLL fishery to further reduce the mortality of incidentally caught sea turtles (69 FR 40734). These measures include requirements on hook type, hook size, bait type, dipnets, line clippers, and safe handling guidelines for the release of incidentally caught sea turtles. These requirements were developed based on the results of the 2001 – 2003 NED experiment (Watson *et al*., 2003; Watson *et al*., 2004; Shah *et al*., 2004). These requirements are predicted to decrease the number of total interactions, as well as the number of mortalities, of both leatherback and loggerhead sea turtles (NMFS, 2004e). Post-release mortality rates are expected to decline due to a decrease in the number of turtles that swallow hooks which engage in the gut or throat, a decrease in the number of turtles that are foul-hooked and improved handling and gear removal protocols. NMFS is working to export this new technology to PLL fleets of other nations to reduce global sea turtle bycatch and bycatch mortality. U.S gear experts have presented this bycatch reduction technology and data from research activities at approximately 15 international events that included fishing communities and resource managers between 2002 and mid-2005 (NMFS, 2005a).

On February 7, 2007, NMFS published a rule that required BLL vessels to carry the same dehooking equipment as the PLL vessels. To date, all bottom and PLL vessels with commercial shark permits are required to have NMFS-approved sea turtle dehooking equipment onboard (PLL: July 6, 2004, 69 FR 40734; BLL: February 7, 2007, 72 FR 5639).

A May 20, 2008 Biological Opinion (BiOp) issued under Section 7 of the ESA for Amendment 2 to the 2006 Consolidated HMS FMP concluded, based on the best available scientific information, that Amendment 2 to the Consolidated HMS FMP was not likely to jeopardize the continued existence of endangered green, leatherback, and Kemp's ridley sea turtles; the endangered smalltooth sawfish; or the threatened loggerhead sea turtle.

Internationally, the United States is pursuing sea turtle conservation through international, regional, and bilateral organizations such as ICCAT, the Asia Pacific Fishery Commission, and FAO Committee on Fisheries (COFI). The United States intends to provide a summary report to FAO for distribution to its members on bycatch of sea turtles in U.S. longline fisheries and the research findings as well as recommendations to address the issue. At the 24th session of COFI held in 2001, the United States distributed a concept paper for an international technical experts meeting to evaluate existing information on turtle bycatch, to facilitate and standardize collection of data, to exchange information on research, and to identify and consider solutions to reduce turtle bycatch. COFI agreed that an international technical meeting could be useful despite the lack of agreement on the specific scope of that meeting. The United States has developed a prospectus for a technical workshop to address sea turtle bycatch in longline fisheries as a first step. Other gear-specific international workshops may be considered in the future.

Smalltooth sawfish

On April 1, 2003, NMFS listed smalltooth sawfish as an endangered species (68 FR 15674) under the ESA. After reviewing the best scientific data and commercial fisheries information, the status review team determined that 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; over utilization for commercial, recreational,

scientific, or educational purposes; inadequacy of existing regulatory mechanisms; and other natural or manmade factors affecting its continued existence. NMFS is working on designating critical habitat for smalltooth sawfish.

NMFS believes that smalltooth sawfish takes in the shark gillnet fishery are rare given the high rate of observer coverage. 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 an annual basis. The May 20, 2008, BiOp Amendment 2 to the 2006 Consolidated HMS FMP, which includes the shark gillnet fishery, found that the shark gillnet fishery was not likely to jeopardize the continued existence of endangered smalltooth sawfish.

Smalltooth sawfish have been observed caught (eight known interactions, seven released alive, one released in unknown condition) in shark bottom longline fisheries from 1994 through 2004 (NMFS, 2003a). Based on these observations, expanded sawfish take estimates for 1994-2002 were developed for the shark bottom longline fishery (NMFS, 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. All were released alive except one. Estimates of sawfish bycatch for 2003-06 have been developed and range from 0 to 161 interactions per year (Richards, 2007a; 2007b). However, due to the sparseness of observations (interactions) and effort variables chosen for the various approaches to estimating total interactions, the results were not very precise. A small BLL time-area closure to protect smalltooth sawfish southwest of Key West, FL was considered during the development of the 2006 Consolidated HMS FMP (NMFS, 2006a) but not implemented due to the lack of information regarding critical habitat for this species. A proposed rule to designate critical habitat for smalltooth sawfish was published on November 20, 2008 (73 FR 70290). The May 20, 2008, BiOP Amendment 2 to the 2006 Consolidated HMS FMP, which includes the shark bottom longline fishery, found that the shark bottom longline fishery was not likely to jeopardize the continued existence of endangered smalltooth sawfish.

