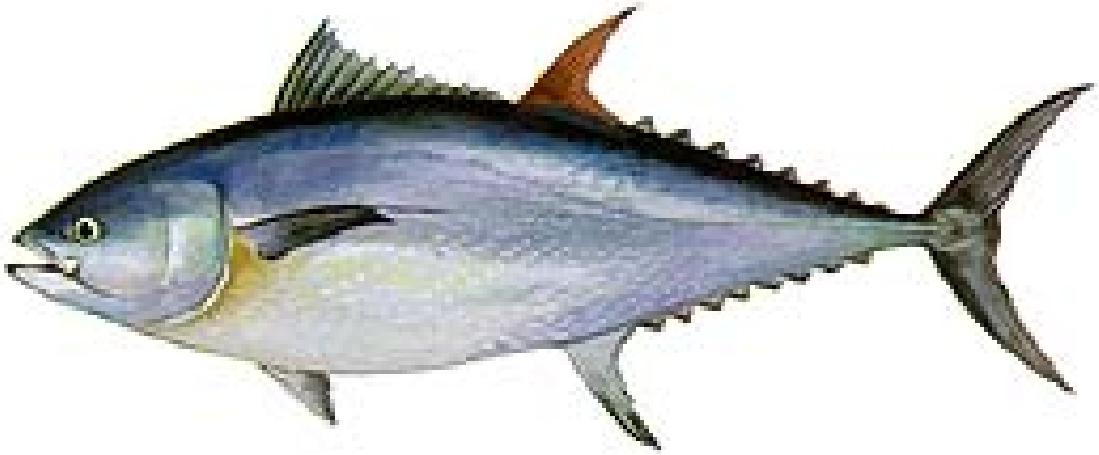
STOCK ASSESSMENT AND FISHERY EVALUATION (SAFE) REPORT FOR

ATLANTIC HIGHLY MIGRATORY SPECIES



2008

DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service

Stock Assessment and Fishery Evaluation (SAFE) Report for

Atlantic Highly Migratory Species
2008

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Dealer Permits:

Tuna dealer permits are issued out of the Northeast Regional Office of NOAA Fisheries (978-281-9370), shark and swordfish dealer permits are issued out of the NOAA Fisheries Southeast Regional Office (727-824-5326).

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Atlantic Shark and Swordfish Permits:

Questions regarding renewals or transfers of shark and swordfish limited access permits should be directed to the NOAA Fisheries Southeast Regional Office (727-824-5326).

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1.0 INTRODUCTION

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) established a long-range, transparent, and inclusive process to sustainably manage the fisheries of the United States. As part of this process, National Standard (NS) 2 of the Magnuson-Stevens Act requires the use of the best scientific information available. The NS 2 guidelines (50 CFR 600.315) require the National Marine Fisheries Service (NMFS) to, among other things, assure that a Stock Assessment and Fishery Evaluation (SAFE) Report or similar document is prepared, reviewed annually, and changed as necessary for each fishery management plan (FMP). As such, this document constitutes the 2008 SAFE Report for Atlantic highly migratory species (HMS) managed under the 2006 Consolidated HMS FMP.

Consistent with the NS 2 guidelines, this 2008 SAFE Report provides a summary of the best available scientific information on the condition of HMS stocks, marine ecosystems, and fisheries being managed under Federal regulation. It also provides updated information regarding the economic status of HMS fisheries, fishing communities, and industries, as well as the socio-economic and environmental impacts of recently implemented regulations. This information evaluates the effectiveness of Federal and state Atlantic HMS management programs, and provides the basis for future management decisions.

This document is one method that NMFS uses to introduce new information, identify additional management issues that may need to be addressed, and begin a preliminary assessment and evaluation of fishery regulations. This SAFE Report includes the latest stock assessment data, recommendations, and resolutions from the International Commission for the Conservation of Atlantic Tunas (ICCAT) and its Standing Committee on Research and Statistics (SCRS). The report also includes the latest domestic shark assessment information. In compliance with the NS 2 guidelines, the report presents a comprehensive summary of the most recent Atlantic HMS fisheries-related data from a variety of sources across a wide range of disciplines.

1.1 Summary and Update on HMS Management Division Activities and Regulatory Actions In 2008

Table 1.1 provides a list of most of the abbreviations and acronyms that are used in this document or that are commonly used in fisheries management.

From January 1 through October 31, 2008, NMFS took or proposed a number of actions in regards to Atlantic HMS. All such actions published in the Federal Register during that time frame are listed in Table 1.2. Most documents related to these actions can be found on the Atlantic HMS webpage at http://www.nmfs.noaa.gov/sfa/hms/. Actions taken before January 1, 2008, are noted in similar tables in previous SAFE reports. A summary of the actions listed in the table is presented below.

NMFS held HMS Advisory Panel meetings from April 15 - 17, 2008, and September 30 - October 2, 2008, in Silver Spring, MD (February 27, 2008, 73 FR 10424; September 16, 2008, 73 FR 53408). These meetings provided valuable comments on a suite of management actions

that NMFS took or considered in 2008. Summaries of these discussions can be found on the HMS website at: www.nmfs.noaa.gov/sfa/hms, along with the meeting transcripts. These documents are also available by calling the HMS Management Division at 301-713-2347.

In April, NMFS released the Final Environmental Impact Statement (FEIS) for Amendment 2 to the Consolidated HMS FMP. The final rule implementing Amendment 2 published in June and was effective on July 24, 2008 (June 24, 2008, 73 FR 35778; correction published July 15, 2008, 73 FR 40658). Amendment 2 establishes numerous regulations designed, among other things, to rebuild and prevent overfishing of various shark species. The final rule for Amendment 2 also contained the fishing season notification regarding available quotas for the different shark species/complexes. As part of Amendment 2, NMFS also established a shark research fishery. On June 24, 2008, NMFS announced its intent to issue shark research fishery permits and requested applications (June 24, 2008, 73 FR 35834). In May 2008, NMFS announced its intent to prepare two Environmental Impact Statements (EIS) to amend the Consolidated HMS FMP (May 7, 2008, 73 FR 25665; May 27, 2008, 73 FR 30381). These two EISs will be for Amendments 3 and 4 to the Consolidated HMS FMP and would amend the FMP in order to rebuild blacknose sharks and address HMS issues in the Caribbean region, respectively. NMFS also announced scoping meetings for those FMP Amendments. In September, NMFS released the Draft of Amendment 1 to the FMP, which outlines several alternatives for redefining HMS essential fish habitat (EFH) and proposes to establish a habitat area of particular concern (HAPC) for bluefin tuna (BFT) (Sept. 19, 2008, 73 FR 54384).

Besides FMP amendments, NMFS conducted other rulemakings relating to Atlantic HMS. In January and again in September, NMFS released temporary rules that made inseason adjustments to the BFT retention limits. In April and May, NMFS released three proposed rules regarding: 1) international trade permits and permit requirements for shark importers and exporters (June 2, 2008, 73 FR 31380), 2) the renewal of Atlantic tunas longline permits and shark dealer workshop requirements (April 11, 2008, 73 FR 19795), and 3) the use of different gears (*e.g.*, greenstick) in HMS fisheries and the need for additional sea turtle handling and release equipment (May 6, 2008, 73 FR 24922). These rules were finalized in June, July, and September, respectively (June 2, 2008, 73 FR 31380; July 3, 2008, 73 FR 38144; Sept. 23, 2008, 73 FR 54721). In June, the Office of Protected Resources released a proposed rule regarding the 2009 List of Fisheries consistent with the Marine Mammal Protection Act (June 13, 2008, 73 FR 33760). This rule proposed certain categories of HMS fisheries for classification as high seas fisheries, including the Atlantic HMS pelagic longline, purse seine, and shark gillnet fisheries.

In January, NMFS released a notice of availability of a final environmental assessment regarding scientific research in closed areas to study bycatch rates of pelagic longline gear (January 3, 2008, 73 FR 450). NMFS also requested comments for several data collections, per the Paperwork Reduction Act (PRA), and announced the fall meetings of the Advisory Committee to the U.S. section of the International Commission for the Conservation of Atlantic Tunas (ICCAT).

While not specific to Atlantic HMS, NMFS has also released a number of proposed rules to implement measures in the Magnuson-Stevens Reauthorization Act that could impact Atlantic HMS management. These rules include, but are not limited to, the creation of annual catch

limits (ACLs) and accountability measures (AMs) (June 9, 2008, 73 FR 32526) and changes to the way NMFS integrates National Environmental Policy Act (NEPA) documents into the fishery management process (May 14, 2008, 73 FR 27997). For more information on the implementation of the Reauthorized Magnuson-Stevens Act and for copies of those and other proposed rules, please go to http://www.nmfs.noaa.gov/msa2007/.

1.2 2007 and 2008 Accomplishments of the International Commission for the Conservation of Atlantic Tunas (ICCAT)

ICCAT is an international fishery management organization with 46 members, including the United States. The 16th Special Meeting of ICCAT was held in Marrakech, Morocco, November 17-24, 2008. The 20th Regular Meeting of ICCAT was held in Antalya, Turkey, November 12-18, 2007. The United States helped develop recommendations aimed at promoting the conservation and rebuilding of Atlantic highly migratory fish stocks (*e.g.*, tunas, swordfish, sharks), including those critical to U.S. fishermen. ICCAT made progress on a number of issues in 2007 and 2008, including compliance issues and action to address the decline of both eastern and western Atlantic bluefin tuna. Dr. Christopher Rogers, of the United States, was elected as Chairman of the Compliance Committee in 2007. U.S. leadership of this committee provided the United States a heightened ability to positively affect compliance issues in 2008.

Marlins: No new binding measures were adopted in 2007 or 2008 for Atlantic billfishes.

North Atlantic Swordfish: No new measures were adopted in 2007. In 2008, ICCAT adopted recommendation 08-02 which extended current north Atlantic swordfish management measures through 2009. These measures, initially adopted in 2006 via ICCAT Recommendation 06-02, set a total allowable catch (TAC) of 14,000 metric tons (mt) for 2007 and 2008 with 3,907 mt allocated to the United States per year. Recommendation 08-02 extends this and the other provisions through 2009. In addition, recommendation 08-02 continued carryover caps for Contracting Parties and Co-operating Non-Contracting Parties, Entities or Fishing Entities (CPCs). The maximum underage that a CPC may carry over cannot exceed 50 percent of its quota allocation, which is 1,953.5 mt for the United States under the current allocation scheme. Furthermore, it extended a clause that allows CPCs with a TAC allocation to make a one-time transfer within a fishing year of up to 15 percent of its TAC allocation to other CPCs with TAC allocations. Recommendation 08-02 allocates 1,345 mt of U.S. underharvest from the previous management period to the TAC for 2009 in an effort to accommodate interest expressed by a number of developing states to develop fisheries for North Atlantic swordfish. Recommendation 08-02 also extends the provision allowing the United States to harvest up to 200 mt of its annual catch limit between 5 degrees North latitude and 5 degrees South latitude, and the provision for the transfer of 25 mt to Canada annually.

South Atlantic Swordfish: No new measures were adopted at the 2007 or 2008 meeting. The 2006 ICCAT Recommendation 06-03 set a TAC of 17,000 mt for 2007, 2008, and 2009, with 100 mt allocated to the United States per year. In addition, the recommendation set carryover caps for CPCs. The maximum underage that a CPC may carry over cannot exceed 50 percent of its quota allocation.

Western Atlantic Bluefin Tuna: No new measures were adopted in 2007. In 2008, a new recommendation (08-04) was adopted that sets the western Atlantic BFT (WBFT) TAC for 2009 and 2010 at 1900 t and 1800 t, respectively. These new TACs represent a 10% and 14% reduction, respectively, from the current 2100 t-TAC and are intended to stop overfishing by 2010 with a 75% probability of success. The new TACs also substantially increase the probability of rebuilding the stock by 2019, consistent with the 1998 rebuilding program. Another notable change from the previous recommendation (06-06) is that the 10% tolerance of WBFT<115 cm (primarily the U.S. school fishery) will now be managed over a two-year period (2009-2010) rather than a four-year period. Recommendation 08-04 also includes provisions for Mexico to transfer 73 t of its accrued underharvest to Canada in 2009. For 2010, recommendation 08-04 specifies that Mexico will transfer accrued underage to Canada such that Canada's initial allocation is 480 t. If Mexico has insufficient underharvest to keep Canada at 480 t in 2010, the recommendation includes a provision for the United States to provide some underharvest to Canada if available. WBFT quota allocations will be renegotiated in 2010.

Eastern Atlantic and Mediterranean Bluefin Tuna: While the United States, in 2007, pressed ICCAT to adopt a measure to suspend bluefin fishing in the eastern Atlantic and Mediterranean until monitoring and control issues could be addressed, ICCAT instead adopted a non-binding measure (Resolution 07-05). The non-binding measure requested that parties submit documents by February 2008 detailing how they are implementing ICCAT's 2006 management plan for the eastern fishery and submit a report at the end of the fishing season on the results of implementation. ICCAT also adopted Recommendation 07-04, which specified a yearly deduction of 1,480 mt for the period 2009-2011 from the European Community's quota allocation to repay a 2007 quota overharvest.

In 2008, ICCAT adopted recommendation 08-05 which includes a number of changes to the rebuilding plan for the Eastern Atlantic and Mediterranean BFT (EBFT), including: setting total allowable catches (TACs) for 2009 (22,000 t), 2010 (19,950 t) and 2011 (18,500 t); amending the EC overharvest repayment plan to cover 4,020 t of its previous overharvest during the period 2009-12; extending the purse seine time and area closure by 15 days; requiring reductions in fleet capacity by 2013; freezing farming capacity at 2008 levels; and, strengthening monitoring and control elements in the plan. EBFT allocations will be renegotiated in 2010.

North and South Atlantic Albacore: At the 2007 meeting, ICCAT adopted a two-year measure (Recommendation 07-02) on North Atlantic albacore tuna catch limits for 2008 and 2009 that reduced the TAC. This measure reduced the U.S. allocation of northern albacore from 607 mt to 538 mt. The recommendation provided that overages/underages of annual catch limits should be deducted from, or added to, specific future catch limits, and the 2007 recommendation limits carryover of underharvests to 25 percent of the initial U.S. catch quota. A binding recommendation (Recommendation 07-03) was adopted for Southern Atlantic albacore for 2008 through 2011 that reduces the TAC consistent with scientific advice. No new measures for north or south Atlantic albacore were adopted in 2008.

Sharks: At the 2007 meeting, ICCAT adopted measures for the conservation of sharks (Recommendation 07-06) that included requirements to submit Task I and Task II data on bycatch and targeted fisheries for sharks, and to reduce fishing mortality in fisheries targeting

porbeagle and shortfin mako sharks. This binding measure also requires research on pelagic sharks, consideration of time-area closures, and an assessment of porbeagle sharks as soon as possible, but no later than 2009. At the 2008 meeting, ICCAT adopted a binding management recommendation (08-07) requiring the live release of bigeye thresher sharks that are brought to the boat alive as well as mandating reporting of bycatch and live releases of bigeye thresher sharks. A non-binding resolution (08-08) was adopted that suggested a joint meeting with the International Council for the Exploration of the Seas should be held to help further the assessment of porbeagle sharks. Resolution 08-08 also recommended a joint meeting of representatives from regional fisheries management organizations (RFMOs) concerned with fisheries for porbeagle in the Atlantic to examine the possibility of adopting compatible management measures.

Trade related measures: No trade restrictive measures were passed by the Commission at the 2007 meeting or 2008 meeting. ICCAT adopted a catch documentation scheme for bluefin tuna (Recommendation 07-10) which should improve overall data reporting since the new approach will document bluefin tuna catch and landings as well as the international trade of this species. NMFS implemented this recommendation in June 2008. The new program repeals the pre-existing statistical document program and continues to require that bluefin tuna are fitted with a tail tag upon sale to a domestic dealer, thus tracking domestic harvest to international markets. In 2008, ICCAT amended 07-10 through the adoption of 08-12 to improve the functioning of the catch document scheme.

Seabirds: A recommendation on reducing the incidental by-catch of seabirds in longline fisheries (Recommendation 07-07) was adopted. This recommendation requires the use of tori lines and line weighting on vessels fishing south of 20 degrees south to reduce seabird bycatch. However, the United States does not have any vessels actively participating in ICCAT-managed fisheries south of 20 degrees S longitude. No new recommendations pertaining to seabirds were adopted in 2008.

Vessel Monitoring & Compliance: In 2007, ICCAT adopted a recommendation (Recommendation 07-08) that requires installation of VMS on vessels fishing for bluefin tuna in the Eastern Atlantic and Mediterranean. In 2008, ICCAT adopted recommendation 08-09 that establishes a process for the submission and review of compliance related information. ICCAT also agreed (via recommendation 08-13) to hold an intercessional meeting of the Compliance Committee in March 2009 focused primarily on the multiannual EBFT recovery plan and farming of EBFT.

IUU vessel list: A measure was adopted in 2007 (Recommendation 07-09), that amended provisions of the ICCAT IUU vessel list, including defining IUU activities, establishing a process for incorporating or deleting vessels on the ICCAT IUU list based on IUU lists established by other RFMOs managing tuna and tuna-like species.

Vessel Length: In 2008, ICCAT adopted recommendation 08-10 to harmonize the measurement of the length of vessels authorized to fish in the ICCAT convention area by defining the length of a vessel, as referred to in ICCAT recommendations, as length overall.

Length overall was defined as the distance measured in a straight line between the foremost point of the bow and the aftermost point of the stern.

1.3 Existing State Regulations

Table 1.3 outlines the existing State regulations as of October 15, 2008, with regard to HMS species. While the HMS Management Division updates this table periodically throughout the year, persons interested in the current regulations for any state should contact that state directly.

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

AA	Assistant Administrator for Fisheries
ABC	Acceptable biological catch
ACCSP	Atlantic Coastal Cooperative Statistics Program
ACL	Annual catch limit
ACS	Angler consumer surplus
ACT	Annual catch target
AM	Accountability measure
ANPR	Advanced Notice of Proposed Rulemaking
AOCTRP	Atlantic Offshore Cetacean Take Reduction Plan
AOCTRT	Atlantic Offshore Cetacean Take Reduction Team
AP	Advisory Panel
APA	Administrative Procedure Act
ASMFC	Atlantic States Marine Fisheries Commission
ATCA	Atlantic Tunas Convention Act
B	Biomass
BAYS	Bigeye, albacore, yellowfin, skipjack tunas
BET	Bigeye tuna
BFT	Bluefin tuna
BiOp	Biological Opinion
B_{MSY}	Biomass expected to yield maximum sustainable yield
B_{OY}	Biomass expected to yield optimum yield
CFMC	Caribbean Fishery Management Council
CFL	Curved fork length
CFR	Code of Federal Regulations
CHB	Charter/Headboat
CIE	Center for Independent Experts
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CPUE	Catch per unit effort
CSFOP	Commercial shark fishery observer program

CZMA	Coastal Zone Management Act
DEIS	Draft Environmental Impact Statement
DPS	Distinct population segment
dw	Dressed weight
EA	Environmental Assessment
EEZ	Exclusive economic zone
EFH	Essential fish habitat
EFP	Exempted fishing permit
EIS	Environmental Impact Statement
EO	Executive Order
ESA	Endangered Species Act
F	Instantaneous fishing mortality
FAO	Food and Agriculture Organization
FEIS	Final Environmental Impact Statement
FL	Fork Length
FMP	Fishery Management Plan
F_{MSY}	Instantaneous fishing mortality rate expected to yield maximum sustainable yield
FMU	Fishery management unit
F_{OY}	Fishing mortality rate expected to yield optimum yield
FR	Federal Register
FRFA	Final regulatory flexibility analysis
GSAFF	Gulf and South Atlantic Fishery Foundation
GMFMC or GOMFMC	Gulf of Mexico Fishery Management Council
GSMFC	Gulf States Marine Fisheries Commission
HAPC	Habitat area of particular concern
HMS	Highly migratory species: Atlantic sharks, tunas, swordfish, and billfish
HMS FMP	Consolidated Highly Migratory Species Fishery Management Plan
ICCAT	International Commission for the Conservation of Atlantic Tunas
IPOA	International Plan of Action
IRFA	Initial regulatory flexibility analysis
ITQ	Individual transferable quota

ITS	Incidental take statement
LAP	Limited access permit
LCS	Large coastal sharks
LOA	Letter of acknowledgment
LPS	Large Pelagic Survey
LWTRP	Large Whale Take Reduction Plan
LWTRT	Large Whale Take Reduction Team
MAFMC	Mid-Atlantic Fishery Management Council
Magnuson-Stevens Act	Magnuson-Stevens Fishery Conservation and Management Act
MFMT	Maximum fishing mortality threshold
MMPA	Marine Mammal Protection Act
MPA	Marine protected area
MRFSS	Marine Recreational Fishing Statistics Survey
MSST	Minimum stock size threshold
MSY	Maximum sustainable yield
mt	Metric tons
NEFMC	New England Fishery Management Council
NEFSC	Northeast Fisheries Science Center
NEPA	National Environmental Policy Act
NERO	Northeast Regional Office
NGO	Non-governmental organization
nmi	Nautical mile
NOA	Notice of Availability
NMFS	National Marine Fisheries Service
NOAA	National Oceanographic and Atmospheric Administration
NOI	Notice of Intent
NPOA	National Plan of Action
NS	National Standards
OSF	Office of Sustainable Fisheries
OY	Optimum yield
POP	Pelagic observer program
OPR	Office of Protected Resources

PRA	Paperwork Reduction Act
Reg Flex Act	Regulatory Flexibility Act
RIR	Regulatory Impact Review
RPAs	Reasonable and Prudent Alternatives
RPMs	Reasonable and Prudent Measures
SAFE Report	Stock Assessment and Fishery Evaluation report
SAFMC	South Atlantic Fishery Management Council
SCRS	Standing Committee for Research and Statistics
SCS	Small coastal sharks
SDC	Status determination criteria
SEFSC	Southeast Fisheries Science Center
SEIS	Supplemental environmental impact statement
SERO	Southeast Regional Office
SEW	Stock evaluation workshop
SFA	Sustainable Fisheries Act
SFL	Straight fork length
SK Program	Saltonstall-Kennedy Program
SRP	Scientific research permit
SSB	Spawning stock biomass
TAC	Total allowable catch
TAL	Total allowable landings
TCs	Terms and Conditions
TL	Total length
USFWS	United States Fish and Wildlife Service
VMS	Vessel monitoring system
WTP	Willingness to pay
ww	Whole weight

Table 1.2 Summary of NMFS' Atlantic HMS Fisheries Actions as of October 31, 2008.

Action Type NMFS ID#	50 CFR Part	Action Description	Publication Info
Notice RIN 0648-XD57	NA	Pelagic Longline Research; Notice of availability.	Jan. 3, 2008 73 FR 450
Temporary Rule RIN 0648-XF39	635	Atlantic Bluefin Tuna Fisheries; inseason retention limit adjustment.	Feb. 8, 2008 73 FR 7479
Notice RIN 0648-XF41	NA	Notice of public meeting regarding the AP meeting.	Feb. 27, 2008 73 FR 10423
Notice	NA	Proposed Information Collection; Comment Request; Atlantic Highly Migratory Species Vessel and Gear Marking	Mar. 4, 2008 73 FR 11619
Notice	NA	Notice of Atlantic Shark Identification and Protected Species Safe Handling, Release, and Identification Workshops	Mar. 4, 2008 73 FR 11621
Proposed Rule RIN 0648-AU88	300, 635	International Fisheries; Atlantic Highly Migratory Species; request for comments; notice of public hearings.	April 4, 2008 73 FR 18473
Notice	NA	Proposed Information Collection; Comment Request; Atlantic Highly Migratory Species Observer Notification Requirements	April 7, 2008 73 FR 18781
Proposed Rule RIN 0648-AW46	635	Renewal of Atlantic Tunas Longline Limited Access Permits; and, Atlantic Shark Dealer Workshop Attendance Requirements; Request for Comments.	April 11, 2008 73 FR 19795
Notice	NA	Proposed Information Collection; Comment Request; Atlantic Highly Migratory Species Permit Family of Forms	April 28, 2008 73 FR 22921
Proposed Rule RIN 0648-AV92	600, 635	Atlantic Tuna Fisheries; Gear Authorization and Turtle Control Devices; request for comments; notice of public hearings.	May 6, 2008 73 FR 24922
Notice RIN 0648-AW65	NA	Atlantic Shark Management Measures; Stock Status Determinations; Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS); request for comments.	May 7, 2008 73 FR 25665

Action Type NMFS ID#	50 CFR Part	Action Description	Publication Info
Notice RIN 0648-AW83	NA	Environmental Impact Statement for Amendment 4 to the 2006 Consolidated Atlantic Highly Migratory Species Fishery Management Plan; Notice of intent; request for comments.	May 27, 2008 73 FR 30381
Final Rule RIN 0648-AU88	300, 635	International Fisheries; Atlantic Highly Migratory Species; International Trade Permit Program; Bluefin Tuna Catch Documentation Program	June 2, 2008 73 FR 31380
Notice	NA	Notice of Atlantic Shark Identification and Protected Species Safe Handling, Release, and Identification Workshops	June 6, 2008 73 FR 32309
Proposed Rule RIN 0648-AW48	229	List of Fisheries for 2009; Request for Comments.	June 13, 2008, 73 FR 33760
Final Rule RIN 0648-AU89	600, 635	Atlantic Shark Management Measures; fishing season notification	June 24, 2008 73 FR 35778
Notice RIN 0648-XH17	NA	Atlantic Shark Management Measures; Research Fishery; Notice of intent; request for applications.	June 24, 2008 73 FR 35834
Notice RIN 0648-AW65	NA	Atlantic Shark Management Measures; Notice of availability; notice of public scoping meetings; Extension of comment period.	July 2, 2008 73 FR 37932
Final Rule RIN 0648-AW46	635	Renewal of Atlantic Tunas Longline Limited Access Permits; Atlantic Shark Dealer Workshop Attendance Requirements	July 3, 2008 73 FR 38144
Notice RIN 0648-AW83	NA	Caribbean Management; Notice of availability; notice of public scoping meetings.	July 14, 2008 73 FR 40301
Final Rule; Republication RIN 0648-AU89	600, 635	Atlantic Shark Management Measures; fishing season notification	July 15, 2008 73 FR 40658
Final Rule RIN 0648-AU89	635	Atlantic Shark Management Measures; effectiveness of collection-of-information requirements.	Aug. 15, 2008 73 FR 47851
Notice	NA	Submission for OMB Review; Comment Request; Atlantic Highly Migratory Species Vessel and Gear Marking.	Aug. 20, 2008 73 FR 49160
Temporary Rule RIN 0648-XJ69	635	Atlantic Bluefin Tuna Fisheries; inseason retention limit adjustment.	Aug. 29, 2008 73 FR 50885

Action Type NMFS ID#	50 CFR Part	Action Description	Publication Info
Notice	NA	Notice of Atlantic Shark Identification and Protected Species Safe Handling, Release, and Identification Workshops	Sept. 3, 2008 73 FR 51448
Notice RIN 0648-XK41	NA	Notice of public meeting, public hearing, and scoping meetings regarding the AP meeting and various other hearings/meetings.	Sept. 16, 2008 73 FR 53408
Notice RIN 0648-AW65	NA	Atlantic Shark Management Measures; Changing the time and location of a scoping meeting.	Sept. 17, 2008 73 FR 53851
Notice	NA	Environmental Impacts Statements; Notice of Availability of Draft Amendment 1 to the Consolidated HMS FMP	Sept. 19, 2008 73 FR 54397
Notice RIN 0648-AV00	NA	Notice of availability of a draft integrated environmental impact statement and a fishery management plan amendment (Amendment 1); request for written comments; notice of public hearings	Sept. 19, 2008 73 FR 54384
Final Rule RIN 0648-AV92	600, 635	Atlantic Tuna Fisheries; Pelagic and Bottom Longline Fisheries; Gear Authorization and Turtle Control Devices	Sept. 23, 2008 73 FR 54721
Notice	NA	Submission for OMB Review; Comment Request; Atlantic Highly Migratory Species Observer Notification Requirements.	Sept. 24, 2008 73 FR 55030
Notice	NA	Submission for OMB Review; Comment Request; Atlantic Highly Migratory Species Permit Family of Forms	Sept. 24, 2008 73 FR 55030
Notice	NA	Atlantic Highly Migratory Species; Advisory Panel; Request for nominations	Oct. 21, 2008 73 FR 62482
Proposed Rule RIN 0648-AX03	635	Atlantic Highly Migratory Species; Atlantic Commercial Shark Management Measures; Proposed rule; request for comments.	Oct. 27, 2008 73 FR 63668
Notice	NA	Atlantic Highly Migratory Species; Atlantic Shark Management Measures; Extension of Comment Period	Oct. 29, 2008 73 FR 64307

Table 1.3 State Rules and Regulations Pertaining to Atlantic HMS, as of October 15, 2008.

