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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 HMS Management and HMS Fisheries

Atlantic (Highly Migratory Species) HMS fisheries are managed directly by the Secretary of Commerce, who designated that responsibility to the National Marine Fisheries Service (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 are not the Magnuson-Stevens Act or ATCA. Because of their migratory nature, HMS fishery management requires 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 unless that state has more restrictive regulations. Additionally, in 2005, the Atlantic States Marine Fisheries Commission agreed to develop an interstate coastal shark FMP. Once complete, this interstate FMP would coordinate management measures among all states along the Atlantic coast (Florida to Maine). NMFS is participating in the development of this interstate FMP.

Generally, on the domestic level, NMFS implements international agreements, as appropriate, 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 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 the NMFS regarding shark regulations. NMFS will share this draft FMP amendment with the states and will work with states, to the extent practicable, to ensure complementary regulations. See Section 3.1.3 for more information regarding state regulations by state.

On the international level, NMFS participates in the stock assessments conducted by 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/. 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 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

Unless otherwise specified, the main sources of the following history are the 1993 Atlantic Shark Fishery Management Plan, the 1999 FMP for Atlantic Tunas, Swordfish, and Sharks, and the 2006 Consolidated HMS FMP.

Recreational fishing for Atlantic sharks occurs in Federal and state waters from New England to the Gulf of Mexico and Caribbean Sea. In the past, sharks were often called "the poor man's marlin." Recreational shark fishing with rod and reel is now a popular sport at all social and economic levels, largely because of accessibility to the resource. Sharks can be caught virtually anywhere in salt water, with even large specimens available in the nearshore area to surf anglers or small boaters. Most recreational shark fishing takes place from small to medium-size vessels. 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 some shore-based fishermen active in the Florida Keys.

The commercial shark fishery has been sporadic in nature. 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 this 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).

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

The U.S. Atlantic shark fishery developed rapidly in the late 1970s due to increased demand for their meat, fins, and cartilage. At the time, sharks were perceived to be underutilized as a fishery resource. The high commercial value of shark fins led to the controversial practice of finning, or removing the valuable fins from sharks and discarding the carcass. Growing demand for shark products encouraged expansion of the commercial fishery throughout the late 1970s and the 1980s. Tuna and swordfish vessels began to retain a greater proportion of their shark incidental catch, and some directed fishery effort expanded as well. In January 1978, NMFS published the Preliminary Fishery Management Plan (PMP) for Atlantic Billfish and Sharks (43 FR 3818), which was supported by an EIS (42 FR 57716). This PMP was a Secretarial effort. The management measures contained in the plan were designed to:

1. minimize conflict between domestic and foreign users of billfish and shark resources;
2. encourage development of an international management regime; and
3. maintain availability of billfishes and sharks to the expanding U.S. fisheries.

Primary management measures in the Atlantic Billfish and Shark PMP included:

- Mandatory data reporting requirements for foreign vessels;
- A prohibition on the foreign commercial retention of all billfishes caught within the Fishery Conservation Zone (FCZ) of the United States and stipulated release in a manner that will maximize the probability of survival;
- A hard cap on the catch of sharks by foreign vessels, which when achieved would prohibit further landings of sharks by foreign vessels;
- Permit requirements for foreign vessels to fish in the FCZ of the United States;
- Radio checks by foreign vessels upon entering and leaving the FCZ;
- Boarding and inspection privileges for U.S. observers; and
- Prohibition on intentional discarding of fishing gears by foreign fishing vessels within the FCZ that may pose environmental or navigational hazards.

As catches accelerated through the 1980s, shark stocks suffered a precipitous decline. Peak commercial landings of large coastal and pelagic sharks were reported in 1989. 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. The management measures in the 1993 FMP included:

- Establishing a fishery management unit (FMU) consisting of 39 frequently caught species of Atlantic sharks, separated into three groups for assessment and regulatory purposes (Large Coastal Sharks (LCS), Small Coastal Sharks (SCS), and pelagic sharks);
- Establishing calendar year commercial quotas for the LCS and pelagic sharks and dividing the annual quota into two equal half-year quotas that apply to the following two fishing periods – January 1 through June 30 and July 1 through December 31;
- Establishing a recreational trip limit of four sharks per vessel for LCS or pelagic shark species groups and a daily bag limit of five sharks per person for sharks in the SCS species group;
- Requiring that all sharks not taken as part of a commercial or recreational fishery be released uninjured;
- Establishing a framework procedure for adjusting commercial quotas, recreational bag limits, species size limits, management unit, fishing year, species groups, estimates of maximum sustainable yield, and permitting and reporting requirements;
- Prohibiting finning by requiring that the ratio between wet fins/dressed carcass weight not exceed five percent;
- Prohibiting the sale by recreational fishermen of sharks or shark products caught in the Economic Exclusive Zone (EEZ);
- Requiring annual commercial permits for fishermen who harvest and sell shark (meat products and fins);
- Establishing a permit eligibility requirement that the owner or operator (including charter vessel and headboat owners/operators who intend to sell their catch) must show proof that at least 50 percent of earned income has been derived from the sale of the fish or fish products or charter vessel and headboat operations or at least $20,000 from the sale of fish during one of three years preceding the permit request;
- Requiring trip reports by permitted fishermen and persons conducting shark tournaments and requiring fishermen to provide information to NMFS under the Trip Interview Program; and,
- Requiring NMFS observers on selected shark fishing vessels to document mortality of marine mammals and endangered species.

At that time, NMFS identified 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 SCS. Under the rebuilding plan established in the 1993 FMP, the LCS

quota was expected to increase every year up to the maximum sustainable yield estimated in the 1992 stock assessment, which was 3,787 mt dw.

A number of difficulties arose in the initial year of implementation of the 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 for permitted vessels for LCS was implemented on December 28, 1993 (58 FR 68556), and a control date for the Atlantic shark fishery was established on February 22, 1994 (59 FR 8457). A final rule to implement additional measures authorized by the FMP published on October 18, 1994 (59 FR 52453), which:

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

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

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

In June 1998, NMFS held another LCS stock assessment. The 1998 stock assessment found that LCS were overfished and would not rebuild under 1997 harvest levels. Based in part on the results of the 1998 stock assessment, in April 1999, 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 1999, a court enjoined implementation of the 1999 regulations, as they related to the ongoing litigation on the 1997 quotas. Further history of this litigation and shark management is provided under Section 3.1.1.4 below. A year later, on June 12, 2000, 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).

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 HMS FMP began in September 1997 with the formation of the HMS Advisory Panel (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.

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 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. Before then, each species had its own part. This often led to confusion and, in some cases, conflicting regulations.

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 small coastal shark 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 HMS 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). 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 is occurring on finetooth sharks while the three other species in the SCS complex (Atlantic sharpnose, bonnethead, and blacknose) are not overfished and overfishing is not occurring. On October 17, 2002, NMFS announced the availability of the 2002 LCS stock assessment and the workshop meeting report (67 FR 64098). The results of this stock assessment indicate that the LCS complex is still overfished and overfishing is occurring. Additionally, the 2002 LCS stock assessment found that sandbar sharks are no longer overfished but that overfishing is still occurring and that blacktip sharks are rebuilt and overfishing is not occurring.

Based on the results of both the 2002 SCS and LCS stock assessments, 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, 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). These regulations were based on the 2002 small and large coastal shark 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 maximum sustainable yield (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 of North Carolina for BLL fishermen; and establishing 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 Fishery Conservation and Management 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 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 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. The 2006 Consolidated HMS FMP consolidated the management of all Atlantic HMS into once comprehensive FMP, and combined and simplified the objectives of the previous FMPs.

During the five-and-a-half years that these two FMPs co-existed, there was a growing recognition by the Agency of the interrelated nature of these fisheries and the need to consider management actions together. 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 the management of all HMS 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 final Consolidated HMS FMP changed certain management measures, adjusted regulatory framework measures, and continued the process of updating HMS EFH. Measures that were specific to the shark fisheries included mandatory workshops and certifications for all vessel owners and operators that have PLL or BLL gear on their vessels and that had been issued or were required to be issued any of the HMS limited access permits (LAPs) to participate in HMS longline and gillnet fisheries. These workshops provide information and ensure proficiency with using required 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 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 2nd dorsal fin and the anal fin remain on all 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 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.

Recent 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 2007. During the first season of 2006, the South Atlantic region landed 278.2 percent (393.1 mt dw) of their LCS quota (141.3 mt dw) and 15.6 percent (44.5 mt dw) of their SCS quota (284.6). The Gulf of Mexico also landed 151.1 percent (336.6 mt dw) of their LCS quota (222.8 mt dw) and 527 percent (78 mt dw) of the SCS quota (14.8 mt dw). The North Atlantic region experienced underharvests for both their LCS and SCS quotas (landing approximately 3.8 percent and 0 percent, respectively). As a result of these extensive overharvests in 2006, NMFS closed the South Atlantic region to directed LCS fishing during the 2007 first season. NMFS transferred 63.2 mt dw of the South Atlantic's regional SCS underharvest in the 2006 first season to the Gulf of Mexico, allowing a first season SCS fishery in both regions. This afforded the Gulf of Mexico region its baseline SCS quota of 15.1 mt dw in the 2007 first season. This rule also gave NMFS the flexibility to open the mid-Atlantic shark closed area during the month of July in 2007, pending available quota. Although the South Atlantic region was closed to LCS fishing in the first season of 2007, there is still overharvest from the first season in 2006 that needs to be addressed.

NMFS recently (72 FR 5633, February 7, 2007) expanded the equipment required for the safe handling, release, and disentanglement of sea turtles caught in the Atlantic shark BLL fishery. 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 spawning areas and EFH consistent with the Caribbean Fishery Management Council Sustainable Fisheries Act (SFA) amendment.

3.1.2 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. 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. 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.

3.1.2.1 Atlantic Sharks

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 calls 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 requires a data prepatory meeting to be held in 2007 to review all relevant data on biological parameters, catch, effort, discards, trade, and historical data.

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, 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.

3.1.3 Existing State Regulations

Table 3-1 outlines the existing State regulations as of April 19, 2007, with regard to shark species. The HMS Management Division updates this table periodically throughout the year. 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 Sharks, as of April 19, 2007.** 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	Regulations apply to coastal sharks and Spiny dogfish. Regulations prohibit dogfish & shark finning; dogfish trip limit and matches federal closures.	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 CMRs available online at http://www.mass.gov/dfwele/dmf/commercialfishing/cmr_index.htm	Regulations apply to Spiny 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 April Valliere Phone: 401-423-1939 FAX: 401-423-1925
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 Gordon Colvin Phone: 631/444-0435 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 Additional contact: Peter Clarke 609 748-4334
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 Reg. title 8, § 02.05.17	Recreational: min size - 54" FL or 31" carcass; 1 shark/vessel/trip; 1 Atlantic sharpnose/person/trip with no min size; Commercial: 4000 lbs/day; Finning and longline prohibition; Prohibited Species are same as Federal regulations.	MD Department of Natural Resources Harley Speir Howard King Phone: 410/260-8264

State	Cite Reference	Regulatory Details	Contact Information
VA	4 VA Administrative Code 20-490	Recreational regulations are identical to Federal regulations for restricted species, species groupings, and possession limits. The only difference between VA and Federal recreational shark regulations is that VA allows fishermen to remove the head and the tail, but the CL must be at least 30 inches. If whole, must be 54 inches, just like the Federal regulations. For smooth and spiny dogfish, same as Federal regulation. Commercial regulations (for all non smooth or spiny dogfish)—east of the COLREGS line—are identical to Federal regulations (VA does not require fishermen to have the Federal permit), all other restrictions—same as Federal regulations. One exception: when Federal waters are closed, VA does not close. Commercial regulations (for all non smooth or spiny dogfish)—west of COLREGS line—same as above, except VA established a 58 inch FL or 31 inch CL minimum size limit and there is no tolerance for an under-sized shark. Smooth dogfish – identical to Federal regulations. Spiny dogfish – VA is complying with the ASMFC spiny dogfish FMP. VA is near to adopting a 3,000 pound possession limit. Fishing periods and division of yearly quota in the ASMFC FMP are same as Federal, but the ASMFC TAC is 2 million pounds greater for this fishing year (2007). When the quota for either fishing period has been determined to be caught, further state landings prohibited. All spiny dogfish are required to be sold to Federally permitted dealers. Gear restrictions—1. no longlining in any state waters; 2. large mesh gill net restrictions (>7 inches) for protected resources (sea turtles and bottlenose dolphin) are in place much of the warm months of the year.	VA Marine Ressources Commission Lewis Gillingham Phone: 757/247-2243 Fax: 757/247-2020

State	Cite Reference	Regulatory Details	Contact Information
NC	NC Administrative Code tit. 15A, r.3M.0505; Proclamation FF-38-2006 * Modify closed area off NC to allow fishing outside 15 fathoms during 1st trimester (Jan 1 - Feb 15)	Director may impose restrictions for size, seasons, areas, quantity, etc. via proclamation; Commercial: open seasons and species groups same as Federal; 4000 lb trip limit for LCS; 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 Louis B. Daniel III 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; Illegal in state waters to harvest/retain sharks taken in gillnet; Annual state permit required in addition to federal permit to take sharks for commercial purposes in state waters	SC Department of Natural Resources Mel Bell Phone: 843/953-9007 Fax: 843/953-9386
GA	GA Code Ann. § 27-4-130.1; OCGA § 27-4-7(b); GA Comp. R. & Regs. § 391-2-4-.04	Gear Restrictions/Prohibitions - Use of gillnets is prohibited in state waters. Sharks – 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 Atlantic sharpnose) 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 gillnets.	GA Department of Natural Resources Phone: 912/264-7218 Fax: 912/262-3143

State	Cite Reference	Regulatory Details	Contact Information
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. Spiny dogfish is prohibited.	FL Fish and Wildlife Conservation Commission Lisa Gregg Phone: 850/488-6058 Fax: 850/488-7152
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 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: 4,000 lb LCS trip limit, no min size; Com & Rec Harvest Prohibited: 4/1-6/30; Prohibition: same as Federal regulations, as well as smalltooth and largetooth sawfish	LA Department of Wildlife and Fisheries Harry Blanchet 225/765-2889 fax 225/765-2489
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 Mike Buchanan 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.	TX Parks & Wildlife Aaron Reed (Austin) Phone: 512/389-8046 Fax: 512/389-4450 Mark Lingo (Brownsville) Phone: 956/350-4490

State	Cite Reference	Regulatory Details	Contact Information
Puerto Rico	Regulation #6768 Article 8 – General Fishing Limits Article 13 – Limitations Article 17 – Permits for Recreational Fishing	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.	Puerto Rico Department of Natural and Environmental Resources Craig Lilyestrom Phone: 787-724-8774 x4042 craig@caribe.net
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.	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 Tunas, Swordfish, and Shark 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 1 of the Magnuson-Stevens Act (Restrepo *et al.*, 1998). These thresholds will not change as a result this Amendment 2 to the 2006 Consolidated HMS FMP.

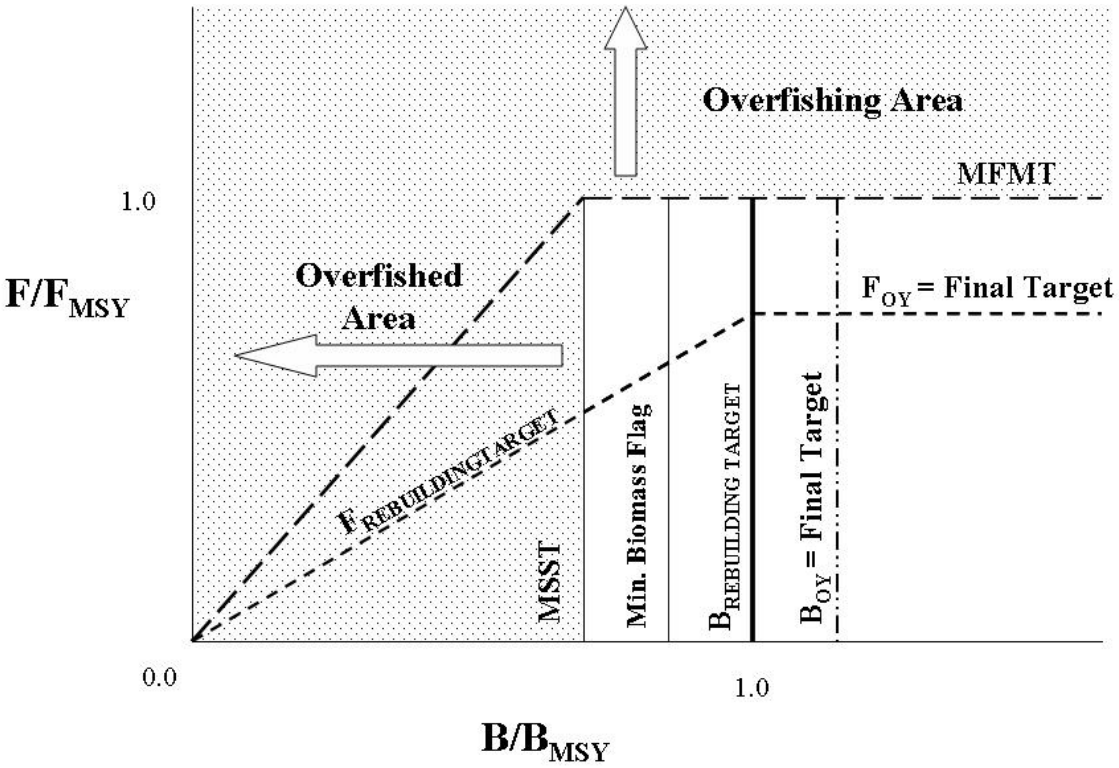

Figure 3-1 Illustration of the status determination and rebuilding terms.

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 maximum sustainable yield (B_{MSY}). Maximum sustainable yield (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.

This Amendment 2 to the Consolidated HMS FMP does not change these threshold levels. The current status of shark stocks is provided in Table 3-2 below. The currently ongoing SCS stock assessment is expected to be final in 2007, which could change this status. The results of the SCS stock assessment will not be considered complete until the review workshop document is finalized, likely in summer 2007.

Table 3-2 Stock Status Summary Table for LCS, Sandbar, Blacktip, Dusky, and Porbeagle Sharks.

Species	Current Relative Biomass Level	Current Biomass B_{YEAR}	N_{MSY}	Minimum Stock Size Threshold (MSST)	Current Relative Fishing Mortality Rate	Maximum Fishing Mortality Threshold (F_{MSY})	Outlook
Sandbar Sharks	*SSF_{2004}/SSF_{MSY}=0.72	3.06E+07	5.94E+05	4.75 - 5.35E+05	F_{2004}/F_{MSY} = 3.72	0.015	Overfished; Overfishing is occurring
Gulf of Mexico Blacktip Sharks**	*SSF_{2004}/SSF_{MSY}= 2.54 - 2.56	1.33E+08 – 1.93E+09	1.23 – 1.78E+07	0.99 - 1.07E+07	F_{2004}/F_{MSY} = 0.03-0.04	0.20	Not overfished; No overfishing is occurring
Atlantic Blacktip Sharks	unknown	unknown	unknown	unknown	unknown	unknown	unknown
Dusky Sharks**	B_{2003}/B_{MSY}= 0.15 - 0.47	687,290	4,409,144	unknown	F_{2003}/F_{MSY}=1.68-1,810	0.00005 – 0.0115	Overfished; Overfishing is occurring
LCS Complex	unknown	unknown	unknown	unknown	unknown	unknown	unknown
Porbeagle Sharks	*SSN_{2004}/SSN_{MSY} = 0.15 – 0.32	5,520-12,945	29,382 – 40,670	unknown	F_{2004}/F_{MSY} = 0.83	0.033 – 0.065	Overfished; overfishing is not occurring

*Spawning stock fecundity (SSF) or spawning stock number (SSN) was used as a proxy of biomass since biomass (B) does not influence pup production in sharks.
** Ranges of values are provided for these species because the assessment did not recommend a specific value for that parameter, rather the ranges reflect high and low estimates of different outputs achieved from numerous models that were employed.

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 (*Carcharhinus plumbeus)* (Casey and Hoey, 1985; Sminkey and Musick, 1995; Heist *et al*., 1995), lemon (*Negaprion brevirostris)* (Brown and Gruber, 1988), and bull sharks (Branstetter and Stiles, 1987), do not reach maturity until 12 to 18 years of age. Various factors determine this low reproductive rate: slow growth, late sexual maturity, one to two-year reproductive cycles, a small number of young per brood, and specific requirements for nursery areas. These biological factors leave many species of sharks vulnerable to overfishing.

There is extreme diversity among the 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 (*Carcharhinus leucas)*, and great hammerhead (*Sphyrna mokarran*). Some shark species reproduce by laying eggs, others nourish their embryos through a placenta. Despite their diversity in size, feeding habits, behavior and reproduction, many of these adaptations have contributed greatly to the evolutionary success of sharks.