3.10.2.3 Interactions with Seabirds

Observer data from 1992 through 2007 indicate that seabird bycatch is relatively low in the U.S. Atlantic pelagic longline fishery (NMFS, 2008b). Since 1992, a total of 141 seabird interactions have been observed, with 101 observed killed (71.6 percent). In 2007, there were 117 active U.S. pelagic longline vessels fishing for swordfish in the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea that reportedly set approximately 6.1 million hooks. A total of six seabirds were observed taken. Extrapolated estimates of seabird bycatch varied substantially from 1992-2007, ranging from 0 in 1996 to a high of 1,109 in 1997. The average extrapolated estimate of seabird bycatch was 210 per year while the extrapolated estimate of dead seabird bycatch was 150 per year, ranging from 0 to 623.

The NPOA for Reducing the Incidental Catch of Seabirds in Longline Fisheries was released in February 2001. The NPOA for Seabirds calls for detailed assessments of longline fisheries, and, if a problem is found to exist within a longline fishery, for measures to reduce seabird bycatch within two years. NMFS, in collaboration with the appropriate Councils and in consultation with the USFWS, will prepare an annual report on the status of seabird mortality for each longline fishery. The United States is committed to pursuing international cooperation, through the Department of State, NMFS, and U.S. Fish and Wildlife Service, to advocate the

development of National Plans of Action within relevant international fora. NMFS intends to meet with longline fishery participants and other members of the public in the future to discuss possibilities for complying with the intent of the plan of action. Because interactions appear to be relatively low in Atlantic HMS fisheries, the adoption of immediate measures is unlikely.

Bycatch of seabirds in the shark BLL fishery has been virtually non-existent. A single pelican has been observed killed from 1994 through 2005. No expanded estimates of seabird bycatch or catch rates for the BLL fishery have been made due to the rarity of seabird takes.

3.10.3 Measures to Address Protected Species Concerns

NMFS has taken a number of actions designed to reduce interactions with protected species over the last few years. Bycatch reduction measures have been implemented through the Fishery Management Plan for Atlantic Tunas, Swordfish and Sharks (NMFS, 1999), in Regulatory Amendment 1 to the 1999 FMP (NMFS, 2000), in Regulatory Adjustment 2 to the 1999 FMP (NMFS, 2002), in Amendment 1 to the 1999 FMP (NMFS, 2003a), and in the June 2004 Final Rule for Reduction of Sea Turtle Bycatch and Bycatch Mortality in the Atlantic Pelagic Longline Fishery (69 FR 40734). NMFS closed the Southeast U.S. Restricted Area to gillnet fisheries from February 15, 2006, to March 31, 2006, as a result of an entanglement and subsequent mortality of a right whale with gillnet gear (71 FR 8223). NMFS also closed eight Marine Protected Areas under Amendment 2 to the 2006 Consolidated HMS FMP (73 FR 35778 corrected 73 FR 40658). NMFS continues to monitor observed interactions with marine mammals and sea turtles on a quarterly basis and reviews data for appropriate action, if any, as necessary.

Table 3.50 Estimated sea turtle interactions by species in the US Atlantic pelagic longline fishery, 1999-2007, and Incidental Take Levels (ITS).

PLL Fishery	1999	2000	2001	2002	2003	2004	2005	2006	2007	3 year ITS, 2004-06 / 2007-09	
										Total	Annual
Leatherback	1,016	769	1,208	962	1,112	1,362	368	415	500	1,981 / 1,764	660 / 588
Loggerhead	994	1,256	312	575	727	733	282	558	542	1,869 / 1,905	632 / 635
Other/Unidentified Sea Turtles	66	128	0	50	38	0	0	11	1	105 / 105	35 / 35
Marine Mammals	422	403	177	201	300	164	372	313	151	NA	NA

3.10.4 Bycatch of HMS in Other Fisheries

NMFS is concerned about bycatch mortality of Atlantic HMS in any federal or state-managed fishery which captures them. NMFS plans to address bycatch of these species in the appropriate FMPs through coordination with the responsible management body. For example, capture of swordfish and tunas incidental to squid trawl operations is addressed in the Squid, Mackerel, and Butterfish FMP. Capture rates of tunas in coastal gillnet fisheries are being explored through issuance of exempted fishing permits and reporting requirements. NMFS continues to solicit bycatch data on HMS from all state, interjurisdictional, and federal data

collection programs. NMFS supports development of an interstate management plan for coastal sharks by the ASMFC to protect sharks caught incidentally in state-managed fisheries. NMFS has requested assistance from the ASMFC, GSMFC, and Atlantic and Gulf Regional Fishery Management Councils in identifying potential sources of bycatch of finetooth sharks in state waters fisheries or other fisheries outside the jurisdiction of this FMP.