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

State	Species				Cite Reference	Regulatory Details	Contact Information
	Tuna	*Swords*	*Billfish*	*Sharks*			
ME	X			X	**Tuna** -ME Rev. Stat. Ann. tit. 12, " 6001, 6502, and 6551 **Sharks** - Code ME R. 13-188 ' 50.02	**Tuna** - Retention limit - 1 tuna/year - non resident special tuna permit holder; Unlawful to fish for tuna with gear other than harpoon or hook and line or possess tuna taken in unlawful manner. No minimum size limits. **Sharks** - Regulations apply to Spiny dogfish only.	ME Department of Marine Resources George Lapointe Phone: 207/624-6553 Fax: 207/624-6024
NH	X		X	X	**Tuna** - FIS 603.10 (REPEALED) **Billfish** - FIS 603.13 **Sharks** - FIS 603.19	**Billfish** - Possession limit - 1 billfish/trip; Minimum size (LJFL) - Blue marlin - 99"; White marlin - 66"; Sailfish - 57"; May be taken by hook and line only; Unlawful to sell billfish **Sharks** - Regulations apply to Spiny dogfish only.	NH Fish and Game Clare McBane Phone: 603/868-1095 Fax: 603/868-3305
MA	X		X	X	**Tuna** - 322 CMR ' 6.04 **Billfish** – 322 CMR ' 6.11 (REPEALED) **Sharks** – 322 CMR ' 6.35, 6.37, & 6.41 CMRs available online at http://www.mass.gov/dfwele/dmf/commercialfishing/cmr_index.htm	**Tuna** - Reference to ATCA and Federal regulations **Billfish** – repealed as of December 2005 **Sharks** - Regulations apply to Spiny and Smooth dogfish; Prohibition on harvest, catch, take, possession, transportation, selling or offer to sell any basking, dusky, sand tiger, or white sharks.	MA Division of Marine Fisheries Melanie Griffin Phone: 617/626-1528 Fax: 617/626-1509

State	Species				Cite Reference	Regulatory Details	Contact Information
	Tuna	*Swords*	*Billfish*	*Sharks*			
RI				X	**Sharks** - RIMFC Regulations ' 7.15	**Sharks** - Regulations apply to spiny dogfish only.	RI Department of Environment Management Brian Murphy Phone: 401/783-2304
CT				X	**Dogfish** – Regulations of Connecticut State Agencies § 26-159a-19	**Sharks** - Regulations apply to spiny dogfish only.	CT Department of Environmental Protection David Simpson Phone: 860/434-6043 Fax: 860/434-6150
NY			X	X	**Billfish** -NY Environmental Conservation ' 13-0339 (5) **Sharks** - NY Environmental Conservation ' 13-0338; State of New York Codes, Rules and Regulations (Section 40.1)	**Billfish** - Blue marlin, White marlin, Sailfish, and Longbill spearfish shall not be bought, sold or offered for sale; Striped marlin, Black marlin, Shortbill spearfish shall not be bought, sold or offered for sale. **Sharks** - Shark finning prohibited; Reference to the Federal regulations 50 CFR part 635; Prohibited sharks listed.	NY Department of Environmental Conservation Phone: 631/444-0430 Fax: 631/444-0449
NJ				X	**Sharks**-NJ Administrative Code, Title 7. Department of Environmental Protection, NJAC 7:25-18.1 and 7:25-18.12(d)	**Sharks** - Commercial/Recreational: min size 48" TL or 23" **f**rom 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

State	Species				Cite Reference	Regulatory Details	Contact Information
	Tuna	*Swords*	*Billfish*	*Sharks*			
DE			X	X	**Billfish** - DE Code Ann. tit. 7, ' 1310 **Sharks** - DE Code Regulations 3541	**Billfish/Sharks** - Reference to Federal regulations for sharks; Prohibition on sale of Atlantic Sailfish and Blue/White/Striped marlin **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	X	X	X	X	**Tuna** - Code of Maryland Regulations tit. 8, ' 02.12.03 and tit. 8, ' 02.05.23 **Swordfish** - Code of Maryland Regulations tit. 8, ' 02.12.03 and tit. 8, ' 02.05.27 **Billfish** - Code of Maryland Regulations tit. 8, ' 02.12.03 and tit. 8, ' 02.05.26 **Sharks** - Code of Maryland Regulations tit. 8 ' 02.12.03 and tit. 8, ' 02.05.17	**Tuna** - Reference to listing Bluefin Tuna as in need of conservation; Federal regulations used to control size and seasons and recreational catch required to be tagged. **Swordfish** - Reference to listing Swordfish as in need of conservation; Federal regulations used to control size and seasons and recreational catch required to be tagged. **Billfish** (blue and white marlin and sailfish) - Reference to listing Billfish as in need of conservation; Federal regulations control size and seasons and recreational catch required to be tagged. **Sharks** – Reference to listing sharks of the order Squaliformes as in need of conservation; In the process of adopting into regulation all measures of the ASMFC Interstate Fishery Management Plan for Atlantic Coastal Sharks (August 2008). It will be effective March 23, 2009.	MD Department of Natural Resources Harley Speir Phone: 410/260-8264

State	Species				Cite Reference	Regulatory Details	Contact Information
	Tuna	*Swords*	*Billfish*	*Sharks*			
VA			X	X	**Billfish** - 4 VA Administrative Code 20-350 **Sharks** - 4 VA Administrative Code 20-490	**Billfish** - Prohibition on sale of billfish **Sharks** – Recreational: bag limit – 1 LCS, SCS, or pelagic shark/vessel/day with a min size of less than 54" FL or 30" CL; 1 Atlantic sharpnose and bonnethead/person/day with no min size; No limits on rec harvest of smooth and spiny dogfish; Commercial: possession limit - 4000 lb dw/day, min size - 58" FL or 31" CL west of the COLREGS line and no min size limit east of the COLREGS line; Prohibitions: fillet at sea, finning, longlining, same prohibited shark species as Federal regulations; and spiny dogfish commercial regulations.	VA Marine Resources Commission Jack Travelstead Phone: 757/247-2247 Fax: 757/247-2020
NC			X	X * Modify closed area of NC to allow fishing outside 15 fathoms during 1st trimester (Jan 1 - Feb 15)	**Billfish** -NC Administrative Code tit. 15A, r.3M.0507 **Sharks** -NC Administrative Code tit. 15A, r.3M.0505; Proclamation FF-24-2004	**Billfish** - Recreational possession limit - 1 Blue or White marlin/vessel/trip; 1 Sailfish/person/day; Minimum size - Blue marlin - 99"; White marlin - 66"; Sailfish - 63"; unlawful to sell or offer for sale Blue or White marlin and Sailfish. **Sharks** - Director may impose restrictions for size, seasons, areas, quantity, etc. 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 Randy Gregory Phone: 252/726-7021 Fax: 252/726-0254

State	Species				Cite Reference	Regulatory Details	Contact Information
	Tuna	*Swords*	*Billfish*	*Sharks*			
SC	X		X	X	**Tuna** -SC Code Ann. ' 50-5-2730 **Billfish** - SC Code Ann. ' 50-5-1700 **Sharks** -SC Code Ann. ' 50-5-2725	**Tuna** - Reference to ATCA and MSA regulations for Tuna **Billfish** - Unlawful to sell billfish; hook and line gear only; unlawful to possess while transporting gillnets, seines, or other commercial gear. **Sharks** – Recreational: 2 Atlantic sharpnose/per/day and 1 Bonnethead/person/day, no min size; All others – 1 shark/boat/trip, min size – 54" FL; Reference to Federal commercial regulations and prohibited species.	SC Department of Natural Resources Robert Boyles Phone: 843/953-9304 Fax: 843/953-9159
GA			X	X	Gear Restrictions/Prohibitions - GA Code Ann. ' 27-4-7; **Billfish** - GA Code Ann. ' 27-4-130.2; GA Comp. R. & Regs. ' 391-2-4-.04 **Sharks** - GA Code Ann. ' 27-4-130.1; OCGA ' 27-4-7(b); GA Comp. R. & Regs. ' 391-2-4-.04	Gear Restrictions/Prohibitions - Use of gillnets is prohibited in state waters. **Billfish** - Possession prohibited in state waters, except for catch and release. **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 sharpnoses) or 2 different species, SCS min size 30" TL; All other sharks - 2 sharks/person or boat, whichever is less, min size 48" TL, may include only 1 greater than 84"; Prohibited Species: sand tiger sharks. All species must be landed head and fins intact. Sharks may not be landed in Georgia if harvested using gill nets.	GA Department of Natural Resources Carolyn Belcher Phone: 912/264-7218 Fax: 912/262-3143

State	Species				Cite Reference	Regulatory Details	Contact Information
	Tuna	*Swords*	*Billfish*	*Sharks*			
FL		X	X	X	**Sharks** -FL Administrative Code Ann. r.68B-44, F.A.C **Swordfish/ Billfish** - FL Administrative Cod Ann. r. 68B-33 F.A.C	**Billfish** – Longbill/Mediterranean/roundscale spearfish – harvest/possession/landing/purchase/sale/exchange prohibited. **Blue/White Marlin and Sailfish** – Sale prohibited; Aggregate possession of 1 fish/person; Gear restriction (hook and line only); Minimum size limit (Blue Marlin – 99" LJFL; White Marlin – 66" LJFL; Sailfish – 63" LJFL); Recreational catch reporting requirement (all non-tournament landings must be reported NOAA within 24 hours); Must land in whole condition (gutting allowed) **Swordfish** - Minimum size - 47 in LJFL/29" cleithrum to keel/33 lbs. dw; Possession limit 1 fish/person/day or 3 fish/vessel/day (with 3 or more persons onboard); Commercial harvest and sale allowed only with Florida saltwater products license and a federal LAP for swordfish; Recreational catch reporting requirement (all non-tournament landings must be reported NOAA within 24 hours). **Sharks** – Commercial/Recreational: min size - none; possession limit – 1 shark/person/day or 2 sharks/vessel on any vessel with 2 or more persons on board; State waters close to commercial harvest when adjacent Federal waters close; Federal permit required for commercial harvest, so Federal regulations apply unless state regulations are more restrictive; Finning & Filleting prohibited; and same prohibited species as Federal regulations, except Caribbean sharpnose is not included.	FL Fish and Wildlife Conservation Commission Lisa Gregg Phone: 850/487-0554 Fax: 850/487-4847

State	Species				Cite Reference	Regulatory Details	Contact Information
	Tuna	*Swords*	*Billfish*	*Sharks*			
AL	X	X	X	X	**Sharks** - AL Administrative Code r. 220-2-.46, r.220-3-.30, r.220-3-.37	**Tuna/Swordfish/Billfish/Sharks** - Reference to Federal regulations. **Sharks** – Recreational & 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 make, sand tiger, basking, whale, white, and nurse sharks.	AL Department of Conservation and Natural Resources Major Jenkins jjenkins@dcnr.state.al.us Phone: 251 861 2882
LA	X	X	X	X	**Tuna** -LA Administrative Code Title 76, Pt. VII, Ch. 3, § 361 **Swords/Billfish** - LA Administrative Code Title76, Pt. VII, Ch. 3, § 355 **Sharks** - LA Administrative Code Title 76, Pt. VII, Ch. 3, § 357	**Tuna** - Recreational bag and possession limit Yellowfin (3 fish/person); Rec/Commercial minimum size - Yellowfin, Bigeye and Bluefin (27 in CFL). **Billfish/Swordfish** - Minimum size - Blue marlin (99 in LJFL), White marlin (66" LJFL), Sailfish (63 in LJFL), Swordfish (29 in carcass length or 33 lbs dw); Recreational creel limit - 5 swordfish/vessel/trip. **Sharks** - Recreational: min size – 54" FL, except Atlantic sharpnose and bonnethead; bag limit - 1 sharpnose/person/day; all other sharks – 1 fish/person/day; Commercial: 33 per vessel per trip limit, no min size; Com & Rec Harvest Prohibited: 4/1-6/30; Prohibition: same as Federal regulations.	LA Department of Wildlife and Fisheries Harry Blanchet 225 765-2889 fax (225) 765-2489 hblanchet@wlf.louisiana.gov

State	Species				Cite Reference	Regulatory Details	Contact Information
	Tuna	*Swords*	*Billfish*	*Sharks*			
MS	X		X	X	**Tuna/Billfish/Sharks** - MS Code Title-22 part 7	**Tuna** – Min size - Bigeye 27" CFL; Yellowfin 27" CFL; No commercial bag limit; Bag limit of 3 yellowfin tuna/person in recreational; No recreational limit for BET; No commercial take of bluefin tuna; 1 bluefin tuna/vessel/week and landing must be reported to MDMR. **Billfish** - No take provisions for commercially harvested Blue and White marlin and Sailfish; Recreational minimum size - Blue marlin 99" LJFL; White marlin 66" LJFL; Sailfish 63" LJFL; No position for longbill spear fish. No limit for recreational take. **Sharks** – Recreational: min size - LCS/Pelagics 37" TL; SCS 25" TL; bag limit - LCS/Pelagics 1/person up to 3/vessel; SCS 4/person; Commercial & Prohibited Species - Reference to Federal regulations.	MS Department of Marine Resources Kerwin Cuevas Phone: 228/374-5000
TX		X	X	X	**Billfish/Swordfish/Sharks** - TX Administrative Code Title 31, Part 2, Parks and Wildlife Code Title 5, Parks and Wildlife Proclamations 65.3 and 65.72	Blue Marlin, White Marlin, Sailfish, Sharks, Longbill spearfish, and Broadbill swordfish are gamefish and may only be taken with pole and line (including rod and reel); Blue Marlin, White Marlin, Sailfish, and Longbill spearfish may not be sold for any purpose; **Billfish** - Bag limit none; min size Blue Marlin – 131" TL; White Marlin – 86" TL; Sailfish – 84" TL; **Sharks** - 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 Mark Lingo Phone: 956/350-4490 Fax: 956/350-3470

State	Species				Cite Reference	Regulatory Details	Contact Information
	Tuna	*Swords*	*Billfish*	*Sharks*			
Puerto Rico	X	X	X	X	Regulation #6768 Article 8 – General Fishing Limits Article 13 – Limitations Article 17 – Permits for Recreational Fishing (March 2004)	Sell, offer for sale, or traffic in any billfish or marlin, either whole or processed, captured in jurisdictional waters of Puerto Rico. Swordfish or billfish, tuna and shark 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. Billfish captured incidentally with long line must be released by cutting the line close to the fishhook, avoiding the removal of the fish from the water. In the case of tuna and swordfish, fishers shall obtain a permit according to the requirements of the Federal government.	Puerto Rico Department of Natural and Environmental Resources Craig Lilyestrom Phone: 787-724-8774 x4042 craig@caribe.net
U.S. Virgin Islands	X	X	X	X	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

2.0 STATUS OF THE STOCKS

The thresholds used to determine the status of Atlantic HMS are fully described in Chapter 3 of the 1999 Tunas, Swordfish, and Shark FMP and Amendment 1 to the Billfish FMP, and are presented in Figure 2.1. These thresholds were carried over in full in the 2006 Consolidated HMS FMP. 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).

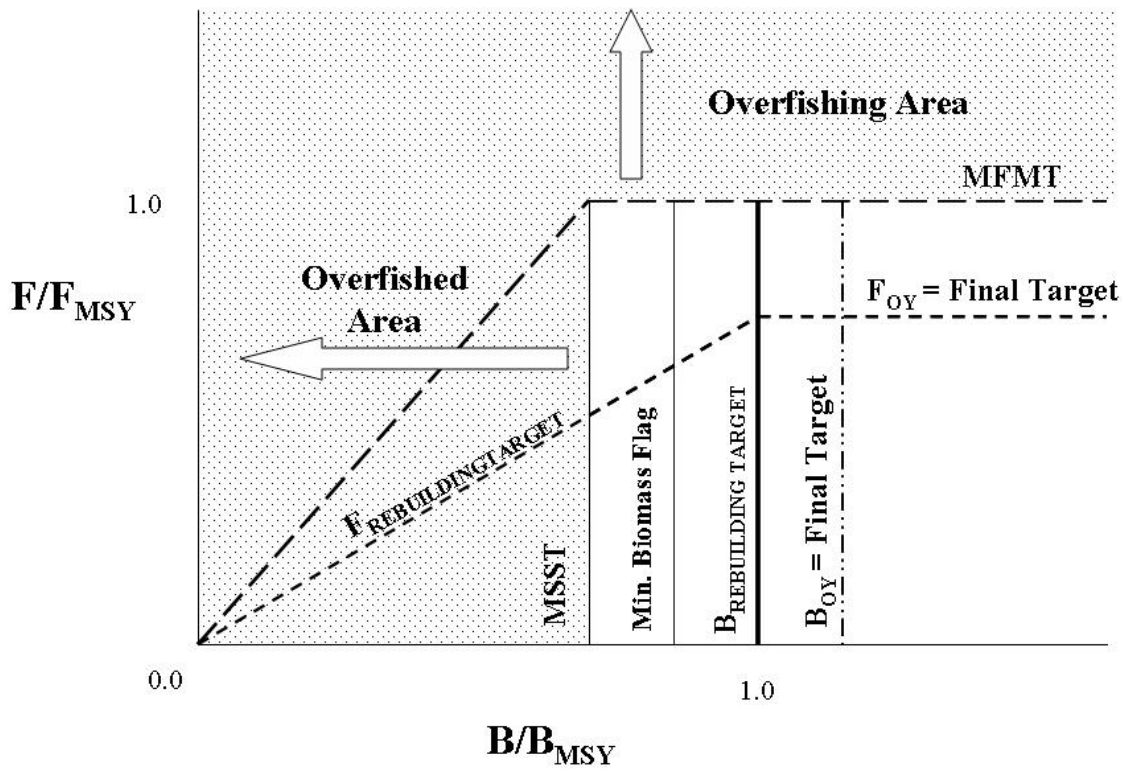

Figure 2.1 Illustration of the status determination criteria and rebuilding terms.

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 used to calculate the status of Atlantic HMS, as described in the 1999 FMP and Amendment 1 to the Billfish 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 $M >= 0.5$ (for billfish, the specific MSST values are: blue marlin = $0.9B_{MSY}$; white marlin = $0.85B_{MSY}$; west Atlantic sailfish = $0.75B_{MSY}$);
- 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 bluefin tuna, spawning stock biomass (SSB) is used as a proxy for biomass
- For sharks, in some cases, spawning stock fecundity (SSF) or spawning stock number (SSN) was used as a proxy for biomass since biomass does not influence pup production in sharks.

With the exception of Atlantic sharks, stock assessments for Atlantic HMS are conducted by ICCAT's SCRS. In 2007, SCRS completed several stock assessments for Atlantic HMS: Atlantic bigeye tuna, albacore, and Mediterranean swordfish (not considered in the HMS management unit), and provided an update to the 2006 Atlantic bluefin tuna and 1999 skipjack tuna stock assessments. In 2008, SCRS completed stock assessments for western and eastern Atlantic bluefin tuna, yellowfin tuna, skipjack tuna, shortfin mako and blue sharks. Additionally, ecological risk assessments were conducted for several other shark species. All SCRS final stock assessment reports can be found at www.iccat.int/assess.htm.

Atlantic shark stock assessments for LCS and small coastal sharks (SCS) are completed by the NMFS Southeast Data, Assessment, and Review (SEDAR) process. The LCS complex, blacktip, and sandbar sharks were evaluated in 2006 (July 24, 2006, 71 FR 41774). The 2006 LCS assessment assessed blacktip sharks for the first time as two separate populations - Gulf of Mexico and Atlantic – and also assessed the status of sandbar sharks separately. In addition, the

first dusky-specific shark assessment was released on May 25, 2006 (71 FR 30123). In 2007, NMFS released a stock assessment for SCS, including individual assessments for Atlantic sharpnose, bonnethead, blacknose, and finetooth sharks (November 13, 2007, 72 FR 63888).

For porbeagle sharks, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) conducted a species report and assessment in 2004 (COSEWIC, 2004) and recommended to the Canadian Minister of Fisheries that porbeagle sharks be listed as endangered under the Species at Risk Act (SARA). The Canadian Department of Fisheries and Oceans conducted the latest assessment on porbeagle sharks in 2005, and NMFS has deemed this assessment the best available science and appropriate to use for U.S. domestic management measures (November 7, 2006, 71 FR 65086).

Table 2.1and Table 2.2 summarize stock assessment information and the current status of Atlantic HMS as of October 2008.

Table 2.1 **Stock Assessment Summary Table for Atlantic tunas, swordfish, and marlin.** Source: SCRS, 2008.

Species	Current Relative Biomass Level	Minimum Stock Size Threshold	Current Relative Fishing Mortality Rate	Maximum Fishing Mortality Threshold	Outlook – From Status of Stocks for U.S. managed species
West Atlantic Bluefin Tuna	SSB_{07}/SSB_{MSY} = 0.57 (0.46-0.70) (low recruitment) SSB_{07}/SSB_{MSY} = 0.14 (0.08-0.21) (high recruitment) SSB_{07}/SSB_{75} = 0.25	$0.86SSB_{MSY}$	F_{04-06}/F_{MSY} = 1.27 (1.04-1.53) (low recruitment) F_{04-06}/F_{MSY} =2.18 (1.74-2.64) (high recruitment)	F_{year}/F_{MSY} = 1.00	Overfished; overfishing is occurring.
Atlantic Bigeye Tuna	B_{06}/B_{MSY} = 0.92 (0.85-1.07)	$0.6B_{MSY}$ (age 2+)	F_{05}/F_{MSY} = 0.87 (0.70-1.24)	F_{year}/F_{MSY} = 1.00	Rebuilding; overfishing not occurring.
Atlantic Yellowfin Tuna	B_{06}/B_{MSY} = 0.96 (0.72-1.22)	$0.5B_{MSY}$ (age 2+)	$F_{current}/F_{MSY}$=0.86 (0.71-1.05)*	F_{year}/F_{MSY} = 1.00	Not overfished ; overfishing not occurring.
North Atlantic Albacore Tuna	B_{05}/B_{MSY} = 0.81 (0.68-0.97)	$0.7B_{MSY}$	F_{05}/F_{MSY} = 1.5 (1.3-1.7)	F_{year}/F_{MSY} = 1.00	Overfished; overfishing is occurring.
West Atlantic Skipjack Tuna	B_{06}/B_{MSY}: most likely>1	*Unknown*	F_{06}/F_{MSY}: most likely<1	F_{year}/F_{MSY} = 1.00	Unknown
North Atlantic Swordfish	B_{06}/B_{MSY} = 0.99 (0.87-1.27)	*Unknown*	F_{05}/F_{MSY} = 0.86 (0.87-1.27)	F_{year}/F_{MSY} = 1.00	Rebuilding; overfishing not occurring
South Atlantic Swordfish	Likely >1	*Unknown*	Likely <1	F_{year}/F_{MSY} = 1.00	Unknown

Species	Current Relative Biomass Level	Minimum Stock Size Threshold	Current Relative Fishing Mortality Rate	Maximum Fishing Mortality Threshold	Outlook – From Status of Stocks for U.S. managed species
Blue Marlin	$B_{04}<B_{MSY}$: yes	$0.9B_{MSY}$	$F_{04}>F_{MSY}$: Yes	F_{year}/F_{MSY} = 1.00	Overfished: overfishing is occurring
White Marlin	$B_{04}<B_{MSY}$: yes	$0.85B_{MSY}$	$F_{04}>F_{MSY}$: Possibly	F_{year}/F_{MSY} = 1.00	Overfished: overfishing is occurring
West Atlantic Sailfish	*Unknown*	$0.75B_{MSY}$	*Unknown*	*Not estimated*	Overfished; overfishing is occurring
Spearfish	*Unknown*	*Unknown*	*Unknown*	*Not estimated*	*Unknown*

*$F_{current}$ refers to F2006 in the case of ASPIC, and the geometric mean of F across 2003-2006 in the case of VPA.