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 (*Carcharhinus limbatus*), finetooth, bull, lemon, and sharpnose sharks (*Rhizoprionondon terraenovae*). 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 (*Isurus oxyrinchus*), blue (*Prionace glauca*), and oceanic whitetip (*Carcharhinus longimanus*) 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 Atlantic States Marine Fisheries Commission 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 groups for management: (1) large coastal sharks, (2) small coastal sharks, (3) pelagic sharks, and (4) prohibited species (Table 3-3).

Table 3-3 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
Large Coastal Sharks (11)	Sandbar, silky, tiger, blacktip, bull, spinner, lemon, nurse, smooth hammerhead, scalloped hammerhead, and great hammerhead sharks
Small Coastal Sharks (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 sandtiger, 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 (Cortes, 2002; Cortes *et al*., 2002). ICCAT and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) have recently conducted assessments of three pelagic shark species. Stock assessments were conducted for LCS in 2006, and the SCS stock assessment will be finalized during the summer of 2007. NMFS also recently released a stock assessment for dusky sharks (May 25, 2006, 71 FR 30123). Species-specific assessments for blacktip and sandbar sharks within the LCS complex and finetooth sharks, Atlantic sharpnose sharks, blacknose sharks (*Carcharhinus acronotus*), and bonnethead sharks (*Sphyrna tiburo*) within the SCS complex, were conducted in 2002. The conclusions of these assessments are fully described in Amendment 1 to the 1999 Atlantic Tunas, Swordfish, and Sharks FMP. Summaries of recent stock assessments and reports on several species of pelagic sharks (blue sharks, shortfin mako sharks, and porbeagle sharks (*Lamna nasus*) by COSEWIC and ICCAT are also included in this section.

3.2.1.3 Large Coastal Sharks

The 2005/2006 stock assessment for LCS follows the Southeast Data, Assessment, and Review (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.

The latest 2005/2006 stock assessments for LCS in the Gulf of Mexico and Atlantic Ocean were recently completed. 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 this stock assessment, sandbar sharks (*Carcharhinus plumbeus*) 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: Gulf of Mexico and Atlantic. 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 advise an increase in catch.

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). The 2006 dusky shark stock assessment used data through 2003 and indicates that dusky sharks

(*Carcharhinus obscurus*) are overfished (B_{2003}/B_{MSY} = 0.15 – 0.47) with overfishing occurring (F_{2004}/F_{MSY} = 1.68 – 1810). 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).

3.2.1.4 Small Coastal Sharks

The 2007 stock assessment for SCS is currently underway. This assessment follows the SEDAR process. The SCS Data Workshop was held February 5-9, 2007 at the Bay Point Marriott Resort in Panama City, Florida. The SCS Assessment Workshop was held May 7-11, 2007 and the SCS Review Workshop is scheduled for Aug 6-10, 2007. After that date, a completed assessment will be released.

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

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

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

Table 3-4 Summary Table of Biomass and Fishing Mortality for Small Coastal Sharks (SCS). Source: Cortes, 2002.

Species	Current Relative Biomass Level	Current Biomass B_{YEAR}	N_{MSY}	Minimum Stock Size Threshold (MSST)	Current Relative Fishing Mortality Rate	Maximum Fishing Mortality Threshold (F_{MSY})	Outlook
Small Coastal Sharks (SCS)	1.38-2.39	77.1 – 83.8	7.0 – 2.2 mill lb dw	16.2-50.2	0.27 – 0.78	0.04 – 0.28	Not overfished; overfishing is not occurring
Bonnethead Sharks	1.46-2.78	4.6 – 9.2	1.8 – 0.5 mill lb dw	2.3-7.3	0.35 – 0.56	0.05 – 0.53	Not overfished; overfishing is not occurring
Atlantic Sharpnose Sharks	1.69-3.16	72.7 – 73.2	7.8 – 1.9 mill lb dw	11.5-33.4	0.14 – 0.42	0.04 – 0.42	Not overfished; overfishing is not occurring
Blacknose Sharks	1.92-3.15	10.4	0.8 – 0.2 mill lb dw	1.6-4.5	0.61 – 0.65	0.03 – 0.32	Not overfished; overfishing is not occurring
Finetooth Sharks	1.39 – 2.37	1.9 – 2.3	0.26 – 0.05 mill lb dw	0.4 – 1.4	3.42 – 4.13	0.03 – 0.42	Not overfished; 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.

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 plans to conduct another

assessment of Atlantic pelagic sharks beginning in 2008. All SCRS stock assessments can be found at http://www.iccat.es/assess.htm.

ICCAT Stock Assessment on Blue and Shortfin Mako Sharks

At the 2004 Inter-Sessional Meeting of the ICCAT Subcommittee on bycatch, stock assessments for Atlantic blue shark and shortfin mako were conducted. 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 assessment indicated that the current biomass of North and South Atlantic blue shark seems to be above MSY ($B>B_{MSY}$), however, these results are conditional and based on assumptions that were made by the committee. These assumptions indicate that blue sharks are not currently overfished, however, this conclusion is conditional and based on limited landings data. The committee estimates that between 82,000 and 114,000 mt ww (180,779,054 – 251,326,978 lb) of blue shark are harvested from the Atlantic Ocean each year.

The North Atlantic shortfin mako population has experienced some level of stock depletion as suggested by the historical CPUE trend and model outputs. The current stock may be below MSY ($B<B_{MSY}$), suggesting that the species may be overfished. Overfishing may also be occurring as between 13,000 and 18,000 mt ww (28,660,094 – 39,683,207 lb) of shortfin mako are harvested in the Atlantic Ocean annually. South Atlantic stocks of shortfin mako shark are likely fully exploited as well, but depletion rates are less severe than in the North Atlantic.

The results of both of these assessments should be considered preliminary in nature due to limitations on quality and quantity of catch data available (SCRS, 2004). The subcommittee stated that catch data currently being reported to ICCAT does not represent the total catch actually landed, and are very limited with regard to size, age, and sex of shark harvested or caught incidentally. In order to attain a more accurate estimate of total landings, and improve future stock assessments, the committee made several recommendations, including: increase the infrastructure investment for monitoring the overall catch composition of sharks, standardize catch per unit effort (CPUE) from major fishing fleets, expand use of trade statistics (fins) to extend historical time series, and include scientists from all Contracting Parties with significant blue and shortfin mako catches in future assessments (SCRS, 2004). ICCAT is holding pelagic shark (blue and shortfin mako) data review meetings in fall 2007. Based upon data presented at the review meetings, ICCAT will confirm pelagic shark assessments scheduled for 2008.

COSEWIC Stock Assessment on Porbeagle

COSEWIC conducted a species report and assessment for porbeagle in 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, both on the commercial fishing industry and on the government who would have to expend over $50,000 annually in monitoring funds (Canada Gazette 2006; http://canadagazette.gc.ca/partII/2006/20060906/html/si110-e.html).

Canada 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, 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 deems it to be the best available science and appropriate to use for U.S. domestic management purposes. The Canadian assessment indicates that porbeagle sharks are overfished (SSN_{2004}/SSN_{MSY} = 0.15 – 0.32; SSN is spawning stock number and used as a proxy for biomass). However, the Canadian assessment indicates that overfishing is not occurring (F_{2004}/F_{MSY} = 0.83). Based on these results, NMFS declared the status of porbeagle sharks as overfished, but overfishing is not occurring (71 FR 65086).

3.2.1.6 Effects of Regulations

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 limited access permitting system in commercial fisheries; and establishing season-specific over- and under-harvest 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 Magnuson Stevens Act, Endangered Species Act, Marine Mammal Protection Act, and the National Environmental Policy Act. 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 (long handled line cutters and dipnets); 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 is accomplished through numerous measures, including, but not limited to: regional and trimester fishing quotas based on MSY; regional and trimester 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 is accomplished by the requirement to possess a limited access permits for commercial shark fisheries and upgrading restrictions for transferred permits. Reducing fishing mortality of prohibited dusky sharks and juvenile sandbar sharks is 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. Results of these stock assessments indicate the SCS complex is not overfished (*e.g.*, depleted in abundance) and overfishing is not occurring; the LCS complex continues to be overfished, and overfishing is occurring; sandbar sharks are not overfished, but overfishing is occurring; blacktip shark stocks are rebuilt and healthy; and finetooth sharks are not overfished, but overfishing is occurring. 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: re-aggregating the large coastal shark complex; using maximum sustainable yield (MSY) as a basis for setting commercial quotas; eliminating the commercial minimum size restrictions; implementing a commercial trip limit for LCS and SCS; implementing trimester commercial fishing seasons effective January 1, 2005; imposing gear restrictions to reduce bycatch; implementing a time/area closure off the coast of North Carolina effective January 1, 2005; and establishing three regional commercial quotas (Gulf of Mexico, South Atlantic, and North Atlantic) for LCS and SCS management units. For more detail on the management history surrounding shark regulations see Section 3.1.

As a result of using the MSY as a basis for setting quotas and implementing a new rebuilding plan, the overall quota for LCS in later years, such as 2004, of 1,017 metric tons (mt) dressed weight (dw) (2.24 million lbs dw) was lower than both the 2002 LCS quota of 1,285 mt dw (2.83 million lbs dw) and the 2003 LCS quota of 1,714 mt dw (3.78 million lbs dw). The annual SCS quota is 454 mt dw per year. The annual quotas for pelagic sharks are 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.

Shark landings are monitored for adherence to regional and trimester quotas by requiring the submission of shark dealer landings reports every two weeks. Fishermen must also submit trip reports describing target and incidental landings within seven days of offloading. These data are used for stock assessments. Regulations are subject to change based on stock assessments, international obligations, litigation, and public sentiment. An updated LCS stock assessment became available in 2006 and data workshops for an updated SCS stock assessment began in early 2007. Domestic management measures affecting the U.S. shark fishery are constantly being evaluated for their effectiveness; furthermore, the United States is taking steps to improve the conservation and management of pelagic sharks within international fora, including ICCAT.

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 includes, 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 calls 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 requires a data prepatory meeting to be held in 2007 to review all relevant data on biological parameters, catch, effort, discards, trade, and historical data.

3.2.1.7 Recent and Ongoing Research

Northeast Fisheries Science Center (NEFSC)

Fishery Independent Survey for Coastal Sharks

The biannual fishery-independent survey of Atlantic large and small coastal sharks in U.S. waters from Florida to Delaware was conducted from April 19 to June 1, 2004. The goals of this survey were to: (1) monitor the species composition, distribution, and abundance of sharks in the coastal Atlantic; (2) tag sharks for migration studies; (3) collect biological samples for age and growth, feeding ecology, and reproductive studies; (4) tag sharks whenever feasible for age validation studies; and (5) collect morphometric data for other studies. Results from the 2004 survey included 557 sharks representing eight species caught on 69 longline sets. The time series of abundance indices from this survey are critical to the evaluation of coastal Atlantic shark species.

Age and Growth of Coastal and Pelagic Sharks

A comprehensive aging and validation study for the shortfin mako continued in conjunction with scientists at Moss Landing Marine Laboratories, California, using bomb carbon techniques. Additional validation studies were begun on the sandbar shark, dusky shark, tiger shark, and white shark (*Carcharodon carcharias*). Age and growth studies on the tiger shark (with scientists at the University of New Hampshire), thresher shark (*Alopias vulpinus*, with scientists at the University of Rhode Island), night shark (*Carcharhinus signatus*, with NMFS scientists at the SEFSC Panama City Laboratory), and bull shark (with scientists with the Florida Division of Natural Resources) are under way. Collection, processing, photographing, and reading of samples are in various stages for these species, including intercalibration of techniques, criteria, and band readings. This intercalibration process involves sharing samples and comparing counts between researchers, including a researcher from the Natal Sharks Board, South Africa, for joint work on shortfin mako, blue, and basking shark band periodicity. Collections of vertebrae took place at tournaments and on the biannual research cruise, with 285 sharks injected with oxytetracycline for validation. Night and dusky sharks were prepared with gross sectioning to determine the best method for reading, and all processing was initiated using histology. Readings were completed on the thresher and tiger sharks toward intercalibration to

generate bias graphs. Vertebrae, length-frequency data, and tag/recapture data collected from 1962 to present are being analyzed on each of these species to obtain growth parameters.

Biology of the Thresher Shark

Life history studies of the thresher shark continued. Data collection was augmented to include reproductive and food habits, in addition to age and growth information.

Biology of the Porbeagle Shark

A cooperative U.S.–Canada research program continued on the life history of the porbeagle shark (*Lamna nasus*), with preliminary analysis of porbeagle tagging and recapture data using information from U.S., Canadian, and Norwegian sources.

Collection of Recreational Shark Fishing Data and Samples

Biological samples for age and growth, feeding ecology, and reproductive studies and catch data for pelagic sharks were collected at recreational fishing tournaments in the Northeast. Analysis of these tournament landings data was initiated by creating a database of historic information (1961–2004) and producing preliminary summaries of one long-term tournament. The collection and analysis of these data are critical for input into species- and age-specific population and demographic models for shark management.

Essential Fish Habitat and Shark Identification Updates

Through the cooperation of NMFS staff in the HMS Management Division and the Northeast Fisheries Science Center, updates of EFH maps began for shark using information from observer and tagging databases. In addition, a guide was published to aid in identification of sharks and other HMS.

Cooperative Shark Tagging Program (CSTP)

The CSTP — involving over 6,500 volunteer recreational and commercial fishermen, scientists, and fisheries observers since 1962—continued to tag large coastal and pelagic sharks and provide information to define essential fish habitat for shark species in U.S. Atlantic and Gulf of Mexico waters.

Atlantic Blue Shark Life History and Assessment Studies

A collaborative program to examine the biology and population dynamics of the blue shark, in the North Atlantic is ongoing. Research on the food and feeding ecology of the blue shark is being conducted cooperatively with University of Rhode Island staff with additional samples collected and a manuscript under revision. A detailed reexamination of the reproductive parameters of the blue shark continued with collection of additional biological samples to determine if any changes have occurred since the 1970s. A manuscript on blue shark stock structure based on tagging data was completed, detailing size composition and movements between Atlantic regions. In addition, research focused on the population dynamics in the North Atlantic with the objectives of constructing a time series of blue shark catch rates (CPUE) from

research surveys, estimation of blue shark migration and survival rates, and the development of an integrated tagging and population dynamics model for the North Atlantic for use in stock assessment continued in collaboration with scientists at the School of Aquatic and Fishery Sciences, University of Washington. Progress, to date, includes the preliminary recovery of historical research survey catch data, size composition, and biological sampling data on pelagic sharks and preliminary analysis of survival and movement rates for blue sharks based on tag and release data from the NMFS CSTP. Preparation of standardized catch rate and size composition data compatible with PLL observer data continued with a resulting ICCAT submission. As part of this comprehensive program, cooperative research continued with the Irish Marine Institute and Central Fisheries Board on mark-recapture databases, including coordination of formats and programs with the NMFS CSTP for joint data analyses.

Atlantic Shortfin Mako Life History and Assessment Studies

A collaborative program with students and scientists at the University of Rhode Island to examine the biology and population dynamics of the shortfin mako in the North Atlantic was continued. Ongoing research included an update on age and growth and reproductive parameters and an examination of the predator–prey relationships between the shortfin mako and its primary prey, the bluefish (*Pomatomus saltatrix*). A manuscript was completed comparing contemporary and historic levels of bluefish predation. Future research includes the estimation of shortfin mako migration rates and patterns and survival rates using CSTP mark-recapture data and satellite tags with movements correlated with Advanced Very High Resolution Radiometer (AVHRR) sea surface temperature data. Toward these goals, two shortfin mako sharks were tagged with pop-up archival transmitting tags.

Blacktip Shark Migrations

Analysis is ongoing of movements of the blacktip shark (*Carcharhinus limbatus*) in the western North Atlantic and Gulf of Mexico based on release and re=capture data, with the examination of general migration patterns and exchange between and within regions of United States and Mexican waters. Release and re-capture data were analyzed for evidence of Atlantic and Gulf of Mexico primary and secondary blacktip nursery grounds.

Cooperative Atlantic States Shark Pupping and Nursery Survey (COASTSPAN)

NEFSC Apex Predators Program staff manage and coordinate this project, using researchers in major coastal Atlantic states from Florida to Delaware to conduct a cooperative, comprehensive, and standardized investigation of valuable shark nursery areas. This research identifies which shark species utilize coastal zones as pupping and nursery grounds, gauges the relative importance of these areas, and determines migration and distribution patterns of neonate and juvenile sharks.

Juvenile Shark Survey for Monitoring and Assessing Delaware Bay Sandbar Sharks

NEFSC staff conducts this part of the COASTSPAN monitoring and assessment project for the juvenile sandbar shark population in the Delaware Bay nursery grounds using monthly longline surveys from June to September each year. A random stratified sampling plan based on depth and geographic location is ongoing to assess and monitor the juvenile sandbar shark

population during the nursery season. In addition, the tagging and recapture data from this project are being used to examine the temporal and spatial relative abundance and distribution of sandbar sharks in Delaware Bay.

Habitat Utilization, Food Habits, and Essential Fish Habitat of Delaware Bay Sandbar and Smooth Dogfish Sharks

The food habits portion of the study characterizes the diet, feeding periodicity, and foraging habits of the sandbar shark, and examines the overlap in diet and distribution with the smooth dogfish shark (*Mustelus canis*). Stomachs from over 800 sandbar sharks and over 200 smooth dogfish sharks have been sampled for contents through a non-lethal lavage method. Acquired data will be coupled with environmental data, providing information on preferred habitat. This information is an important contribution toward understanding EFH and provides information necessary for nursery ground management and rebuilding of depleted shark populations.

Ecosystems Modeling

Ecosystem modeling, focusing on the role of sharks as top predators, will be conducted using ECOPATH–ECOSIM models, using the sandbar shark as a model species and examining the ecological interactions between sandbar and smooth dogfish sharks in Delaware Bay.

Overview of Gulf and Atlantic Shark Nurseries

To meet the need for a better understanding of shark nursery habitat in U.S. coastal waters, NEFSC staff are the editors for an American Fisheries Society symposium proceedings volume on U.S. Atlantic and Gulf of Mexico coastal shark nursery ground and habitat studies.

Hueter, RE, JL Castillo–Geniz, JF Marquez–Farias, and JP Tyminski. 2006. *The use of Laguna Yalahau, Quintana Roo, Mexico as a primary nursery for the blacktip shark (*Carcharhinus limbatus*)*. In: Shark Nursery Grounds of the Gulf of Mexico and the East Coast of the United States. C. McCandless, N. Kohler and H.L. Pratt (eds.). Special Publication of the American Fisheries Society. In press.

Abstract: Mexican coastal waters of the Gulf of Mexico serve as nursery areas for many shark species and traditional fishing grounds for artisanal fishermen. To characterize the use of these areas as shark nurseries, obtain information on the biology of juvenile sharks and understand the fishing pressure on these resources, a bi-national study was conducted in Laguna Yalahau, a shallow coastal lagoon located on the northeastern corner of the Yucatan peninsula. Using primarily gillnet surveys and tagging of juvenile sharks during the late spring months of May-June, we conducted six expeditions inside the lagoon from 1995-2001. Sixty-seven species of teleosts, elasmobranchs and other marine vertebrates comprising 5,590 individuals were collected during the surveys. We captured 1,384 sharks of which 99% were neonate, young-of-the-year (YOY) or older juvenile blacktip sharks, *Carcharhinus limbatus*, confirming that Laguna Yalahau is a primary nursery for that species. Other sharks collected were lemon (*Negaprion brevirostris*), bonnethead (*Sphyrna tiburo*), nurse (*Ginglymostoma cirratum*),

and Atlantic sharpnose (*Rhizoprionodon terraenovae*) sharks. Using the Petersen method during 2000 and 2001, we calculated the population size of newborn blacktip sharks being sampled in the lagoon to be 726 and 1,057, respectively. Over the course of the study 1,154 sharks were tagged and released. The recapture rate of tagged sharks by artisanal fishermen was 21.9%, more than five times the rate for similar sharks off the Florida coast, and all recaptures came from the coast of the Yucatan peninsula. In light of this high recapture rate, it appears that Laguna Yalahau serves as a primary nursery for sharks that are heavily exploited by Mexican artisanal fishermen.

Hueter, RE and JP Tyminski. 2006. Species-specific distribution and habitat characteristics of shark nurseries in Gulf of Mexico waters off peninsular Florida and Texas. In: Shark Nursery Grounds of the Gulf of Mexico and the East Coast of the United States. C. McCandless, N. Kohler and H.L. Pratt (eds.). Special Publication of the American Fisheries Society. In press.