3.10.4.1 Shrimp Trawl Fishery

Shark bycatch in the shrimp trawl fishery consists mainly of sharks too small to be highly valued in the commercial market. As a result, few sharks are retained. Bycatch estimates of LCS in this fishery have been generated and were reviewed in the most recent LCS assessment (Table 3.51) (SEDAR 11, 2006). Bycatch estimates of the small coastal shark complex were generated for both the GOM and SA shrimp trawl fisheries for the most recent SCS stock assessment. Requirements for turtle excluder devices in these fisheries have probably resulted in less bycatch because sharks are physically excluded from entering the gear. Bycatch of the SCS complex in the Gulf of Mexico shrimp trawl fishery consists mainly of Atlantic sharpnose and bonnethead sharks (SEDAR 13, 2007). However, approximately 45 percent of blacknose shark mortality occurs in the Gulf of Mexico shrimp trawl fishery. Finetooth sharks were added as a select species for the shrimp trawl observer program in 2005 to help determine if this fishery has bycatch of finetooth sharks. Prior to this, data on finetooth shark bycatch was not recorded.

Table 3.51 Estimates of bycatch (numbers of fish) of small coastal sharks in the U.S. south Atlantic and Gulf of Mexico shrimp trawl fisheries and bottom longline fishery relative to total catch. Source: SEDAR 13, 2007.

Year	Shrimp Bycatch (GOM)	Percent of Total Catch (GOM)	Shrimp Bycatch (SA)	Percent of Total Catch (SA)	Bottom Longline Discards	Percent of Total Catch	Total Catch
1992	1172572	81.9	147409	10.3			1431810
1993	509360	76.4	64034	9.6			666956
1994	443215	69.3	55718	8.7			639406
1995	1051681	69.2	132211	8.7	32494	2.1	1520508
1996	920627	71.7	115736	9.0	15627	1.2	1284416
1997	703350	63.2	88421	7.9	9035	0.8	1113361
1998	806300	65.7	101363	8.3	9038	0.7	1228131
1999	641017	59.9	80585	7.5	14379	1.3	1070164
2000	796602	61.9	100144	7.8	22196	1.7	1286476
2001	641786	55	80682	6.9	14365	1.2	1167231
2002	1104353	69.2	138833	8.7	24906	1.6	1595703
2003	544058	59.1	68396	7.4	26518	2.9	919918
2004	797000	67.1	101330	8.5	30165	2.5	1188402
2005	530943	59.9	66893	7.5	29020	3.3	886732

Table 3.52 Estimates of bycatch (numbers of fish) of blacknose sharks in the U.S. south Atlantic and Gulf of Mexico shrimp trawl fisheries and bottom longline fishery relative to total catch. Source: SEDAR 13, 2007.

Year	Shrimp Bycatch (GOM)	Percent of Total Catch (GOM)	Shrimp Bycatch (SA)	Percent of Total Catch (SA)	Bottom Longline Discards	Percent of Total Catch	Total Catch
1992	38197	79.3	4802	10	-	-	48198
1993	15514	76.3	1950	9.6	-	-	20339
1994	27351	60.4	3438	7.6	-	-	45253
1995	40316	58.3	5068	7.3	5181	7.5	69191
1996	35295	45.1	4437	5.7	2195	2.8	78322
1997	58309	47.7	7330	6	1869	1.5	122306
1998	34082	45.5	4285	5.7	2622	3.5	74856
1999	27461	41.4	3452	5.2	901	1.4	66273
2000	31556	30.4	3967	3.8	11321	10.9	103856
2001	45593	43.6	5732	5.5	3456	3.3	104537
2002	25400	33.7	3193	4.2	6623	8.8	75333
2003	54258	56.6	6821	7.1	5131	5.4	95801
2004	65546	62.4	8243	7.9	1999	1.9	105038
2005	20568	38.2	2586	4.8	5617	10.4	53835

3.10.5 Evaluation of Other Bycatch Reduction Measures

NMFS continues to monitor and evaluate bycatch in HMS fisheries through direct enumeration (pelagic and BLL observer programs, shark gillnet observer program), evaluation of management measures (closed areas, trip limits, gear modifications, *etc*.), and VMS.