Table 2.2 **Stock Assessment Summary Table for Atlantic sharks.** Sources: SCRS, 2007; Gibson and Campana, 2005; Cortés *et al*., 2006; NMFS, 2006; NMFS, 2007.

Species	Current Relative Biomass Level	Minimum Stock Size Threshold	Current Relative Fishing Mortality Rate	Maximum Fishing Mortality Threshold	Outlook
LCS Complex	*Unknown*	*Unknown*	*Unknown*	*Unknown*	*Unknown*
Sandbar	SSF_{04}/SSF_{MSY} = 0.72	4.75-5.35E+05	F_{04}/F_{MSY} = 3.72	0.015	Overfished; overfishing is occurring
Gulf of Mexico Blacktip	SSF_{04}/SSF_{MSY} = 2.54-2.56	0.99-1.07E+07	F_{04}/F_{MSY} = 0.03–0.04	0.20	Not overfished; overfishing not occurring
Atlantic Blacktip	*Unknown*	*Unknown*	*Unknown*	*Unknown*	*Unknown*
Dusky Sharks	B_{03}/B_{MSY} = 0.15-0.47	*Unknown*	F_{03}/F_{MSY} = 1.68-1,810	0.00005-0.0115	Overfished; overfishing is occurring
SCS Complex	N_{05}/N_{MSY} = 1.69	2.1E+07	F_{05}/F_{MSY} = 0.25	F_{MSY} = 0.091	Not overfished; overfishing not occurring
Bonnethead Sharks	SSF_{05}/SSF_{MSY} = 1.13	1.4 E+06	F_{05}/F_{MSY} = 0.6	F_{MSY} = 0.31	Not overfished; overfishing not occurring
Atlantic Sharpnose Sharks	SSF_{05}/SSF_{MSY} = 1.47	4.09 E+06	F_{05}/F_{MSY} = 0.74	F_{MSY} = 0.19	Not overfished; overfishing not occurring
Blacknose Sharks	SSF_{05}/SSF_{MSY} = 0.48	4.3 E+05	F_{05}/F_{MSY} = 3.77	F_{MSY} = 0.07	Overfished; overfishing is occurring

Species	Current Relative Biomass Level	Minimum Stock Size Threshold	Current Relative Fishing Mortality Rate	Maximum Fishing Mortality Threshold	Outlook
Finetooth Sharks	$N_{05}/N_{MSY} = 1.80$	2.4E+06	$F_{05}/F_{MSY} = 0.17$	$F_{MSY} = 0.03$	Not overfished; overfishing not occurring
Pelagic sharks	*Unknown*	*Unknown*	*Unknown*	*Unknown*	*Unknown*
Porbeagle Sharks	$SSN_{04}/SSF_{MSY} = 0.15$-0.32	*Unknown*	$F_{04}/F_{MSY} = 0.83$	0.033-0.065	Overfished; overfishing is not occurring

2.1 Atlantic Swordfish

2.1.1 Life History and Species Biology

Swordfish are one of the fastest and largest predators of the Atlantic Ocean, reaching maximum size at 530 kg. Highly migratory in nature, swordfish exhibit a long bill that is used for both foraging and defense of territory. Swordfish are also pelagic in nature, but have been known to feed throughout the water column on ground fish, pelagic, deep-water fish, and invertebrates. A fusiform body and stiff, deeply forked tail allow them to swim at high speeds.

In 2006, a SCRS workshop examined both the swordfish stock structure and the boundaries of the North and South Atlantic and Mediterranean stocks. This workshop, held in Crete, was conducted to satisfy ICCAT's resolution 99-03, *Resolution by ICCAT on the Clarification of the Stock Structure and Boundaries Between the Swordfish Stocks in the Atlantic.* In this resolution, ICCAT noted that there were considerable uncertainties about the structure, mixing and boundaries of the swordfish stocks, and called for national and international research programs on swordfish stock structure. The stock structure data presented at the 2006workshop were consistent with current theories about Atlantic and Mediterranean swordfish stock structure. Researchers at the workshop found that without intensified collaborative and multi-disciplinary research, different swordfish stock boundaries could not be improved upon. However, the workshop confirmed that some mixing of stocks between the Atlantic and Mediterranean occur, and fish from the Mediterranean stock are genetically different from swordfish in other oceans. The next stock assessment scheduled by ICCAT is to take place in 2009.

2.1.2 Stock Status and Outlook

North Atlantic

The biomass of North Atlantic swordfish has improved, reaching 99 percent of the level necessary to support MSY in 2006. Several strong year classes in the late 1990s, and a reduction in the overall catch since 1987, has allowed the rebound of swordfish in the North Atlantic. In 2005, the fishing mortality for North Atlantic swordfish was 14 percent below the level needed to maintain MSY. The F_{2005} was less than $F_{MSY,}$ but the SCRS has shown some uncertainty in

the estimates of F_{2005}. The replacement yield for 2006 (14,438 t) was slightly above MSY, and the TAC set by ICCAT in 2005 was 14,000 t assuming that North Atlantic swordfish biomass would continue to reach B_{MSY} with those catch levels (Table 2.3).

Table 2.3 Summary Table for the Status of North Atlantic Swordfish. Source: SCRS 2006

Age/size at Maturity	Females: 180 cm lower jaw fork length (LJFL) Male: 129 cm LJFL
Spawning Sites	Warm tropical and subtropical waters throughout the year
Current Relative Biomass Level	B_{06}/B_{MSY} = .99 (0.87-1.27)
Current Relative Fishing Mortality Rate *Maximum Fishing Mortality Threshold*	F_{05}/F_{MSY} = 0.86 (0.65-1.04) F_{year}/F_{MSY} = 1.00
Maximum Sustainable Yield	14,133 t (12,800-14,790)
Current (2007) Yield	11,938 t
Current (2006) Replacement Yield	14,438 t
Outlook	Stock is nearly rebuilt; overfishing is not occurring

South Atlantic

The SCRS used a simple production model using catch per unit effort (CPUE) data to estimate the biomass of South Atlantic swordfish. Depending on the use of bycatch fishery data or target fishery data, two different outcomes are reached. When using bycatch CPUE the conclusion is a relatively low abundance. In contrast, using target CPUE data leads to a positive outlook. The SCRS believes that the bycatch CPUE data could not be supported as an indicator of abundance. In addition, the use of target fishery data cannot be used because it is believed that increased catchablity of South Atlantic swordfish and not abundance was the reason for high CPUE. The SCRS chose to use a composite CPUE for both fisheries data for the base case estimate. Though more research is needed, results from the analyses using data from both fisheries show that current fishing mortality is less than that needed to maintain MSY, and biomass levels are above that which would occur when fishing at F_{MSY} for a long period of time. The estimated MSY (about 17,000 t) is 33 percent higher than current reported landings (Table 2.4).

Table 2.4 Summary Table for the Status of South Atlantic Swordfish. Source: SCRS, 2006

Age/size at Maturity	Females: 180 cm lower jaw fork length (LJFL) Male: 129 cm LJFL
Spawning Sites	Warm tropical and subtropical waters throughout the year
Current Relative Biomass Level	Likely >1
Current Relative Fishing Mortality Rate *Maximum Fishing Mortality Threshold*	Likely <1 F_{year}/F_{MSY} = 1.00
Maximum Sustainable Yield	~17,000 t
Current (2007) Yield	15,416 t
Current (2006) Replacement Yield	*not estimated*
Outlook	*unknown*

2.1.3 Management Recommendations

North Atlantic

The SCRS noted in the 2006 stock assessment summary that in order to maintain the northern Atlantic swordfish stock close to a level that would produce MSY, the SCRS continues to recommend continuing the present TAC (14,000 t). Given the estimated stock productivity (r=0.49) and MSY (14,100 t), this TAC should be sustainable into the future, and reflects the maximum yield that could be harvested from the population under existing environmental and fishery conditions.

South Atlantic

The SCRS recommends that until sufficiently more research can been conducted to reduce the high uncertainty in stock status evaluations for the southern Atlantic swordfish stock, the SCRS recommends that annual catch should not exceed the provisionally estimated MSY (about 17,000 t).

2.1.4 Recent and Ongoing Research

In late 2007, NMFS issued an Exempted Fishing Permit to three U.S. vessels in order to allow them to fish in portions of areas currently closed to pelagic longline fishing off the coast of the Southeastern U.S. NMFS contracted with Nova Southeastern University to conduct a study on these vessels in order to evaluate the catch rates of target and bycatch species inside the closed areas relative to open fishing areas. The research may also evaluate bycatch reduction and immediate mortality reduction using 18/0 non-offset circle hooks on various species (particularly undersize swordfish). The vessels began conducting the study in February 2008 and are expected to continue through 2009.

NMFS also continues to tag swordfish with pop-up satellite archival tags to better understand behavior. Ten and three swordfish were released with these tags in 2007 and 2008, respectively. In addition, 172 swordfish have been released with conventional tags in 2007 and 2008.

2.2 Atlantic Bluefin Tuna

Information for the text, figures and tables for this section are from the SCRS 2008 Report, as well as the U.S. National Report to ICCAT, 2008. All weights are reported as whole weights unless indicated otherwise.

2.2.1 Life History and Species Biology

The Atlantic bluefin tuna is one of the only large pelagic fish living permanently in temperate Atlantic waters. They are distributed from the Gulf of Mexico to Newfoundland in the West Atlantic, from roughly the Canary Islands to south of Iceland in the East Atlantic, and

throughout the Mediterranean Sea. Historically, catches of bluefin tuna were made from a broad geographic range in the Atlantic and Mediterranean.

Archival tagging and tracking information confirmed that bluefin tuna can sustain cold as well as warm temperatures while maintaining stable internal body temperature. Until recently, it was assumed that bluefin tuna preferentially occupied the surface and subsurface waters of the coastal and open-sea areas, but archival tagging and ultrasonic telemetry data indicate that bluefin tuna frequently dive to depths of 500 m to 1,000 m (1,640 to 3,280 ft). Bluefin tuna appears to display homing behavior and spawning site fidelity in both the Mediterranean Sea and Gulf of Mexico, which constitute the two main spawning areas being clearly identified today. Less is known about feeding migrations within the Mediterranean and the North Atlantic, but results from electronic tagging indicated that bluefin tuna movement patterns vary considerably between individuals, years and areas. The appearance and disappearance of important past fisheries further suggest that important changes in the spatial dynamics of bluefin tuna may also have resulted from interactions between biological factors, environmental variations and fishing. Although the Atlantic bluefin tuna population is managed as two stocks, separated at 45° W latitude, its population structure remains poorly understood and needs to be further investigated. Recent genetic and microchemistry studies as well as work based on historical fisheries tend to indicate that the bluefin tuna population structure is complex.

Bluefin tuna are assumed to mature at 4 years of age (approximately 25 kg or 55 lb) in the Mediterranean and at approximately 8 to 10 years of age (approximately 140 kg-150 kg or 300 lb to 330 lb) in the Gulf of Mexico. Juvenile and adult bluefin tuna are opportunistic feeders (as are most predators) and their diet can include jellyfish and salps, as well as demersal and sessile species such as, octopus, crabs and sponges. However, in general, juveniles feed on crustaceans, fish and cephalopods, while adults primarily feed on fish such as herring, anchovy, sand lance, sardine, sprat, bluefish, and mackerel. Juvenile growth is rapid for a teleost fish (about 76 cm or 30 inches/year), but slower than other tuna and billfish species. Fish born in June attain a length of about 76-102cm (30-40 inches) long and a weight of about 1 kg (2.3 lb) by October. After one year, fish reach about 4 kg (8.8 lb) and 60 cm (24 inches) long. Growth in length tends to be lower for adults than juveniles, but growth in weight increases. At 10 years old, a bluefin tuna is about 200 cm (79 inches) and 150 kg (331 lb) and reaches about 300 cm (118 inches) and 400 kg (882 lb) at 20 years. However, there remain large uncertainties about bluefin tuna growth curves, and bluefin tuna in the West Atlantic generally reach a larger maximum size compared to bluefin tuna caught in the East Atlantic. Bluefin tuna is a long lived species, with a lifespan of 20 years or more, as indicated by recent studies from radiocarbon deposition.

In the 2006 stock assessment, a need to integrate recent and anticipated advances in otolith microconstituent analyses, age determination, archival tagging and genetics into the next assessment and management evaluation processes was noted. While more work needs to be completed, SCRS has achieved important progress towards that goal. Concerning age determination, SCRS received new information that presented a novel approach for determining age and area of natal origin from the same otolith, allowing construction of area-specific growth curves. The preliminary results diverge considerably from the age-length relationship used by

SCRS for the western stock, and could have significant impacts for estimates of stock productivity.

In 2008, SCRS continued to be concerned with the effects of mixing and management measures on the eastern stock. Bluefin tuna are known to be highly migratory and the nature and extent of their ability to conduct transoceanic migrations are the subject of significant research (see section on Research below). Movements between the east and west are complex and it is difficult to quantify the amount of mixing that occurs. A positive correlation between age and migration distances exists with all Atlantic bluefin tuna. The information on natal origin derived from otolith microchemistry received by SCRS indicated that there is an increasing contribution of eastern origin fish to the western fisheries with decreasing average size of the fish in the catch (*i.e,*. up to 62% for fish in the 69-119 cm or 27-47 inch size class, i.e., school bluefin tuna). In contrast, other western fisheries supported by the largest size classes had minimal or no eastern component in the catch. However, there remains considerable uncertainty and therefore additional samples are needed to improve understanding about the relative contribution of the two populations to the different fisheries over time.

Other recent research activities for bluefin tuna can be found in the 2008 Annual Report of the United States to ICCAT (NMFS, 2008), available by calling the HMS Management Division at 301-713-2347 or at www.nmfs.noaa.gov/sfa/hms/hmsdocument_files/ICCAT.htm.

2.2.2 Stock Status and Outlook

The last full stock assessment for western Atlantic bluefin tuna was conducted in 2008 by SCRS with the next scheduled for 2010. Summarized information for western Atlantic bluefin tuna and eastern Atlantic/Mediterranean bluefin tuna are shown in Table 2.5 and Table 2.6, respectively. This section summarizes the findings of SCRS.

The 2008 western bluefin tuna assessment, which included information up to 2007, showed results consistent with previous year evaluations, in that spawning stock biomass (SSB) declined steadily between the early 1970s and 1992. Since then, SSB has fluctuated between 18 percent and 27 percent of the 1975 level (Figure 2.2). The stock has experienced different levels of fishing mortality (F) over time, depending on the size of fish targeted by various fleets. F for spawners (age 8+) declined markedly between 2002 and 2007.

Estimates of recruitment were very high in the early 1970's, and additional analyses involving longer catch and index series suggest that recruitment was also high during the 1960s. Since 1977, recruitment has varied from year to year without trend. SCRS noted that a key factor in estimating MSY-related benchmarks is the highest level of recruitment that can be achieved in the long term. Assuming that average recruitment cannot reach the high levels from the early 1970s, recent F (2004-2006) is about 30 percent higher than the MSY level and SSB is about half of the MSY level (Figure 2.3). Estimates of stock status are more pessimistic if a high recruitment scenario is considered (F/F_{MSY}=2.1, B/B_{MSY}=0.14).

One important factor in the recent decline of fishing mortality on large bluefin tuna is that the TAC has not been taken during this time period, due primarily to a shortfall by U.S. fisheries that target large bluefin tuna. Two plausible explanations for the shortfall were put forward previously by SCRS: (1) that availability of fish to the U.S. fishery has been abnormally low, and/or (2) the overall size of the population in the Western Atlantic declined substantially from the level of recent years. SCRS noted that while there is no overwhelming evidence to favor either explanation over the other, the base case assessment [which excluded the Canadian Gulf of St. Lawrence catch per unit effort (CPUE) index since inclusion might produce overly optimistic results] implicitly favors the first hypothesis (regional changes in availability) because a large recent reduction in SSB is not estimated. Nevertheless, SCRS noted that substantial uncertainty remains on this issue and more research needs to be done. SCRS also cautioned that the conclusions of the 2008 assessment do not capture the full degree of uncertainty in the assessments and projections, due to: (1) mixing between fish of eastern and western origin, (2) recruitment, both in terms of recent levels (which are estimated with low precision in the assessment), and potential future levels (the "low" vs. "high" recruitment hypotheses which affect management benchmarks), and (3) the assumed growth curve, which may be revised based on new information that is being collected. If the growth curve changes substantially, it may impact the assessment results as well as management benchmarks.

To determine the outlook, SCRS conducted a medium-term (12-year) evaluation of changes in spawning stock size and yield over the remaining rebuilding period under various management options. In order to provide advice relative to rebuilding the western Atlantic bluefin tuna resource, SCRS conducted projections for two scenarios about future recruitment. The “low recruitment” scenario assumed that future average recruitment will approximate the average of recruitment (at age one) levels observed from 1976 through 2004 (70,000 recruits). The “high recruitment” scenario assumed average recruitment levels would increase as the stock rebuilds (an MSY level of 160,000 recruits). SCRS had no strong evidence to favor one scenario over the other and noted that both are reasonable (but not extreme) lower and upper bounds on rebuilding potential. The outlook for bluefin tuna in the West Atlantic with the low recruitment scenario (Figure 2.4) is similar to that from the 2006 assessment. A total catch of 2,100 mt is predicted to have at least a 50 percent chance of achieving the convention objectives of preventing overfishing and rebuilding the stock to MSY levels by 2019, the target rebuilding time. The outlook under the high recruitment scenario is more pessimistic since the rebuilding target would be higher; a total catch of less than 1,500 mt is predicted to stop overfishing in 2009, but the stock would not be expected to rebuild by 2019 even with no fishing.

Table 2.7 below summarizes the results of projections of both scenarios at different catch levels. The projections for the low recruitment scenario suggests that catch levels of 2,400 mt will have about a 50 percent chance of rebuilding the stock by 2019 and catches of 2,000 mt or lower will have greater than a 75 percent chance of rebuilding. If the high recruitment scenario is correct, then the western stock will not rebuild by 2019 even with no catch, although catches of 1,500 mt or less are expected to immediately end overfishing and initiate rebuilding (Table 2.8). SCRS also examined an alternative model that excluded the Canadian Gulf of St. Lawrence CPUE index, noting considerations of possible resource re-distribution, and the observation that the recent high values were difficult to reconcile with other available fisheries data, and could reflect the impact of a single or a limited number of strong year-classes. The levels of catch that

lead to rebuilding with that alternative model are lower; 1,800 mt will have about a 50 percent chance and 1,500 mt will have a 75 percent chance.

Table 2.5 Summary Table for the Status of West Atlantic Bluefin Tuna. Source: SCRS, 2008.

Age/size at Maturity	Age 8/~ 200 cm fork length
Spawning Sites	Gulf of Mexico and Florida Straits
Current Relative Biomass Level *Minimum Stock Size Threshold*	SSB_{07}/SSB_{75} (low recruitment) = .25 (.16-.38) SSB_{07}/SSB_{75} (high recruitment) = .25 (.16-.38) SSB_{07}/SSB_{msy} (low recruitment) = .57 (.46-.70) SSB_{07}/SSB_{msy} (high recruitment) = .14 (.08-.21) $0.86B_{MSY}$
Current Relative Fishing Mortality Rate *Maximum Fishing Mortality Threshold*	$F_{04\text{-}06}/F_{MSY}$ (low recruitment) = 1.27 (1.04-1.53) $F_{04\text{-}06}/F_{MSY}$ (high recruitment) = 2.18 (1.74-2.64) F/F_{MSY} = 1.00
Maximum Sustainable Yield	Low recruitment scenario: 2,852 mt (2,680-3,032) High recruitment scenario: 6,201 mt (4,887-9,142)
Catch (2007) including discards	~1,624 mt
Short Term Sustainable Yield	(not provided)
(Outlook – Status of Stocks, NMFS, 2008)	***(Overfished; overfishing continues to occur)***

Table 2.6 Summary Table for the Status of East Atlantic Bluefin Tuna. Source: SCRS, 2008.

Age/size at Maturity	Age 4-5
Spawning Sites	Mediterranean Sea
Current Relative Biomass Level	SSB_{07}/SSB_{FMAX} (low recruitment) = .35 SSB_{07}/SSB_{FMAX} (high recruitment) = .14
Current Relative Fishing Mortality Rate	F_{07}/F_{MAX} =3.04 (reported catches) F_{07}/F_{MAX} =3.42 (adjusted catches)
Short-term Sustainable Yield	F_{MAX}: 15,000 mt or less
Long-term Potential Yield	$\simeq$ 50,000 mt
Current (2007) Yield	32,398 mt reported; 61,000 mt (SCRS estimate)
Outlook	Overfished; overfishing continues to occur

Table 2.7 **Estimated chance of recovery under the high and low recruitment scenarios and various levels of future catch. No shading indicates the chance of recovery by the given year is greater than or equal to the reference probability level (50 or 75 percent). Gray shading indicates the chance of recovering by 2019 is less than the reference probability level.** Source: SCRS, 2008.

Projected Catch Level	50% Probability		75% Probability	
(mt)	Low	High	Low	High
0	2012	No	2013	No
500	2012	No	2013	No
1,000	2013	No	2014	No
1,500	2014	No	2015	No
1,600	2014	No	2016	No
1,700	2015	No	2016	No
1,800	2015	No	2017	No
1,900	2015	No	2018	No
2,000	2016	No	2019	No
2,100	2017	No	No	No
2,200	2017	No	No	No
2,300	2018	No	No	No
2,400	2019	No	No	No
2,500	No	No	No	No
2,600	No	No	No	No
2,700	No	No	No	No
3,000	No	No	No	No
5,000	No	No	No	No

Table 2.8 **Estimated chance of ending overfishing under the high and low recruitment scenarios and various levels of future catch. Entries are year overfishing ends or "no" if overfishing has less than the given probability of success by 2019.** Source: SCRS, 2008.