Abstract: At least 16 species of coastal sharks from four families (Carcharhinidae, Sphyrnidae, Ginglymostomidae, Triakidae) utilize Gulf of Mexico waters off Florida and Texas as primary and/or secondary nursery areas. From 1991-2004, data were collected on 12,879 neonates, young-of-the-year (YOY) and older juveniles of these 16 species in the U.S. Gulf of Mexico, primarily in coastal waters of the Florida peninsula and secondarily along the Texas coast. Five main areas of Florida (Yankeetown, Tampa Bay, Charlotte Harbor, Ten Thousand Islands, and Florida Keys) and three areas of Texas (Sabine Pass, Matagorda Bay, and Corpus Christi) were studied as shark nurseries. In general, most pupping activity in these Gulf nurseries occurs in the late spring and early summer and the neonate and YOY animals inhabit the primary nurseries throughout the summer and into the fall. Declining water temperatures in the fall typically are associated with the exit of sharks from these natal inshore waters. In some cases, annual cycles of philopatric behavior are indicated whereby juveniles of both large and small coastal species migrate back to the nurseries in spring and summer. In these cases, primary nurseries for neonates and YOY may function additionally as secondary nurseries for older juveniles. The importance of Florida and Texas coastal habitats in the early life history of Gulf of Mexico sharks underscores the need for conservation of these areas to help rebuild depleted shark populations.

Gelsleichter, J., NJ Szabo, and JJ Morris. 2006. *Organochlorine contaminants in juvenile sandbar (*Carcharhinus plumbeus*) and blacktip (*Carcharhinus limbatus*) sharks from major nursery areas on the east coast of the United States. In: Shark Nursery Grounds of the Gulf of Mexico and the East Coast of the United States.* C. McCandless, N. Kohler and H.L. Pratt (eds.). Special Publication of the American Fisheries Society. In press.

Heupel, MR. 2006. *Exiting Terra Ceia Bay: examination of cues stimulating migration from a summer nursery area*. In: Shark Nursery Grounds of the Gulf of Mexico and the East Coast of the United States. C. McCandless, N. Kohler and H.L. Pratt (eds.). Special Publication of the American Fisheries Society. In press.

Abstract: The use of a summer nursery ground by the blacktip shark (*Carcharhinus limbatus*) was examined to define the period of residency within the nursery and potential cues for emigration from the area. Newborn sharks were fitted with acoustic tags in each of four consecutive years and continuously monitored using an array of acoustic monitors. The duration of residency in the summer nursery was different between years. Individuals were born at the same time each year, but the last animals left between October and late November. Male sharks left the summer nursery on average a month earlier than females. It is unclear why this difference occurred. Two physical factors – day length and water temperature – were examined to determine if sharks used these cues to time their departure from the nursery. The day-length at which sharks left the nursery were different between years, and varied from 10.6 to 11.2 h. The water temperature at which sharks left the nursery was also different between years. However, departures of sharks were closely correlated with rapid drops in water temperature. These drops in temperature were caused by the passage of cold fronts, and resulted in drops of up to 5 °C over two days. It was concluded that these drops in temperature were the primary cue that juvenile blacktip sharks used to time their emigration from the nursery area. The results of this study provide new insights into the utilization of essential habitat for young sharks and the cues that they use to leave these areas.

Other Shark Research in Press

Hueter, RE, and CA Simpfendorfer. 2006. *Trends in blue shark abundance in the western North Atlantic as determined by a fishery-independent survey*. In: Sharks of the Open Ocean, E. Pikitch and M. Camhi (eds.) In press.

Abstract: The blue shark (*Prionace glauca*, Carcharhinidae) is the most abundant large, pelagic shark inhabiting upper oceanic waters. Because of its widespread distribution and its relatively high fecundity, the blue shark has been depicted by some as possibly being more resistant to the impacts of fishing pressure than other shark species. To test this hypothesis, we investigated historical trends in the abundance of blue sharks in the western North Atlantic during a period in which commercial and recreational catches of pelagic sharks were substantial. We used catch and effort data from the R.V. Geronimo, a fishery-independent longliner operating that operated consistently in the summer months from 1977 to 1994, in U.S. continental shelf waters off the southern coasts of Massachusetts, Rhode Island, and New York. In this area, male blue sharks were caught more often than females, and the catches included juveniles and adults of both sexes, but very few adult females. When catch per unit of effort (CPUE) of blue sharks was analyzed using a generalized linear model, male blue sharks showed an approximately 80% decline between the mid-1980s and the early 1990s. A significant change in female catch rates could not be demonstrated, primarily because of the fewer lower numbers of females in the catch. These results suggest that a dramatic decline occurred in the abundance of male blue sharks inhabiting a portion of the western North Atlantic. The broader significance of this finding result is not known, but it challenges the common view that the relatively prolific nature of these sharks makes them immune to the effects of overfishing.

Southeast Fisheries Science Center (SEFSC)

Stock Assessments of Large Coastal and Prohibited Sharks

The 2005/2006 assessment for the LCS Complex was run following, as close as possible, the procedures of the SEDAR process. The process involves three meeting workshops: Data, Assessment, and Review. The Data Workshop for the LCS complex was held in Panama City, FL, October 31 through November 4, 2005 (LCS05/06: Large coastal shark complex, blacktip and sandbar sharks; Large coastal shark complex data workshop report, 12 January 2006- SEDAR 11). Initial data compilations and exploratory analyses for SEDAR assessments were requested from participants in the form of "working documents" to be submitted in advance and evaluated over the course of the workshop. Three working groups were established to address the quality and suitability of available data for stock assessment. The working groups were: 1) life history, 2) catch statistics, and 3) indices of relative abundance. Participants were initially assigned to one of the groups based on their expertise and the type of documents they were submitting; however, participants were allowed to participate in any working group they wished. Group rapporteurs reported issues and progress to Data Workshop plenary sessions several times during the week. Written reports from the life history and catch statistics working groups were substantially complete by week's end, whereas the indices group report was only in the preliminary stages. There was some subsequent editing and further analyses sketched out during the Data Workshop that was completed later. Some additional analyses recommended at the Data Workshop were too extensive to allow completion prior to circulation of the Data Workshop report. These analyses were reported and evaluated at the Assessment Workshop that was held in February 2006, and reviewed at the Review Workshop in June 2006. A stock assessment of dusky shark, a prohibited species under the shark FMP and candidate for listing under the Endangered Species Act (ESA), was also almost completed and was to be released in FY06.

Update on Catches of Atlantic Sharks

An update on catches of large and small coastal and pelagic sharks in U.S. Atlantic, Gulf of Mexico, and Caribbean waters was generated in October 2006 (Updated catches of Atlantic sharks. 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 large coastal shark 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 bottom-longline observer program were also included. Another update on catches of Atlantic sharks will be generated in FY 2007.

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, finned, etc.). The target coverage level is 3.9 percent of the total fishing effort. 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 Marine Mammal Protection Act (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 Atlantic Large Whale Take Reduction Plan and the Biological Opinion 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. 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 is being developed to model the Gulf of Mexico ecosystem dynamics. Hypotheses regarding the depletion of apex predators, and their impact on predation mortality of major prey groups will be examined. Further, hypotheses regarding the role of complementary niches among sharks will be explored.

Elasmobranch Feeding Ecology and Shark Diet Database

The Consolidated HMS FMP gives little consideration to ecosystem function because there is little quantitative species-specific data on diet, competition, predator-prey interactions, and habitat requirements of sharks. Therefore, 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, I.E., Murie, D.J., Carlson, J.K.2006. Trophic dynamics of the Atlantic angel Shark in the northern Gulf of Mexico Abstract: American Society of Ichthyologists and Herpetologists/American Elasmobranch Society Annual meeting). The diet of the roundel skate *Raja texana* from the northern Gulf of Mexico is also being examined (Bethea, D.M., Hale, L. 2006. Diet of the roundel skate *Raja texana* from the northern Gulf of Mexico Abstract: American Society of Ichthyologists and Herpetologists/American Elasmobranch Society Annual meeting). A database containing information on quantitative food and feeding 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 in FY 2007 and will be 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 essential fish habitat 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.

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 Beck et al. (2001), 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, D.M., J.K. Carlson, J. Buckel, and M. Satterwhite. Ontogenetic and site-related trends in the diet of the Atlantic sharpnose shark from the northeast Gulf of Mexico. Bulletin of Marine Science 78(2): 287-307) concluded that Crooked Island Sound provided a greater "nursery value" than Apalachicola Bay, FL.

Determining differences in the ratios of fin to carcass weight among sharks

Although many different species are harvested for their fins, the "5 percent rule" was established using data from only sandbar sharks due to a lack of data for other shark species. Using standardized data collated from state and federal databases, additional fin weight ratios were calculated for several commercially valuable shark species from coastal waters of the U.S. Atlantic Ocean and Gulf of Mexico. The wet fin to dressed carcass weight ratio of the sandbar shark (5.3 percent) was the largest of the 14 species examined, while the silky shark exhibited the lowest ratio at 2.5 percent. The fin to dressed weight ratio of the sandbar shark was significantly higher than most of the other large coastal species examined, and the bonnethead shark had a fin weight ratio (4.9 percent) significantly higher than other small coastal species examined. Additional data will be gathered beginning in 2006 with the cooperation of the commercial shark industry, with the ultimate goal of developing a guide to fins and shark carcasses.

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, J.K. J.R. Sulikowski, and I.E. Baremore. In press. Do differences in life history exist for blacktip sharks, *Carcharhinus limbatus*, from the United States South Atlantic Bight and Eastern Gulf of Mexico? Environmental Biology of Fishes) and scalloped hammerhead sharks (Piercy, A., J.K. Carlson, J.R. Sulikowski, and G.M. Burgess. In press. Age and growth of the scalloped hammerhead shark, *Sphyrna lewini*, in the northwest Atlantic Ocean and Gulf of Mexico. Marine and Freshwater Research) 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, J.A. W.B. Driggers, T.S. Ford, R. Boonstra and J.K. Carlson. Reproductive cycle of the blacknose shark, *Carcharhinus acronotus*, in the Gulf of Mexico. Journal of Fish Biology). Along this line, new studies began in 2006 on the reproductive cycle of blacktip sharks in the Gulf of Mexico and sandbar sharks in the Atlantic Ocean.

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. A publication of this study is in press (Hale, L.F., J.V. Dudgeon, A.Z. Mason, and C. G. Lowe. Elemental signatures in the vertebral cartilage of the round stingray, *Urobatis halleri*, from Seal Beach, California, Environmental Biology of Fishes).

Cooperative Research—Habitat Utilization among Coastal Sharks

Through a collaborative effort between the SEFSC Panama City Shark Population Assessment Group and Mote Marine Laboratory, the utilization of coastal habitats by neonate and young-of-the-year blacktip and Atlantic sharpnose sharks will be monitored through an array of underwater acoustic receivers (VR2, Vemco Ltd.) placed throughout each study site. Movement patterns, home ranges, activity space, survival, and length of residence of individuals will be compared by species and area to provide information for better management of critical species and essential fish habitats.

Cooperative Research—Definition of Summer Habitats and Migration Patterns for Bull Sharks in the Eastern Gulf of Mexico

A collaborative effort between the SEFSC Panama City Shark Population Assessment Group, University of Florida, and Mote Marine Laboratory is under way to determine summer habitat use and short-term migration patterns of bull sharks. Sharks are being outfitted with pop-off satellite archival tags (PAT) during July and August and scheduled to deploy in autumn. Preliminary results indicate sharks, while occupying summer habitats, do not travel extensive distances. This project is driven by the lack of data for this species and its current prominence within the Florida coastal community. A better understanding of this species is required to effectively manage this species for both commercial and recreational fishers as well as the general public. Concerns regarding this species will continue to be an issue as fishers and the public demand that state and federal governments provide better information concerning the presence and movements of these sharks.

Shark Assessment Research Surveys

The SEFSC Mississippi Laboratories (MSL) 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 small coastal sharks 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, MSL 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.

3.3 Habitat

Section 303(a)(7) of the Magnuson-Stevens Act, 16 U.S.C. §§ 1801 *et seq*., as amended by the Sustainable Fisheries Act in 1996, requires 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 essential fish habitat:

> "Waters' include aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include aquatic areas historically used by fish where appropriate; 'substrate' includes sediment, hard bottom, structures underlying the waters, and associated biological communities; 'necessary' means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and 'spawning, breeding, feeding, or growth to maturity' covers a species' full life cycle."

The EFH regulations 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 are currently being identified and described as EFH 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, and more recently updated EFH for five shark species (blacktip, sandbar, dusky, nurse, and finetooth sharks) in Amendment 1 to the 1999

Tunas, Swordfish, and Shark FMP, which was implemented in 2003. The EFH regulations further 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 on November 7, 2006 (71 FR 65087). NMFS may recommend that certain EFH boundaries need to be modified in a subsequent rulemaking. At that time, alternatives for boundary modifications would be proposed. For a complete description of the comprehensive five-year review of all new EFH information see Chapter 10 and Appendix B of the 2006 Consolidated HMS FMP.

3.3.1.1 Habitat Areas of Particular Concern

To further the conservation and enhancement of EFH, the EFH guidelines encourage FMPs to identify Habitat Areas of Particular Concern (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, only one area for sandbar sharks off of North Carolina, Chesapeake Bay, MD, and Great Bay, NJ, has been identified as a HAPC for HMS (1999 FMP). Although no new HAPCs have been identified since the 1999 FMP, and no new HAPCs were proposed in the Consolidated HMS FMP, the information compiled during the review may be used to identify HAPC areas in the EFH Amendment.

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 is 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 exclusive economic zone (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; 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

Commercial shark fishing effort is generally concentrated in the southeastern United States and Gulf of Mexico (Cortes and Neer, 2002). During 1997 – 2003, 92 – 98 percent of LCS, 38 – 49 percent of pelagic sharks, and nearly all SCS (80 – 100 percent) came from the southeast region (Cortes, pers. comm.). 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. Bottom longline 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 finfishes 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. NMFS selects approximately 40 - 50 vessels for observer coverage during each season. Vessels are randomly selected if they have a directed shark limited access permit, 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 large coastal and small coastal shark 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 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.

Data from the shark observer program between 2000 and 2002 show that LCS comprised 66.2 percent of the total catch (Burgess and Morgan, 2002). During 2003, LCS comprised 68.4 percent of the total catch, and in 2004 LCS comprised 66.7 percent of the total catch. Sandbar sharks dominated the observed catches with 30.6 percent of total LCS catch in 2003 and 26.6 percent 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 large coastal shark catch. In the Florida Gulf region, sandbar sharks comprised 62.0 percent of the total catch and 66.5 percent of the large coastal catch, 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 large coastal shark catch (Burgess and Morgan, 2003). Blacktip sharks comprised 13.9 percent of total observed catch and 20.3 percent of the large coastal catch (Burgess and Morgan, 2002). Tiger sharks comprised 7.5 percent of the total observed catch and 11.0 percent of the large coastal shark 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.

On the trips targeting grouper/snapper or grouper/shark in the Gulf of Mexico, 3,848 individual animals were caught. This consisted of 91.2 percent teleosts, 8.3 percent sharks, 0.1 percent batoids, and 0.2 percent invertebrates. Large coastal shark species comprised 20.6 percent of the shark catch, while SCS comprised the majority of the shark catch at 79.1 percent. Red grouper was the most caught teleost, and sharpnose and blacknose were the most caught sharks.

On the trips targeting shark in the Gulf of Mexico, 4,732 individual animals were caught. This consisted of 92.7 percent sharks, 6.4 percent teleosts, 0.7 percent invertebrates, and 0.1 percent batoids. Large coastal shark species comprised the greatest amount of shark catch, at 75.4 percent, and SCS comprised 24.2 percent. King snake eel and red grouper were the most caught teleost, while sandbar and blacknose were the most caught sharks.

On the trips targeting shark in the South Atlantic, 4,836 individual animals were caught. This consisted of 95.5 percent sharks, 2.3 percent teleosts, 2.1 percent batoids, and 0.02 percent invertebrates. Large coastal shark species comprised 13.5 percent of the shark catch. Other shark species caught were smooth dogfish, spiny dogfish, dusky shark, sand tiger shark, Caribbean reef shark, night shark, and shortfin mako shark. Red grouper was the most caught teleost.

On the trips targeting tilefish in the South Atlantic, 1,293 individual animals were caught. This consisted of 99.2 percent teleosts, 0.3 percent sharks, and 0.5 percent invertebrates. Large coastal sharks comprised 25 percent of the shark catch, while no small coastal shark species were caught. Other shark species caught included the night shark and smooth dogfish (75 percent). Tilefish was the most caught teleost at 91.4 percent.

Bottom longlining for sharks has relatively low observed bycatch rates. For vessels targeting snapper/grouper and shark/grouper in 2005-2006, seven loggerhead turtles were observed caught in BLL gear. Of this seven, two were released alive, three were released dead, and two were released with unknown status. For vessels targeting shark in the Gulf of Mexico, four loggerhead turtles were observed caught in BLL gear. Of these four, two were released alive, one was released dead, and one was released with unknown status. For vessels targeting shark in the South Atlantic, five loggerheads were observed in BLL gear. Of these five, one was released alive, two were released dead, and two were released with unknown status. In addition, one leatherback turtle was observed caught in BLL gear and released dead. Four smalltooth sawfish were observed caught and all were released alive.

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) (March 28, 2007; 72 FR 14466). On October 29, 2003, NMFS issued a biological opinion (BiOp) pursuant to ESA regarding Atlantic shark fisheries. This BiOp concluded that the level of anticipated take in the Atlantic shark fishery resulting from measures implemented in Amendment 1 to the 1999 FMP (68 FR 74746), were 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. Furthermore, it concluded that the actions in the rule were not likely to adversely affect marine mammals. As a result of this conclusion, NMFS (NMFS, 2003) anticipates that the continued operation of the shark BLL fishery will result in a five year total incidental take of the following numbers of sea turtles: Leatherback – 172; loggerhead – 1,370; a total of 30 in any combination of hawksbill, green, and Kemp's ridley sea turtles. NMFS also anticipates a five year take of 261 smalltooth sawfish, of which no lethal takes are expected. If the actual calculated incidental captures or mortalities exceed the incidental take statement, a formal

consultation for that gear type must be re-initiated immediately. More information is available in Amendment 1 to the 1999 FMP and the October 2003 BiOp and is not repeated here.

Loggerhead Sea Turtles

In the BLL fishery, a total of 74 sea turtles were observed caught from 1994 through 2006 (Table 3-7, Table 3-8). Seasonal variation indicates that most of the sea turtles were caught early in the year. Of the 74 observed sea turtles, 59 were loggerhead sea turtles, of which 30 were released alive. Another 14 loggerheads were released in an unknown condition and 15 were released dead. Based on extrapolation of observer data in Amendment 1 to the 1999 FMP, it was estimated that a total of 2,003 loggerhead sea turtles were taken in the shark BLL fishery from 1994 through 2002 (NMFS, 2003a). An additional 503 unidentified sea turtles were estimated to have been taken. On average, 222 loggerhead sea turtles and 56 unidentified sea turtles were estimated to have been taken annually during this time period in the shark BLL fishery.

Leatherback Sea Turtles

Of the 74 observed sea turtle interactions in the BLL fishery from 1994 – 2006, six were leatherback sea turtles of which one was dead and one was released with its condition unknown (Table 3-7, Table 3-8). Based on extrapolation of observer data done for Amendment 1, it was estimated that 269 leatherback sea turtles were taken in the shark BLL fishery from 1994 through 2002 (NMFS, 2003a). On average, 30 leatherback sea turtle interactions occurred each year in the shark BLL fishery during this period. This analysis only estimates takes without discriminating between live and dead releases. Of the observed leatherback takes, approximately 25 percent were lethal. Applying the observed mortality rate of 25 percent to the total leatherback takes, and an additional 42 percent post-release mortality estimate due to hook ingestion to the remaining, results in an estimated total number of 17 leatherbacks killed per year as a result of the interaction with BLL gear. The leatherback mortality is very conservative because it is known that leatherbacks rarely ingest or bite hooks, but are usually foul hooked on their flippers or carapaces, reducing the likelihood of post-hooking release mortality. However, leatherback-specific data for this fishery is not available and therefore the most conservative estimate is used.

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 working on designating critical habitat for smalltooth sawfish.

Sawfish have been observed caught (12 known interactions, 11 released alive, one released in unknown condition) in shark BLL fisheries from 1994 through 2006 (Morgan pers. comm.; Burgess and Morgan, 2004; NMFS' Shark Observer Program). Based on these observations, expanded sawfish take estimates for 1994 – 2002 were developed for the shark BLL fishery (NMFS, 2003a). A total of 466 sawfish were estimated to have been taken in this fishery from 1994 – 2002, resulting in an average of 52 per year. All but one of the observed sawfish was released alive.

Marine Mammals

Four delphinids have been observed caught and released alive between 1994 and 2004 (G. Burgess, pers. comm.). Bycatch estimates for the shark BLL fishery have not been extrapolated for marine mammals.