The following section provides a review of additional management measures or issues that may address bycatch reduction:

ALWTRP regulations

Major changes to the ALWTRP were implemented in a final rule that published on October 5, 2007 (72 FR 57104). Regulations that affect HMS fisheries specifically gillnet fisheries, include: 1) a closed area for all gillnet fisheries from November 15 – April 15 from 29^{o} 00' N to 32^{o} 00' N from shore eastward to 80^{o} 00'W and off SC, within 35 nautical miles of the coast (Southeast US Restricted Area North); 2) a restricted area from December 1 – March 31 from 27^{o} 51'N to 29^{o} 00'N from shore eastward to 80^{o} 00'W (Southeast US Restricted Area South); 3) additional seasonal boundaries for EEZ waters east of 80^{o} 00'W from 26^{o} 46.50'N to 32^{o} 00'N (Other Southeast Gillnet Waters); and 4) a monitoring area specific to the Atlantic shark gillnet fishery that extends from the area along the coast from 27^{o} 51'N south to 26^{o} 46.50'N eastward to 80^{o} 00'W (Southeast US Monitoring Area) effective December 1 – March

31. Specific compliance requirements for fishing in these areas varies and are summarized in the Guide to the Atlantic Large Whale Take Reduction Plan. For additional information please see the ALWTRP website http://www.nero.noaa.gov/whaletrp/index.html.

Atlantic Bottlenose Dolphin Take Reduction Team

NMFS published a final rule on April 22, 2006, to implement the TRP. Included in the final rule are: 1) effort reduction measures; 2) gear proximity requirements; 3) gear or gear deployment modifications; and 4) outreach and education measures to reduce dolphin bycatch below the stock's potential biological removal level. The final rule also includes time/area closures and size restrictions on large mesh fisheries to reduce incidental takes of endangered and threatened sea turtles as well as to reduce dolphin bycatch.

MMPA List of Fisheries Update/Stock Assessment

NMFS continues to update the MMPA List of Fisheries and the 2008 final list is available. The final 2009 List of Fisheries published on December 1, 2008 (73 FR 73032). Final 2007 and draft 2008 stock assessment reports are available and can be obtained on the web at: http://www.nmfs.noaa.gov/prot_res/PR2/Stock_Assessment_Program/sars.html.

AOCTRT

NMFS has disbanded the AOCTRT due to the fact that two of the three fisheries addressed by the AOCTRT were closed by fishery management actions, leaving only the PLL fishery in operation. This fishery has been the subject of recent fishery management actions and increased observer coverage related to bycatch. As discussed below, a take reduction team specific to the PLL fishery has been formed.

PLTRT

NMFS appointed a PLTRT in June 2005, to address issues in the longline fishery and marine mammals, specifically pilot whales. A proposed rule to implement the TRP has been developed and published on June 24, 2008 (73 FR35623). The PLTRT recommended a suite of management strategies to reduce mortality and serious injury of pilot whales and Risso's dolphins in the Atlantic pelagic longline fishery. NMFS proposed the following three regulatory measures: (1) Establish a Cape Hatteras Special Research Area (CHSRA), with specific observer and research participation requirements for fishermen operating in that area; (2) set a 20–nm (37.02–km) upper limit on mainline length for all pelagic longline sets within the MAB; and (3) develop and publish an informational placard that must be displayed in the wheelhouse and the working deck of all active pelagic longline vessels in the Atlantic fishery. The final rule for this action published May 19, 2009 (74 FR 23349).

VMS in the PLL fishery

NMFS adopted fleet-wide VMS requirements in the Atlantic PLL fishery in May 1999, but was subsequently sued by an industry group. By order dated September 25, 2000, the U.S. District Court for the District of Columbia prevented any immediate implementation of VMS in the Atlantic PLL fishery, and instructed to "undertake further consideration of the scope of the

[VMS] requirements in light of any attendant relevant conservation benefits." On October 15, 2002, the court issued a final order that denied plaintiff's objections to the VMS regulations. Based on this ruling, NMFS implemented the VMS requirement in September 2003.

VMS in other HMS fisheries

Starting in 2004, gillnet vessels with a directed shark permit and gillnet gear onboard were required to install and operate a VMS unit during the Right Whale Calving Season (November 15 – March 31). In an attempt to better quantify bycatch, NMFS required all vessels with shark LAPs to participate in the Directed Shark Gillnet Observer program. Directed shark BLL vessels located between 33^{o} N and 36^{o} 30' N need to install and operate a VMS unit from January through July.

3.11 Effectiveness of Existing Time/Area Closures in Reducing Bycatch

Since 2000, NMFS has implemented a number of time/area closures and gear restrictions in the Atlantic Ocean and Gulf of Mexico for the PLL fishery to reduce discards and bycatch of a number of species (juvenile swordfish, bluefin tuna, billfish, sea turtles, *etc*.). Preliminary analyses of the effectiveness of these closures are summarized here.