Projected Catch Level	50% Probability		75% Probability	
(mt)	Low	High	Low	High
0	2009	2009	2009	2019
500	2009	2009	2009	2009
1,000	2009	2009	2009	2010
1,500	2009	2009	2009	2015
1,600	2009	2010	2009	2016
1,700	2009	2011	2009	2018
1,800	2009	2012	2011	2019
1,900	2009	2013	2012	No
2,000	2010	2014	2013	No
2,100	2011	2015	2014	No
2,200	2012	2016	2016	No
2,300	2014	2017	2019	No
2,400	2015	2018	No	No
2,500	2017	No	No	No
2,600	No	No	No	No
2,700	No	No	No	No
3,000	No	No	No	No
5,000	No	No	No	No

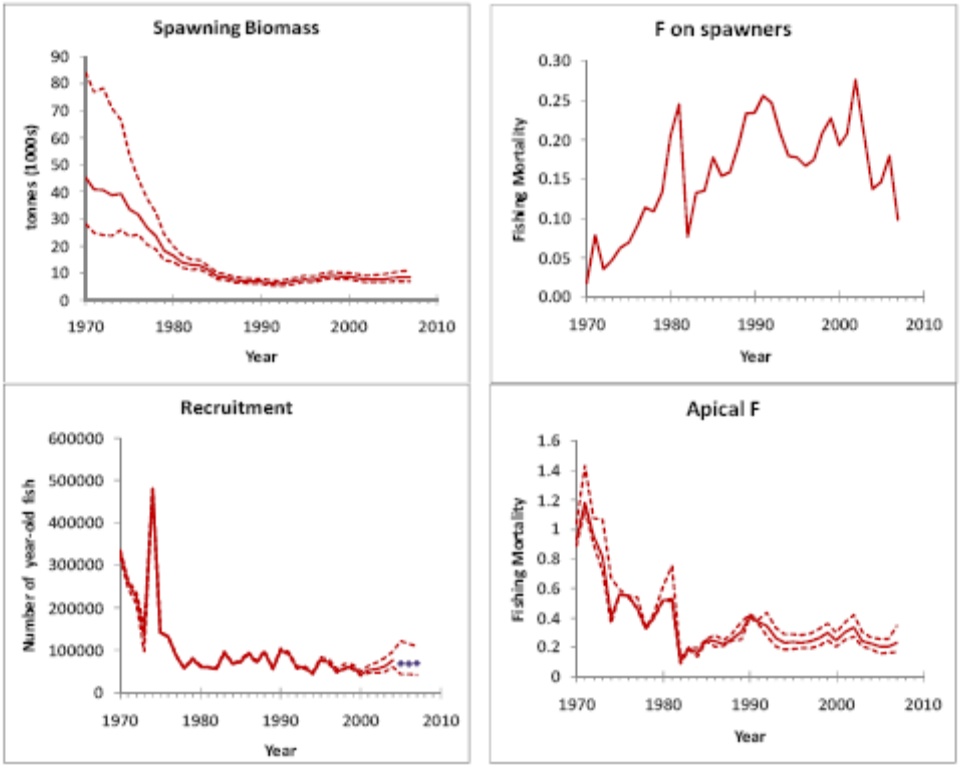

Figure 2.2 **Median estimates of spawning biomass (mt) and fishing mortality on spawners, (age 8+), apical fishing mortality (F on the most vulnerable age class), and recruitment (numbers) for the base VPA model. Source: SCRS, 2008.**

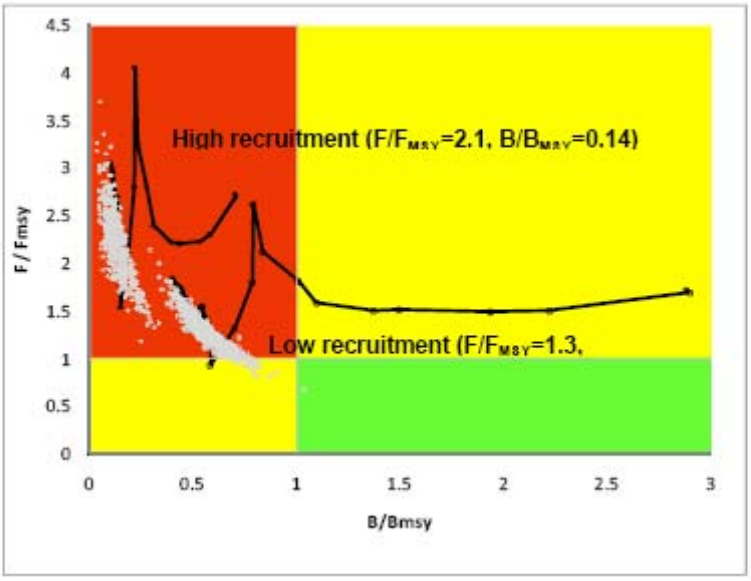

Figure 2.3 **Estimated status of stock relative to the Convention objectives (MSY) by year (1970 to 2007). The lines give the time series of point estimates for each recruitment scenario and the clouds of white symbols depict the corresponding bootstrap estimates of uncertainty for the most recent year. Source: SCRS, 2008.**

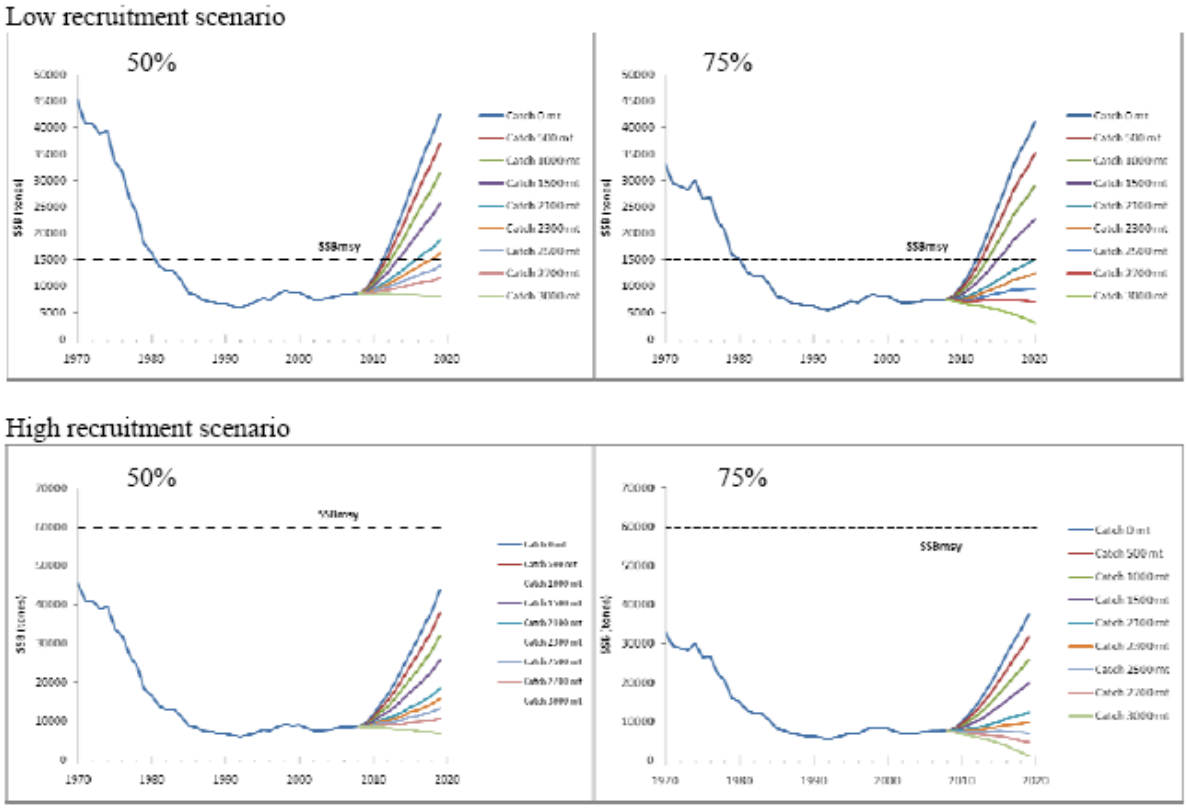

Figure 2.4 **Projections of spawning stock biomass (SSB) for the Base Case assessment under low recruitment (top panels) and high recruitment (bottom panels) and various levels of constant catch. The labels "50%" and "75%" refer to the probability that the SSB will be greater than or equal to the values indicated by each curve. Note that curves are arranged sequentially in the same order as the legends. The dashed horizontal lines represent the median (50%) level of SSB at MSY. Source: SCRS, 2008.**

2.2.3 Effects of Regulations

<u>ICCAT Management Recommendations</u>

The first ICCAT recommendation for a scientific monitoring level was adopted for western Atlantic bluefin tuna catches in 1981. Since then, the total allowable catch has varied from a high of 2,700 mt to the recent 1,900-mt TAC, inclusive of dead discards, set in 2008 and effective beginning in 2009. SCRS noted that catches of western bluefin tuna have been below the TAC since 2003, although that was not always the case prior to then (Figure 2.5).

For the West Atlantic, the ICCAT-recommended size limit of 6.4 kg with 15 percent allowance, in number of fish, has been in effect since 1975. In addition, a prohibition on the taking and landing bluefin tuna less than 30 kg (or 115 cm) with an eight percent tolerance, by weight on a national basis, became effective in 1992. The tolerance was increased to ten percent in 2006. SCRS noted that the estimated percentage of fish less than 47 inches (school bluefin

tuna) in the catch has been less than 8 percent of the TAC from 1992 to 2006, although this percentage increased in 2007 to about 11 percent of TAC.

The western Atlantic bluefin tuna recommendation historically has included a provision to subtract overharvest from a country's allocation the following year and, conversely, to allow carryforward of underharvest of an allocation in a given year to the following year. In 2006, the carryforward of underharvest to the next year was limited to 50% of the country's initial allocation.

SCRS noted in its 2007 and 2008 reports that the 2006 western Atlantic bluefin tuna recommendation was expected to result in a rebuilding of the stock by 2019 with fishing mortality rates at about the estimated MSY level, but also noted that more conservative management measures may be necessary.

Domestic Regulations

The U.S. bluefin tuna fishery continues to be limited by quotas, seasons, gear restrictions, limits on catches per trip, and size limits, consistent with ICCAT recommendations. U.S. 2008 provisional estimated landings and discards from the northwest Atlantic (including the Gulf of Mexico), as reported by the United States to ICCAT in its annual National Report (NMFS, 2008), were 758 mt and 91 mt, respectively. Those estimated landings and discards represent an increase of 234 mt from the 2006 estimates. (Out of a total western Atlantic management area TAC of 2,100 mt, total reported catches were 1,811 mt in 2006 and 1,632 mt in 2007). The 2007 U.S. landings by gear were: 28 mt by purse seine, 23 mt by harpoon, 634 mt by rod and reel, and 151 mt by longline (including discards) of which 81 mt were from the Gulf of Mexico.

To properly implement 1992 regulations limiting the allowable catch of small fish by U.S. fishermen, in conformity with ICCAT agreements, enhanced monitoring of the rod and reel fishery was implemented in 1993 for the purpose of providing near real-time advice on catch levels by this fishery. This monitoring activity has continued and has included estimation of catches by finer scale size categories than reported above. The preliminary estimates for the 2007 rod and reel fishery off the northeastern United States (including the North Carolina winter fishery) for landings in several size categories were 52 fish < 66 cm; 6,100 fish 66-114 cm; 6,565 fish 115-144 cm, and 1,549 fish 145-177 cm (an estimated 0.2, 155, 239, and 112 mt, respectively) (NMFS, 2008).

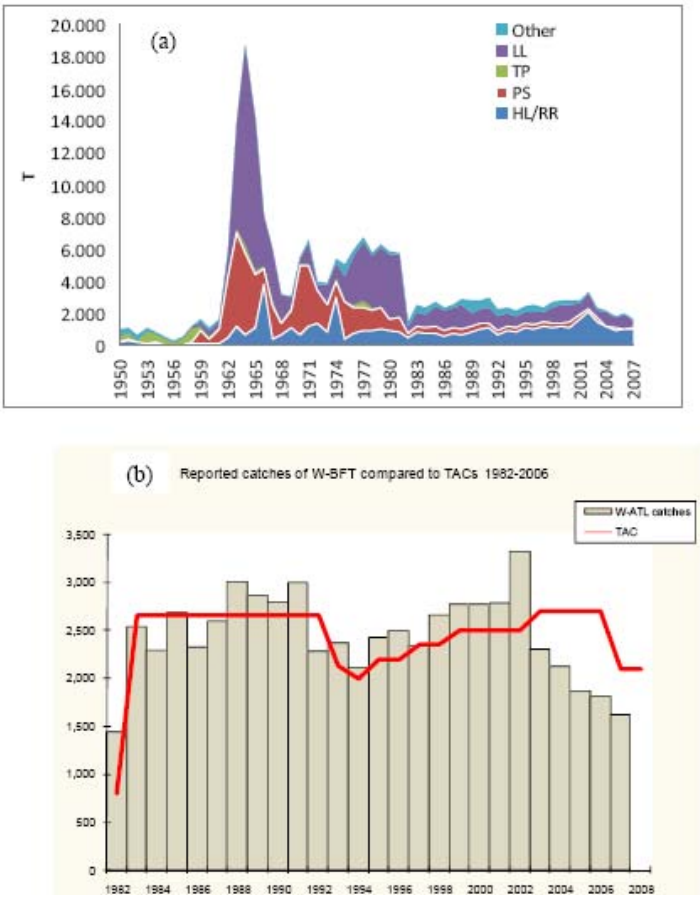

Figure 2.5 **Historical catches of western bluefin tuna: (a) by gear type (LL=longline, TP=trap, PS=purse seine, HL/RR= hand line/rod and reel) and (b) in comparison to TAC levels agreed by ICCAT. Source: SCRS, 2008.**

2.2.4 Management Recommendations

SCRS' management recommendations for the western Atlantic bluefin tuna management area are directed at the Rebuilding Program adopted by ICCAT in 1998. According to the Program, the MSY rebuilding target can be adjusted based on advice from SCRS. Specifically, the TAC for the west would be adjusted from the 2,100 mt level only if the TAC under consideration will allow the MSY target to be achieved within the rebuilding period with a 50 percent or greater probability. In 2008, SCRS determined that the stock has not yet rebuilt as projected under the plan initially, and that the 2007 SSB was estimated to be 7 percent below the level of the Plan's first year.

Based on a strict interpretation of the base case projections and the rebuilding program, SCRS found itself facing TAC options that range between 2,400 mt and 0 mt depending on its

choice of recruitment scenarios and choice of the probability of rebuilding. SCRS notes that making decisions based on the low recruitment scenario when in fact the high recruitment scenario is true, could be riskier in terms of stock rebuilding. In light of the uncertainty about recruitment and other uncertainties not taken into account in the projections, SCRS strongly advised against an increase in TAC. Recent analyses suggested that the projections made during past assessments were too optimistic. This is reinforced by the observation that, halfway through the rebuilding program, biomass is still below what it was at the beginning. Noting that the rebuilding plan calls for ICCAT to adopt harvest levels that provide a 50% *or greater* chance of meeting rebuilding targets, and the lack of progress on rebuilding, SCRS recommended that ICCAT adopt more conservative catch levels that will result in a higher probability (for example, 75% chance) that B_{MSY} is achieved by the beginning of 2019. Under the more optimistic "low recruitment" scenario, this target could be achieved with a TAC of 2,000 mt. However, if the assessment and estimates of future yield are positively biased or if there is implementation error (both of which have occurred in the past), the TAC should be lower (for instance, based on the assessment results without the Gulf of St. Lawrence CPUE index, the TAC would need to be reduced to less than 1,500 mt in order to achieve B_{MSY} by 2019 with 75% probability).

In 2008, SCRS again noted that both the productivity of western Atlantic bluefin tuna and western Atlantic bluefin tuna fisheries are linked to the eastern Atlantic and Mediterranean stock. Therefore, management actions taken in the eastern Atlantic and Mediterranean are likely to influence the recovery in the western Atlantic, because even small rates of mixing from East to West can have significant effects on the West due to the fact that the Eastern plus Mediterranean resource is much larger than that of the West.

2.2.5 Recent and Ongoing Research

As part of its commitment to the Bluefin Year Program (the SCRS Atlantic bluefin tuna research program), research supported by the United States has concentrated on ichthyoplankton sampling, growth and reproductive biology, methods to evaluate hypotheses about mixing and movement patterns, spawning area fidelity, stock structure investigations and population modeling analyses.

Ichthyoplankton surveys in the Gulf of Mexico during the bluefin tuna spawning season were continued in 2007 and 2008. Data resulting from these surveys, which began in 1977, are used to develop a fishery-independent abundance index of spawning for western Atlantic bluefin tuna. This index has continued to provide one measure of bluefin tuna abundance that is used in SCRS assessments of the status of the resource (SCRS/2008/086). In addition to the regular survey which occurs over a fixed spatial grid, adaptive sampling was carried out in 2008 to better understand larval distribution in relation to oceanographic features. Neuston and bongo samples were taken across the Loop Current and adjacent mesoscale structures to sample for larval bluefin tuna during the time period 1-8 May, 2008. Transects were selected to provide high resolution physical and biological mapping of larval scombrids in relation to rapidly changing current flows and gyre movement. The larvae are being sorted and preliminary results are expected to be made available to SCRS in 2009.

Scientists from the Virginia Institute of Marine Science continue to investigate the stock composition of small bluefin tuna caught off the northeastern U.S. and larger bluefin tuna caught in the Gulf of Mexico and off Canada. Genetic markers derived from young-of-the-year bluefin tuna caught in the Mediterranean Sea and the Gulf of Mexico are being used to assign origin.

Scientists from the University of Maryland initiated a study to age bluefin tuna sampled from the Gulf of Mexico and elsewhere. Part of this research was conducted jointly with Canadian scientists who have developed validated age readings. A new growth model was fit for recent year-classes (after 1970) for western captured, western-origin Atlantic bluefin tuna, which results in expected lengths that differ substantially from the model adopted by SCRS for fish ages 12 and older (SCRS/2008/084). Future priority on age determinations may be given to samples from the Mediterranean population and historical samples from the Gulf of Mexico population.

Scientists from Texas A & M University and the University of Maryland continue to study the stock structure of bluefin tuna using otolith chemistry particularly focusing on large bluefin tuna from the Gulf of Mexico and the Mediterranean Sea. This research is greatly facilitated through continued collaboration with Canadian, Italian, and Spanish scientists. Results from stable isotope analysis of otoliths provide strong evidence for natal homing by two populations of Atlantic bluefin tuna each with discrete centers of origin (Mediterranean Sea and Western Atlantic). As more samples are analyzed, it is possible that this type of information will feed directly into stock assessments.

Scientists at Stanford University and the TAG-A-Giant research team continued to deploy electronic tags in the western Atlantic in 2007 and 2008 (n=67 deployments). Three additional bluefin tuna also were fitted with pop-up satellite archival tags in the Mediterranean Sea off the coast of France. These efforts brought the total number of electronic tags deployed on Atlantic bluefin tuna by the TAG team to nearly 1,000. Tagging in the Gulf of St. Lawrence revealed a strong linkage between fish there and the Gulf of Mexico spawning grounds (SCRS/2008/092), corroborating findings from otolith studies. In collaboration with scientists from the University of British Columbia, a new stock assessment model is being developed (Multi-Stock Age-Structured Tag-Integrated stock assessment model, or MAST) that models eastern and western Atlantic bluefin tuna stocks simultaneously but includes different growth, movement, maturity and natural mortality parameters for each stock, season and age group. The model includes four areas and quarterly time steps (SCRS/2008/097). Model revision and simulation testing are now underway.

Researchers at the University of New Hampshire continue to engage in ecological analyses seeking to identify the underlying dynamics of Atlantic bluefin tuna migration, maturity schedules and reproduction, age and growth, and forage relationships. In 2006, the UNH-DFO electronic tagging program included release of 26 PSATs on giant bluefin tuna (24 in Canadian waters, 2 by U.S. longliners), and 10 in 2007 (all in Canadian waters), and continuation of the Tag-a-Tiny juvenile tagging program in 2007, when over 25 miniature PSATs, or X-tags, were deployed on juvenile bluefin tuna in the New England region, and implanted archival tagging of school bluefin tuna continues. A study is also underway on shifts in oceanographic regimes and possible impacts on bluefin tuna and their prey.

NMFS scientists have developed a virtual population analysis (VPA) model to estimate the degree of mixing between two stocks based on conventional tagging data, electronic tagging data, and new data on the proportion of the catch that comes from each stock (as deduced from genetic and otolith microconstituent analyses). The new model was applied to bluefin tuna stocks in collaboration with scientists from other ICCAT nations during the 2008 assessment meeting.

From early March through mid-June 2008, NMFS conducted extensive observations of the pelagic longline fishery in the Gulf of Mexico, as a continuation of a similar effort undertaken in 2007. Roughly 75 percent of known fishing trips and a higher percentage of total effort was observed. During that sampling, more than 3,305 yellowfin tuna, about 3,774 swordfish, 347 bluefin tuna, 97 shortfin mako and 32 bigeye tuna were observed. Fifty of the bluefin tuna were landed, 201 were released dead, 72 were released alive and 24 broke off. Various tissues were taken from the bluefin tuna including otoliths, gonads and muscle. Contracts were awarded to conduct research on bluefin tuna stock structure, growth, gender determination and reproduction.

At the same time as the extended coverage observer program, NMFS has been assessing the efficacy of new technologies and changes in fishing practices in reducing the bycatch mortality of bluefin tuna in the directed yellowfin tuna fishery in the Gulf of Mexico. The 2008 pilot study was a continuation of research conducted in April 2007 to examine "weak link" concepts which would allow bluefin tuna to escape capture on pelagic longlines, while retaining yellowfin tuna. Results to date are encouraging, suggesting that retention of yellowfin tuna is not reduced. There are plans to continue this research in 2009.

2.3 Atlantic Bigeye Tuna, Albacore, Yellowfin Tuna, and Skipjack Tuna

All text, figures and tables for this section are from the SCRS 2008 Report and the U.S. National Report to ICCAT, 2008. All weights are reported as whole weights unless otherwise indicated.

2.3.1 Atlantic Bigeye Tuna

2.3.1.1 Life History and Species Biology

Bigeye tuna are distributed throughout the Atlantic Ocean between 50ºN and 45ºS, but not in the Mediterranean Sea. This species swims at deeper depths than other tropical tuna species and exhibits extensive vertical movements. Similar to the results obtained in other oceans, pop-up tagging and sonic tracking studies conducted on adult fish in the Atlantic have revealed that they exhibit clear diurnal patterns: they are found much deeper during the daytime than at night. Spawning takes place in tropical waters when the environment is favorable. From nursery areas in tropical waters, juvenile fish tend to diffuse into temperate waters as they grow larger. Catch information from surface gears indicate that the Gulf of Guinea is a major nursery ground for this species.

Bigeye tuna feed on a variety of prey organisms including fish, mollusks, and crustaceans. Bigeye tuna exhibit relatively fast growth: about 105 cm fork length at age 3; 140 cm at age of 5; and, 163 cm at age 7. Bigeye tuna over 200 cm are relatively rare, but do occur with some frequency. Bigeye tuna mature at about 3-5 years of age. Young fish form schools mostly mixed with other tunas such as yellowfin and skipjack tuna. These schools are often associated with drifting objects, whale sharks, and sea mounts. This association appears to weaken as bigeye tuna grow larger. Estimated natural mortality rates (M) for juvenile fish, obtained from tagging data, were of a similar range as those applied in other oceans. Various pieces of evidence, such as a lack of identified genetic heterogeneity, the time-area distribution of fish and movements of tagged fish, suggest an Atlantic-wide single stock for this species, which is currently accepted by SCRS. However, the possibility of other scenarios, such as the existence of north and south stocks, should not be disregarded.

2.3.1.2 Stock Status and Outlook

The most recent stock assessment for bigeye tuna was conducted in 2007. Due to the early date of the assessment, the last year for which catch data was available was 2005 (71,000 mt at the time of the assessment). The 2007 stock assessment used various types of models. In general, data availability has improved but there is still a lack of information regarding detailed fishing and size data from certain fleets, in addition to the past catch and fishing activities of IUU fleets (e.g., size, location and total catch), leading to the need to assume catch-at-size for an important part of the overall catch. Species composition of Ghanaian fisheries catch was reconstructed for 1997 based on improved sampling and catch-at-size estimated in recent years as part of the data improvement projects of ICCAT.

Two new indices of relative abundance and updated indices of those previously used were made available to SCRS for the 2007 assessment. In total, six indices were provided, of which four were from longline fisheries from Japan, Chinese Taipei, United States, and Brazil. The other two indices were from a purse seine fishery operated by the EC, and from a baitboat fishery located in the Azores. The Japanese indices are the longest in duration and represent about 20-40% of the total catch. The other indices are shorter and account for smaller fractions of the catch than the Japanese fishery, except for Chinese Taipei's longline index which is based on catch as high as Japan's. These longline indices primarily relate to medium and large-size fish. The purse seine index was developed from fish aggregating device (FAD) fishing operations, and represents the stock trend in recruitment. The Azorean baitboat index represents various size components.

Several types of assessment models, including production models, VPA, and a statistical integrated model (Multifan-CL) were applied to the available data. A range of stock status evaluations were obtained from the various model formulations applied, but not all were judged to be equally likely.

Consistent with previous assessments of Atlantic bigeye tuna, the results from non-equilibrium production models were used to provide the best characterization of the status of the resource. The current MSY estimated using two types of production models was around 90,000 mt and 93,000 mt, although uncertainty in the estimates broadens the range. In addition, the

estimates reflect the current relative mixture of fisheries that capture small or large bigeye tuna. MSY can change considerably with changes in the relative fishing effort exerted on the stock by surface and longline fisheries.

The 2007 assessment results indicated that the bigeye tuna stock declined rapidly during the 1990s due to the large catches taken in that period, and it has recently stabilized at around or below the level that produces MSY in response to a large reduction in reported catches. Estimated fishing mortality exceeded F_{MSY} for several years in the period of the mid-1990s and has rapidly been reduced since 1999. A summary of the 2007 stock assessment is provided in Table 2.9.

The estimated stock trajectory is shown in Figure 2.6. The biomass at the beginning of 2006 was estimated to be nearly 92% of the biomass at MSY, and the 2005 fishing mortality rate was estimated to be about 13% below the fishing mortality rate at MSY. The replacement yield for 2006 was estimated to be slightly below MSY. Projections indicate that catches reaching 85,000 mt or less will permit the stock to rebuild in the future. SCRS indicated that this overall characterization best represents the current status of bigeye tuna in the Atlantic, however, it was also noted that there are other models showing both more optimistic and more pessimistic stock status evaluations.

SCRS suggested that the biomass would possibly decline further with constant catches of 90,000 mt or more, and recommended that the total catch not exceed 85,000 mt. The Committee indicated that if major countries were to take the entire bigeye tuna catch limit set under Recommendation 04-01 and other countries were to maintain recent catch levels, then the total catch could well exceed 100,000 mt.

Table 2.9 Summary Table for the Status of Atlantic Bigeye Tuna. Source: SCRS, 2008.

Age/size at Maturity	Age 3/~100 cm curved fork length
Spawning Sites	Tropical waters
Current Relative Biomass Level *Minimum Stock Size Threshold*	B_{06}/B_{MSY} = 0.92 (0.85-1.07) *$0.6B_{MSY}$ (age 2+)*
Current Relative Fishing Mortality Rate *Maximum Fishing Mortality Threshold*	F_{05}/F_{MSY} = 0.87 (0.70-1.24) *F_{year}/F_{MSY} = 1.00*
Maximum Sustainable Yield	90,000 - 93,000 mt
Current (2007) Yield	67,172 mt
Current (2006) Replacement Yield	Slightly below MSY
(Outlook – Status of Stocks, NMFS, 2008)	***Rebuilding; Overfishing not occurring)***

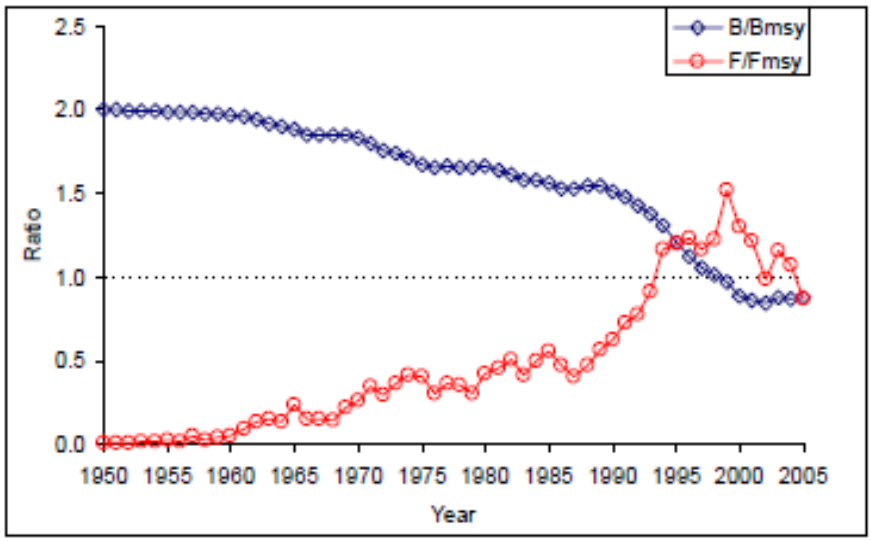

Figure 2.6 **Trajectories of B/Bmsy and F/Fmsy estimated for the 2007 assessment.** Source: SCRS, 2008.