Seabirds

Bycatch of seabirds in the shark BLL fishery has been virtually non-existent. A single pelican has been observed killed from 1994 through 2005. The pelican was caught in January 1995 off the Florida Gulf Coast (between 25° 18.68 N, 81° 35.47 W and 25° 19.11 N, 81° 23.83 W) (G. Burgess, University of Florida, pers. comm., 2001). No expanded estimates of seabird bycatch or catch rates are available for the BLL fishery.

Table 3-5 Species composition of observed BLL catch during 2005-2006 for BLL trips targeting sharks in the South Atlantic (77 hauls). Source: Hale and Carlson, 2007.

Species	Total Number Caught	% Total Catch	% Kept	% Discarded Dead	% Discarded Alive
Large Coastal Sharks					
Sandbar shark	1599	33.29	99.1	0.1	0.0
Tiger shark	1294	26.94	36.8	3.6	57.5
Blacktip shark	623	12.97	98.9	0.5	0.0
Nurse shark	111	2.31	0.9	0.9	98.2
Scalloped hammerhead shark	83	1.73	95.2	1.2	3.6
Silky shark	74	1.54	98.6	1.4	0.0
Dusky shark	46	0.96	8.7	37.0	54.3
Bull shark	31	0.65	93.5	0.0	3.2
Lemon shark	23	0.48	100.0	0.0	0.0
Spinner Shark	23	0.48	100.0	0.0	0.0
Great hammerhead shark	20	0.42	90.0	0.0	0.5
Sand Tiger shark	15	0.31	0.0	0.0	100.0
Caribbean Reef shark	12	0.25	91.7	0.0	8.3
Night shark	6	0.12	50.0	33.3	16.7

Species	Total Number Caught	% Total Catch	% Kept	% Discarded Dead	% Discarded Alive
Smooth hammerhead shark	1	0.02	100.0	0.0	0.0
Hammerhead shark	1	0.02	0.0	0.0	0.0
Total	3962	82.49			
Small Coastal Sharks					
Atlantic Sharpnose shark	544	11.33	69.7	29.2	1.1
Blacknose shark	76	1.58	89.5	6.6	2.6
Finetooth shark	2	0.04	100.0	0.0	0.0
Bonnethead shark	1	0.02	0.0	100.0	0.0
Total	623	12.97			
Pelagic Sharks					
Shortfin mako shark	1	0.02	100.0	0.0	0.0
Total	1	0.02			
Dogfish Sharks					
Smooth dogfish	15	0.31	100.0	0.0	0.0
Spiny dogfish	13	0.27	7.7	0.0	92.3
Total	28	0.58			
Other Sharks					
Requiem shark Family	1	0.02	0.0	0.0	0.0
Unidentified	1	0.02	0.0	0.0	0.0
Total	2	0.04			

Table 3-6 Species composition of observed BLL catch during 2005-2006 for BLL trips targeting sharks in the Gulf of Mexico (82 hauls). Source: Hale and Carlson, 2007.

Species	Total Number Caught	% Total Catch	% Kept	% Discarded Dead	% Discarded Alive
Large Coastal Sharks					
Blacktip shark	1754	53.2	90.6	8.0	0.5
Sandbar shark	642	19.5	97.8	0.0	1.1
Nurse shark	325	9.9	0.3	99.1	0.3
Tiger shark	184	5.6	33.2	4.3	60.9
Bull shark	129	3.9	93.8	0.0	1.6
Spinner shark	123	3.7	99.2	0.0	0.0
Lemon shark	44	1.3	93.2	2.3	0.0

Species	Total Number Caught	% Total Catch	% Kept	% Discarded Dead	% Discarded Alive
Silky shark	36	1.1	83.3	11.1	5.6
Great Hammerhead shark	30	0.9	96.7	0.0	3.3
Scalloped hammerhead shark	24	0.7	91.7	0.0	4.2
Dusky shark	4	0.1	0.0	75.0	25.0
Hammerhead shark	1	0.0	0.0	100.0	0.0
Total	3296				
Small Coastal Sharks					
Blacknose shark	622	58.6	78.9	18.5	1.4
Atlantic Sharpnose shark	437	41.2	67.3	32.0	0.5
Finetooth shark	2	0.2	100.0	0.0	0.0
Total	1,061	100.0			
Dogfish Sharks					
Smooth dogfish	12	100.0	0.0	58.3	41.7
Total	12	100.0			
Other Sharks					
Requiem shark Family	14	82.4	14.3	57.1	0.0
Unidentified	3	17.6	0.0	66.7	33.3
Total	17	100.0			

Table 3-7 Total Number of Observed Sea Turtle Interactions by Species by Month for Years 1994-2006 in the Shark BLL Fishery. Source: Shark BLL Observer Program

Month	Leatherback Sea Turtle	Loggerhead Sea Turtle	Other Sea Turtles	Total
Jan	1	12	1	15
Feb	3	10	6	19
Mar		7		9
Apr		4		4
May	1			1
Jun				
July		18		18
Aug		4		4
Sept	1	2	1	4
Oct		2	1	3
Nov				
Dec				
Total	6	62	9	74

Table 3-8 Total number of Observed Sea Turtle Interactions by Year for Years 1994-2006 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
Total	6	59	9	74

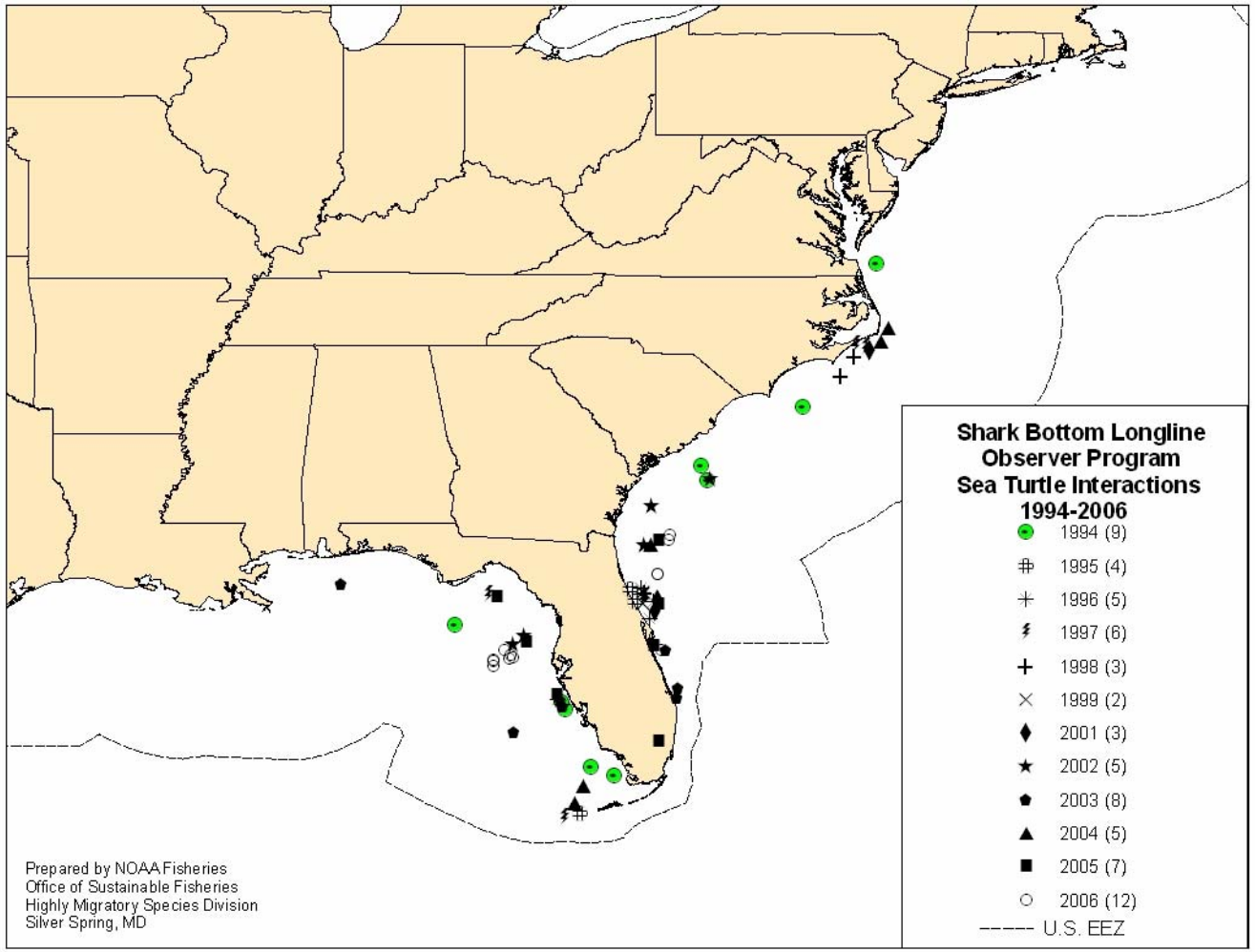

Figure 3-2 **Observed sea turtle interactions in the shark BLL fishery from 1994-2006.** Source: Commercial Shark Fishery Observer Program data (1994-1st season of 2005) and NMFS' Shark Observer Program data (2nd season 2005-2006).

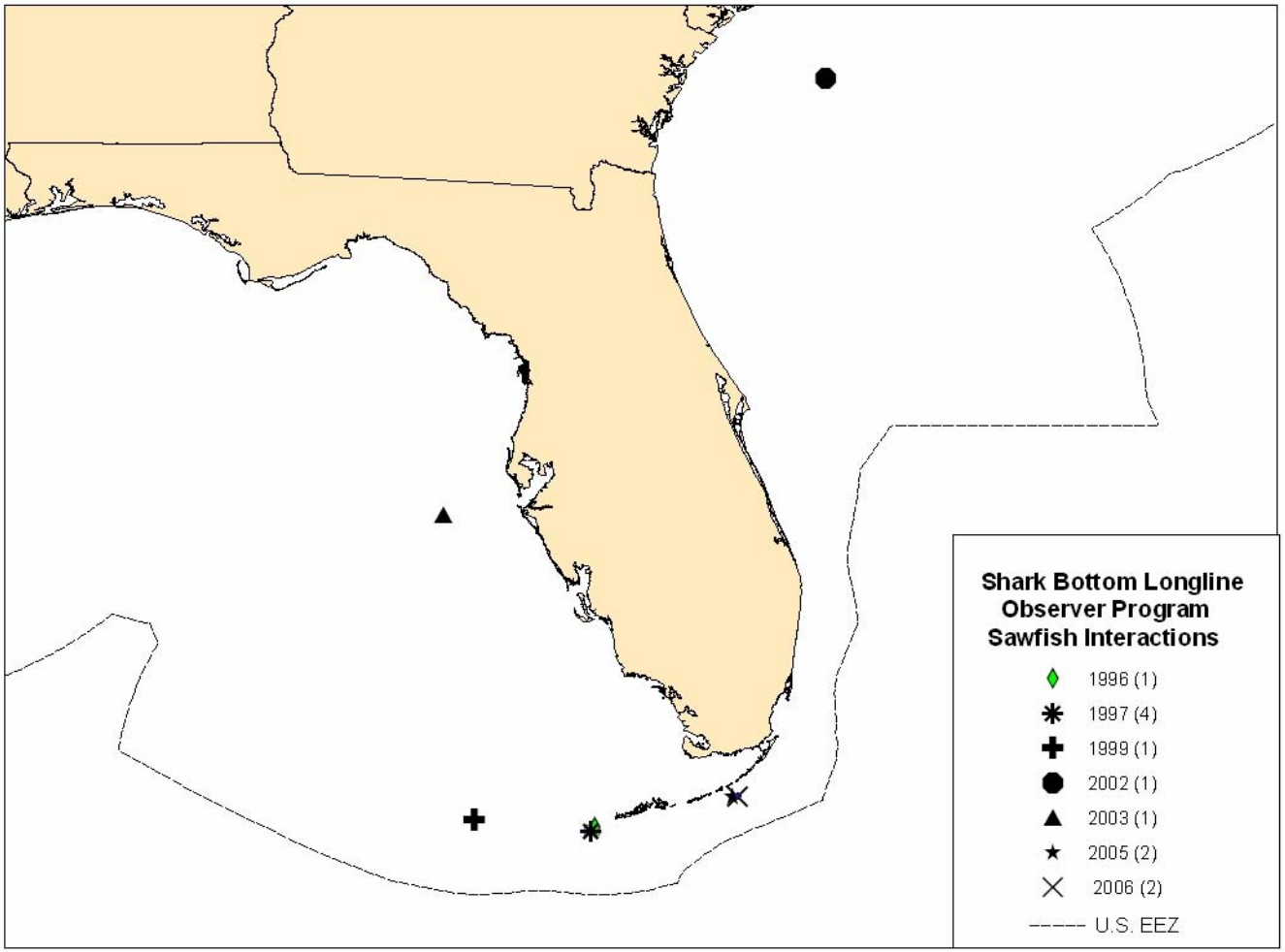

Figure 3-3 **Observed sawfish interactions and observed sets (smaller grey circles) in the shark BLL fishery from 1994-2006.** Source: Commercial Shark Fishery Observer Program data (1994-1st season of 2005) and NMFS' Shark Observer Program data (2nd season 2005-2006).

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) that use nets typically 456 to 2,280 meters long and 6.1 to 15.2 meters deep, with stretched mesh from 12.7 to 22.9 cm. This fishery is currently prohibited in the state waters off South Carolina, Georgia, and Florida, thereby forcing some of these vessels to operate in deeper waters under Federal jurisdiction, where gillnets are less effective. The entire process (set to haulback) takes approximately 9 hours (Carlson and Baremore, 2002a).

In the southeast shark gillnet fishery, NMFS modified the requirement to have 100 percent observer coverage at all times on March 30, 2001 (66 FR 17370), by reducing the level required to a statistically significant level outside of right whale calving season (100 percent observer coverage is still required during the right whale calving season from November 15 through March 31). This modification of observer coverage reduced administrative costs while maintaining statistically significant and adequate levels of coverage to provide reasonable estimates of sea turtle and marine mammal takes outside the right whale calving season. The level of observer coverage necessary to maintain statistical significance will be reevaluated annually and adjusted accordingly. Additionally, in 2001 NMFS established a requirement to conduct net checks every two hours to look for and remove any protected species.

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 2006 Directed Shark Gillnet Fishery Observer Program report described the gear and soak time deployed by drift gillnet, strike gillnet, and sink gillnet fishermen. Set duration was generally 0.3 hours in depths averaging 20.9 m, and haulback averaged 3.3 hours. The average time from setting the net through completion of haulback was 10.2 hours. Stretched mesh sizes measured from 12.7-25.4 cm. Strikenetters use 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 7.3-20.3 cm mesh size and the process lasted for approximately 6.1 hours. This gear was also observed being deployed to target non-HMS (teleosts); using a stretched mesh size of 6.4-12.7 cm, and the entire process took approximately 2.3 hours (Carlson and Bethea, 2007).

The total observed strike gillnet catch consisted of eight species of sharks. Finetooth and blacktip sharks made up the greatest percentage of catch in terms of total number caught in strike gillnets (Table 3-9). The total observed driftnet catch consisted of eleven species of sharks. Atlantic sharpnose and blacktip sharks made up the greatest percentage of catch in terms of total number caught in drift gillnets (Table 3-10).

Gillnet Landings and Bycatch

On September 23, 2002, NMFS implemented a restricted area to reduce bycatch of right whales from November 15 through March 31 (67 FR 59471). In this area, only gillnets used in a

strikenet fashion can operate during times when right whales are present. Operation in this area at that time requires 100 percent observer coverage. Vessels fishing in a strikenet fashion used nets 364.8 meters long, 30.4 meters deep, and with mesh size 22.9 cm.

In 2005 and 2006, observed drift gillnet catches by number were 88.7 percent shark, 10.8 percent teleosts, 0.5 percent non-shark elasmobranchs, and 0.03 percent protected resources. Three species of sharks made up 91.3 percent of the observed drift gillnet catch: Atlantic sharpnose, blacktip, and bonnethead sharks. Two species of teleosts made up the majority of the catch, including: little tunny and king mackerel. Four loggerhead and one leatherback sea turtle were observed (Carlson and Bethea, 2007).

In the strikenet fishery, 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). Sinknet landings and bycatch vary by target species. Four main groups were targeted on observed sink gillnet trips in 2005 and 2006, including: shark, Spanish mackerel, kingfish, and various teleosts. Vessels targeting sharks with this gear caught 79.3 percent sharks, 17.6 percent teleosts, and 3.1 percent non-shark elasmobranchs. Vessels targeting Spanish mackerel caught 89.5 percent teleosts, 10.4 percent sharks, and 0.02 non-shark elasmobranchs. Vessels targeting kingfish caught 90.5 percent teleosts, 3.9 percent sharks, and 6.1 percent non-shark elasmobranchs. When targeting various teleosts with sink gillnet gear, vessels caught 98 percent teleosts and 2 percent shark (Carlson and Bethea, 2007).

There were 41 species of teleosts, four species of rays, and no marine mammal species observed caught during the sink gillnet season (Table 3-12). The species of teleosts making up the largest percentage by number of the overall non-shark species in observed strikenet catches were southern kingfish, gulf flounder, whitebone porgy, and crevalle jack.

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 Atlantic Large Whale Take Reduction Plan (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.

The regulations at 50 CFR 229.32(g)(1) also require NMFS to close the Southeast U.S. Restricted Area for the rest of the time period, and for the time period November 15 through March 31 in each subsequent year, unless NMFS revises the restricted period or unless other measures are implemented. NMFS plans to seek assistance and recommendations from the ALWTRT at their next meeting in order to evaluate whether permanent closures within the Southeast U.S. Restricted Area are necessary.

On November 15, 2006, NMFS published a final rule (72 FR 34632, June 25, 2007) to close Atlantic waters to gillnetting in an area South of New Smyrna Beach, Florida to the South Carolina/Georgia border (71 FR 66469). 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.

Loggerhead Sea Turtles

Loggerhead sea turtles are rarely caught in the shark gillnet fishery. During the 1999 right whale calving season, no loggerhead sea turtles were observed caught in this fishery (Carlson and Lee, 1999), and 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, 2003). In 2004 there were no observed sea turtle interactions in either the strikenet or drift gillnet fisheries.

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).

Leatherback Sea Turtles

In the shark gillnet fishery, leatherback sea turtles are sporadically caught. During the 1999 right whale calving season, two leatherback sea turtles were caught in this fishery, and both were released alive (Carlson and Lee, 1999). No leatherback sea turtles were observed caught with strikenets during the 2000 – 2002 right whale calving seasons (Carlson, 2000; Carlson and Baremore, 2001; Carlson and Baremore, 2002a). Leatherback sea turtles have been observed caught in shark drift gillnets including 14 in 2001 and 2 in 2002 (Carlson, 2000; Carlson and Baremore, 2001; Carlson and Baremore, 2002a; Garrison, 2003). 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, no leatherbacks were observed caught in gillnets (Table 3-13).

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 southeast Florida and was released alive (Carlson and Baremore, 2003). The set was characteristic of a typical drift gillnet set, with gear extending 30 to 40 feet deep in 50 to 60 feet of water. Prior to this event it was speculated that the depth at which drift gillnets are set above the sea floor may preclude smalltooth sawfish from being caught. From 2004-2006, there were no observed catches of smalltooth sawfish in shark gillnet fisheries (Table 3-14).

Although sometimes described as a lethargic demersal species, smalltooth sawfish feed mostly on schooling fish, thus they would occur higher in the water column during feeding activity. In fact, smalltooth sawfish and Atlantic sharks may be attracted to the same schools of fish, potentially making smalltooth sawfish quite vulnerable if present in the area fished. The previous absence of smalltooth sawfish incidental capture records is more likely attributed to the relatively low effort in this fishery and the rarity of smalltooth sawfish, especially in Federal waters. These factors may result in little overlap of the species with the gear. The 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.

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 2003 BiOp estimated that one incidental capture of a sawfish (released alive) over the next five years, will occur as a result of the use of gillnets in this fishery (NMFS, 2003a).

Marine Mammals

Observed takes of marine mammals in the Southeast Atlantic shark gillnet fishery during 1999 – 2004, totaled 12 bottlenose dolphins and four spotted dolphins. Extrapolated observations from these data suggest serious injury and mortality of 25 bottlenose dolphin and one Atlantic spotted dolphin in the shark gillnet fishery from 1999 through 2002 (Garrison, 2003).

Table 3-9 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

Species	Total Number Caught	Kept (%)	Discarded Alive (%)	Discarded Dead (%)
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 3-10 Total Shark Catch by Species and Species Disposition in Order of Decreasing Abundance for all Observed Driftnet Sets 2005-2006. Source: Carlson and Bethea, 2007.