The combined effects of the individual area closures and gear restrictions were examined by comparing the reported catch and discards from 2005-2007 to the averages for 1997-1999 throughout the entire U.S. Atlantic fishery. Previous analyses attempted to examine the effectiveness of the time/area closures only by comparing the 2001-03 reported catch and discards to the base period (1997-99) chosen and are included here as well for reference. The percent changes in the reported numbers of fish caught and discarded were compared to the predicted changes from the analyses in Regulatory Amendment 1 to the 1999 FMP (NMFS, 2000). Overall effort, expressed as the number of hooks reported set, declined by 30 percent from 1997-99 (Table 3.53). Declines were noted for both the numbers of kept and discards of almost all species examined including swordfish, tunas, sharks, billfish, and sea turtles. The only positive changes from the base period were the numbers of bluefin tuna and dolphin kept and discarded. The reported number of bluefin tuna kept increased by 39.2 percent for 2005-07 compared to 1997-99 (Table 3.53). The number of reported discards of bluefin tuna increased by almost 12 percent between the same time periods, which matches the predicted 11 percent increase from the analyses in Regulatory Amendment 1. The number of dolphin kept was virtually unchanged between time periods and the number of dolphin discards increased by 13 percent, although the absolute number of discards were relatively low (less than one thousand fish) (Table 3.53). Billfish (blue and white marlin, sailfish) discards reportedly decreased by 61.3 to 76 percent from 1997-99 to 2005-07 (Table 3.53). The reported discards of spearfish declined by 30.4 percent, although the absolute number of discards was also low (less than 200 fish). The reported number of turtle interactions decreased by 67.5 percent from 1997-99 to 2005-07.

Table 3.53 **Total number of pelagic sharks, large coastal sharks, dolphin (mahi mahi), and wahoo reported landed or discarded and number of billfish (blue and white marlin, sailfish, spearfish) and sea turtles reported caught and discarded in the U.S. Atlantic PLL fishery, 1997 – 2007, and percent change from 1997-99.**
Predicted values from Regulatory Amendment 1 where Pred [1] = without redistribution of effort, Pred [2] = with redistribution of effort.
Source: HMS logbook data.

Year	Pelagic Sharks kept	Pelagic Shark discards	Large Coastal Sharks kept	Large Coastal Shark discards	Dolphin kept	Dolphin discards	Wahoo kept	Wahoo discards	Blue Marlin discards	White Marlin discards	Sailfish discards	Spearfish discards	Sea Turtles
1997	5,110	82,022	13,746	7,869	63,530	1,204	4,787	91	2,309	2,436	1,765	384	267
1998	3,731	45,261	6,458	5,577	23,643	299	5,445	305	1,301	1,511	850	103	890
1999	2,852	28,995	6,375	5,477	31,960	321	5,285	128	1,253	1,971	1,411	151	632
2000	3,068	28,048	7,758	6,727	29,272	294	4,232	48	1,163	1,286	1,106	79	271
2001	3,511	23,954	6,510	4,892	27,914	329	3,084	62	659	874	358	142	421
2002	3,071	23,325	4,077	3,968	30,559	185	4,223	33	1,181	1,449	386	161	467
2003	3,129	21,771	5,332	4,882	29,609	452	4,020	126	606	813	280	114	399
2004	3,460	25,414	2,304	5,144	39,561	295	4,674	35	713	1,060	425	172	370
2005	3,150	21,560	3,365	5,881	25,709	556	3,360	280	569	990	367	155	154
2006	2,098	24,113	1,768	5,326	25,658	1,041	3,608	100	439	557	277	142	128
2007	3,504	27,478	546	7,133	68,124	467	3,073	52	611	744	321	147	300
Mean													
1997-99	3,898	52,093	8,860	6,308	39,711	608	5,172	175	1,621	1,973	1,342	213	596
A) 2001-03	3,237	23,017	5,306	4,581	29,361	322	3,776	74	815	1,045	341	139	429
B) 2005-07	2,917	24,384	1,893	6,113	39,830	688	3,347	144	540	764	322	148	194
% dif (A)	-17.0	-55.8	-40.1	-27.4	-26.1	-47.0	-27.0	-57.8	-49.7	-47.0	-74.6	-34.6	-28.1
% dif (B)	-25.2	-53.2	-78.6	-3.1	0.3	13.2	-35.3	-17.6	-66.7	-61.3	-76.0	-30.4	-67.5
Pred [1]	-9.5	-2.0	-32.1	-42.5	-29.3				-12.0	-6.4	-29.6		-1.9
Pred [2]	4.1	8.4	-18.5	-33.3	-17.8				6.5	10.8	-14.0		7.1

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