2.3.1.3 Effects of Regulations

ICCAT Management Recommendations

ICCAT Recommendation 04-01 established a multi-year conservation and management program for bigeye tuna and specified a number of regulations for 2005-2008 including an overall TAC for major harvesting countries set at 90,000 mt as well as capacity limitations. The overall estimated catch in 2007 (67,172 mt) was well below the TAC.

Recommendation 04-01 also implemented a new, smaller closure for surface fishing in the area 0º - 5º N, 10º W - 20º W during November in the Gulf of Guinea. SCRS examined the percentages of the small bigeye tuna (<53 cm or 21 inches) based on the catch-at-size information created at the time of 2007 assessment. Based on that information, the percentage of small bigeye tuna is at about 70% in number of fish and there is a general increasing trend. Considering that the new closed area is much smaller in time and area than the previous moratorium time/area, and is located in an area which historically has lower effort anyway, this regulation is likely to be less effective in reducing the overall catches of small bigeye tuna by the surface fishery. This expectation is supported by an analysis of 1994 - 2007 purse seine catches which was presented to SCRS, confirming that the new closure has been less effective than previous moratoria in reducing the proportional catch of small bigeye tuna. SCRS stressed that, if time/area closures are to be effective in reducing small fish harvests and growth overfishing, such a closure should be expanded in time and space and focused in locations with optimal potential benefit.

Domestic Regulations

The United States considers the status of the bigeye tuna stock to be not overfished (rebuilding). Several management measures have been implemented in the United States, consistent with ICCAT advice to limit fishing effort and to prevent overfishing. In 1999, NMFS implemented limited access in the pelagic longline fishery for Atlantic tunas. The United States has also maintained its minimum size limit for bigeye tuna of 27". An ICCAT recommendation recommending a smaller size was ultimately repealed because it was not feasible to sort the undersized bigeye and yellowfin tuna from purse seine and bait-boat catch mixed with regulation sized small skipjack tuna without large quantities of dead discards of small bigeye and yellowfin tuna.

Total reported U.S. bigeye tuna catches and landings (preliminary) for 2007 decreased by approximately 468 mt from 991 mt in 2006 to 523 mt. Like yellowfin tuna, the estimates of rod and reel catch are considered provisional and may be revised based on results of a future review of recreational harvest estimates.

Management Recommendations

The assessment results indicated that the stock declined rapidly during the 1990s due to the large catches taken in that period, and recently it has stabilized at or below the level that produces MSY in response to a large reduction in reported catches. Estimated fishing mortality exceeded F_{MSY} for several years in the period of the mid-1990s and rapidly declined since 1999. Projections indicate that catches reaching 85,000 mt or less will permit the stock to rebuild in the future. SCRS advised ICCAT to be aware that if major countries were to take the entire catch limit set under Recommendation 04-01 and other countries were to maintain recent catch levels, then the total catch could well exceed 100,000 mt. SCRS recommended that the total catch not exceed 85,000 mt. The assessment and subsequent management recommendations are conditional on the reported and estimated history of catch for bigeye tuna in the Atlantic. SCRS reiterated its concern that unreported catches from the Atlantic might have been and may continue to be poorly estimated, but available statistical data collection mechanisms are insufficient to fully investigate this possibility. It also suggested that coordination amongst the tuna RFMOs be encouraged, among other objectives, to examine the possibility of 'fish laundering' for bigeye tuna and other species.

Recent and Ongoing Research

In addition to monitoring catch and effort statistics for tropical tunas that include bigeye tuna, U.S. scientists participated in the 2007 ICCAT SCRS bigeye tuna stock assessment session of the Tropical Species Group, held in Madrid, Spain, June, 5-12 2007. U.S. scientists also participated in the Tropical Species Group meeting (Madrid, Spain, Sept. 24-26, 2008) where the recent work of the Group in evaluating alternative measures to protect juvenile tropical tunas was continued.

In 2008, U.S. scientists pursued research to develop demographically-based prior distributions for the intrinsic rate of population increase for tropical tunas. Also, U.S. scientists

from the University of Miami's Rosenstiel School of Marine and Atmospheric Science collaborated with EC scientists on an EC-funded FEMS project regarding management strategy evaluations related to tropical tuna fisheries. U.S. scientists have continued to conduct cooperative research with scientists from Mexico, combining observer data collected from each nation's longline fleets in the Gulf of Mexico, pursuing the development of indices of abundance for species of concern to ICCAT as well as descriptive analyses of that fishery.

2.3.2 Atlantic Yellowfin Tuna

2.3.2.1 Life History and Species Biology

Yellowfin tuna is a cosmopolitan species distributed mainly in the tropical and subtropical oceanic waters of the three oceans. The size of yellowfin tuna exploited by fisheries ranges from 30 cm to 170 cm fork length; and maturity occurs at about 100 cm fork length. Smaller fish (juveniles) form mixed schools with skipjack and juvenile bigeye tuna, and are mainly limited to surface waters, while larger fish form schools in surface and sub-surface waters.

Reproductive output among females has been shown to be highly variable. The main spawning ground is the equatorial zone of the Gulf of Guinea, with spawning primarily occurring from January to April. Juveniles are generally found in coastal waters off Africa. In addition, spawning occurs in the Gulf of Mexico, in the southeastern Caribbean Sea, and off Cape Verde, although the relative importance of these spawning grounds is unknown.

Although such separate spawning areas might imply separate stocks or substantial heterogeneity in the distribution of yellowfin tuna, a single stock for the entire Atlantic is assumed as a working hypothesis, taking into account the trans-Atlantic migration (from west to east) indicated by tagging, a 40-year time series of longline catch data that indicates yellowfin tuna are distributed continuously throughout the entire tropical Atlantic Ocean, and other information (*e.g.*, time-area size frequency distributions and locations of fishing grounds). Males are predominant in the catches of larger sized fish. Natural mortality is assumed to be higher for juveniles than for adults; this is supported by tagging studies for Pacific yellowfin tuna.

Growth rates have been described as relatively slow initially, increasing at the time the fish leave the nursery grounds. Nevertheless, questions remain concerning the most appropriate growth model for Atlantic yellowfin tuna. A recent study (SCRS/2006/146) developed a new growth curve using daily growth increment counts from otoliths. The results of this study, as well as other recent hard part analyses, do not support the concept of the two-stanza growth model (initial slow growth) which is currently used for ICCAT (as well as other management bodies) yellowfin tuna stock assessments and was developed from length frequency and tagging data. This discrepancy in growth models could have implications for stock assessments and is being investigated. The younger age classes of yellowfin tuna exhibit a strong association with FADs (fish aggregating devices/floating objects, which can be natural or artificial). SCRS noted that this association with FADs, which increases the vulnerability of these smaller fish to surface fishing gears, may also have a negative impact on the biology and on the ecology of yellowfin tuna due to changes in feeding and migratory behaviors.

2.3.2.2 Stock Status and Outlook

A full stock assessment was conducted for yellowfin tuna in 2008, applying both an age-structured model and a non-equilibrium production model to the available catch data through 2006. Catch data for 2007 were provided soon after the assessment and available in the 2008 SCRS report. Information from the assessment is summarized in Table 2.9.

Since the relatively high catch levels of 2001 (164,650 t), catches have declined each year to a level of 108,160 t, a reduction of 34%. Catches in 2005 and 2006 represented the lowest level of catches since 1974. The catch estimate in 2007 (96,580 t) is preliminary, but may be even lower. A potential explanation for this decline is the reduction in eastern Atlantic purse seine effort, but that alone does not explain the reduction of baitboat and purse seine catches in the western Atlantic, nor the more recent declines of longline catches in both the western and eastern Atlantic.

An age-structured virtual population analysis (VPA) was conducted using fifteen indices of abundance. The VPA, using results from the base case runs, estimates that the levels of fishing mortality and spawning biomass in recent years have been very close to MSY levels. The estimate of MSY derived from these analyses was 130,600 mt. This estimate may be below what was achieved in past decades because overall selectivity has shifted to smaller fish; the impact of this change in selectivity on estimates of MSY is clearly seen in the results from VPA. The estimate of relative fishing mortality (F_{06}/F_{MSY}) was 0.84, and for relative biomass (B_{06}/B_{MSY}) was 1.09.

The stock was also assessed with a production model (ASPIC). Analyses were conducted using either nine separate indices or using a combined index created from all available abundance indices by fleet and gear, and weighting each index by the area covered by that fishery. The estimate of MSY derived using the basic case runs of ASPIC was 146,600 mt. Although the estimate of MSY was somewhat higher than that from the age structured model, the stock status results are slightly more pessimistic. The estimate of relative fishing mortality (F_{06}/F_{MSY}) was 0.89, and for relative biomass (B_{06}/B_{MSY}) was 0.83.

Trajectories of B/B_{MSY} and F/F_{MSY} from both age structured (VPA) and the production model (ASPIC) analyses are shown in Figure 2.7. The trend estimated from VPA indicates that overfishing ($F>F_{MSY}$) has occurred in recent years, but that the current status is neither overfished ($B<B_{MSY}$) nor is there over fishing. The more pessimistic ASPIC estimates indicate that there has been both overfishing and an overfished status in recent years, but that overfishing was not occurring in 2006. Bootstrapped estimates of the current status of yellowfin tuna based on each model, which reflect the variability of the point estimates given assumptions about uncertainty in the inputs, are shown in Figure 2.8. Examination of the distribution of these estimates from both models shows that about 40% indicate a sustainable situation, in which the stock is not overfished and overfishing is not occurring.

In summary, 2006 catches are estimated to be well below MSY levels, stock biomass is estimated to be near the ICCAT Convention Objective and recent fishing mortality rates somewhat below F_{MSY}. The recent trends indicate declining effective effort and some recovery of stock levels. However, when the uncertainty around the point estimates from both models is

taken into account, there is still about a 60% chance that stock status is not consistent with Convention Objective.

Projections were made considering a number of constant catch scenarios. These indicate that catches of 130,000 t or less are sustainable during the projection interval, while catches in excess of 130,000 t can lead to overfishing. Maintaining current catch levels (110,000 t) is expected to lead to a biomass somewhat above B_{MSY}. In terms of equilibrium conditions, the various assessment model results show that increasing fishing mortality in the long term by up to 10% (depending on the model) to reach F_{MSY} would only result in equilibrium yield gains of 1% to 4% over the expected yields at current fishing mortality levels. Yearly catches of small (less than 3.2 kg) yellowfin tuna in numbers have ranged around 60-75% of purse seine catches and about 40-80% of baitboat catches since 2000, occurring primarily in the equatorial fisheries. The generally declining trends in average weight may still be a cause for concern. Minimum size limits for yellowfin tuna have been shown to be ineffective by themselves, due to difficulties related to the multi-species nature of the fishery. Previously conducted yield-per-recruit analyses have indicated that reductions in fishing mortality on fish less than 3.2 kg could result in gains in yield-per-recruit and modest gains in spawning biomass-per-recruit. The protection of juvenile tunas may therefore be important and alternative approaches to minimum size regulations to accomplish this should be studied. In accordance with concerns expressed at ICCAT that alternatives be examined, a limited evaluation was conducted on the relative impact of effective effort restrictions on individual fisheries in terms of yield per recruit and spawning biomass per recruit. This evaluation is presented in a separate report.

Table 2.10 Summary Table for the Status of Atlantic Yellowfin Tuna. Source: SCRS, 2008.

Age/size at Maturity	Assumed to be knife-edge at the beginning of Age 3 ~100 cm curved fork length
Spawning Sites	Tropical waters
Relative Biomass Level *Minimum Stock Size Threshold*	B_{06}/B_{MSY} = 0.96 (0.72 - 1.22) $0.5B_{MSY}$ (age 2+)
Relative Fishing Mortality Rate *Maximum Fishing Mortality Threshold*	$F_{current}/F_{MSY}$ = 0.86 (0.71-1.05)* F_{year}/F_{MSY} = 1.00
Maximum Sustainable Yield	~ 130,600 mt (120,100-136,500 mt) (VPA) ~ 146,600 mt (128,200-152,500 mt) (ASPIC)
Current (2006) Yield	108,160 mt
Replacement Yield (2006)	~ 130,000 mt
(Outlook – Status of Stocks, NMFS, 2008)	*(Not Overfished; overfishing not occurring)*

*$F_{current}$ refers to F2006 in the case of ASPIC, and the geometric mean of F across 2003-2006 in the case of VPA.

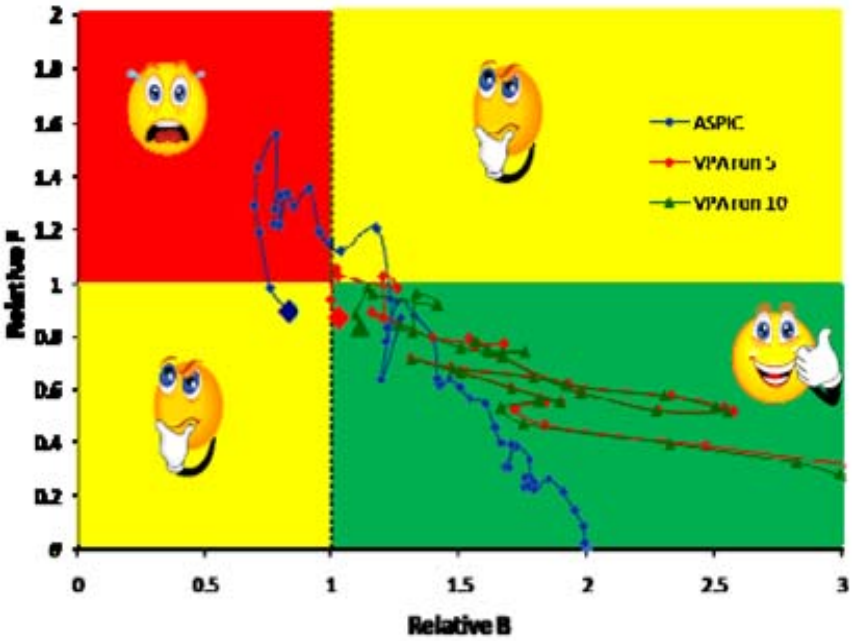

Figure 2.7 **Stock status trajectories of B/BMSY and F/FMSY from age-structured (VPA) and production model (ASPIC) analyses. The age structured analysis started in 1970 and the production model in 1950. Current status is indicated by the large point at the end of each time-series.** Source: SCRS, 2008.

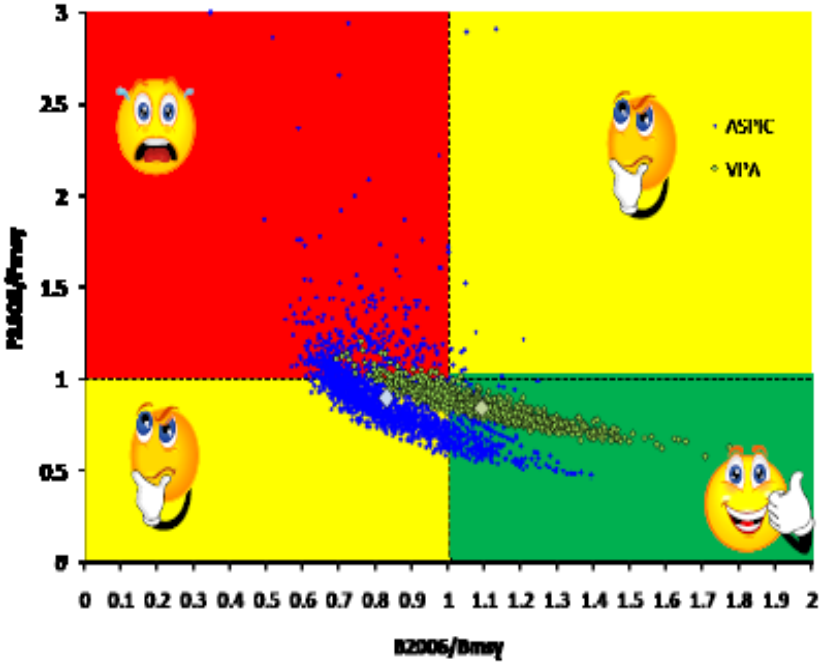

Figure 2.8 **Current status of yellowfin tuna based on age structured and production models. The median point estimate for each model is shown as a large diamond and the clouds of symbols depict the bootstrap estimates of uncertainty for the most recent year.** Source: SCRS, 2008.

2.3.2.3 Effects of Regulations

ICCAT Management Recommendations

Recommendation 04-01 implemented a small closure for surface fishing in the area 0º-5ºN, 10ºW-20ºW during November in the Gulf of Guinea. Although this regulation is intended to reduce small bigeye tuna catches, SCRS recognizes that its implementation and the change from the previous moratorium to the current regulation will potentially impact yellowfin tuna catches. Given the relatively small time-area coverage of the closure, any reduction in juvenile mortality is expected to be minimal. Although there are as yet insufficient data to conduct a thorough evaluation of the impact of Rec. 04-01, an analysis of 1994-2007 purse seine catches presented to SCRS confirms that the new closure has been less effective than previous moratoria in reducing small fish harvests and avoiding growth overfishing.

In 1993, ICCAT recommended "that there be no increase in the level of effective fishing effort exerted on Atlantic yellowfin tuna, over the level observed in 1992." As measured by fishing mortality estimates from VPA, during the 2008 assessment, effective effort in 2006 appeared to be well below (about 25-30% below) the 1992 levels, and there has been a declining trend in recent years.

Domestic Regulations

Yellowfin tuna is listed as approaching an overfished condition by the United States. Several management measures have been implemented in the United States, consistent with ICCAT recommendations to limit fishing effort and to prevent overfishing. In 1999, NMFS implemented limited access in the pelagic longline fishery for Atlantic tunas, as well as a recreational retention limit for yellowfin tuna. The United States has also maintained its minimum size limit for YFT of 27" which was greater (i.e., more restrictive) than an intial recommendation by ICCAT that was ultimately repealed by ICCAT because of implementation problems.

Yellowfin tuna is the principal species of tropical tuna landed by U.S. fisheries in the western North Atlantic. Total estimated landings decreased to 5,559 mt in 2007, from the 2006 landings estimate of 7,090 mt. The 2007 estimate is considered provisional and may change owing to incorporation of late reports of commercial catches as they become available and to possible revisions in estimates of rod and reel catches made by recreational anglers. A high proportion of the estimated landings were due to rod and reel catches of recreational anglers in the Northwest Atlantic (2,756 mt). Estimates of U.S. recreational harvests for tuna and tuna-like species continue to be reviewed and this may result in the need to report additional revisions to the available estimates in the future (NMFS, 2008).

Management Recommendations

The status of yellowfin tuna has shown some improvement since the last assessment, which is not surprising in that catches and fishing effort have generally declined and there have

been small increases in catch rates observed for some longline fisheries over the past few years. Currently, stock biomass is estimated to be near the ICCAT Convention Objective and recent fishing mortality rates somewhat below F_{MSY}. Continuation of current catch levels is expected to lead to a healthy biomass, somewhat above B_{MSY}, which should provide adequate safeguard against biomass falling below the Convention Objective as long as fishing effort does not substantially increase. Effort increases on the order of about 10% above current levels (in order to achieve MSY) would be expected in the long run to increase yield by only about 1-4% over what could be achieved at current effective effort levels, but with substantially increased risk of biomass falling below the Convention Objective. In addition, SCRS indicated that ICCAT should be aware that increased harvest of yellowfin tuna could have negative consequences for bigeye tuna in particular, and other species caught together with yellowfin tuna in fishing operations taking more than one species. SCRS also continued to recommend that effective measures be found to reduce fishing mortality of small yellowfin tuna, if ICCAT wishes to increase long-term sustainable yield.

Recent and Ongoing Research

U.S. scientists participated in the ICCAT SCRS yellowfin tuna and skipjack tuna stock assessment session of the Tropical Species Group, held in Florianopolis, Brazil, 21-29 July, 2008. U.S. scientists also participated in the Tropical Species Group meeting (Madrid, Spain Sept. 24-26, 2008) where the recent work of the Group in evaluating alternative measures to protect juvenile tropical tunas was continued.

In 2008, U.S. scientists have presented several papers to SCRS consisting of indices of abundance and length-frequencies of yellowfin and skipjack tuna from U.S. fisheries. U.S. scientists have also pursued research to develop demographically-based prior distributions for the intrinsic rate of population increase for tropical tunas. These prior distributions were essential input into Bayesian and non-Bayesian surplus production modeling conducted during the 2008 skipjack tuna assessment.

U.S. scientists from the University of Miami's Rosenstiel School of Marine and Atmospheric Science collaborated with EC scientists on an EC-funded FEMS project regarding management strategy evaluations related to tropical tuna fisheries. U.S. scientists have continued to conduct cooperative research with scientists from Mexico, combining observer data collected from each nation's longline fleets in the Gulf of Mexico, pursuing the development of indices of abundance for species of concern to ICCAT as well as descriptive analyses of that fishery. U.S. and Mexican scientists collaboratively calculated abundance indices for the 2008 yellowfin tuna stock assessment using the combined database. U.S. scientists also collaborated with EC scientists to calculate skipjack tuna abundance indices from the Azorean baitboat fishery as well as in the estimation of potential trends in catchability in the European purse seine fleet.

2.3.3 Atlantic Albacore Tuna

2.3.3.1 Life History and Species Biology

Albacore is a temperate tuna widely distributed throughout the Atlantic Ocean and Mediterranean Sea. On the basis of the biological information available for assessment purposes, the existence of three stocks is assumed: northern and southern Atlantic stocks (separated at 5ºN) and a Mediterranean stock. Nevertheless, there is likely intermingling of Indian Ocean and South Atlantic immature albacore which needs further research. Present available knowledge about habitat distribution according to size, spawning areas and maturity estimates are based on limited studies.

Albacore spawning areas in the Atlantic are found in subtropical western areas of both hemispheres and throughout the Mediterranean Sea. Spawning takes place during austral and boreal spring-summer. Sexual maturity is considered to occur at about 90 cm FL (age five) in the Atlantic, and at smaller size (62 cm, age two) in the Mediterranean. Until this age, they are mainly found in surface waters, where they are targeted by surface gears. Some adult albacore are also caught using surface gears but, as a result of their deeper distribution, they are mainly caught using longlines. Young albacore tuna are also caught by longlines in temperate waters.

2.3.3.2 Stock Status and Outlook

The most recent stock assessment for northern and southern albacore tuna was conducted in 2007. The Mediterranean stock has never been assessed. A thorough revision of North and South Atlantic Task I and Task II (catch and effort) data was conducted for the 2007 assessment, and a more robust method for catch-at-size analyses was utilized. In addition, catch rate analyses were improved and updated with new information for the northern and southern albacore fisheries and a substantial effort was undertaken to implement assessment methods which did not assume that catch-at-age is perfectly known. The analyses were also conducted to incorporate longer time-series of catch, effort and size information into the assessment. This approach provided an opportunity to evaluate a range of hypotheses about how albacore fisheries have operated over time, and their impact on the population. The results of these efforts are reflected in the following summaries of stock status, which analyzed data through 2005.

<u>North Atlantic</u>

SCRS noted that the most recent CPUE trends showed somewhat different patterns for the surface fleets (which catch mostly immature fish) and the longline fleets (which catch mostly mature fish). The Spanish age 2 troll series, showed evidence of a relatively strong 2003 year class entering the fishery. For the Spanish age 3 troll series, the age-two signal is not yet fully reflected, leading to uncertainty about the possibility of a good year class. For the longline fleets, the general CPUE trend shows a decline over time, with varying rates. Given the variability associated with these catch rate estimates, definitive conclusions about recent trends could not be reached by examining CPUE alone which represent different parts of the population.

Based on the 2007 assessment which considered catch, size and effort since the 1930s, SCRS stated that the northern albacore spawning stock biomass has declined. In 2005, the spawning stock biomass was about one quarter of the peak levels estimated for the late 1940s. Estimates of recruitment to the fishery, although variable, have shown generally higher levels in the 1960s and earlier periods, with a declining trend thereafter. However, the most recent recruitment is estimated to be large, but uncertain.

Table 2.11 provides a summary of the stock assessment results for northern albacore. The 2007 northern albacore stock assessment indicates that the stock has recently rebuilt to levels near B_{MSY} (current SSB is approximately 20% below the MSY level, compared to 2000 when it was 50% below). Recent fishing mortality rates have generally been above F_{MSY} (current F is approximately 50% larger than F_{MSY}) (Figure 2.9).

While estimates of MSY varied over time as the relative combination of fisheries taking juvenile and mature albacore varies, which results in different overall selectivity patterns across time, the biomass that supports that MSY has little variation. For the three most recent years, the estimate of MSY is about 30,000 t, but over time the estimates have ranged from about 26,000 mt to 34,000 t, depending on the relative importance of the surface and longline fisheries catch levels. If recruitment were at the levels estimated in the 1960s, then MSY would be higher. For example, the total annual albacore average catch was about 50,000 mt during the 30 years from 1956-1986, which is much higher than the 2005 MSY estimate of about 30,200 mt. This decline in MSY may partially be due to environmental factors affecting the productivity of the stock and also possibly due to economic variables. Thus, further studies need to be conducted to achieve an improved condition of the stock. There is some uncertainty around the 2005 estimates of biomass and fishing mortality ratios.