Species	Total Number Caught	Kept (%)	Discarded Alive (%)	Discarded Dead (%)
Atlantic sharpnose	11,320	98.5	0	1.4
Blacktip	2,583	97.8	0.9	1.3
Bonnethead	567	98.4	0.0	1.6
Spinner	474	98.2	.7	1.1
Finethooth	413	95.6	0	4.4
Blacknose	407	99.5	0	0.5
Scalloped Hammerhead	77	96.6	0	3.4
Great Hammerhead	11	77.8	0	22.2
Silky	2	100	0	0
Bull	1	100	0	0
White	1	0	0	100
Total	**15,856**			

Table 3-11 Total bycatch in NMFS observed drift gillnet sets in order of decreasing abundance and species disposition for all observed trips, 2005-2006. Source: Carlson and Bethea, 2007.

Species	Total Number Caught	Kept (%)	Discard Alive (%)	Discard Dead (%)
Little tunny	1008	99.6	0	0.4
King mackerel	597	47.9	0.7	51.4
Cobia	95	86.3	3.2	10.5
Barracuda	89	100	0	0
Cownose ray	65	0	76.9	23.1
Atlantic moonfish	35	2.9	0	97.1
Atlantic sailfish	25	0	0	100
Bluefish	24	95.8	4.2	0
Great barracuda	17	100	0	0
Spanish Mackerel	11	100	0	0
Remora	8	0	62.5	37.5
Tarpon	7	0	0	100
Spotted eagle ray	6	0	100	0
Dolphin	4	100	0	0
Manta ray	3	0	100	0
Blackfin tuna	3	100	0	0
Wahoo	2	100	0	0
Jacks	1	100	0	0
Blue runner	1	100	0	0
Crevalle jack	1	100	0	0
Tripletail	1	100	0	0
Lobsters	1	100	0	0

Table 3-12 Total Sink 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 (%)
Atlantic sharpnose shark	2,245	99.5	0.1	0.4
Bonnethead shark	892	89.6	3.7	6.7
Blacktip shark	767	27.7	2.8	69.5
Blacknose shark	346	100	0	0
Finetooth shark	199	98.5	1.0	0.5
Little tunny	162	97.5	0	2.5
King mackerel	115	44.3	0	55.7
Bluefish	109	78.9	2.8	18.3
Scalloped hammerhead	97	38.1	26.8	35.1
Banded drum	75	0	22.7	77.3
Atlantic guitarfish	67	100	0	0
Northern kingfish	65	90.8	0	9.2

Species	Total Number Caught	Kept (%)	Discarded Alive (%)	Discarded Dead (%)
Cownose ray	63	0	100	0
Cobia	53	32	34	34
Clearnose skate	47	14.9	85.1	0
Spanish mackerel	40	97.5	0	2.5
Spinner shark	39	48.7	28.2	23.1
Gulf flounder	38	73.7	26.3	0
Hard head catfish	34	0	76.5	23.5
Whitebone porgy	31	90.3	9.7	0
Southern flounder	27	100	0	0
Spot	26	92.3	0	7.7
Crevalle jack	24	100	0	0
Southern Kingfish	23	100	0	0
Smooth dogfish	23	69.6	30.4	0
Weakfish	18	55.6	11.1	33.3
Atlantic moonfish	17	88.2	11.8	0
Atlantic spadefish	16	18.8	43.7	37.5
Atlantic bumper	13	0	53.8	46.2
Baracudas	12	100	0	0
Red snapper	11	18.2	45.4	36.4
Harvestfish	11	90.9	0	9.1
Tiger shark	10	20	70	10
Bull Shark	1	100	0	0
Gafftop catfish	9	11.1	0	88.9
Scrawled cowfish	8	50	50	0
Inshore lizardfish	8	100	0	0
Red drum	7	0	100	0
Blue runner	6	100	0	0
Black sea bass	5	0	40	60
Remora	5	0	60	40
Littlehead porgy	4	75	25	0
Mutton snapper	4	100	0	0
Black drum	4	0	75	25
Sheepshead	3	100	0	0
Ladyfish	3	100	0	0
Lined seahorse	3	0	100	0
Black grouper	3	66.7	33.3	0
Porgies	3	0	33.3	66.7

Species	Total Number Caught	Kept (%)	Discarded Alive (%)	Discarded Dead (%)
Silky shark	3	0	33.3	66.7
Jolthead porgy	2	100	0	0
Southern stingray	2	0	100	0
Margaret grunt	2	0	0	100
Tomtate grunt	2	50	0	50
Manta ray	2	0	100	0
Batfishes	2	0	100	0
Dusky shark	1	0	0	100
Sandbar shark	1	0	0	100
Sandtiger shark	1	0	100	0
Nurse shark	1	0	100	0
Lemon shark	1	0	100	0
Atlantic angel	1	0	100	0
Spotted eagle ray	1	0	100	0
African pompano	1	100	0	0
Saucereye porgy	1	0	100	0
Great Barracuda	1	100	0	0
Herrings	1	0	0	100
Silver seatrout	1	0	0	100
Bluestriped grunt	1	100	0	0
Tripletail	1	100	0	0
Grey snapper	1	100	0	
Silk snapper	1	0	0	100
Kingfish	1	0	100	0
Scamp	1	0	0	100
Spinycheek scorpionfish	1	0	100	0
Polka dot batfish	1	0	0	100
Vermillion snapper	1	0	100	0
Greater amberjack	1	100	0	0

Table 3-13 **Total number of Observed Sea Turtle Interactions by Year from 2000-2006 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
Total	1	11	12

Table 3-14 Observed Interactions of Protected Species with the Shark Gillnet Fishery from 2004-2006. Source: Directed Shark Gillnet Observer Program.

Observed Total Takes (2004-2006)				
Species	**Drift Gillnet**	**Strikenet**	**Sink Gillnet**	**Total Observed Takes/5 yr ITS (total takes)**
Loggerhead Sea Turtle	3	3	1	7/10
Leatherback Sea Turtle	1	0	0	1/22
Smalltooth Sawfish	0	0	0	0/1
Observed Dead Takes (2004-2006)				
Species	**Drift Gillnet**	**Strikenet**	**Sink Gillnet**	**Total Observed Takes/5 yr ITS (total takes)**
Loggerhead Sea Turtle	1	1	0	2/1
Leatherback Sea Turtle	0	0	0	0/3
Smalltooth Sawfish	0	0	0	0/0

*The 5 yr ITS was established for the drift gillnet fishery. However, one dead loggerhead was encountered in the drift gillnet and strikenet fisheries.

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, pelagic sharks (including mako, thresher, and porbeagle sharks), as well as several species of large coastal 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. Pelagic longline 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. Pelagic longline gear is composed of several parts (see 3.4[1]) (NMFS, 1999).

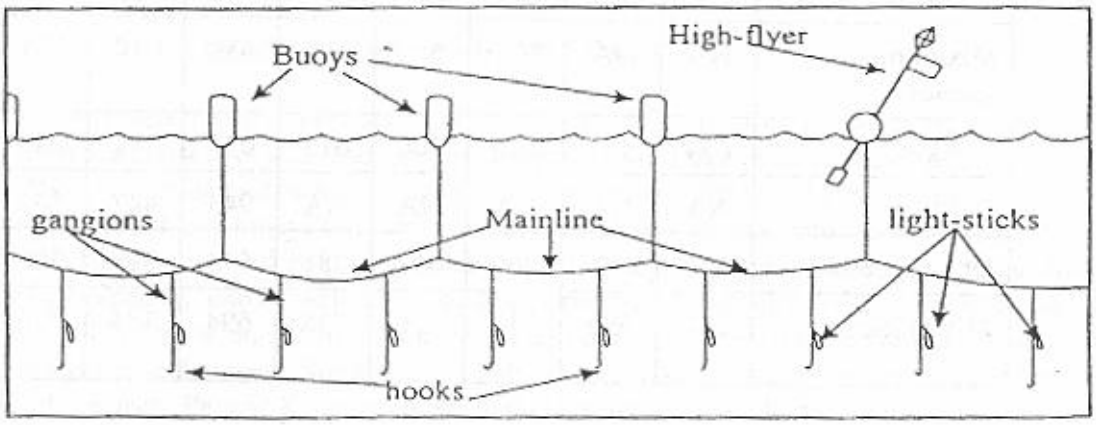

Figure 3-4 Typical U.S. PLL Gear. Source: Arocha, 1996

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 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 (3.16) (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 the discussions of alternative H4 in Chapters 2 and 4 of the 2006 Consolidated HMS FMP. At present, NMFS is considering alternatives in regard to changes with greenstick use in HMS fisheries.

[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.

Table 3-15 Average Number of Hooks per PLL Set, 1999-2005. Source: Data reported in PLL logbook.

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

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 many changes in the regulations since 1999 (*e.g.*, time/area closures and gear restrictions), the fishing practices and strategies of these different segments may have changed.

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, limited access permitting, bluefin tuna catch requirements, shark quotas, protected species incidental take limits, reporting requirements (including logbooks), gear and bait requirements, and mandatory workshop requirements. Current billfish regulations prohibit the retention of billfish by PLL 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. This is a heavily managed gear type and, as such, is strictly monitored. Because it is difficult for PLL fishermen to avoid undersized 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 vessel monitoring system (VMS).

In June 2004, NMFS conditionally re-opened the NED to PLL fishing. NMFS limited vessels with PLL gear onboard in that area, at all times, to possessing onboard and/or using only 18/0 or larger circle hooks with an offset not to exceed ten degrees. Only whole mackerel and squid baits may be possessed and or utilized with allowable hooks. In August of 2004, NMFS limited vessels with PLL gear onboard, at all times, in all areas open to PLL fishing, excluding the NED, to possessing onboard and/or using 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.

Permits

The 1999 FMP established six different limited access permit 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 11, 2007, approximately 182 directed swordfish limited access permits, 78 incidental swordfish limited access permits, 231 directed shark limited access permits, and 290 incidental shark limited access permits had been issued. As of April 30, 2007, approximately 236 tuna longline permits had been issued. Vessels with limited access swordfish and shark permits do not necessarily use PLL gear, but these are the only permits that allow for the use of PLL gear in HMS fisheries.

Monitoring and Reporting

Pelagic longline 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 2005, NMFS observers recorded 796 PLL sets for an overall fishery coverage of 10.1 percent. In non-experimental fishing, the overall observer coverage was 7.2 percent. A total of 247 experimental PLL sets were observed in the NEC, GOM, FEC, MAB, and SAB areas, primarily during the second and third quarters. These experimental sets (EXP) had 100 percent observer coverage and are separated from the normal commercial fishery in Table 3-16 (Walsh and Garrison, 2006). In 2004, NMFS observers recorded 702 PLL sets for an overall coverage of 7.3 percent. During the first and second quarters of 2004, 60 experimental sets employing circle hooks were made in the Gulf of Mexico. These sets had 100 percent observer coverage (Garrison, 2005). One thousand eighty-eight PLL sets were observed and recorded by NMFS observers in 2003 (11.5 percent overall coverage – 100 percent coverage in the NED; and 6.2 percent coverage in remaining areas) (Garrison and Richards, 2004). 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, 2003; Garrison and Richards, 2004; Garrison, 2005; Walsh and Garrison, 2006.

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

*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 these 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 1999-2005. Source: PLL Logbook Data.

Species	1999	2000	2001	2002	2003	2004	2005
Swordfish Kept	67,120	62,978	47,560	49,320	52,838	46,507	41,139
Swordfish Discarded	20,558	17,074	13,993	13,035	12,084	10,687	11,134
Blue Marlin Discarded	1,253	1,443	635	1,175	606	713	567
White Marlin Discarded	1,969	1,261	848	1,438	813	1,060	989
Sailfish Discarded	1,407	1,091	356	379	280	425	367
Spearfish Discarded	151	78	137	148	114	172	150
Bluefin Tuna Kept	263	235	177	178	275	475	375
Bluefin Tuna Discarded	604	737	348	585	881	1,031	765
Bigeye, Albacore, Yellowfin, Skipjack Tunas Kept	114,438	94,136	80,466	79,917	64,601	77,297	57,132
Pelagic Sharks Kept	2,894	3,065	3,460	2,987	3,129	3,445	3,149
Pelagic Sharks Discarded	28,967	28,046	23,813	22,828	21,771	25,415	21,550
Large Coastal Sharks Kept	6,382	7,896	6,478	4,077	5,332	2,292	3,362
Large Coastal Sharks Discarded	5,442	6,973	4,836	3,815	4,882	5,237	5,877
Dolphin Kept	31,536	29,125	27,586	30,384	29,609	38,811	25,707
Wahoo Kept	5,136	4,193	3,068	4,188	4,020	4,657	3,348
Turtles Discarded	631	271	424	465	399	370	152
Number of Hooks (X 1,000)	*7,902*	*7,976*	*7,564*	*7,150*	*7,120*	*7,276*	*5,911*

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

Pelagic longline 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 35 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 authorized total allowable catches (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 (Figure 3-5) (SCRS, 2004). Purse seines produce the highest volume of catch of ICCAT managed species from the Atlantic (SCRS, 2004). From 1999 through 2002 (inclusive) there was a declining trend in estimated international landings of HMS for fisheries in which the United States participated. In 2004, international landings of HMS for fisheries in which the U.S. participated totaled 106,774 mt, which represented a modest decrease from 2003 (SCRS, 2005).

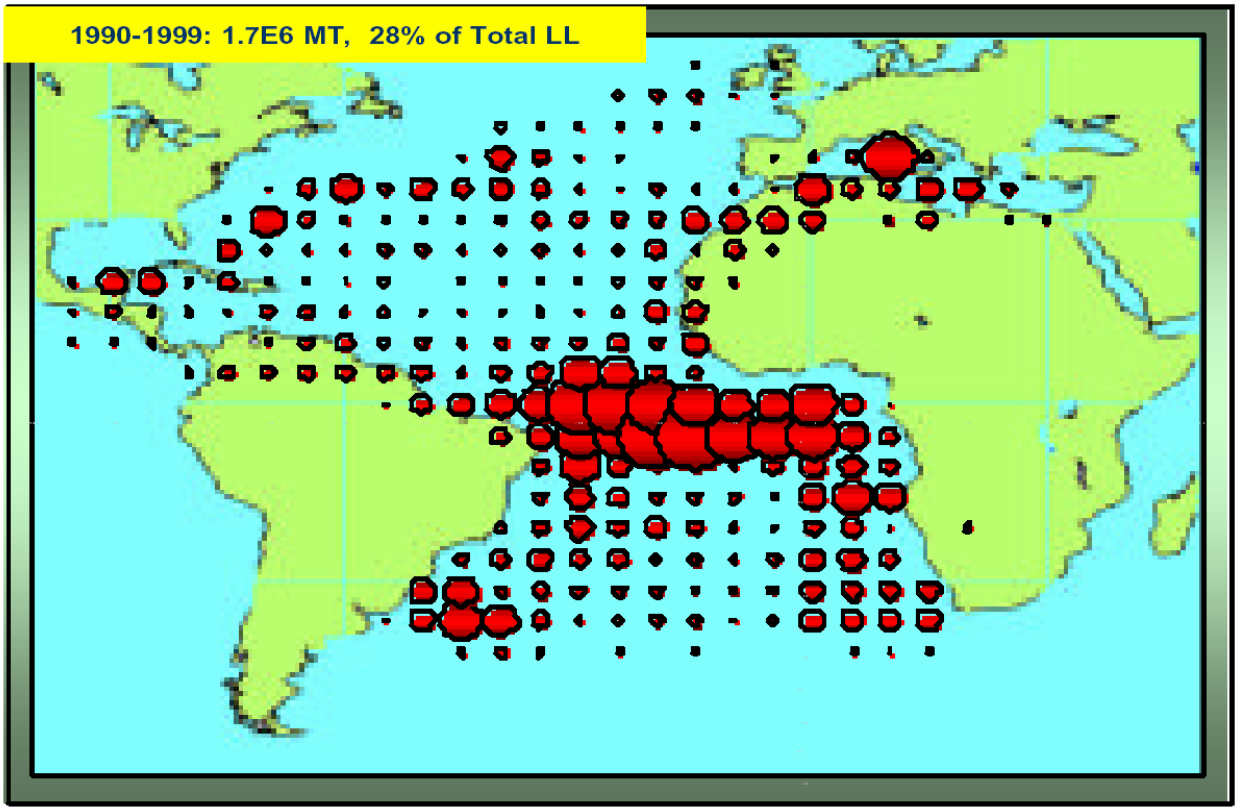

Figure 3-5 Distribution of Atlantic Longline Catches for all Countries 1990-1999. Source: SCRS, 2004

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, entered into force in mid-2005 and requires at least five percent observer coverage of PLL vessels over 24 meters fishing for bigeye.

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. Even within the area where the U.S. fleet operates, the U.S. portion of fishing effort (in numbers of hooks fished) is less than 10 percent of the entire international fleet's effort, and likely less than that due to differences in reporting effort between ICCAT countries (NMFS, 2001).

Atlantic Sharks

There is currently no comprehensive international reporting system for Atlantic shark catches and landings. While there are some international data, not all countries report shark catches and landings and those that do use varying reporting methods. The most recent landings reports for blue, shortfin mako, and porbeagle sharks are presented in Table 3-19, Table 3-20, Table 3-22, respectively. In 2001, ICCAT passed a resolution on Atlantic sharks to determine needed improvements in data collection for Atlantic shortfin mako and blue sharks, and to conduct an interim meeting in 2003 to discuss the issue. In addition, the resolution called upon

contracting parties and non-contracting parties to: (1) submit catch and effort data on Atlantic shortfin mako, porbeagle, and blue sharks; (2) encourage the release of live sharks that are caught incidentally; (3) minimize waste and discards from shark catches; and (4) voluntarily agree not to increase fishing effort targeting Atlantic porbeagle, shortfin mako and blue sharks until sustainable levels of harvest can be determined through stock assessments.

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* which, among other things, bans shark finning, requires vessels to fully utilize their entire catches of sharks, encourages the release of live sharks that are caught incidentally and are not used for food, and reviews the assessment of shortfin mako sharks in 2005, and reassess blue sharks and shortfin mako no later than 2007. The ICCAT recommendation also encouraged countries to engage in research to identify shark nursery areas and collect data on shark catches.

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 calls 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 requires a data prepatory meeting to be held in 2007 to review all relevant data on biological parameters, catch, effort, discards, trade, and historical data.