The assessment indicated that the spawning stock will decline from the levels estimated in 2005 over the next few years, particularly given the fact that the 2006 catch was higher than the 2005 level. The spawning stock response to different catch levels after the next few years depends upon the real strength of the 2003 year class, which could be relatively strong (although SCRS did not have confidence in the overall level).

Table 2.11 Summary Table for the Status of Northern Atlantic Albacore Tuna. Source: SCRS, 2008.

Age/size at Maturity	Age 5/~90 cm curved fork length
Spawning Sites	Subtropical western waters of the northern Hemisphere
Current Relative Biomass Level *Minimum Stock Size Threshold*	B_{05}/B_{MSY} = 0.81 (0.68-0.97) $0.7B_{MSY}$
Current Relative Fishing Mortality Rate *Maximum Fishing Mortality Threshold*	F_{05}/F_{MSY} = 1.5 (1.3-1.7) F_{year}/F_{MSY} = 1.00
Maximum Sustainable Yield	30,200 mt [26,800 - 34,100 mt]
Current (2007) Yield	21,549 mt
Current (2006) Replacement Yield	~32,000
(Outlook – Status of Stocks, NMFS, 2008)	***(Overfished; overfishing is occurring)***

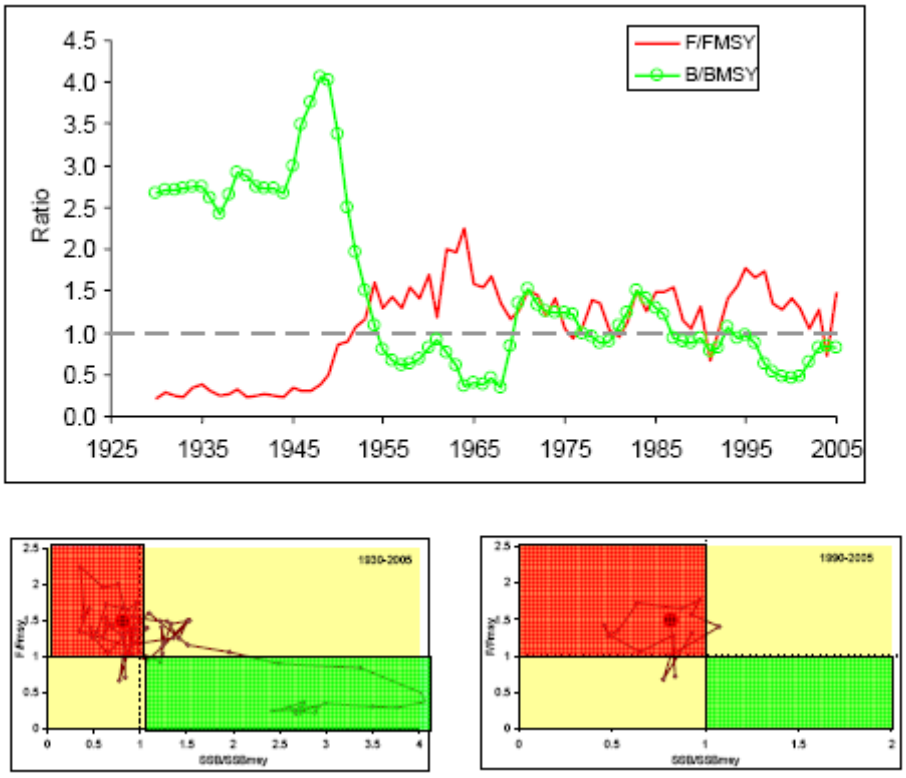

Figure 2.9 **Stock status of northern albacore, estimated with Multifan-CL. Top: Relative biomass (B/BMSY) and relative fishing mortality (F/FMSY) trajectories over time. Bottom: joint trajectories of B/BMSY and F/FMSY. The large closed circle in the lower panels represents the stock status in 2005.** Source: SCRS, 2008.

South Atlantic

In 2003, SCRS assessed the status of the Southern Atlantic albacore stock using the same specifications as were used in 2000, but with updated data. Because of the detailed review, revisions, and updates of the data since that time, SCRS incorporated additional information into the model used for assessing the Southern Albacore stock, and incorporated an assessment methodology in 2007 that more objectively brought information about fishery selectivity into the evaluation. Table 2.12 provides a summary of the stock assessment results for southern albacore.

Table 2.12 Summary Table for the Status of Southern Atlantic Albacore Tuna. Source: SCRS, 2008.

Age/size at Maturity	Age 5/~90 cm curved fork length
Spawning Sites	Subtropical western waters of the Southern Hemisphere
Current Relative Biomass Level	B_{05}/B_{MSY} = 0.91 (0.71-1.16)
Current Relative Fishing Mortality Rate	F_{05}/F_{MSY} = 0.63 (0.47-0.9)
Maximum Sustainable Yield	33,200 mt [29,900 – 36,700 mt]
Current (2007) Yield	20,032 mt
Current (2006) Replacement Yield	28,800 mt (25,800-29,300 mt)
Outlook	Overfished; overfishing is not occurring

Regarding southern albacore CPUE trends, trends in the longline fisheries harvesting mostly mature albacore showed a strong declining trend in CPUE in the early part of the time series, and a less steep decline over the past decade. CPUE trends from the surface fishery, harvesting mostly juvenile albacore, are more recent and show no apparent trend.

Based on the 2007 stock assessment which considered catch, size and effort since the 1950s, SCRS stated that the southern albacore spawning stock biomass has declined to about 25% of its unfished level. SCRS concluded that the stock is below the maximum sustainable yield (MSY) level at about 90% of B_{MSY} in 2005. The fishing mortality rate in 2005 was about 60% of F_{MSY}. MSY was estimated to be around 33,300 mt, whereas the replacement yield, averaged over the last 10 years, is estimated to be approximately 29,000 mt.

The assessment indicates that the spawning stock will increase from the levels estimated in 2005 over the next few years, assuming that catches in 2006 and 2007 remain at about the 2005 level, which is below the estimated replacement yield of about 29,000 mt.

Mediterranean

Due to the lack of adequate data, an assessment of the Mediterranean stock has never been conducted by SCRS.

2.3.3.3 Effects of Regulations

North Atlantic

ICCAT Management Recommendations

In 2001, ICCAT established a total allowable catch (TAC) of 34,500 mt for northern albacore and, in 2003, extended the TAC to 2007. Furthermore, a 1998 recommendation limiting fishing capacity to the average of 1993 – 1995 remains in force. SCRS found that

reported northern albacore catches for the period 2001-2004 had been below the TAC, but 2005 and 2006 catches were above TAC. The reported catch of 21,549 mt in 2007 was well below the established northern albacore TAC.

Domestic Regulations

Historically, albacore has not been a main focus of the U.S. commercial tuna fisheries operating in the North Atlantic. Reported commercial catches were relatively low prior to 1986; however, these catches increased substantially and have remained at higher levels throughout the 1990s, with nearly all of the production coming from the northeastern U.S. coast. The U.S. landings from the Caribbean increased in 1995 to make up over 14% of the total U.S. harvest of albacore, but have since remained below 4% of the total. Estimated total catches of albacore were 532 MT in 2007, an increase of 132 MT from 2006.

South Atlantic

ICCAT Management Recommendations

Since 1999, ICCAT has established a total allowable catch (TAC) for this stock. For 2001 - 2007 the TAC was set at 29,200 mt. SCRS noted that reported catches in 2007 were well below the established TAC.

Mediterranean

There are no ICCAT recommendations that specifically address the Mediterranean stock.

Management Recommendations

North Atlantic

The TAC for the northern albacore stock until 2007 was 34,500 mt. SCRS noted that the reported catches in 2005 and 2006 were over the TAC, and that the 2007 catch was well below the TAC. Furthermore, stock projections indicate that the northern stock will not recover from the overfished conditions if catch levels remain over 30,000 mt. If strong year classes enter the fishery, which is uncertain but suggested by some CPUE series, the stock will recover faster. In 2007, the ICCAT implemented Recommendation 07-02, intended to reduce the TAC to 30,200 mt in 2008 and 2009 and allow rebuilding of the northern albacore stock from an overfished condition. However, it was noted that fishing opportunities provided in Recommendation 07-02 allow the potential catch to exceed the TAC.

South Atlantic

In the case of the southern stock, the TAC from 2001 – 2007 was set at 29,200 mt. Recent catches have been below this level. The SCRS assessment showed that the southern stock is overfished. Current model projections indicate that catches at about the 2006 level will recover the stock. The observed 2007 catch was, however, even lower. SCRS considered that

the current management regulations in effect are sufficient for the recovery of the southern stock. In 2007, the Commission adopted Recommendation 07-03 which establishes a catch limit of 29,900 mt (the lowest estimate of MSY) until 2011.

Recent and Ongoing Research

NMFS scientists continue to be involved in the development of alternative, more detailed statistical-based models, in efforts to evaluate more fully the relationship between this species' population dynamics and associated fishery operations (i.e., areas of uncertainty in an overall stock assessment). In addition, research is being conducted to improve the implementation of the stochastic approach being used currently to estimate catch-at-age for northern albacore. It is envisioned that these analyses will be completed in time for the 2009 albacore assessment.

2.3.4 Atlantic Skipjack Tuna

2.3.4.1 Life History and Species Biology

Skipjack tuna is a gregarious species that is found in schools in the tropical and subtropical waters of the three oceans. It is the predominant species found under fish aggregating devices (FADs) where it is caught in association with juvenile yellowfin tuna, bigeye tuna and with other species of epipelagic fauna. Skipjack tuna show an early maturity (around first or second year of life), high fecundity and spawn opportunistically throughout the year in warm waters above 25º C. Skipjack tuna are also thought to be a faster-maturing and shorter lived species than yellowfin tuna. One of the characteristics of skipjack tuna is that from its first year of life it spawns opportunistically throughout the year and in vast sectors of the ocean. A recent analysis of tagging data from the eastern Atlantic confirmed that the growth of skipjack tuna varies according to the latitude. However, this variation is not as great as had been previously thought. For example, the growth curve parameters obtained recently for the 10° N latitude region were closer to the estimates made in the Gulf of Guinea or in other oceans than those that had been estimated in Senegal in the early 1980s. The increasing use of FADs since the early 1990s, have changed the species composition of free swimming schools. It is noted that, in effect, the free schools of mixed species were considerably more common prior to the introduction of FADs. Furthermore, the association with FADs may also have an impact on the biology (food intake, growth rate, plumpness of the fish) and on the ecology (displacement rate, movement orientation) of skipjack and yellowfin tuna (ecological trap concept).

2.3.4.2 Stock Status and Outlook

The last full stock assessment for skipjack tuna was conducted in 2008. Summarized information for west Atlantic skipjack tuna and east Atlantic skipjack tuna are shown in Table 2.13 and Table 2.14, respectively.

Traditional stock assessment models have been difficult to apply to skipjack tuna because of their particular biological (continuous spawning, areal variation in growth) and fishery characteristics (non-directed effort, weak cohorts identified). In order to overcome these difficulties, several different assessment methods which accommodate expert opinion and prior knowledge of the fishery and biological characteristics of skipjack tuna have been carried out on

the two stocks of Atlantic skipjack tuna. Additionally, several fishery indicators were analyzed for evidence of changes in the state of the stock over time. Although the fisheries operating in the east have extended toward the west beyond 30º W longitude, SCRS decided to maintain the hypothesis in favor of two distinct stock units, based on available scientific studies. However, taking into account the state of current knowledge of skipjack tuna migrations and the geographic distances between the various fishing areas, the use of smaller stock units continues to be the envisaged hypothesis.

Table 2.13 Summary Table for the Status of West Atlantic Skipjack Tuna. Source: SCRS, 2008.

Maturity schedule	Assumed to be knife-edge at the beginning of Age 2
Spawning Sites	Spawn opportunistically in tropical and subtropical waters
Current Relative Biomass Level *Minimum Stock Size Threshold*	B_{06}/B_{MSY}: most likely >1 *Unknown*
Current Relative Fishing Mortality Rate *Maximum Fishing Mortality Threshold*	F_{06}/F_{MSY}: most likely <1 $F/F_{MSY} = 1.00$
Maximum Sustainable Yield	Around 30,000-36,000 mt
Current (2007) Yield	25,400 t
Current Replacement Yield	Somewhat higher than 25,400 mt
(Outlook – Status of Stocks, NMFS, 2008)	***(Unknown)***

Table 2.14 Summary Table for the Status of East Atlantic Skipjack Tuna. Source: SCRS, 2008.

Maturity schedule	Assumed to be knife-edge at the beginning of Age 2
Spawning Sites	Spawn opportunistically in tropical and subtropical waters
Current Relative Biomass Level *Minimum Stock Size Threshold*	B_{06}/B_{MSY}: most likely >1 *N/A (no U.S. fishing)?*
Current Relative Fishing Mortality Rate *Maximum Fishing Mortality Threshold*	F_{06}/F_{MSY}: most likely <1 *N/A (no U.S. fishing)?*
Maximum Sustainable Yield	Around 143,000-170,000 mt
Current (2007) Yield	125,400 mt
Current Replacement Yield	Somewhat higher than 125,400 mt
Outlook	Not overfished; overfishing not occurring.

Western stock

The standardized CPUEs of Brazilian baitboats remain stable while those of Venezuelan purse seiners and U.S. rod and reel decreased in recent years. This decrease, also observed in the yellowfin tuna CPUE time series of Venezuela, could be linked to specific environmental

conditions (high surface temperatures, lesser accessibility of prey). The average weight of skipjack tuna caught in the western Atlantic is higher than in the east (3 to 4.5 kg vs. 2 to 2.5 kg), at least for the Brazilian baitboat fishery. The catch only model estimated MSY at around 30,000 t and the Bayesian surplus model (Schaefer formulation) at 34,000 mt. SCRS attempted several analyses, specifically sensitivity runs using different values of natural mortality. For this stock, only the three fisheries mentioned above were considered. The final estimate of MSY converges also at about: 31,000-36,000 mt. It must be stressed that all of these analyses correspond to the current geographic coverage of this fishery (i.e., relatively coastal fishing grounds due to the deepening of the thermocline and of the oxycline to the East). For the western Atlantic stock, it is unlikely that the current catch is larger than the current replacement yield as shown by the trajectories of B/B_{MSY} and F/F_{MSY} (Figure 2.10).

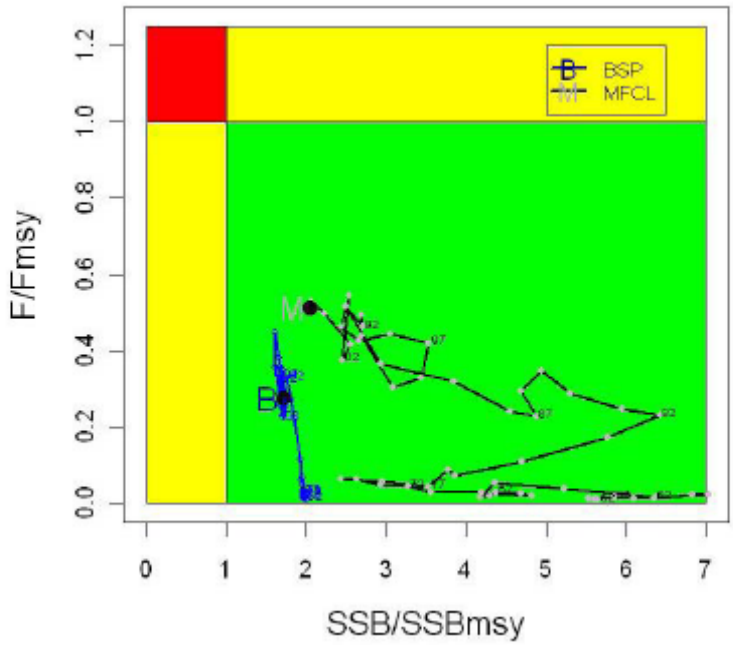

Figure 2.10 **2007 stock status for western skipjack tuna. Trajectories of B/BMSY and F/FMSY from the Bayesian surplus production model (Schaefer type) and from the generalized multi-fleets dynamic model and from MULTIFAN-CL.** Source: SCRS, 2008.

Eastern stock

SCRS analyzed two standardized indices from the EC-purse seine fishery: The first index depicting skipjack tuna caught in free school in the Senegalese area during the 2nd quarter of the year and the second index characterizing small fish captured under FADs in the equatorial area. In previous meetings of the Tropical Tunas Species Group it was confirmed that the increase in CPUE of the European purse seiners in the late 1990s was due, mainly, to the increase in the catches of positive sets under FADs. Furthermore, the regular increase in the skipjack tuna yields of the baitboats based in Senegal (contrary to the other two tropical tuna species) may only have been the result of an increase in catchability linked to the adoption of the so-called "baitboat associated school" fishing towards the mid-1980s. Furthermore, no marked trend has

been observed for the Canary Islands baitboats as well as for a peripheral fishery such as the Azorean baitboat fishery. The fact that a reduction in abundance for a local segment of the stock would have little repercussion on abundance in other areas, leads to suppose that only a minor proportion of skipjack tuna carry out extensive migrations between areas. This assumption was reinforced by a recent tagging study on growth variability of skipjack tuna between two eastern Atlantic regions divided by 10° N latitude, which were established on the basis of their low amount of mixing (only 0.9% of the tagged fish crossed this limit).

A new Bayesian method, using only catch information, estimated the MSY (under a Schaefer-type model parameterization) at 143,000-156,000 t, a result which agrees with the estimate obtained by the modified Grainger and Garcia approach: 149,000 mt. In addition, two surplus biomass production models (a multi-fleets generalized dynamic model and a Schaeferbased dynamic model) were applied for 8 time series of CPUEs, and for a combined index weighted by fishing areas. To account for the increase in catchability of purse seine fisheries, a correction factor of 3% per year was applied. As for the catch only model, different working hypothesis on the distribution of the priors of the parameters of the surplus production model (i.e., growth rate, carrying capacity, catchability coefficient of each fleet, etc.) were tested. In general, the range of plausible MSY values estimated from these models (155,000-170,000 mt) were larger than in the catch only model. SCRS stated the difficulty of estimating MSY due to the one-way trip trend depicted by this fishery and, as the result, the needs to constraint the range distribution of some priors (e.g., for growth rate, or for the shape parameter of the generalized model). Although some caution is needed as regards to the generalization of the status to the overall stocks in the East Atlantic, due to the moderate mixing rates that seem to occur among the different sectors of this region, it is unlikely that skipjack tuna be exploited in the eastern Atlantic (Figure 2.11).

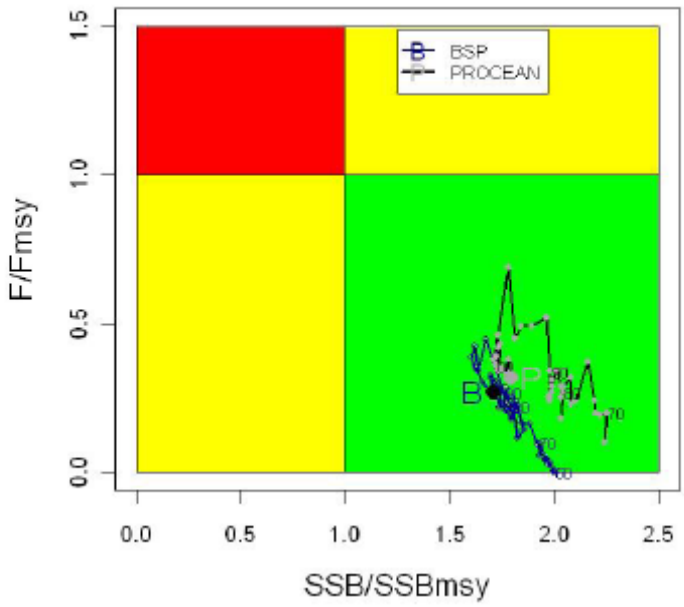

Figure 2.11 **2007 stock status for eastern skipjack tuna. Trajectories of B/BMSY and F/FMSY from the Bayesian surplus production model (Schaefer type) and from the generalized multi-fleets dynamic model and from MULTIFAN-CL.** Source: SCRS, 2008.

2.3.4.3 Effects of Regulations

ICCAT Management Recommendations

There is currently no specific regulation in effect for skipjack tuna. However, with the aim of protecting juvenile bigeye tuna, the French and the Spanish boat owners voluntarily decided to apply a moratorium for fishing under floating objects between November and the end of January for the 1997-1998 and 1998-1999 periods. ICCAT implemented a similar moratorium from 1999 to January 2005. This moratorium has had an effect on skipjack tuna catches made with FADs. On the basis of a comparison of average catches between 1993-1996, prior to the moratoria, and those between the 1998-2002 period, the average skipjack tuna catches between November and January for the purse seine fleets that applied the moratoria, were reduced by 64%. During that period (1998-2002), the average annual skipjack tuna catches by purse seine fleets that applied the moratoria decreased by 41% (42,000 t per year). However, this decrease is possibly a combined result of the decrease in effort and the impact of the moratoria (the average annual catch per boat decreased only 18% between these two periods). The repealing in 2006 of Recommendation [Rec. 05-01] on the 3.2 kg minimum size limit on yellowfin tuna [Rec. 72-01] and the establishment of a time/area closure of the surface fishery [Rec. 04-01], which replaces the old strata relative to the moratorium on catches under floating objects, are regulatory measures whose effects were analyzed during the species Group meeting. Considering that the new closed area is much smaller in time and surface than the previous moratorium time/area, and is located in an area which historically has lower effort anyway, this regulation is likely to be less effective in reducing the overall catches of small bigeye tuna (the species for which the regulation was applied) by the surface fishery. When the fishing effort for the EC purse seine fleet was at its maximum value (period 1994-1996, i.e., before the implementation of the first moratorium), the skipjack tuna catch from this fleet within the time and area limits defined by Rec. 04-01, was only on average at 7,180 t (i.e., 7.5% of the total skipjack tuna catch from the EC purse seiners).

Domestic Regulations

Skipjack tuna are caught by U.S. vessels in the western North Atlantic. Total reported skipjack tuna landings (preliminary) increased from 61 mt in 2006 to 66.4 mt in 2007. Over 75 percent of U.S. landings are from recreational rod and reel catches and landings from the Northwest Atlantic, Gulf of Mexico, and Caribbean areas, based on LPS statistical surveys of the U.S. recreational harvesting sector. Estimates of recreational harvests of skipjack tuna continue to be reviewed and could be revised again in the future (NMFS, 2008).

Management Recommendations

Although SCRS did not make specific management recommendations in 2008, it indicated that catches should not be allowed to exceed MSY, and that ICCAT should be aware that increasing harvests and fishing effort for skipjack tuna could lead to unintended consequences for other species that are harvested in combination with skipjack tuna in certain fisheries.

Recent and Ongoing Research

U.S. scientists participated in the ICCAT SCRS yellowfin tuna and skipjack tuna stock assessment session of the Tropical Species Group, held in Florianopolis, Brazil, 21-29 July, 2008. U.S. scientists also participated in the Tropical Species Group meeting (Madrid, Spain Sept. 24-26, 2008) where the recent work of the Group in evaluating alternative measures to protect juvenile tropical tunas was continued.

In 2008, U.S. scientists presented several papers to SCRS consisting of indices of abundance and length-frequencies of yellowfin and skipjack tuna from U.S. fisheries. U.S. scientists have also pursued research to develop demographically-based prior distributions for the intrinsic rate of population increase for tropical tunas. These prior distributions were essential input into Bayesian and non-Bayesian surplus production modeling conducted during the 2008 skipjack tuna assessment.

U.S. scientists from the University of Miami's Rosenstiel School of Marine and Atmospheric Science collaborated with EC scientists on an EC-funded FEMS project regarding management strategy evaluations related to tropical tuna fisheries. U.S. scientists have continued to conduct cooperative research with scientists from Mexico, combining observer data collected from each nation's longline fleets in the Gulf of Mexico, pursuing the development of indices of abundance for species of concern to ICCAT as well as descriptive analyses of that fishery. U.S. and Mexican scientists collaboratively calculated abundance indices for the 2008 yellowfin tuna stock assessment using the combined database. U.S. scientists also collaborated with EC scientists to calculate skipjack tuna abundance indices from the Azorean baitboat fishery as well as in the estimation of potential trends in catchability in the European purse seine fleet.

2.4 Atlantic Billfish

2.4.1 Blue Marlin

2.4.1.1 Life History and Species Biology

Blue marlin (*Makaira nigricans*) range from Canada to Argentina in the western Atlantic, and from the Azores to South Africa in the eastern Atlantic. Blue marlin are large apex predators with an average weight of 100 – 175 kg (220 – 385 lb). Female blue marlin grow faster and reach a larger maximum size than males. Young blue marlin are one of the fastest growing teleosts, reaching 30 – 45 kg (66 – 99 lb) after the first year. The maximum growth rate of these fish is 1.66 cm/day (0.65 inches/day) which occurs at 39 cm LJFL (15.3 inches) (NMFS, 1999). Life expectancy for blue marlin is between 20 – 30 years based on age and growth analyses of dorsal spines.

Estimates of natural mortality rates for juvenile and adult billfish would be expected to be relatively low, generally in the range of 0.15 to 0.30, based on body size, behavior and physiology (NMFS, 1999). Sagitta otolith weight is suggested to be proportional to age, indicating that both sexes are equally long-lived, based on the maximum otolith weight observed

for each sex. Predicting age from length or weight is imprecise due to many age classes in the fishery, and otoliths may provide a more accurate measure of age.

Blue marlin have an extensive geographical range, migratory patterns that include trans-Atlantic as well as trans-equatorial movements, and are generally considered to be a rare and solitary species relative to the schooling Scombrids (tunas). Graves et al. (2002) captured eight blue marlin with recreational fishing gear and then implanted fish with pop-up satellite tags. These fish moved 74 – 248 km (40–134 nautical miles (nm)) over five days, with a mean displacement of 166 km (90 nm). Fish spent the vast majority of their time in waters with temperatures between 22 and 26°C (71–78°F) and at depths less than 10 m. Prince et al. (2005) tagged one blue marlin with a PSAT tag off the coast of Punta Cana, Dominican Republic and found that the fish moved 406.2 km (219.3 nm) during a 40-day deployment (10.15 km/day (5.48 nm/day)). The maximum time at liberty recorded of a tagged individual was 4,024 days (about 11 years) for a blue marlin that was estimated to weigh 29.5 kg (65 lb) at the time of release. Junior et al. (2004) found the depth of capture for blue marlin with pelagic longline gear ranged from 50 – 190 m (164 – 623 feet), with most individuals captured at 90 m (295 feet).

Temperature-depth vertical habitat utilization for Atlantic blue marlin has been recently studied using data collected by 51 electronic pop-up satellite archival tags (PSATs) attached to fish released by recreational and commercial fishers (Goodyear, et. al., 2008). The average maximum depth observed was 319 m. A few of the monitored animals confined their vertical excursions to less than 100 m but dives below 800 m were also observed. The mean of the lowest temperatures explored was 17°C, with a range from just less than 10°C to just over 24°C. The distributions of times at depth were significantly different between day and night. At night, the fish spent most of their time at or very close to the surface. During daylight hours, they were typically below the surface, often at 40 to 100+ m. The blue marlin sometimes remained below the near-surface layer throughout the daylight hours, but they often returned briefly to the surface. This pattern of behavior also meant the distributions of time at temperature were significantly different between day and night, with the fish occupying warmer strata during darkness. Frequency distributions of the time blue marlin spend at temperatures relative to the temperature of the surface mixed layer, a key issue in some CPUE analyses, were determined for periods of darkness, daylight and, twilight. Results were highly variable within the time series for individual fish, and among individuals (SCRS, 2008).

The Cooperative Tagging Center (CTC) program has tagged 24,108 blue marlin and recaptured over 220 of these fish and found that they moved an average of 903 km (488 nm) (Ortiz et al., 2003). Some individuals have exhibited extended movement patterns, and strong seasonal patterns of movement of individuals between the United States and Venezuela are evident. The greatest straight-line distance traveled for a blue marlin was 14,893 km (8,041 nm) and the maximum number of days at large was 4,024 days.

Adults are found primarily in the tropics within the 24°C (75°F) isotherm, and make seasonal movements related to changes in sea surface temperatures. In the northern Gulf of Mexico they are associated with the Loop Current, and are found in blue waters of low productivity rather than in more productive green waters. Off of Puerto Rico, the largest numbers of blue marlin are caught during August, September, and October. Equal numbers of

both sexes occur off northwest Puerto Rico in July and August, with larger males found there in May and smaller males in September. Coastal areas off West Africa have strong seasonal upwelling, and may be feeding areas for blue marlin. Very large individuals, probably females, are found off the southern coast of Jamaica in the summer and off the northern coast in winter, where males are caught in December and January. Prince and Goodyear (2006) reported evidence of habitat compression in areas where there is a distinct band of cold, hypoxic water close to the surface in the eastern Atlantic and Pacific Oceans. This restricts the acceptable habitat of billfish to shallower water in these areas, making them more vulnerable to surface gear, but also increases their access to prey items, possibly increasing growth rates. Figure 2.12 shows blue marlin catches by major gear from 2000 - 2006.

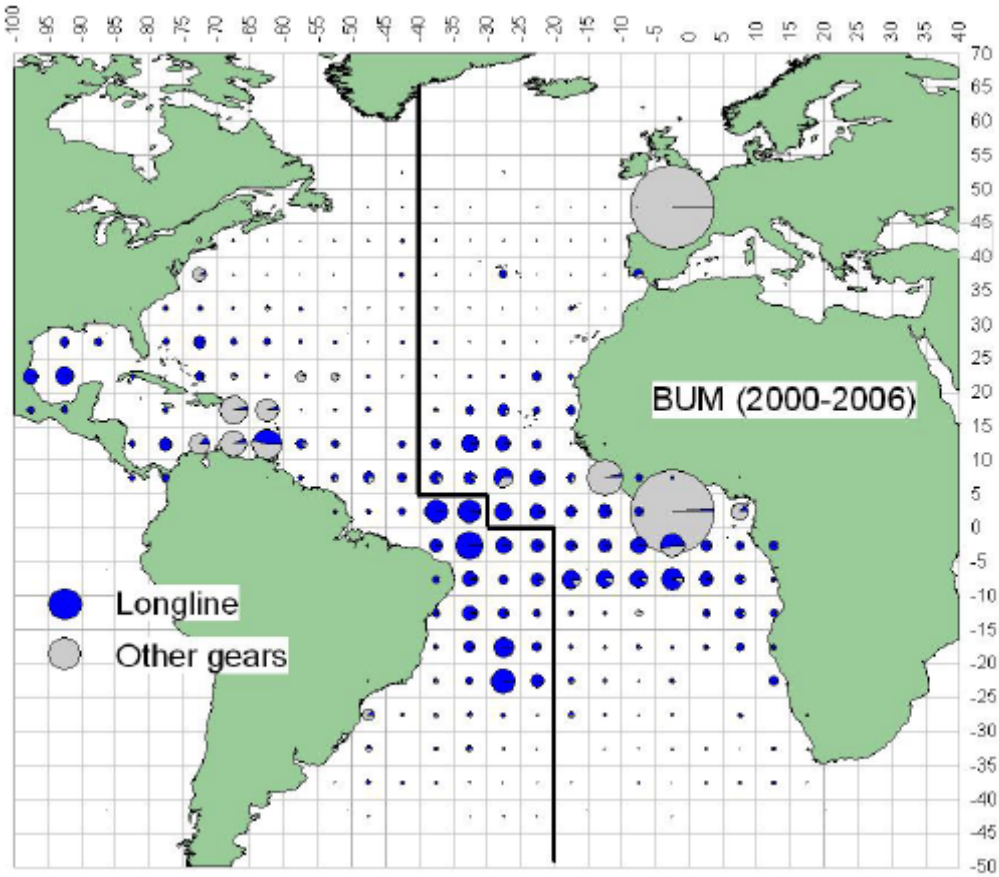

Figure 2.12 **Geographic distribution of mean blue marlin catch for the period 2000 – 2006 by major gears. Largest circle corresponds to catch of 789 mt.** Source: SCRS 2008.

Information on the timing and location of spawning, as well as size at first maturity and fecundity can help identify critical areas and size classes for protection. These fish generally reproduce between the ages of two and four, at 220 – 230 cm (86 – 90 inches) in length, and weigh approximately 120 kg (264 lb). Female blue marlin begin to mature at approximately 47 – 60 kg (104 – 134 lb), while males mature at smaller weights, generally from 35 – 44 kg (77 – 97 lb). A female specimen weighing over 1,000 lb. was found to be in spawning condition, indicating that even the largest females are capable of spawning (Luckhurst et.al. 2006).

The central and northern Caribbean Sea and northern Bahamas have historically been known as the primary spawning area for blue marlin in the western North Atlantic. Recent reports show that blue marlin spawning can also occur north of the Bahamas in an offshore area near Bermuda at about 32º-34º N. lat. New information on the reproduction of blue marlin from West Africa reported no evidence of spawning events from female blue marlin caught by artisanal vessel in Ivory Coast. Pre-spawning and post-spawning females are present in larger numbers than males (4:1 female/male ratio) in this area (SCRS, 2008).

There are likely two separate spawning events that occur at different times in the North and South Atlantic. In the South Atlantic, offshore from southeast Brazil (17º to 18º S lat. and 37º to 38ºW long.) blue marlin spawn from March to April. Peak spawning activity in the North Atlantic Ocean occurs between July and October, with females capable of spawning up to four times per reproductive season (de Sylva and Breder, 1997). Prince et al. (2005) conducted 23 neuston tows in the vicinity of Punta Cana, Dominican Republic between 23 April and 17 May and successfully identified four larval blue marlin; the size of the larvae indicated that spawning activity was taking place in the same general area where these samples were conducted. Serafy et al. (2003) identified 90 blue marlin larvae in the vicinity of Exuma Sound, Bahamas in the month of July, indicating that spawning activity had taken place 18 days prior to sampling. Luckhurst (2006) described evidence of spawning in blue marlin during July in the waters of Bermuda. This represents a northern extension (32°N) of the known spawning area in the northwest Atlantic for blue marlin.

During the spawning season, blue marlin release between one and eleven million small (1 – 2 mm), transparent pelagic planktonic eggs. The number of eggs has been correlated to interspecific sizes among billfish and the size of individuals within the same species. Ovaries from a 147 kg (324 lb) female blue marlin from the northwest Atlantic Ocean were estimated to contain 10.9 million eggs, while ovaries of a 125 kg (275 lb) female were estimated to contain seven million eggs. Males are capable of spawning at any time.

Larval blue marlin are voracious predators and feed on copepods and cladocerans in their first feeding stages but soon switch to a piscivourous diet (SCRS, 2008). Blue marlin are generalist predators feeding primarily on epipelagic fish and cephalopods in coastal and oceanic waters, however, mesopelagic fish and crustaceans associated with rocky, sandy, and reef bottoms are also important components of their diet. Feeding in mesopelagic areas probably takes place at night (Rosas-Alayola et al., 2002). Diet studies of blue marlin off the northeastern coast of Brazil indicate that oceanic pomfret (*Brama brama*) and squid (*Ornithoteuthis antillarum*) were the main prey items and present in at least 50 percent of stomachs. Other important prey species vary by location and include dolphin fishes, bullet tuna (*Auxis. spp*) around the Bahamas, Puerto Rico, and Jamaica, and dolphin fishes and scombrids in the Gulf of Mexico. Stomach contents have also included deep-sea fishes such as chiasmodontids.

Constant ingestion of small quantities of food is necessary. Blue marlin have relatively small stomachs, reducing the proportion of the body allocated for visceral mass, and allocating more volume to musculature for swimming speed and endurance (Junior *et al*., 2004). In the Pacific Ocean, changes in the diet observed are related more with abundance and distribution of

prey than preferences in food items, with *Auxis* spp. (bullet and frigate tunas) well represented in all locations. Predators of blue marlin are relatively unknown. Sharks will attack hooked blue marlin, but it is not known if they attack free-swimming, healthy individuals.

2.4.1.2 Stock Status and Outlook

Since 1995, blue marlin have been managed internationally under a single stock hypothesis because of tagging data and mitochondrial DNA evidence that are consistent with one Atlantic-wide stock. The most recent stock assessment for blue marlin was conducted in 2006. However, large catches of billfish continue to be reported to ICCAT as unclassified and reporting gaps remain for some important fleets, which introduced significant uncertainty into the 2006 SCRS stock assessment. As a result, specific quantitative reference points normally associated with stock assessments could not be produced with reasonable confidence levels, and the 2006 assessment focused instead on recent trends in abundance. It should be noted that these trends are based only on a few years of observations. Confirmation of these recent apparent changes in abundance trends will require at least an additional four or five years of data (SCRS, 2006).

The October 2008 SCRS Report indicated that no new information on blue marlin stock status has become available since the 2006 assessment, which found that blue marlin remain overfished (Table 2.15), and that the biomass level most likely remains well below the B_{msy} estimated in 2000. However, over the period 2001-2005, several indicators suggest that a decline in abundance has been at least partially arrested, although some other indicators suggest that abundance has continued to decline. While the 2006 assessment includes significant uncertainty, it appears that recent abundance trends (2001-2004) have possibly stabilized for blue marlin (Table 2.15, and Figure 2.13). Current and provisional mortality estimates suggest that F has recently declined during 2000 – 2004 and is possibly smaller than $F_{replacement}$, but larger than the F_{msy} estimated in the 2000 assessment. The SCRS reported that blue marlin have the potential to rebuild under the current ICCAT management plan but this potential needs verification with an additional 4-5 years of data collection, especially since the reliability of recent information has diminished and may continue to do so (SCRS, 2006). Recent analyses suggest that the recovery of blue marlin stock might proceed faster than would have been estimated at the 2000 assessment, provided catches remain at the level estimated for 2004. Some signs of stabilization in the abundance trend are apparent in the most recent catch per unit of effort data of blue marlin (2000-2004). Despite more positive results in the 2006 SCRS blue marlin stock assessment than existed in the 2002 assessment, the overfished status of blue marlin remains unchanged.

To increase the likelihood of success of the blue marlin rebuilding plan, the SCRS indicated that further reductions in mortality would be needed, for example by improving compliance with current regulations, encouraging the use of circle hooks, and/or broader application of time/area catch restrictions. The SCRS also recommended that additional steps be taken to ensure that the reliability of recent fishery information improves. Improvements are needed in monitoring the fate and amount of dead and live releases, with verification from scientific observer programs. Additionally, verification of current and historical landings from some artisanal and industrial fleets needs to be conducted. Further, the results of habitat research are not yet sufficient to allow the SCRS to reach consensus on the best method to directly estimate MSY benchmarks for marlins based on a complete time series of data. Continued

research is needed on the development of methods to incorporate habitat data into stock assessments to provide a basis for increasing the certainty with which management advice can be provided (SCRS 2006).

Recent trends in blue marlin abundance are contained in Figure 2.13. A summary of both Atlantic blue and white marlin stock assessment data may be found in Table 2.15.

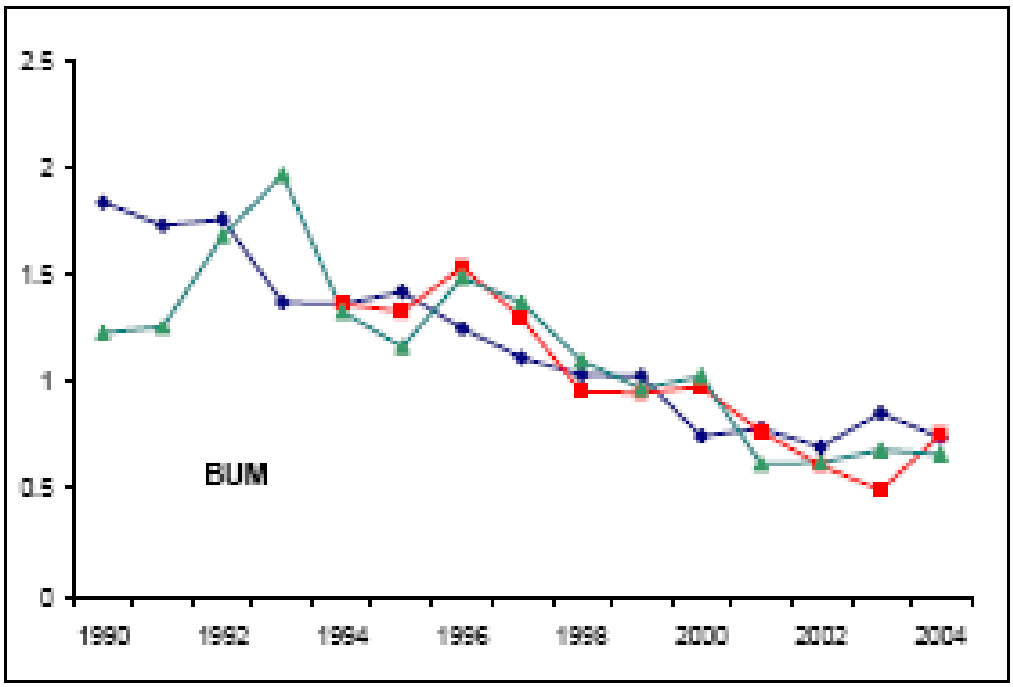

Figure 2.13 **Relative abundance indices for blue marlin estimated by combining data for four longline fleets. Three different statistical models are shown for comparison.** Source: SCRS, 2006.

Table 2.15 Summary of Atlantic Blue and White Marlin Stock Assessment Data. Source SCRS, 2008.

Atlantic blue marlin and Atlantic white marlin summary		
	WHM	BUM
$B_{2004} < {}^{1}B_{MSY}$	Yes	Yes
Recent Abundance Trend (2001-2004)	Slightly upward	Possibly stabilizing
$F_{2004} > F_{replacement}$	No	Possibly
$F_{2004} > {}^{1}F_{MSY}$	Possibly	Yes
${}^{2}Catch_{recent}/Catch_{1996}$ Longline and Purse seine	0.47	0.52
${}^{3}Catch_{2004}$	610 t	2,916 t
Rebuilding to B_{MSY}	Potential to rebuild under current management plan but needs verification.	Potential to rebuild under current management plan but needs verification.
${}^{1}MSY$	[4] 600-1,320 t	~ 2,000 t (1,000 ~ 2,400 t)

[1] As estimated during the 2000 (Anon. 2001) and 2002 (Anon. 2003a) assessments.
[2] Catch recent is the average longline catch for 2000-2004.
[3] Estimate of total removals obtained by the Committee. The Task I catch reported for 2006 is 2,182 t for blue marlin and 387 t for white marlin. The preliminary Task I catch reported for 2007 is 2,303 t for blue marlin and 302 t for white marlin. Final estimates for 2005-2007 are likely to be greater.
[4] Range of estimates were obtained in the previous assessments, but recent analyses suggest that the lower bound for white marlin should be at least 600.

2.4.1.3 Effects of Regulations

ICCAT Management Recommendations

ICCAT Recommendation 97-09 required Contracting Parties to reduce, starting in 1998, blue marlin and white marlin landings by at least 25 percent for each species from 1996 landings, by the end of 1999. In 2000, ICCAT recommended that a blue marlin minimum size be established for recreational fisheries (251 cm (98.8 inches) LJFL). Recommendations 00-13, 01-10, 02-13, and 04-09 also imposed or extended additional catch restrictions for blue marlin. These included limiting the annual amount of blue marlin that can be harvested by pelagic longline and purse seine vessels and retained for landing to no more than 50 percent of the 1996 or 1999 landing levels, whichever is greater, as well as requiring that all blue marlin and white marlin brought to pelagic longline and purse seine vessels alive be released in a manner that maximizes their survival. The live release provision does not apply to marlins that are dead when brought alongside the vessel or that are not sold or entered into commerce (SCRS, 2004). In addition, these recommendations limited recreational landings in the United States to 250 blue and white marlin combined, on an annual basis. Most recently, ICCAT recommendation 06-09 consolidated all previous recommendations, extended phase one of the ICCAT mortality reduction plan through 2010, and scheduled the next assessment of Atlantic blue marlin for 2010.

Most countries started reporting live releases in 2006. Additionally, more information has become available, for some fleets, on the potential for using gear modifications to reduce bycatch and increase the survival rate of marlins. Such studies have also provided information on the rates of live releases for those fleets. However there is not enough information on the proportion of fish being released alive for all fleets to evaluate the effectiveness of the ICCAT recommendation relating to the live release of marlins. While the stock status evaluations are uncertain, the SCRS noted that the ICCAT billfish recommendations have the potential to rebuild these stocks, although verification is necessary.

Globally, catches of blue marlin appear to have been reduced as a result of ICCAT recommendations, which tied reductions in blue marlin landings to 1996 or 1999 levels, whichever is greater. During the 2006 marlin assessment, it was noted that catches of blue marlin had continued to decline through 2004 (Figure 2.14). Task 1 catches of blue marlin in 2005 were 3,436 t, including large catches that were newly reported from Caribbean FAD fleets. In 2006, Task 1 catches of blue marlin were 2,060 t. Task I catches of blue marlin in 2006 and 2007 were 2,182 t. and 2,303 t., respectively. The 2007 estimate is considered preliminary. Historical reports of unclassified billfish remain an important issue in the estimation of historical removals from marlin stocks.

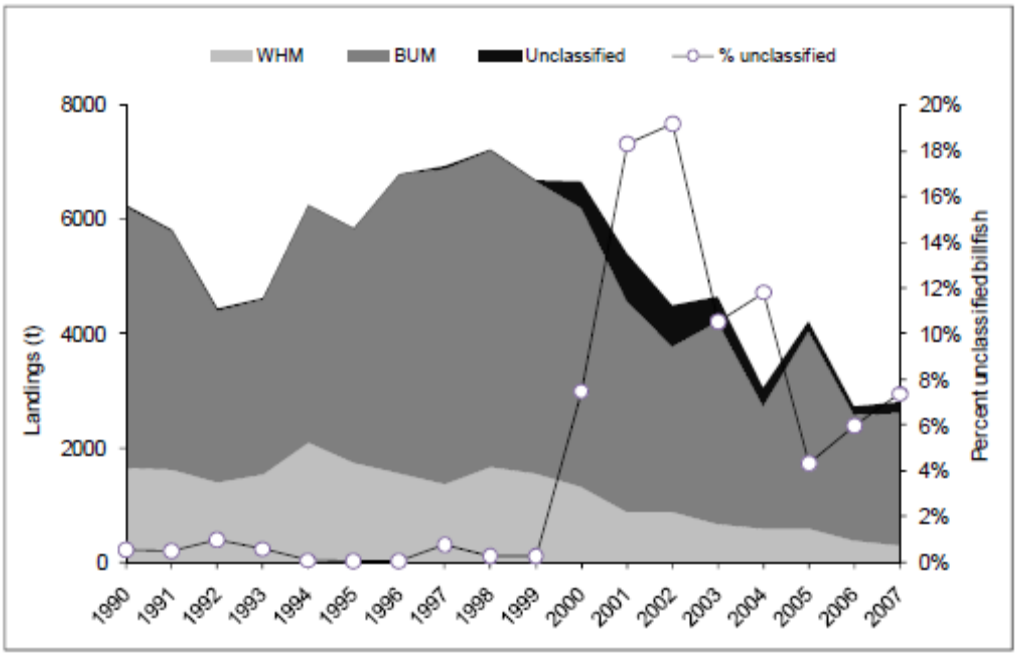

Figure 2.14 **Total catch of Blue Marlin, White Marlin, and Unclassified Billfish for 1990 – 2007, and Percentage of the Ratio of Unclassified Billfish (line with symbols) with Respect to the Total Blue Marlin and White Marlin Catch.** Source SCRS, 2008.

Domestic Regulations

The U.S. Atlantic billfish fishery, including blue marlin, white marlin, sailfish, and spearfish, has been managed as a recreational fishery through domestic regulation since 1988. Possession of Atlantic billfish is prohibited by U.S. pelagic longline vessels and no sale of

Atlantic billfish is allowed. The recreational fishery is an open access fishery. Anglers must possess either a HMS Angling category permit or a CHB category permit to possess billfish. General category tuna permit holders may possess Atlantic billfish only when participating in a registered HMS tournament. Details of the permitting program, including the number of permit holders can be found in Section 0 of this document. Data on domestic recreational catches of Atlantic billfish are obtained from a combination of sources, including: the Recreational Billfish Survey; the HMS swordfish and billfish non-tournament reporting line; MRFSS, LPS, and some state catch card programs (MD and NC). U.S. recreational billfish landings can be seen in Section 4.4.2 of this document. The U.S. implemented a minimum legal size of 251 cm (99 inches), 167 cm (66 inches), 160 cm (63 inches) for blue marlin, white marlin, and sailfish respectively, in 1999. Possession of Atlantic longbill spearfish has been prohibited since 1988. Rod and reel is the only type of gear authorized in the domestic billfish fishery.

Recent and Ongoing Research

The NMFS SEFSC has played a substantial role in the ICCAT Enhanced Research Program for Billfish which began in 1987 and has continued through 2007, with SEFSC scientists acting as the coordinator for research in the western Atlantic Ocean. Major accomplishments in the western Atlantic in 2007 are documented in SCRS/2007/144. Highlights include four at-sea sampling trips with observers on Venezuelan industrial longline vessels in 2007. Although this represents less than half of what had been planned for 2007, the activity provides uninterrupted continuation of the biological sampling of this fleet that was initiated in 1991. Sampling of Venezuelan artisanal catches also continued in Margarita Island and in the central coast of Venezuela. Biological samples from the pelagic longline and artisanal Venezuelan fisheries have provided large numbers of spines and gonads for age, growth and reproductive studies of blue and white marlin. Notably, this program recovered 70 tagged billfish in the first six months of 2007. Finally, participants in the U.S. Southeast Fisheries Science Center's Cooperative Tagging Center (CTC) and the Billfish Foundation Tagging Program (TBF) tagged and released 3,647 billfishes (including swordfish) in 2007 (SCRS, 2008).

Internationally, Brazil continued its collaborative program with U.S. institutions that started in 2005. During 2007, the program focused on testing the performance of circle hooks on board commercial vessels, tagging with PSATs, and collection of spine samples for age and growth studies. Additional research in Brazil will also focus on PSAT tagging of billfish and the collection of biological materials for ageing and molecular genetic analyses. In Bermuda, the ICCAT Enhanced Research Program for Billfishes program continued to support collaborative activities to collect biological materials from billfish tournaments. A review of billfish statistics in Ghana, Senegal, and Ivory Coast, initiated in 2006, has not been completed. However, improvements on catch records from these countries are reflected in recent ICCAT Task I tables for billfish.

The highest priority for the ICCAT Enhanced Research Program for Billfish in 2008 is to support improvement in the collection of statistics on artisanal Atlantic billfish fisheries. Other important activities include support for the continuation of the monitoring of the Venezuelan and Brazilian longline fleets through an observer program, collection of conventional tags, and the

collection of biological samples. Shore-based samples will be conducted on billfish tournaments in Bermuda and Brazil; longline fleets in Venezuela, Uruguay, and Brazil; the gillnet fleet in central Venezuela, Ghana, Ivory Coast, and Senegal; and the recreational fishery in Senegal. Continued at-sea sampling will be conducted onboard Venezuelan and Brazilian vessels. Several on-going projects will be evaluating habitat use and critical habitat needs of blue and white marlin using pop-up satellite archival tag technology. Additionally, ICCAT continues to support a conventional tagging and recovery program for billfishes.