Table 3-19 **Nominal Catches of Blue Shark Reported to ICCAT (landings and discards) by Major Gear and Flag between 1990 and 2005.** Source: SCRS, Summary Report, 2006**.**

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Atlantic Total		2,348	3,533	2,343	7,879	8,310	8,422	9,036	36,895	33,211	34,208	33,462	34,301	31,424	35,241	35,787	18,814
LONGLINE LANDINGS	BELIZE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37	259
	BRAZIL	0	0	0	0	0	0	743	1,103	0	179	1,689	2,173	1,966	2,160	1,568	2,520
	CANADA	0	0	0	0	0	275	12	10	4	53	18	0	5	6	0	11
	CAPE VERDE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CHINA P.R.	0	0	0	0	0	0	0	0	0	0	0	750	420	600	0	0
	CHINESE TAIPEI	0	0	0	0	0	0	0	0	0	0	0	0	0	692	1,206	1,272
	EC CYPRUS	0	0	0	0	0	0	0	0	0	0	9	0	0	3	6	5
	EC ESPANA	0	0	0	0	0	0	0	29,917	28,137	29,005	31,094	25,110	21,037	22,601	24,682	0
	EC FRANCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0
	EC IRELAND	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	EC ITALY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	0
	EC PORTUGAL	1,387	2,257	1,583	5,726	4,669	5,569	5,710	3,966	3,318	3,337	4,220	4,713	4,602	6,926	3,586	7,266
	EC UNITED KINGDOM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	JAPAN	0	0	0	0	2,596	1,589	1,044	996	850	893	494	532	742	830	1,473	0
	MEXICO	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0
	NAMIBIA	0	0	0	0	0	0	0	0	0	0	0	0	2,213	0	1,906	6,616
	PANAMA	0	0	0	0	0	0	0	0	0	177	22	0	0	0	0	0
	SOUTH AFRICA	0	0	0	0	0	0	0	0	23	21	0	82	63	232	128	154
	TRINIDAD & TOBAGO	0	0	0	0	0	0	0	0	0	0	0	0	6	3	2	1
	USA	0	0	0	8	8	4	6	1	3	0	1	3	0	1	7	2
	UK BERMUDA	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0
	URUGUAY	0	8	84	15	93	64	252	286	242	126	119	59	159	620	492	400
	VENEZUELA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	26
LONGLINE DISCARDS	CANADA	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0
	USA	741	772	184	1136	572	618	609	185	173	97	137	105	68	0	63	76
	UK BERMUDA	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0
		1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**

OTHER LANDINGS	BENIN	0	0	0	0	0	0	0	6	4	27	0	0	0	0	0	0
	BRASIL	0	0	0	0	0	0	0	0	0	0	0	0	4	6	99	3
	CANADA	0	0	0	0	0	1	0	1	1	1	0	0	0	0	0	0
	EC DENMARK	2	1	1	0	1	2	3	1	1	0	2	1	13	0	0	0
	EC FRANCE	130	187	276	322	350	266	278	213	163	0	395	207	109	0	98	120
	EC IRELAND	0	0	0	0	0	0	0	0	0	65	9	66	11	0	0	0
	EC ITALY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	81	76
	EC PORTUGAL	0	0	0	0	0	0	0	0	0	0	0	0	0	561	302	1
	EC UNITED KINGDOM	1	0	0	0	0	12	0	0	1	0	12	9	6	0	0	2
	SENEGAL	0	0	0	0	0	0	0	0	0	0	0	456	0	0	0	0
	SOUTH AFRICA	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
	USA	87	308	214	672	21	19	277	210	252	217	291	39	0	0	0	0
OTHER DISCARDS	CANADA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	USA	0	0	0	0	0	0	102	0	22	4	0	0	0	0	1	0
	UK BERMUDA	0	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0

Table 3-20 Nominal Catches of Shortfin Mako Shark Reported to ICCAT (landings and discards) by Major Gear and Flag between 1990 and 2005. Source: SCRS, Summary Report, 2006**.**

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Atlantic Total		1,245	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	7,409	3,790
LONGLINE LANDINGS	BRAZIL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37	259
	CANADA	0	0	0	0	0	0	743	1,103	0	179	1,689	2,173	1,966	2,160	1,568	2,520
	CHINA P.R.	0	0	0	0	0	275	12	10	4	53	18	0	5	6	0	11
	CHINESE TAIPEI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	EC ESPANA	0	0	0	0	0	0	0	0	0	0	0	750	420	600	0	0
	EC PORTUGAL	0	0	0	0	0	0	0	0	0	0	0	0	0	692	1,206	1,272
	EC UNITED KINGDOM	0	0	0	0	0	0	0	0	0	0	9	0	0	3	6	5
	JAPAN	0	0	0	0	0	0	0	29,917	28,137	29,005	31,094	25,110	21,037	22,601	24,682	0
	MEXICO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0
	NAMIBIA	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	PANAMA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	0
	SOUTH AFRICA	1,387	2,257	1,583	5,726	4,669	5,569	5,710	3,966	3,318	3,337	4,220	4,713	4,602	6,926	3,586	7,266
	TRINIDAD & TOBAGO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	USA	0	0	0	0	2,596	1,589	1,044	996	850	893	494	532	742	830	1,473	0
	URUGUAY	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0
	VANUATU	0	0	0	0	0	0	0	0	0	0	0	0	2,213	0	1,906	6,616
	VENEZUELA	0	0	0	0	0	0	0	0	0	177	22	0	0	0	0	0
LONGLINE DISCARDS	MEXICO	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0
	USA	741	772	184	1136	572	618	609	185	173	97	137	105	68	0	63	76
	UK BERMUDA	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0
OTHER LANDINGS	BRASIL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	61	0
	CANADA	0	0	0	0	0	18	11	11	15	17	20	10	17	10	10	17
	COTE D'IVOIRE	0	9	13	7	17	12	15	23	10	10	9	15	15	30	15	14
	EC PORTUGAL	0	0	0	0	0	0	0	0	0	0	0	0	0	93	74	0
	EC UNITED KINGDOM	0	0	0	0	0	0	0	0	0	2	3	2	1	0	0	0
	SOUTH AFRICA	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0

	ST VINCENT AND THE GRENADINES	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0
	USA	268	210	250	667	317	1422	232	164	148	69	290	215	248	0	222	0
	UK BERMUDA	0	0	0	0	0	0	1	1	2	0	0	0	0	0	0	0

Table 3-21 **Nominal Catches of Porbeagle Shark Reported to ICCAT (landings and discards) by All Gears and Flag between 1990 and 2005.** Source: SCRS, Summary Report, 2006**.**

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Atlantic Total		1,282	1,944	2,588	1,889	2,676	2,121	1,548	1,859	1,468	1,143	1,469	998	848	332	725	556
ALL GEAR LANDINGS	BENIN	0	0	0	0	0	0	0	4	0	4	0	0	0	0	0	0
	BULGARIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CANADA	78	329	813	919	1,575	1,353	1,051	1,334	1,070	965	902	499	237	142	232	202
	CHILE	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	EC DENMARK	46	85	80	91	93	86	72	69	85	107	73	76	42	0	0	0
	EC ESPANA	0	1	0	0	0	0	31	27	27	0	20	25	57	35	15	0
	EC FRANCE	551	300	496	633	820	565	267	315	219	0	410	361	461	0	413	276
	EC GERMANY	0	0	0	0	0	0	0	0	0	0	17	1	3	0	0	0
	EC IRELAND	0	0	0	0	0	0	0	0	0	7	1	6	3	0	0	0
	EC ITALY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
	EC POLAND	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	EC PORTUGAL	2	1	0	0	0	0	0	0	0	0	9	4	10	101	54	16
	EC SWEDEN	2	2	4	3	2	2	1	1	1	1	1	1	0	0	0	0
	EC UNITED KINGDOM	9	0	0	0	0	0	0	0	1	6	8	12	10	0	0	24
	FALKLANDS	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	FAROE ISLANDS	550	1,189	1,149	165	48	44	8	9	7	10	0	0	0	0	0	0
	ICELAND	0	0	1	3	4	6	5	3	4	2	2	3	2	0	0	0
	JAPAN	0	0	0	1	0	0	8	18	0	1	0	0	0	0	0	0
	NORWAY	43	32	41	24	24	26	28	17	27	32	22	11	14	19	0	8
	SEYCHELLES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	USA	2	5	1	50	106	35	78	56	13	3	1	1	1	0	1	0
	URUGUAY	0	0	0	0	0	3	0	5	13	2	4	0	8	34	8	28
ALL GEAR DISCARDS	EC IRELAND	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	USA	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0
	URUGUAY	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0

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, and harpoon) fishery includes both commercial and recreational fisheries and is described fully in Section 2.5.8 of the 1999 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 to the discussions of alternative H4 in Chapters 2 and 4 of the 2006 Consolidated HMS FMP. At present, NMFS is considering alternatives in regard to changes with greenstick use in HMS fisheries, and what NMFS should keep in mind about greenstick gear when considering a change in authorization of this gear.

3.4.4.1 Overview of History and Current Management

Atlantic tunas, swordfish, and sharks are managed under the 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 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 are oftentimes exploited 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. Amendment 1 to the 1999 Atlantic Tunas, Swordfish, and Shark FMP limited the recreational fishery to rod and reel and handline gear only.

Table 3-22 Estimates of Total Recreational Harvest of Atlantic Sharks: 1998-2005 (numbers of fish in thousands). Source: Cortés and Neer 2005, Cortés, pers. comm. Estimates include prohibited species.

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

Table 3-23 Recreational Harvest of Atlantic Large Coastal Sharks (LCS) by Species, in number of fish: 1999-2005. Sources: Cortés and Neer 2005, Cortés, pers. comm.

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

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

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

Table 3-24 Recreational Harvest of Atlantic Pelagic Sharks by Species, in number of fish: 1999-2005. Sources: Cortés and Neer 2005, Cortés, pers. comm**.**

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

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

Table 3-25 Recreational Harvest of Atlantic SCS by Species, in number of fish: 1999-2005. Sources: Cortés and Neer 2005, Cortés, pers. comm.

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

*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. Therefore, in some cases, 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 should be 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 – 2004 is presented in Table 3-26.

Table 3-26 **Observed or reported number of Atlantic Shark kept and released in the rod and reel fishery, Maine through Virginia, 1997-2005.**
Source: Large Pelagic Survey (LPS) Preliminary Data**.**

	Number of Fish Kept								Number of Fish Released Alive							
Species	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Thresher Shark	7	3	2	5	20	24	58	45	2	2	1	0	5	8	27	8
Mako Shark	78	49	49	27	72	141	216	99	92	49	114	65	120	208	350	143
Sandbar Shark	2	2	1	2	0	9	7	1	56	6	4	10	17	26	68	37
Dusky Shark	6	1	0	0	1	0	0	0	54	7	32	8	9	0	60	49
Tiger Shark	2	0	0	1	1	0	0	1	5	0	3	2	3	12	0	6
Porbeagle	1	0	0	0	1	0	1	1	6	0	0	0	14	3	1	1
Blacktip Shark	1	0	0	1	0	1	0	1	2	5	0	0	6	0	1	19
Atlantic Sharpnose Shark	1	0	0	0	0	0	0	0	3	0	0	0	0	0	0	11
Blue Shark	26	11	12	2	36	65	74	67	780	572	374	141	505	2,061	2,242	821
Hammerhead Shark	1	1	1	2	0	0	1	0	4	5	0	1	6	38	2	5

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 3-27 **Commercial landings of large coastal sharks in lb dw: 2000-2005.** Sources: Cortés 2003; Cortés and Neer 2002, 2005; Cortés pers. comm.

Large Coastal Sharks	2000	2001	2002	2003	2004	2005
Basking**	0	0	0	0	0	0
Bignose*	672	1,442	0	318	0	98
Bigeye sand tiger**	0	0	0	0	0	0
Blacktip	1,633,919	1,135,199	1,099,194	1,474,362	1,092,600	993,380
Bull	24,980	27,037	40,463	93,816	49,556	133,265
Caribbean Reef*	0	1	0	0	0	0
Dusky*	205,746	1,973	8,779	23,288	1,025	874
Galapagos*	0	0	0	0	0	0
Hammerhead, Great	0	0	0	0	0	0
Hammerhead, Scalloped	0	0	0	0	0	0
Hammerhead, Smooth	0	0	0	0	92	54
Hammerhead, Unclassified	35,060	69,356	108,160	150,368	116,546	197,067
Large Coastal, Unclassified	16,575	172,494	147,359	51,433	0	0
Lemon	45,269	24,453	56,921	80,688	67,810	71,805
Narrowtooth*	0	0	0	0	0	0
Night*	0	0	0	20	0	0
Nurse	429	387	69	70	317	97
Sandbar	1,491,908	1,407,550	1,863,420	1,425,628	1,223,241	1,282,477
Sand Tiger**	6,554	1,248	409	624	1,832	5,167
Silky	31,959	14,197	30,731	51,588	11,808	17,646
Spinner	14,473	6,970	8,447	12,133	14,806	44,150
Tiger	24,443	26,973	16,115	18,536	30,976	33,477
Whale**	0	0	0	0	0	0
White**	1,201	26	0	1,454	58	0
Unclassified, assigned to large coastal	92,117	525,661	771,450	908,077	603,229	527,026

Large Coastal Sharks	2000	2001	2002	2003	2004	2005
Unclassified, fins	87,820	23,988	142,565	181,431	137,375	110,613
Total (excluding fins)	**3,625,305 (1,644 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)**

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

Table 3-28 **Commercial landings of small coastal sharks in lb dw: 2000-2005**. Sources: Cortés and Neer 2002, 2005; Cortés 2003; Cortés pers. comm.

Small coastal sharks	2000	2001	2002	2003	2004	2005
Atlantic Angel*	97	0	495	1,397	818	3,587
Blacknose	178,083	160,990	144,615	131,511	68,108	120,320
Bonnethead	69,411	63,461	36,553	38,614	29,402	33,295
Finetooth	202,572	303,184	185,120	163,407	121,036	107,327
Sharpnose, Atlantic	142,511	196,441	213,301	190,960	230,880	375,881
Sharpnose, Atlantic, fins	0	209	0	0	0	0
Sharpnose, Caribbean*	353	205	0	0	0	0
Unclassified Small Coastal	0	51	35,831	8,634	1,407	9,792
Total (excluding fins)	**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)**

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

Table 3-29 **Commercial landings of pelagic sharks in lb dw: 2000-2005.** Sources: Cortés and Neer 2002, 2005; Cortés 2003; Cortés pers. comm.

Pelagic Sharks	2000	2001	2002	2003	2004	2005
Bigeye thresher*	4,376	330	0	0	719	267
Bigeye sixgill*	0	0	0	0	0	0
Blue shark	3,508	65	137	6,324	423	0
Mako, longfin*	6,560	9,453	3,008	1,831	1,827	403
Mako, shortfin	129,088	171,888	159,840	151,428	217,171	188,608
Mako, Unclassified	74,690	73,556	58,392	33,203	50,978	35,241
Oceanic whitetip	657	922	1,590	2,559	1,082	713
Porbeagle	5,272	1,152	2,690	1,738	5,832	2,452
Sevengill*	0	0	0	0	0	0
Sixgill*	0	0	0	0	0	0
Thresher	81,624	56,893	53,077	46,502	44,915	24,280
Unclassified, pelagic	233	0	5,965	79,439	0	0

Pelagic Sharks	2000	2001	2002	2003	2004	2005
Unclassified, assigned to pelagic	40,951	31,636	182,983	314,300	356,522	18,057
Unclassified, pelagic, fins	3,746	12,239	0	0	41	0
Total (excluding fins)	**346,959 (157 mt dw)**	**345,895 (157 mt dw)**	**467,682 (212 mt dw)**	**637,324 (289 mt dw)**	**679,469 (308 mt dw)**	**270,021 (122 mt dw)**

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

Table 3-30 The number of sharks and non-shark species that were discarded alive, discarded dead, and kept under the exempted fishing program during 2006, 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	12			12
Atlantic Sharpnose Shark	2,512	354	3	2,869
Bigeye Thresher Shark	1	1	1	3
Blacknose Shark	190	44		234
Blacktip Shark	124	117	1	242
Blue Shark	52			52
Bonnethead Shark	407	28	3	438
Bull Shark	33	2		35
Caribbean Reef Shark	4	2		6
Caribbean Sharpnose Shark	3			3
Cuban Dogfish Shark	5			5
Dusky Shark	36			36
Finetooth Shark	1			1
Florida Smoothhound Shark	152	2		154
Great Hammerhead Shark	5	18		23
Lemon Shark	47	2		49
Longfin Mako Shark		1		1
Mako Shark	7			7
Night Shark	3			3
Nurse Shark	146		15	161
Porbeagle Shark	1			1
Sand Tiger Shark	21		6	27
Sandbar Shark	330	61	6	397
Sawfish	5			5
Scalloped Hammerhead Shark	33	8		41
Sevengill Shark	1			1
Silky Shark	15			15
Smooth Dogfish Shark	86	1		87
Smooth Hammerhead Shark			1	1
Spinner Shark	60	10		70
Spiny Dogfish Shark	25			25
Tiger Shark	120			120
Unidentified Shark	10			10

Species	Number Discarded Alive	Number Discarded Dead	Number Kept	Total Number of Interactions
Non-Shark Species				
Barracuda	13			13
Bigeye Tuna		2		2
Black Seabass	5			5
Blacktail Moray	3			3
Blue Marlin	8		1	9
Bluefin Tuna	32	2	108	142
Bluefish	4	2	11	17
Blueline Tilefish		1		1
Bullnose Ray			2	2
Clearnose Skate	3			3
Croaker	1			1
Dasyatis Spp.	3			3
Escoler			2	2
Gafftopsail Catfish	19			19
Goldeye Tilefish	1			1
Goliath Grouper	1			1
Gulf Hake	2	1		3
Hardhead Catfish	5			5
Inshore Lizardfish	1			1
King Mackerel		1		1
King Snake Eel	72			72
Leatherback Sea Turtle	1			1
Leopard Toadfish	1			1
Little Tunny			1	1
Loggerhead Turtle	2		1	3
Dolphin Fish	3	2	13	18
Malabar Grouper		1		1
Palespotted Eel	5			5
Red Drum	4			4
Red Grouper	42	2		44
Red Snapper	36	3		39
Reticulate Moray	2			2
Sailfish	3			3
Sand Perch		1		1
Sand Seabass		1		1
Scamp	3			3
Shark Sucker	3			3
Snakefish	1			1
Snapper Eel	1			1
Snowy Grouper	13			13
Southern Stingray	25			25
Swordfish	1			1
Tilefish	30			30
Unidentified Fish	2			2
Vermilion Snapper	4			4
Warsaw Grouper	1			1
White Marlin	26	1	6	33
Yellowedge Grouper	35			35
Yellowfin Tuna			1	1

Table 3-31 Estimates of total landings and dead discards for large coastal sharks from 1981 through 2005 (numbers of fish in thousands). Sources: Modified from Table 2.2 in SEDAR 11 LCS Data Workshop Report and Cortés, pers. comm.

Year	Commercial Landings	Pelagic longline discards	Recreational catches	Unreported catches	Bottom longline discards	Mexican catches	Menhaden fishery discards	Confiscated Mexican catches in US	Total
1981	16.2	0.9	285.1		0.5	119.971	37.5		460.2
1982	16.2	0.9	539.3		0.5	81.913	38.5		677.3
1983	17.5	0.9	812.7		0.6	85.437	38.0		955.1
1984	23.9	1.3	273.3		0.8	120.684	38.0		458.0
1985	22.2	1.2	407.8		0.7	87.748	34.2		553.9
1986	54	2.9	426.7	24.9	1.7	81.835	33.8		625.8
1987	104.7	9.7	298.3	70.3	3.3	80.16	35.2		601.7
1988	274.6	11.4	317.2	113.3	8.7	89.29	34.2		848.6
1989	351	10.5	224.8	96.3	11.1	105.562	36.1		835.3
1990	267.5	8	219.2	52.1	8.5	122.22	35.2		712.7
1991	200.2	7.5	306.2	11.3	6.3	95.695	27.2		654.4
1992	215.2	20.9	218.0		6.8	103.366	23.9		588.2
1993	169.4	7.3	189.2		5.4	119.82	24.4		515.5
1994	228	8.8	155.2		3.7	110.734	26.1		532.6
1995	222.4	5.2	186.0		5.2	95.996	24.0		538.8
1996	161.0	5.7	196.6		4.8	106.057	23.9		498.0
1997	130.6	5.6	167.6		6.7	83.051	24.4		418.0
1998	174.9	4.3	161.4		6.6	74.136	23.5		444.8
1999	111.5	9.0	82.1		2.9	57.061	25.8		288.4
2000	111.2	9.4	140.0		4.1	52.057	22.1	1.000	339.9
2001	95.8	5.6	137.2		5.5	52.057	20.6	1.470	318.2
2002	123.7	2.43	82.8		4.8	52.057	20.2	1.390	287.4
2003	128.0	3.5	88.8		7.1	52.057	19.7	1.310	300.5
2004	103.4	5.2	66.6		4.7	52.057	20.2	2.120	254.3
2005	107.4	4.5	86.3		8.1	52.057	20.2	2.120	280.6

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 2006 and, in some cases, May 11, 2007, depending on the table in which the data appears. Furthermore, Section 3.9.6 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 2006 (and beyond) are included in Table 3-32. The overall number of HMS permits for Atlantic swordfish and sharks (directed and incidental) decreased between 2006 and May 11, 2007 (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.

State	SHK Directed	SHK Inci-dental	SWO Directed	SWO Inci-dental	GOM Reef Fish	Dolphin Wahoo	*Mack-erel: King and Spanish	Lobster	Snapper Grouper	Non-HMS Charter Head Boat General	Other	# Vessels / # Permits
ME	3	3	3			2						6/11
NH		1										1/1
MA	2	11	8	2		5	5	2			1	13/36
RI		8	2	2		1					4	8/17
CT		2	1									2/3
NY	6	7	9	2		10	2		1	1	1	13/39
NJ	25	20	21	13		21	25	2	2	3	7	45/139
DE	4	1	5			5						5/15
MD	4	2	6			5	2			3		6/22
VA	1	4		3		3	3		2			5/16
NC	16	16	9	9		25	45		13	7	9	32/149
SC	5	11	1			12	12		13	6	1	15/61
GA	2	1				2	3	4	2	3		3/17
FL	141	144	70	30	128	156	296	47	81	131	20	284/ 1252
AL	2	1		1	1	1	2					3/8
MS	1	5			4		9				3	6/21
LA	5	37	30	8	10	4	14				3	42/111

State	SHK Directed	SHK Inci-dental	SWO Directed	SWO Inci-dental	GOM Reef Fish	Dolphin Wahoo	*Mack-erel: King and Spanish	Lobster	Snapper Grouper	Non-HMS Charter Head Boat General	Other	# Vessels / # Permits
TX	2	8	2	4	9	3	5				1	10/34
WV	1				1		2					1/4
PA		3		2		1	4					3/10
No Vessel ID	11	13	15	2							4	26/38
**Total 2007 ** **	**231**	**298**	**182**	**78**	**153**	**256**	**429**	**55**	**114**	**154**	**54**	**529 / 2,004**
Total 2006	**240**	**312**	**191**	**86**	***	***	***	***	***	***	***	**604/ 1,131**
Total 2005	**235**	**320**	**190**	**91**	***	***	***	***	***	***	***	**639/ 1,128**

* of shark directed permit holders, 107 have Spanish mackerel permits, and 87 have king mackerel permits and of shark incidental permit holders, 121 have Spanish mackerel permits, and 117 have king mackerel permits.
** Totals for 2007 are as of May 11, 2007.
*** 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 New England Fishery Management Council (NEFMC) and Mid-Atlantic Fishery Management Council (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 Advisory Panel (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, GRT, and NT) of more than 35 percent, relative to the vessel first issued the HMS limited access permit. Also, all horespower 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 will be removed for all HMS limited access permits. NMFS will provide additional information to limited access permit holders regarding eligibility for the modified vessel upgrading restrictions in a future notice.

3.5.2 HMS CHB Permits

In 2002, NMFS published a final rule (67 FR 77434, Dec. 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 February 1, 2006 and April 25, 2007 (Table 3-33).

Table 3-33 CHB Permits by State as of April 25, 2007.

State	CHB permits	State	CHB Permits
AL	76	NH	49
CT	92	NJ	589
DE	145	NV	1
FL	708	OH	3
GA	27	PA	55
LA	82	PR	24
MA	617	RI	157
MD	171	SC	146
ME	82	TN	--
MI	6	TX	166
MS	24	VA	151
NC	484	VI	20
NY	358	Other	11
Total (2007)			**4,245**
Total (2006)			**4,173**

3.5.3 HMS Angling Permits

Effective March 2003 (67 FR 77434, Dec. 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 Marine Recreational Fisheries Statistics Survey (MRFSS) and the Large Pelagic Survey (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.

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. 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 May 22, 2007, there are 269 permitted shark dealers (Table 3-34). 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 3-34 **Number of shark dealer permits and other permits held by shark dealers by state or country as of May 22, 2007.** The actual number of permits per may change as permit holders move or sell their businesses.

State	Sharks	Domestic Swordfish	Dolphin/ Wahoo	Reef Fish	Rock Shrimp	Snapper/ Grouper	Golden Crab	Wreckfish	Total # of Permits
AL	4	1	2	4	1	2	1	1	16
CA	11	11	2		2	2			28
FL	102	76	37	79	21	65	18	15	413
GA	1	1	1		1	1		1	6
HI	16	16				4			36
LA	12	10	6	11	1	8		1	49
MA	14	14	10	2	1	3	1	1	46
MD	2	2	2						6
MO	1		1	1		1			4
MS	1			1					2
NC	23	15	22	4	2	23		7	96
NJ	15	15	7	1	2	4	1	1	46
NY	17	17	15	10	2	5	2	2	70
PA	1	1	1	1	1	1	1	1	8
PR	1	1							2
RI	6	6	6			1	1	1	21
SC	21	8	15			15		3	62
TX	17	10	3	15	2	4			51
VA	4	2	2			2		1	11
Totals 2007	**269**	**206**	**132**	**129**	**36**	**141**	**25**	**35**	**973**

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.

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 and Gulf of Mexico 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 Biological Opinions. 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 2002 – 2006 by category and species are listed in Table 3-35.

Table 3-35. Number of Exempted Fishing Permits (EFPs), Display Permits, and Scientific Research Permits (SRPs) issued between 2002 and 2006.

Permit type		2002	2003	2004	2005	2006
Exempted Fishing Permit	Sharks for display	7	8	8	6	7
	HMS for display	1	1	1	1	1
	Tunas for display	0	0	1	0	--
	Shark research on a non-scientific vessel	5	9	6	5	7
	Tuna research on a non-scientific vessel	4	5	11	7	5
	HMS research on a non-scientific vessel	5	18	5	3	4
	Billfish research on a non-scientific vessel	0	0	1	2	3
	Shark Fishing	1	1	0	0	--
	HMS Chartering	0	0	1	0	--
	Tuna Fishing	6	7	2	0	5
	TOTAL	**29**	**49**	**36**	**24**	**32**
Scientific Research Permit	Shark research	2	1	3	4	2
	Tuna research	1	0	0	0	--
	Billfish research	0	0	0	0	1
	HMS (multi-species) research	1	1	1	4	4
	TOTAL	**4**	**2**	**4**	**8**	**7**
Letters of Acknowledgement	Shark research	3	3	2	4	5
	TOTAL	**3**	**3**	**2**	**4**	**5**

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 such fish. 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) 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.

The reasons for participation in fishing tournaments include, but are not limited to, competition, camaraderie, and the opportunity to win valuable prizes. A recent search on the Internet for fishing tournaments (December, 2004) indicated that many saltwater tournaments target HMS. It has been estimated that approximately 300 – 400 HMS fishing tournaments occur annually along the U.S. Atlantic coast, including the Gulf of Mexico and Caribbean (NMFS, 1999). These tournaments may 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.

For anglers in HMS tournaments, winning the prize money may not be the only motive for participation. Many HMS fishing tournaments support charitable organizations; an internet search revealed that some of the charities which have benefited from fishing tournaments include: the Cystic Fibrosis Foundation, Make-A-Wish Foundation, Sloan-Kettering Skin Cancer Center, Boy Scouts of America, Ducks Unlimited, The Boys and Girls Club, The Broadstreet Clinic, Core Sound Waterfowl Museum, Hope Mission Christian Ministries, Sertoma by the Bay (breast cancer research), Take A Kid Fishing, Capt. Bob Lewis Scholarship Fund, South Nassau Communities Hospital, South Texas Children's, T. H. Rogers School for Impaired Children's Home, The Billfish Foundation, and Kids In Distress.

Table 3-36 presents the total number of registered HMS tournaments, by state, between 2001 and 2006. This table indicates that, in 2006, HMS fishing tournaments were conducted most frequently in Florida, Louisiana, New Jersey, Puerto Rico, North Carolina, Texas, Maryland, New York, South Carolina, and Georgia. By far, the largest number of registered HMS tournaments has consistently occurred in the state of Florida.

Table 3-36 Number of Registered HMS Tournaments by State between 2001 and 2006. Source: NMFS Atlantic HMS Tournament Registration Database.

STATE	2001	2002	2003	2004	2005	2006
ME	2	3	3	5	3	5
NH	0	0	0	0	0	0
MA	7	1	7	10	4	7
RI	2	2	3	3	2	2
CT	1	0	0	0	1	1
NY	5	4	14	14	10	12
NJ	11	5	18	17	16	19
DE	2	0	0	1	0	0
MD	4	2	14	14	14	13
VA	5	1	5	4	5	4
NC	11	5	15	16	18	17
SC	6	3	13	9	9	12
GA	6	1	12	3	13	11
FL	46	26	66	57	74	83
AL	7	7	9	8	7	8
MS	3	2	7	2	2	1
LA	19	0	20	22	26	20
TX	14	1	17	10	17	17
PR	16	4	13	17	22	19
USVI	9	0	6	1	10	7
Bahamas[1]	3	2	1	2	2	1
Bermuda[1]	0	0	0	0	1	0
Mexico[1]	1	0	0	0	0	0
Turks/Caicos[1]	0	0	1	0	0	0

STATE	2001	2002	2003	2004	2005	2006
TOTAL	181	68	244	215	256	259

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

Table 3-37 shows the number and percentage of HMS tournaments awarding points or awards for a particular HMS, based upon 2005 and 2006 tournament registrations. Blue marlin, sailfish, white marlin, and yellowfin tuna are the predominant target species in HMS fishing tournaments. Bluefin tuna, swordfish and pelagic sharks are also frequently targeted in HMS tournaments.

From 2005 – 2006, the number of tournaments identifying billfish (blue marlin, white marlin, and sailfish) as a target species remained almost constant. The number of tournaments identifying yellowfin, bluefin, and bigeye tuna as a target species declined, and the number of tournaments identifying pelagic, ridgeback, non-ridgeback, and small coastal sharks as target species increased. Also, the number of tournaments identifying albacore and skipjack tuna as target species increased during this period.

Table 3-37 Number and Percent of All 2006 HMS Tournaments Awarding Points or Prizes for a HMS. Source: NMFS Atlantic HMS Tournament Registration Database.

Species	Number of Tournaments		Percent of Tournaments	
	2005	2006	2005	2006
Blue Marlin	174	173	67.9%	66.8%
Sailfish	164	164	64.1%	63.3%
White Marlin	162	163	63.3%	62.9%
Yellowfin Tuna	161	144	62.9%	55.6%
Bluefin Tuna	83	78	32.4%	30.1%
Swordfish	71	74	27.7%	28.6%
Pelagic Sharks	53	67	20.1%	25.9%
Bigeye Tuna	48	42	18.8%	16.2%
Albacore Tuna	13	20	5.1%	7.7%
Ridgeback Sharks	9	13	3.5%	5.0%
Non-Ridgeback Sharks	5	10	2.0%	3.9%
Skipjack Tuna	5	7	2.0%	2.7%
Small Coastal Sharks	5	6	2.0%	2.3%

Table 3-38 through Table 3-40 indicate the percentage and number of 2006 HMS registered tournaments, by state (or country), for pelagic, LCS (ridgeback & non-ridgeback), and SCS, respectively. These tables indicate that the Louisiana/Texas, New York/New Jersey, and Massachusetts/Maine areas are the primary areas for pelagic shark fishing tournaments. Large coastal and small coastal shark fishing tournaments are conducted much less frequently.

Table 3-38 **Registered Pelagic Shark Tournaments, 2006.** Source: NMFS Atlantic HMS Tournament Registration Database.

State	Number of 2006 Tournaments Awarding Points or Prizes for Pelagic Sharks	Percent of Total 2006 Tournaments Awarding Points or Prizes for Pelagic Sharks
Louisiana	19	28.3%
Texas	10	14.9%
New York	9	13.4%
New Jersey	8	11.9%
Massachusetts	6	8.9%
Maine	4	6.0%
Florida	3	4.5%
Maryland	3	4.5%
Puerto Rico	2	3.0%
Rhode Island	2	3.0%
Connecticut	1	1.5%
TOTAL	**67**	**100%**

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

Table 3-39 **Registered Large Coastal Shark (ridgeback and non-ridgeback) Tournaments, 2006**. Source: NMFS Atlantic HMS Tournament Registration Database.

State	Number of 2006 Tournaments Awarding Points or Prizes for Large Coastal Sharks	% of Total 2006 Tournaments Awarding Points or Prizes for Large Coastal Sharks
New York	4	30.8%
Florida	3	23.1%
Maryland	2	15.4%
Alabama	1	7.7%
Puerto Rico	1	7.7%
South Carolina	1	7.7%
Texas	1	7.7%
TOTAL	**13**	**100%**

Table 3-40 Registered Small Coastal Shark Tournaments, 2006. Source: NMFS Atlantic HMS Tournament Registration Database.

State	Number of 2006 Tournaments Awarding Points or Prizes for Small Coastal Sharks	% of Total 2006 Tournaments Awarding Points or Prizes for Small Coastal Sharks
Florida	4	66.7%
South Carolina	1	16.7%
Texas	1	16.7%
TOTAL	**6**	**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 a baseline against which the rule or fishery may be evaluated. In this analysis, as in past SAFE reports, NMFS used 1996 as a baseline. NMFS believes that this baseline is appropriate because the Regulatory Flexibility Act (RFA) and Magnuson-Stevens Act were both amended in 1996, NMFS began to collect economic information voluntarily for vessels using the pelagic logbook in 1996, and regarding HMS specifically, no rules were implemented in 1996 that were classified as significant under RFA. Additionally, while the 1999 FMP for Atlantic Tunas, Swordfish, and Shark and the Billfish Amendment 1 were finalized in 1999, scoping for these two major documents and its final rule began in 1997. It is possible that anticipation of these documents and any potential changes in their implementing regulations could have begun to impact the decisions made by HMS fishermen and any associated businesses.

In addition to using the 1996 baseline, this DEIS also provides six years of data, when possible, in order 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 1996 to 2006 are provided in Table 3-41. 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 2006, the Consumer Price Index (CPI-U) indicates that prices have risen by 28.5 percent, the Gross Domestic Product (GDP) Implicit Price Deflator indicates that prices have risen 23.7 percent, and the Producer Price Index (PPI) for unprocessed finfish indicates a 80.4 percent rise in prices (Table 3-41). From 2004 to 2005, the CPI, GDP Deflator, and the PPI for unprocessed finfish indicate prices rose by 3.4 percent, 3.0 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, 2.9 percent, and 32.2 percent respectively.

Table 3-41 **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	112.7	253.1
2006	201.6	116.0	334.6

3.6.1 Commercial Fisheries[2]

In 2004, the total commercial shark landings at ports in the 50 states by U.S. fishermen were valued at $7.1 million. In 2005, the total commercial shark landings at ports in the 50 states by U.S. fishermen were valued at ~$4.3 million. The 2005 ex-vessel price indicated that prices for LCS and pelagic sharks have decreased, while prices for SCS and shark fins have increased. For a summary of all pricing, see Table 3-41.

3.6.1.1 Ex-Vessel Prices

The average ex-vessel prices per lb dw for 1996 and 1999 to 2006 by shark species complex and area are summarized in Table 3-42. For both of these tables, 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.

Table 3-42 **Average ex-vessel prices per lb for shark by area.**

Species	Area	1996	1999	2000	2001	2002	2003	2004	2005	2006
Non-sandbar large coastal sharks*	Gulf of Mexico	$0.21	$0.56	$0.43	$0.44	$0.36	$0.38	$0.37	$0.49	$0.47
	S. Atlantic	$1.02	$1.10	$0.78	$1.12	$1.27	$0.39	$0.44	$0.49	$0.46
	Mid-Atlantic	$0.55	$0.59	$0.53	$1.09	$1.56	$1.62	$1.93	$0.36	-

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

Species	Area	1996	1999	2000	2001	2002	2003	2004	2005	2006
	N. Atlantic	$0.88	$0.77	$1.01	$1.02	$0.77	$0.72	$0.70	$0.24	-
Pelagic sharks	Gulf of Mexico	-	$1.36	$1.31	$1.42	$1.11	$1.13	$1.08	$1.09	$1.21
	S. Atlantic	$0.62	$0.83	$0.76	$0.68	$0.67	$0.71	$0.65	$0.70	$0.72
	Mid-Atlantic	$1.21	$1.23	$1.20	$1.09	$1.17	$1.21	$1.29	$1.39	-
	N. Atlantic	$1.31	$0.81	$1.10	$1.23	$1.00	$1.12	$1.46	$1.43	-
Small coastal sharks	Gulf of Mexico	-	$0.55	$0.52	$0.58	$0.48	$0.40	$0.45	$0.55	-
	S. Atlantic	$0.25	$0.50	$0.48	$0.52	$0.53	$0.51	$0.61	$0.61	$0.53
	Mid-Atlantic	$0.25	$0.47	$0.38	$0.55	$0.48	$0.38	$0.44	$0.42	$0.55
	N. Atlantic	-	-	-	$1.51	$0.58	-	-	$0.50	-
Sandbar sharks*	Gulf of Mexico	-	-	-	-	-	$0.39	$0.40	$0.45	$0.40
	S. Atlantic	-	-	-	-	-	$0.45	$0.35	$0.42	$0.38
	Mid-Atlantic	-	-	-	-	-	-	-	$0.64	-
	N. Atlantic	-	-	-	-	-	-	-	$0.54	-
Shark fins	Gulf of Mexico	-	$14.01	$15.99	$20.90	$22.64	$18.12	$17.93	$20.21	$20.65
	S. Atlantic	$10.74	$11.10	$14.16	$18.43	$17.10	$15.85	$14.57	$15.42	$16.20
	Mid-Atlantic	$4.60	$3.41	$4.90	-	-	-	-	-	-
	N. Atlantic	$2.69	$1.19	$6.83	-	-	-	-	-	-

*Sandbar sharks are broken out of the large coastal shark complex for 2003-2006 to provide baseline information for this proposed Amendment.

The average ex-vessel price for LCS slightly decreased in the Gulf of Mexico in 2006 and South Atlantic. It is important to note that sandbar sharks are taken out of the LCS complex for 2006, leaving "non-sandbar LCS." Prices for pelagic sharks increased in the Gulf of Mexico and South Atlantic (Table 3-42). The average ex-vessel prices for small coastal sharks (SCS) decreased in the South Atlantic and increased in the Mid-Atlantic (Table 3-42).

3.6.1.2 Revenues

Table 3-43 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 2005), the Shark Evaluation Reports, and information given to ICCAT (Cortes, 2005). These values indicate that the estimated total annual revenue of shark fisheries has increased from approximately $4.6 million in 1996 to approximately ~$4.3 million in 2005. From 2003 to 2004 especially, the annual revenues from shark decreased by over 21 percent. It is important to note that sandbar sharks were removed from the LCS complex, leaving "non-sandbar LCS." This accounts for the large exaggeration in revenue for 2005 when compared across the years.

Table 3-43 **Estimates of the total ex-vessel annual revenues of Atlantic shark fisheries**. Sources: NMFS, 1997; NMFS 2004a; Cortes, 2003; Coastal Fisheries and HMS Logbooks 2005.

Species		1996	1999	2000	2001	2002	2003	2004	2005
Non-Sandbar Large coastal sharks*	Ex-vessel $/lb dw	$0.67	$0.76	$0.68	$0.91	$0.99	$0.78	$0.86	$0.48
	Weight lb dw	5,262,314	3,919,570	3,762,000	3,562,546	4,097,363	4,421,249	3,206,377	1,186,310
	Fishery Revenue	$3,525,750	$2,950,102	$2,560,307	$3,256,955	$4,040,977	$3,437,521	$2,757,484	$569,429
Pelagic sharks	Ex-vessel $/lb dw	$1.05	$1.06	$1.09	$1.11	$0.99	$1.04	$1.12	$1.03
	Weight lb dw	695,531	400,821	215,005	362,925	303,666	616,967	450,833	53,196
	Fishery Revenue	$730,308	$424,273	$233,650	$401,430	$299,487	$643,188	$504,933	$54,792
Small coastal sharks	Ex-vessel $/lb dw	$0.25	$0.51	$0.46	$0.79	$0.52	$0.43	$0.50	$0.59
	Weight lb dw	460,667	672,245	672245*	719,484	579,441	549,799	677,305	438,653
	Fishery Revenue	$115,167	$340,890	$309,926	$568,441	$299,023	$236,414	$338,653	$258,805
Shark fins (weight = 5% of all sharks landed)	Ex-vessel $/lb dw	$6.01	$7.43	$10.47	$19.67	$19.87	$17.09	$16.25	$17.94
	Weight lb dw	320,926	249,632	232,462	232,248	249,024	279,401	216,726	153,292
	Fishery Revenue	$218,561	$1,854,313	$2,434,344	$4,568,937	$4,949,056	$4,774,959	$3,521,793	$2,750,052
Sandbar sharks*	Ex-vessel $/lb dw	-	-	-	-	-	-	-	$0.47
	Weight lb dw	-	-	-	-	-	-	-	1,387,664
	Fishery Revenue	-	-	-	-	-	-	-	$652,202
Total sharks	**Fishery Revenue**	**$4,589,786**	**$5,569,578**	**$5,538,227**	**$8,795,763**	**$9,588,545**	**$9,092,082**	**$7,112,863**	**$4,285,280**

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

*Sandbar sharks are broken out of the large coastal shark complex for 2005 to provide baseline information for this proposed Amendment. This exaggerates the discrepancy in revenue for LCS in 2005 when compared across years.

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 3-44 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 3-44 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 3-44 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, 2004.

Species	Description	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[2] in 2001 found that for the entire United States 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). 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 (USFWS, 2001). Saltwater anglers spent $4.5 billion on trip-related costs and $3.9 billion on equipment (USFWS, 2001). Approximately 76 percent of the saltwater anglers surveyed fished in their home state (USFWS, 2001). Preliminary findings for the USFWS 2006 survey will be available in the spring of 2007 and final reports will be issued beginning in the fall of 2007.

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 NMFS' Marine Recreational Fisheries Statistics Survey (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,

[2] This survey interviewed over 77,000 households during phase 1 and approximately 25,070 sports persons during phase 2. The response rate during phase two of the survey was 75 percent.

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 large coastal shark directed trips, and $81 on small coastal sharks.

The American Sportfishing Association (ASA) also has a report listing the 2001 economic impact of sportfishing on specific states. This report states that all sportfishing (in both Federal and state waters) has an overall economic importance of $116 billion dollars (ASA, 2001). Florida, Texas, North Carolina, New York, and Alabama are among the top ten states in terms of overall economic impact for both saltwater and freshwater fishing (ASA, 2001). Florida is also one of the top states in terms of economic impact of saltwater fishing with $2.9 billion in angler expenditures, $5.4 billion in overall economic impact, $1.5 billion in salaries and wages related to fishing, and 59,418 fishing related jobs (ASA, 2001). California followed Florida with $0.8 billion in angler expenditures, $1.7 billion in overall economic impact, $0.4 billion in salaries and wages, and 15,652 jobs (ASA, 2001). Texas and New Jersey were the next highest states in terms of economic impact (ASA, 2001).

At the end of 2004, NMFS began collecting market information regarding advertised charterboat rates. This preliminary analysis of the data collected includes 99 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 3-45 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 3-45 **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
ME	$900
NC	$1,130

State	2004 Average Daily Charter Rate
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 National Standard 8 (NS 8), conservation and management measures should, consistent with conservation requirements, attempt to both provide for the continued participation of a community and, to the extent practicable, minimize the economic effects on the community. 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)).

The National Environmental Policy Act (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 National Standards (NS) 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 National Standard 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 1998 Wilson et al. 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*., 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. A detailed description of additional information used in the community profiles analysis can be found in Section 9.2.2 of the Consolidated HMS FMP. Several other chapters in this document include information that addresses the requirements described in section 9.1. Please refer to the Description of the Affected Environment in Chapter 3, 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 alternative suites in Chapter 4 includes an assessment of the potential social and economic impacts associated with the proposed alternatives. The preferred alternative suite was selected to minimize economic impacts and provide for the sustained participation of fishing communities, while taking the necessary actions to rebuild overfished fisheries as required by the Magnuson-Stevens Act.

3.7.2 Summary of New Social and Economic Data Available

3.7.2.1 2006 Social Science Publications

NMFS currently has a HMS social impact assessment underway, which is expected to conclude in December of 2007. This assessment is listed below along with one workshop proceedings, a peer reviewed articles, one book, and a technical memorandum.

Impact Assessment. 2006. HMS Social Impact Assessment. (NOAA-NMFS Contract DG133F06SE3980). *In progress.*

Scott, T., J.E. Kirkley, R. Rinaldo, and D.E. Squires. 2006. *Assessing Capacity in the U.S. Northwest Atlantic, PLL Fishery for Highly Migratory Species with Undesirable Outputs*. Methodological Workshop on the Management of Tuna Fishing Capacity. La Jolla, CA, USA, May 8 to 12, 2006. 11 pp.

Abstract: Although excess capacity has been recognized by the United Nations Food and Agriculture Organization (FAO) and member nations as an issue of global concern, the FAO and member nations have also widely recognized the problem of the incidental or inadvertent capture of non-marketable bycatch (*i.e.*, bycatch discards). To date, most assessments of capacity, however, have ignored the potential relationship between capacity output and undesirable bycatch (*i.e.*, capture of other species for which either their retention is prohibited or they cannot be marketed). If undesirable bycatch reduction is one objective of capacity reduction programs, failure to consider bycatch in the estimation and assessment of capacity will result in overestimating capacity output. Alternatively, estimates of capacity output, which exclude the potential for reducing undesirable outputs, will be larger than estimates of capacity, which attempt to directly incorporate reductions in undesirable outputs.

In this paper, we expand the traditional data envelopment analysis (DEA) approach for estimating capacity to explicitly allow for the reduction or non-expansion of undesirable outputs. Instead of using the conventional output distance function approach described in Kirkley and Squires (1999) and Pascoe et al. (2003), we introduce the notion of a directional distance vector, which allows for the estimation of capacity relative to desirable outputs while simultaneously allowing for the reduction of undesirable outputs. We illustrate the methodology using set-level data obtained from gear experiments conducted by PLL gear operations in the U.S. northeast distant water area. The results, although limited relative to depicting capacity representative of the entire fleet, do indicate that capacity output, when estimated conditional on reducing undesirable outputs, is considerably less than estimates of capacity output, which ignore reducing the levels of undesirable outputs.

Gilman E.L., P. Dalzell, and S. Martin. 2006. *Fleet communication to abate fisheries bycatch*. Marine Policy 30(4):360-366.

Abstract: Fleet communication systems report near real-time observations of bycatch hotspots to enable a fishery to operate as a coordinated "One Fleet" to substantially reduce fleet-wide capture of protected bycatch species. This benefits the bycatch species per se, reduces waste, and can provide economic benefits to industry by reducing risk of exceeding bycatch thresholds and causing future declines in target species catch levels. We describe case studies of fleet communication programs of the US North Atlantic longline swordfish fishery, U.S. North Pacific and Alaska trawl fisheries, and US Alaska demersal longline fisheries, and identify alternative fleet communication program designs to reduce fisheries bycatch. Evidence supports the inference that these three fleet communication programs substantially reduced fisheries bycatch and provided economic benefits that greatly outweighed operational costs. Fleet communication may be appropriate in fisheries where there are strong economic incentives to reduce bycatch, interactions with bycatch species are rare events, adequate onboard observer coverage exists, and for large fleets, vessels are represented by a fishery association.

Kirkley, James E., John M. Ward, James Nance, Frank Patella, Karyl Brewster-Geisz, Chris Rogers, Eric Thunberg, John Walden, Will Dasoit, Brad Stenberp, Steve Freese, Jim Hastie, Stephen Holiman, and Mike Travis. 2006. *Reducing Capacity in U.S. Managed Fisheries.* U.S. Dep. Commerce, NOAA Tech. Memo. NMFS-FISPO-76, 45p.

Abstract: NOAA Fisheries (the National Marine Fisheries Service), the Food and Agriculture Organization (FAO), and numerous member nations have long been concerned about the presence of excess and overcapacity in commercial fisheries. Simply, fishing fleets around the world have the capability to harvest well in excess of desired and sustainable levels. NOAA Fisheries has become particularly concerned about the overcapacity in America's commercial fishing industry, and the reduction in fleet size necessary to make it commensurate with sustainable resource levels. In response to this concern, Bill Hogarth, Assistant Administrator (AA) of NOAA Fisheries, has provided this report on the nature of overcapacity and the cost of reducing overcapacity in federally managed fisheries. In addition, an analysis of overcapacity and the cost of a vessel buyback program to reduce overcapacity in five federally managed fisheries was undertaken by NOAA economists and academic researchers. The five fisheries examined were the New England and West Coast groundfish fisheries, the Atlantic swordfish fishery, the Atlantic large coastal shark fishery, and the Gulf of Mexico shrimp fishery. All five fisheries were determined to have substantial overcapacity, with the more severe level of overcapacity occurring in the West Coast groundfish fishery. This report provides a summary and overview of the methodology used to estimate capacity and the cost of reducing capacity. It also provides a description of the data and sources of data used to estimate overcapacity in the five fisheries. Last, it provides estimates of overcapacity and the cost of reducing overcapacity for each of the five fisheries.

National Research Council. 2006. *Review of Recreational Fisheries Survey Methods*. National Academies Press, Washington, D.C., 202 pp.

Abstract: Recreational fishing in the United States is an important social and economic component of many marine fisheries, with an estimated 14 million anglers making almost 82 million fishing trips in 2004. Although each individual angler typically harvests a small number of fish, collectively these sport fisheries can take a significant fraction of the yearly catch—in some cases more than commercial fisheries. For example, in 1999, recreational fishing accounted for 94% of the total catch of spotted sea trout, 76% of striped bass and sheephead, and 60 percent of king mackerel. I t is important that systems used to monitor fishing catch are adequate for timely management of recreational fisheries. However, the large number of anglers and access points makes monitoring recreational fishing much more difficult than monitoring commercial fishing. This report reviews the types of survey methods used to estimate catch in recreational fisheries, including state/federal cooperative programs. The report finds that both telephone survey and onsite access components of the current monitoring systems have serious flaws in design or implementation. There are also several areas of miscommunication and mismatched criteria among designers of surveys, data collectors, and recreational fisheries. The report recommends that a comprehensive, universal sampling frame with national coverage should be established, and that improvements

should be made in statistical analysis of the data collected and in the ways the data are communicated. A permanent and independent research group should be established and funded to evaluate the statistical design and adequacy of recreational fishery surveys and to guide necessary modifications or new initiatives.

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.

3.7.2.3 Shark Community Profile Needs

For future social impact analyses, the HMS permit databases, landings information, and HMS APs should be consulted to determine the most appropriate community profiles for HMS-related fisheries. It was identified in the Consolidated HMS FMP that several new community profiles should be developed and some of the previously profiled communities may no longer be as significantly involved in the fishery as they were in the past (see Chapter 9, Section 9.5; NMFS, 2006). NMFS is currently reviewing existing HMS community profile materials and identifying gaps in existing profiles. NMFS will then identify which communities are dependent upon the HMS fisheries and should be profiled. Part of this review will entail developing guidelines and conducting any rapid assessment that may be needed as part of the identification process for new 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 3-46 indicates the magnitude and value of shark exports by the United States from 1999 – 2006. The reduction in shark fin exports from 2001 to 2002 and 2003 is of particular note, as is the increase in the unit value of shark fins during this time period. Decreases in shark fin trade are expected to be the result of the Shark Finning Prohibition Act, which was enacted in December of 2000 and implemented by final rule in February 2002.

Table 3-46 Amount and value of U.S. shark product exports from 1999-2006. 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

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 3-47 summarizes Census Bureau data on shark imports for 1999 through 2006. Imports of fresh shark products and shark fins have decreased significantly since 1999. The 2004 and 2006 ICCAT recommendations addressing the practice of shark finning may result in a further reduction of imports in the near future. Over the last 5 years, the overall annual amount and value of shark imports decreased fairly consistently year after year to equal approximately half the 1999 amount and value in 2003, with a slight increase in each product category in 2004.

Table 3-47 U.S. imports of shark products from all ocean areas combined: 1999-2006. 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

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, 1998), 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 which are harvested in a fishery, but which are not sold or kept for personal use, and includes economic and regulatory discards. Such term does not include fish released alive under a recreational catch and release fishery management program. Fish is defined as finfish, mollusks, crustaceans, and all other forms of marine animal and plant life other than marine mammals and birds. Seabirds and marine mammals are therefore not considered bycatch under the MSA but are examined as incidental catch.

National Standard 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 proposed 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 fishery management plan 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, 2004a). 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, 2004a). 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, 2004a).

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, 2004a) 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 cluster to one another when obtained under the same protocol. The more precise an estimate is the tighter the cluster. 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, 2004a) 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, 2004a). 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, 2004a). 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 coefficient of variation (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, 2004a). 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, 2004a). 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, 2004), 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, 2004a).

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 *et al.*, in press; as cited by Rago *et al.*, 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. 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, 2004a).

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, 2004a).

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 illegal now. In some instances, logbooks are used to provide effort information against which bycatch rates obtained from observers is 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 Biological Opinion for Atlantic Pelagic Longline Fishery for HMS. Observer coverage in 2004 ranged from 6.2 – 9.0 percent per quarter. 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 snapper/grouper/reef fish/shark logbooks to report their catch and effort, including bycatch species. All vessels having Shark Limited Access Permits are required to report. The Commercial Shark Fishery Observer Program (CSFOP) has monitored the shark BLL fishery since 1994. 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. 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 on the Gulf of Mexico reef fish, South Atlantic snapper-grouper, king and Spanish mackerel, and shark fisheries logbook 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 3,359 vessels with Federal permits in these fisheries in 2003, a total of 452 vessels were selected to report. Of the 3,517 vessels with Federal permits in the fisheries in 2004, 428 were selected to report. Shark fishermen can use the PLL logbook or the northeast vessel trip reports 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.

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 Atlantic Large Whale Take Reduction Plan and the October 2003 Biological Opinion.

During right whale calving season (15 November to 31 March), 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 (in 2003, this was 33.8 percent of the total trips) (Carlson and Baremore, 2002). On June 21, 2005, NMFS proposed modifying the time and areas where 100 percent observer coverage is required during right whale calving season (70 FR 35894). NMFS implemented the final rule on June 25, 2007, (72 FR 34362) that prohibits shark gillnet fishing from November 15 to April 15, between the NC/SC border and 29^{o} 00 N. Gillnet vessels fishing between 29^{o} 00 N and 26^{o} 46.5 N would be required to have 100 percent observer coverage from December 1 to March 31.

Starting in 2005, a pilot observer program was begun 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-highly migratory species 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 (the Large Pelagics Survey and the Marine Recreational Fishery Statistics Survey) for the rod and reel fishery and uses these data to estimate total landings and discards of bycatch or incidental catch. Statistical problems associated with small sample size remain an obstacle to estimating bycatch reliably in the rod and reel fishery. CVs can be high for many HMS (rare event species in the MRFSS) and the LPS does not cover all times/geographic areas for non-bluefin tuna species. New survey methodologies are being developed, however, especially for the Charter/Headboat sector of the rod and reel fishery, which should help to address some of the problems in estimating bycatch for this fishery. In addition, selecting recreational vessels for voluntary logbook reporting may be an option for collecting bycatch information for this sector of the HMS fishery.

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

The National Academy of Sciences 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, and NMFS is in the process of evaluating the recommendations. At the present time, no other alternative approach is available.

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), and in Amendment 1 to the 1999 FMP for Atlantic Tunas, Swordfish and Sharks (NMFS, 2003a). 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.

Pelagic longline dead discards of large coastal sharks 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 National Standard 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 3-48. For all other fisheries, please refer to Table 3.107 in the Consolidated HMS FMP.

NMFS submits annual data (Task I) 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 3-48 **Summary of bycatch species in BLL and gillnet 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 May 2006)

Fishery/Gear Type	Bycatch Species	MMPA Category	ESA Requirements	Bycatch Data Collection	Management Measures
Shark BLL	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); additional dehooking equipment (2007)
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); expanded closure for right whale mortality (2007)

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 five percent in 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 3.4.3.3 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 2003 fishery ranged from 3.3 to 20.7 percent of the total catch. Observed protected species bycatch (sea turtles and marine mammals) was very low, less than 0.1 percent. See Section 3.4.4.2 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 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 National Standard 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 Interactions of HMS Fishing Gears With Protected Species

This section examines the interaction between protected species and Atlantic HMS fisheries under consideration in this Amendment. As a point of clarification, interactions are different than bycatch. Interactions take place between fishing gears and marine mammals, sea turtles, and seabirds while bycatch consists of discards of fish. 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 shark fishery 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 Marine Mammal Protection Act

The Marine Mammal Protection Act of 1972 as amended (MMPA) is one of the principal Federal statutes that guide 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 Caribbean Sea. Draft stock assessment reports are typically published around January and final reports are typically published in the Fall. Final 2006 stock assessment reports are available and can be obtained on the web at: http://www.nmfs.noaa.gov/pr/sars/species.htm.

The following marine mammal species 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 mortality to marine mammals;
2. Category II fisheries are those with occasional serious injury or mortality; and
3. Category III fisheries are those with remote likelihood of serious injury or mortality to marine mammals.

The final 2007 MMPA LOF was published on March 28, 2007 (72 FR 14466). The southeastern Atlantic shark gillnet fishery is classified as Category II (occasional serious injuries and mortalities). The Mid-Atlantic and Gulf of Mexico shark BLL fishery is classified as Category III (remote likelihood or no known serious injuries or mortalities). For additional information on the fisheries categories and how other 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 Biological Opinions for Atlantic HMS fisheries have resulted in a conclusion of no jeopardy for marine mammals. However, a Pelagic Longline Take Reduction Team (PLTRT) met on June 29-30, 2005. The PLTRT replaces the disbanded Atlantic Offshore Cetacean Take Reduction Team (AOCTRT). The PLTRT must develop a Take Reduction Plan (TRP) for pilot whales within 11 months. The Draft TRP has been transmitted to NMFS and was published June 8, 2006. The 1999 HMS FMP implemented several of the recommendations of the 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 PLL vessels; 4) handling and release guidelines; and 5) limited access for swordfish, shark and tuna longline permits.

3.10.2.2 Interactions and the ESA

The Endangered Species Act of 1973 as amended (16 U.S.C. 1531 et seq.) provides for the conservation and recovery of endangered and threatened 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.

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 destroy or adversely modify designated critical habitat.

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.

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 (Epperly *et al*., 2004) and a copy can be found at http://www.nmfs.noaa.gov/sfa/hms/Protected%20Resources/TM_524.pdf.

A Biological Opinion 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 Northeast Distant (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. 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*., 2004a; 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, 2004c). 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, 2005).

On December 22, 2006, the Office of Sustainable Fisheries reinitiated consultation based on preliminary analyses that leatherback takes may have been exceeded by the PLL fishery. On March 2, 2007, the Southeast Office of Protected Resources acknowledged re-initiation and determined, based upon the current BiOp's jeopardy analysis and the available information about the PLL fishery, that continuing the PLL fishery during the re-initiation period will not result in jeopardy to leatherback or loggerhead sea turtles, and therefore is not in violation of sections 7(a)(2) and 7(d) of the ESA. The re-initiation process has not been concluded at this time.

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 (pelagic longine: July 6, 2004, 69 FR 40734; BLL: February 7, 2007, 72 FR 5639).

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 Endangered Species Act (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. Based on this information, the 2003 BiOp estimates that one incidental capture of a sawfish (released alive) over the next five years, will occur as a result of the use of gillnets in this fishery (NMFS, 2003a).

Smalltooth sawfish have been observed caught (eight known interactions, seven released alive, one released in unknown condition) in shark BLL fisheries from 1994 through 2004 (A. Morgan pers. comm., 2003). Based on these observations, expanded sawfish take estimates for 1994 – 2002 were developed for the shark BLL 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. It is important to note that all of the sawfish takes observed, except for one, were released alive.

3.10.2.3 Interactions with Seabirds

Observer data from 1992 through 2005 indicate that seabird bycatch is relatively low in the U.S. Atlantic PLL fishery. Since 1992, a total of 129 seabird interactions have been observed, with 95 observed killed (73.6 percent). In 2005, there were 110 active U.S. PLL vessels fishing for swordfish in the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea that reportedly set approximately 5.9 million hooks. A total of four seabirds were observed taken.

The National Plan of Action (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 U.S. Fish and Wildlife Service, 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 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), 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 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.

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 a complete review of bycatch of HMS in other fisheries, please refer to Section 3.9.11 in the Consolidated HMS FMP.

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 vessel monitoring systems (VMS).

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

- Atlantic Large Whale Take Reduction Plan (ALWTRP) regulations

Observers were placed on shark gillnet vessels during the 2005 season and covered 33 strikenet and 31 driftnet sets during and outside of right whale calving season (Carlson and Bethea, 2006). In addition, observers were placed on vessels fishing with sink gillnets as part of a pilot program and observed 88 sets. Protected species interactions occurred with all three types of gear. One leatherback and four loggerhead sea turtles were observed with all but one loggerhead released alive. One loggerhead was observed taken by strikenet and one with sink net. Both were released alive. No marine mammals or smalltooth sawfish were observed taken.

NMFS has published a proposed rule to modify the right whale areas and the time periods when 100 percent observer coverage would be required (70 FR 35894; 21 June 2005).

- Atlantic Bottlenose Dolphin Take Reduction Team

Due to the observed takes of Atlantic bottlenose dolphin in the shark drift gillnet fishery, representatives of the fishery have been included in the Atlantic Bottlenose Dolphin Take Reduction Team. The Team held seven meetings during 2001 – 2003 and developed a set of recommendations which formed the basis for a TRP. NMFS published a final rule regarding this action on April 26, 2006 (71 FR 24776). Included in the final rule are: 1) effort reduction measures; 2) gear proximity rules; 3) gear or gear deployment modifications; 4) fishermen training; and 5) 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 2007 (72 FR 14466) final list is available at http://www.nmfs.noaa.gov/pr/pdfs/fr/fr72-14466.pdf. Marine mammal stock assessment reports are also available at http://www.nmfs.noaa.gov/pr/sars/.

- Atlantic Offshore Cetacean Take Reduction Team (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.

- Pelagic Longline Take Reduction Team (PLTRT)

NMFS appointed a PLTRT in June 2005, to address marine mammal interactions in the longline fishery, specifically pilot whales. As required by the MMPA, the PLTRT must develop a TRP within eleven months. The PLTRT has met four times since and a draft TRP should be available shortly. NMFS intends to continue reviewing the fishery and any marine mammal interactions to determine if additional take reduction measures are necessary.

- Observer coverage of shark drift gillnet fleet

On March 30, 2001, NMFS reduced the level of observer coverage required in the shark drift gillnet fishery from 100 percent year-round to 100 percent during right whale calving season and to a statistically significant level during the rest of the year. Recent scientific analyses indicate that a 33.8 percent level of coverage is statistically significant and adequate to provide reasonable estimates of sea turtle and marine mammal takes outside of the right whale calving season. The level of observer coverage necessary will be re-evaluated annually and

adjusted accordingly. During the 2005 season, 33 strikenet and 31 driftnet sets were observed (Carlson and Bethea, 2006). No interactions with marine mammals were observed in either drift gillnet or strikenet sets. Four loggerhead sea turtles were observed caught in drift gillnet sets (three released alive, one released injured and assumed to be dead). One leatherback sea turtle was caught in drift gillnet gear and released alive. NMFS began placing observers on vessels with directed shark permits that were targeting species other than sharks in 2005. Management options to address issues in the shark drift gillnet fishery are considered in this document.

- Vessel monitoring systems 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.

- Vessel monitoring systems 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 will require all vessels with Limited Access Shark Permits 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.

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