Several studies by researchers at the Virginia Institute of Marine Science (VIMS) and elsewhere have recently been published, or are in press, that analyze the genetic structure of blue and white marlin; post release survival and habitat use from the recreational fishery for Atlantic white marlin using PSATs; the effects of circle hooks and J-hooks on target and non-target species in the pelagic longline fishery; and the survival of white marlin released from commercial and recreational fisheries.

In addition to the ongoing cooperative billfish research program between the U.S. and Brazil, the SEFSC has also completed several billfish studies since 2006. These include an examination of vertical habitat utilization by large pelagic animals; evidence of blue marlin spawning in Bermuda waters; characterization of the white marlin recreational fishery off Maryland and New Jersey; the identification, and distribution of roundscale spearfish; and, a hook performance study of the south Florida recreational live-bait fishery for sailfish.

The Fishery Management Group of the University of Miami is continuing to conduct research on Atlantic billfish in three areas: population parameter estimation; population modeling; and, development of socio-economic indicators. Others at the University of Miami's Rosenstiel School and elsewhere are conducting research on early life history, reproductive biology and ecology of billfishes, as well as age and growth estimation.

Numerous papers on billfish research were submitted to ICCAT in preparation for the 2006 billfish stock assessment. These included: An evaluation of the importance of discards and other uses of billfish in the Spanish surface longline fishery (SCRS/2006/060); an analysis of the billfish fishery off Rio de Janeiro (SCRS/2006/139); post-release survival of sailfish captured on commercial pelagic longline gear in the southern Gulf of Mexico (SCRS/2006/149); estimates of biological benchmarks using simulated blue marlin data (SCRS/2006/153); analysis of recent catch data of blue marlin caught by Japanese longliners in the Atlantic using logbook information (SCRS/2006/ 100); preliminary results on the reproductive biology of blue marlin in the tropical western Atlantic Ocean (SCRS/2006/104); application of a bayesian surplus production model to Atlantic white marlin (SCRS/2006/064); catch rates of white marlin and blue marlin from the U.S. pelagic longline in the northwest Atlantic and Gulf of Mexico (SCRS/2006/066); catch rates of white marlin and blue marlin from the U.S. recreational tournament fishery in the Northwest Atlantic, Gulf of Mexico, Bahamas and U.S. Caribbean (SCRS/2006/067); white marlin and blue marlin catch rates from the Taiwanese longline fishery in the Atlantic (SCRS/2006/102); an estimation of the relative abundance of Atlantic billfish (SCRS/2006/105); the ratio of live Atlantic blue marlin and white marlin caught by Japanese longliners using data obtained from the observer program in the Atlantic Ocean (SCRS/2006/ 106); ring counts and timing of ring formation in fin spines of white marlin from Venezuelan

longline and artisanal fisheries (SCRS/2006/ 068); recent catch data of white marlin caught by Japanese longliners in the Atlantic using logbooks (SCRS/2006/101); the reproductive biology of the white marlin in the western equatorial Atlantic Ocean (SCRS/2006/103); and, spatial-temporal distribution, sex ratio at size and gonad index of white marlin and longbill spearfish in the western central Atlantic from 2002-2005 (SCRS/2006/061). Please see http://www.iccat.int/Documents/CVSP/CV060_2007/colvol60.htm for more information.

2.4.2 White Marlin

2.4.2.1 Life History and Species Biology

White marlin (*Tetrapturus albidus*) are found exclusively in tropical and temperate waters of the Atlantic Ocean and adjacent seas, unlike sailfish and blue marlin which are also found in the Pacific Ocean. White marlin movements extend to the higher temperate latitudes of their range only during the warmer months of the year. They may occur in small, same-age schools, however they are generally solitary compared to the Scombrids (tunas). Catches in some areas may include a rare species, the so-called "hatchet marlin" (*Tetrapturus georgei*), which is superficially similar to white marlin. The "hatchet marlin" has been caught occasionally in the Gulf of Mexico and South Atlantic (NMFS, 1999).

Large post-spawning aggregations of white marlin are reported off the Mid-Atlantic states during the summer period. A large, mostly catch and release, sport fishery for white marlin occurs during the summer between Cape Hatteras, NC and Cape Cod, MA, and indicates that white marlin inhabit offshore (148 km (80 nm)) submarine canyons, extending from Norfolk Canyon in the Mid-Atlantic to Block Canyon off eastern Long Island. White marlin usually can be found where large numbers of prey items are available. Concentrations of white marlin are associated with rip currents and weed lines (fronts), and with bottom features such as steep drop-offs, submarine canyons, and shoals. Recreational fishing for white marlin also occurs in the Straits of Florida, southeast Florida, the Bahamas, and off the north coasts of Puerto Rico and USVI, and in the Mona Passage east of the Dominican Republic. Summer concentrations in the Gulf of Mexico are found off the Mississippi River Delta and at DeSoto Canyon, with a peak off the delta in July, and in the vicinity of DeSoto Canyon in August. In the Gulf of Mexico, adult white marlin appear to be associated with blue waters of low productivity, being found with less frequency in more productive green waters. While this is also true of the blue marlin, there appears to be a contrast between the factors controlling blue and white marlin abundance, as higher numbers of blue marlin are generally caught when catches of white marlin are low, and vice versa. It is believed that white marlin prefer slightly cooler temperatures than blue marlin. White marlins generally prefer water temperatures above 22°C (71° F) with salinities between 35 – 37 ppt (NMFS, 1999).

White marlin undergo extensive movements, although not as extreme as those of bluefin tuna and albacore. Conventional mark-recapture data collected by the Cooperative Tagging Center (CTC) constituent-based tagging program (NOAA/Southeast Fisheries Science Center, Miami, Fl) has revealed spatial and temporal characteristics of white marlin movement (Ortiz et al. 2003). From 1954 through 2005, a total of 49,543 white marlin were marked and released in the Atlantic basin, resulting in 961 recaptures (1.94%) (Orbesen *et al*., 2005). The majority of

releases took place in the months of July through September, in the western North Atlantic off the eastern coast of the United States; and, to a lesser extent, off Venezuela, the Gulf of Mexico, and the western central Atlantic. The longest distance traveled was 6,523 km (4,053 miles), while the maximum number of days at-liberty was 5,488 (15 yrs). Trans-Atlantic crossing have been recorded for several individuals. However, only two reports of trans-equatorial crossings have been documented (Orbesen et al., 2005). Recaptures indicate a substantial number of individuals moving between the Mid-Atlantic coast of the United States and the northeast coast of South America. Figure 2.15 shows the location of worldwide white marlin catches.

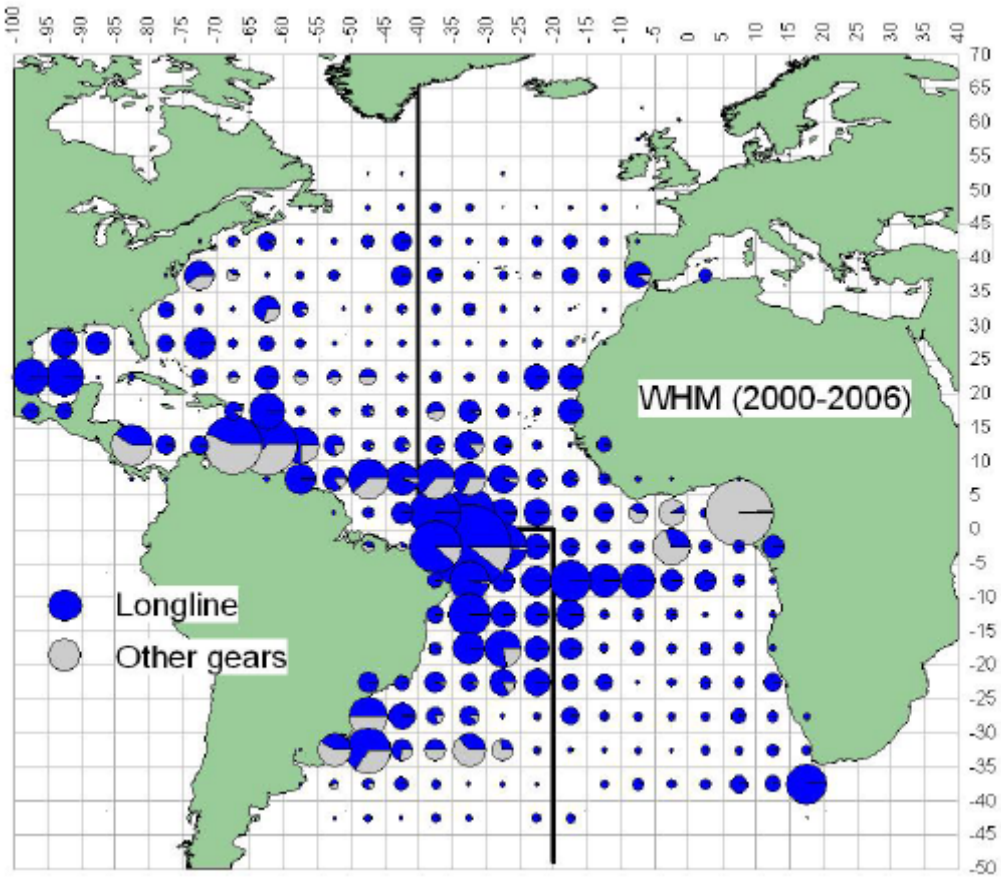

Figure 2.15 **Geographic distribution of mean white marlin catch by major gears (all fleets) for the period 2000 – 2006. Largest circle corresponds to a catch of 52 t.** Source: SCRS 2008.

Prince et al. (2005) monitored movement and behavior of six white marlin released with PSATs off the coast of Punta Cana, Dominican Republic. These individuals were at-liberty for periods ranging from 28 to 37 days. Net displacement between points of release and first transmission ranged from 76 to 496 km, with a mean daily displacement of 6.2 km. The daily displacements are low compared to other marlin PSAT tagging studies. The Punta Cana area is an active white marlin spawning ground during the period these PSATs were monitored. The low displacement rates suggest site affinity that may be associated with spawning behavior. These six white marlin spent more than 50% of their time above 25 m, and about 70% of time in water ranging from 28 to 30 °C. Although most time was spent near the surface, active short-duration vertical movements were made daily; extending as deep as 368 m in one case.

Horodysky et al. (2007) examined vertical movement and habitat use via 47 PSATs attached to white marlin released from recreational and commercial vessels. Most of these PSATs were high resolution tags, collecting data points every 90 seconds. During at-liberty periods ranging from five to ten days, these white marlin spent nearly half their time near the surface (< 10 m). All made frequent short duration dives to depths averaging 51 m, suggesting that a great deal of foraging effort takes place well below the surface waters. Horodysky et al. (2007) suggest that this behavior may explain the relatively high catch rates of white marlin on some deep-set pelagic longline gears. In a study supporting this suggestion, Junior et al. (2004) reported a preference for depths ranging from 50 – 230 m (164-754 feet), with no obvious preference for surface waters for white marlin captured with pelagic longline gear off northeastern Brazil. An analysis of high resolution (≤ 60 s) archival data from two white marlin PSATs showed time engaged in vertical movement ranged from 29.4% to 54.4%, with most of the activity taking place during daylight hours (Hoolihan et al. in prep.). Maximum depths recorded for these individuals were 188 m and 260 m. While dive events were frequent, the majority of time (55.9 and 86.1%) was spent at depths less than 75 m. Prince and Goodyear (2006) used PSAT data from sailfish and blue marlin to show how vertical movement could be restricted by a hypoxic barrier formed during upwelling. One implication of this condition is that billfish movements are constrained to near-surface depths where adequate levels of dissolved oxygen are available. Another is that their susceptibility to capture by surface fishing gears would increase. Given the same conditions, white marlin could be expected to behave similarly.

White marlin exhibit sexually dimorphic growth patterns with females growing larger than males. Size at harvest generally ranges from 20 to 30 kg (44-66 lb). They grow quickly and can reach an age of at least 18 years, based on tag recapture data (SCRS, 2004). Adult white marlin can grow to over 280 cm (110 inches) TL and 82 kg (184 lb).

White marlin are primarily general piscivores, but also feed on squid and other prey items. In the Gulf of Mexico and along the U.S. Atlantic coast important prey items for adult white marlin include herring, dolphinfish (*Coryphaena*), hardtail jacks *Caranx crysos*, and squid (Nakamura 1985). In the northeastern Gulf of Mexico, off the coasts of Florida and Mississippi, Davies and Bortone (1976) found the most common prey items were Scombrids (*Euthynnus* sp. and *Auxis* sp.), squid, and moonfish (*Selene setapinnis)*. In turn, oceanic pomfret (*Brama brama*) and squid (*Ornithoteuthis antillarum*) were the most abundant food items in a study that sampled stomachs collected off the coast of Brazil in the southwestern Atlantic Ocean (Junior et al., 2004). The number of food items per stomach ranged from 1 – 12 individuals, while the largest sized prey items were snake mackerel (*Gempylus serpens*), ranging in length from 40 – 73 cm (15.7 – 28.7 inches) (Junior et al., 2004). Likely predators of adult white marlin include sharks and killer whales (Mather et al., 1975).

Female white marlin are about 20 kg (44 lb) in mass and 130 cm (51.2 inches) in length at sexual maturity. Spawning activity occurs during the spring (March through June) in northwestern Atlantic tropical and sub-tropical waters marked by relatively high surface temperatures (20-29°C) and salinities (> 35 ppt). White marlin move to higher latitudes during summer, as waters warm. White marlin sampled during the summer at these higher latitudes (Mid-Atlantic states) were in a post-spawning state (deSylva and Davis 1963). Arocha et al.

(2006) reported females exhibiting high gonad index values (associated with mature gonads) present in the western North Atlantic from April to July between 18° N. lat. and 22° N. lat. Spawning seems to take place further offshore than sailfish, although larvae are not found as far offshore as blue marlin. Females may spawn up to four times per spawning season (deSylva and Breder 1997). It is believed there are at least five spawning areas in the western north Atlantic: northeast of Little Bahama Bank off the Abaco Islands; northwest of Grand Bahama Island; southwest of Bermuda; the Mona Passage, east of the Dominican Republic; and the Gulf of Mexico. Prince et al. (2005) collected eight white marlin larvae in neuston tows in April/May off the coast of Punta Cana, Dominican Republic indicating that there had been recent spawning activity in this general area. More recently, white marlin larvae were collected during March and April in Bahamian waters, and from May-June in the Florida Straits (D.E. Richardson and S.A. Luthy, unpubl. data). White marlin larvae (n = 15) have also been genetically identified from the Gulf of Mexico, confirming spawning activity in that region (J. Rooker, unpubl. data).

In the south Atlantic, previous reports have mentioned spawning of white marlin off southeast Brazil in the same area where blue marlin spawn, but later in the year from April to June. Off southern Brazil (25º to 26º S. lat., and 45º to 45º W. long.), white marlin spawn from December to March (SCRS, 2008).

There is a paucity of information regarding the age and growth of white marlin. Efforts to accurately determine the incremental growth annuli from fin spines have been hindered by enlargement of the spine's vascular core. This enlargement results in erosion (i.e. obliteration) of early annuli. This problem has been well documented for other istiophorid billfishes (Jolley 1974; Jolley 1977; Hedgepeth and Jolley 1983; Hill et al. 1989; Freire et al. 1998; Hoolihan 2006). Comparing fin spine radius with incremental growth of annuli has allowed some researchers to back-calculate the number of annuli eroded in sailfish fin spines (Alvarado-Castillo and Félix-Uraga 1996; Chiang et al. 2004). A preliminary study has been undertaken to age white marlin using anal fin spines. These researchers reported a value of two annuli for both the median and mode from white marlin anal fin spines collected from two Venezuelan fisheries. However, these counts still require correction for annuli loss due to vascularization (Drew et al. 2006). Validation of annuli counts is necessary prior to interpreting ages. Preliminary analysis of the marginal increment growth suggested one annulus was formed each year. Unfortunately, sample specimens did not include the full size range of white marlin, lacking both very small and very large individuals. In addition, samples were absent from several months (April-June), hindering the validation of this ageing technique (Drew et al. 2006); spawning may influence annuli formation, so obtaining additional samples from these months is necessary.

2.4.2.2 Stock Status and Outlook

White marlin have been managed under a single stock hypothesis by ICCAT since 2000. The most recent stock assessment for white marlin was conducted in 2006. No new information has been provided on stock status since then. Large catches of billfish continue to be reported to ICCAT as unclassified and reporting gaps remain for some important fleets, which introduced significant uncertainty into the 2006 SCRS stock assessment. A special effort was made by ICCAT prior to the 2006 meeting to obtain catches from countries not previously reporting. Controversy continued about interpretation and standardization of Catch per Unit Effort (CPUE)

time series, attracting a considerable amount of analysis and simulation effort by the ICCAT participants. Those efforts were largely unsuccessful in making new progress toward international consensus on CPUE. As a result, the assessment working group elected not to reevaluate population benchmarks from the previous assessment. Instead, the 2006 assessment concentrated on evaluating recent population trends, and looking for possible impacts of the new ICCAT catch restrictions.

The 2006 stock assessment for white marlin indicated that the biomass of white marlin for 2000 – 2004 most likely remained well below the B_{MSY} estimated in the 2002 assessment (Table 2.15). The 2006 assessment estimated that F_{2004} was probably smaller than $F_{replacement}$ and probably also larger than F_{MSY} estimated in the 2002 assessment. Over the period 2001 – 2004, combined longline indices and some individual fleet indices suggest that the decline in abundance has been at least partially reversed, but some other individual fleet indices suggest that abundance has continued to decline (Figure 2.16). Overall, the SCRS noted that some signs of a recovery trend are apparent, and that white marlin have the potential to rebuild to the B_{MSY} level under the current ICCAT management plan, but reports of recent increases in artisanal fisheries could negate this potential (SCRS, 2006). Despite more positive results in the 2006 SCRS white marlin stock assessment than existed in the 2002 assessment, the overfished status of white marlin remains unchanged. It should be noted that the abundance trends are based only on a few years of observations. Confirmation of these recent apparent changes in trends will require at least an additional four or five years of data (SCRS, 2006).

Recent trends in white marlin abundance are contained in Figure 2.16. A summary of both Atlantic blue and white marlin stock assessment data may be found in (Table 2.15).

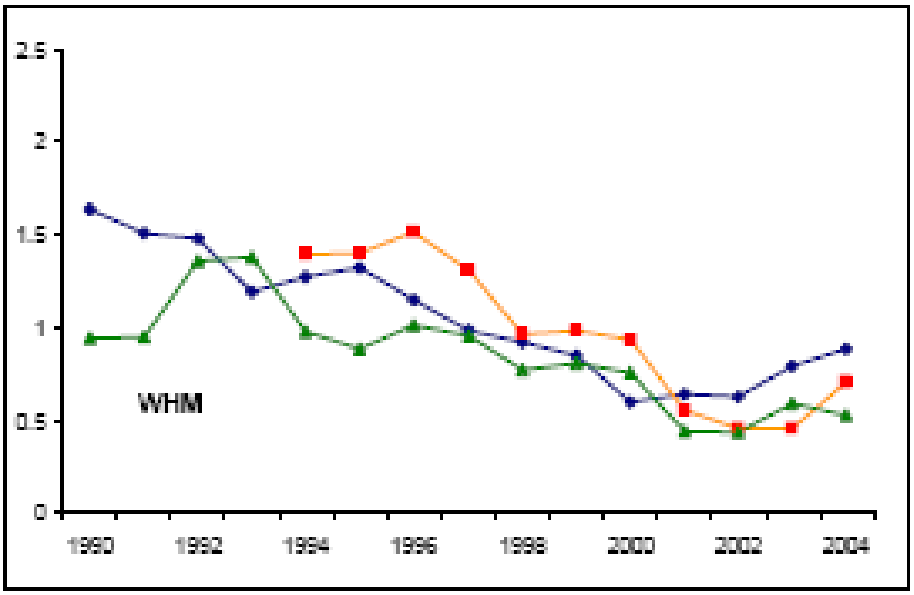

Figure 2.16 **Relative abundance indices for white marlin estimated by combining data for four longline fleets. Three different statistical models are shown for comparison.** Source: SCRS, 2006.

The SCRS recommended that ICCAT should, at a minimum, continue the management measures already in place because marlins have not yet recovered. To increase the likelihood of

success of the white marlin rebuilding plan, the SCRS indicated that further reductions in mortality would be needed, for example by improving compliance with current regulations, encouraging the use of circle hooks, and/or broader application of time/area catch restrictions. The SCRS also recommended that additional steps be taken to ensure that the reliability of recent fishery information improves. Improvements are needed in monitoring the fate and amount of dead and live releases, with verification from scientific observer programs. Additionally, verification of current and historical landings from some artisanal and industrial fleets needs to be conducted. Further, the results of habitat research are not yet sufficient to allow the SCRS to reach consensus on the best method for directly estimating MSY benchmarks for marlins based on a complete time series of data. Continued research on the development of methods to incorporate habitat data into stock assessments is needed to provide a basis for increasing the certainty with which management advice can be provided (SCRS 2006).

2.4.2.3 Effects of Regulations

ICCAT Management Recommendations

ICCAT Recommendation 97-09 required Contracting Parties to reduce, starting in 1998, blue marlin and white marlin landings by at least 25 percent for each species from 1996 landings, by the end of 1999. Recommendations 00-13, 01-10, 02-13, and 04-09 imposed or extended additional catch restrictions for blue marlin. These included limiting the annual amount of blue marlin that can be harvested by pelagic longline and purse seine vessels and retained for landing to no more than 50 percent of the 1996 or 1999 landing levels, whichever is greater, as well as requiring that all blue marlin and white marlin brought to pelagic longline and purse seine vessels alive be released in a manner that maximizes their survival. The live release provision does not apply to marlins that are dead when brought along the side of the vessel or that are not sold or entered into commerce (SCRS, 2004). Recommendation 06-09 consolidated the previous recommendations and extended Phase 1 of the rebuilding plan through 2010.

Most countries started reporting live releases in 2006. Additionally, more information has become available, for some fleets, on the potential for using gear modifications to reduce the bycatch and increase the survival of marlins. Such studies have also provided information on the rates of live releases for those fleets. However there is not enough information on the proportion of fish being released alive for all fleets to evaluate the effectiveness of the ICCAT recommendation relating to the live release of marlins. While the stock status evaluations are uncertain, the SCRS noted that the ICCAT billfish recommendations have the potential to rebuild these stocks although verification is necessary. For white marlin, there has been a slight upward abundance trend.

Globally, catches of white marlin appear to have been reduced as a result of ICCAT recommendations to less than 1,000 mt since 2000. Total Atlantic-wide catches of white marlin, as reported to ICCAT, decreased by approximately 81 percent from 1,556 mt in 1999 to 302 mt in 2007. Task 1 catches of white marlin in 2006 were 387 mt. In 2007, Task 1 catches of white marlin were 302 mt, but this estimate is considered preliminary. Historical reports of unclassified billfish remain an important issue in the estimation of historic removals from marlin stocks. In the United States, white marlin are managed exclusively for recreational fisheries.

The fishery is subject to an ICCAT imposed, 250-fish limit, annually for both blue and white marlin combined. In 2001, time area closures were established in the United States to reduce interactions between longline fisheries and white marlin and other billfish.

Domestic Regulations

Please see the discussion of domestic regulations contained in Section 2.4.1.3 above.

Recent and Ongoing Research

Please see the discussion of recent and ongoing research contained in section under blue marlin.

2.4.3 Sailfish

2.4.3.1 Life History and Species Biology

Sailfish have a pan-tropical distribution and prefer water temperatures between 25°C and 28°C (77°F – 82°F). Sailfish are the most coastal of all billfish species and conventional tagging data suggest that they move shorter distances than other billfishes. Although sailfish are the least oceanic of the Atlantic billfish and have higher concentrations in coastal waters (more than any other Istiophorid), they are occasionally also found in offshore waters. They range from 40°N to 40°S in the western Atlantic and 50°N to 32°S in the eastern Atlantic. Few trans-Atlantic movements have been recorded, suggesting a lack of mixing between east and west. Although sailfish are generally considered to be rare and solitary species relative to the schooling Scombrids, sailfish are known to occur along tropical coastal waters in small groups consisting of at least a dozen individuals. Junior et al. (2004) captured sailfish in the southwestern Atlantic Ocean with pelagic longline gear at depths between 50 – 210 m (164 – 688 feet), with most individuals captured at 50 m. A study in the southern Gulf of Mexico indicated that habitat preferences for sailfish were primarily within the upper 20 m of the water column (SCRS 2008). Sailfish are the most common representative of the Atlantic Istiophorids in U.S. waters (SCRS, 2005). Female sailfish grow faster, and attain a larger maximum size, than males. Sailfish have a maximum age of at least 17 years (SCRS 2008).

In the winter, sailfish are found in schools around the Florida Keys and eastern Florida, in the Caribbean, and in offshore waters throughout the Gulf of Mexico. In the summer, they appear to migrate northward along the U.S. coast as far north as the coast of Maine, although there is a population off the east coast of Florida year-round. During the summer, some of these fish move north along the inside edge of the Gulf Stream. In the winter, they regroup off the east coast of Florida. Sailfish appear to spend most of their time above the thermocline, which occurs at depths of 10 – 20 m (32.8 – 65.6 feet) and 200 – 250 m (656 – 820 feet), depending on location. The 28EC (82°F) isotherm appears to be the optimal temperature for this species. Sailfish are mainly oceanic but migrate into shallow coastal waters. Larvae are associated with the warm waters of the Gulf Stream (NMFS, 1999).

A total of 102,689 sailfish had been tagged and released as of 2001 through the efforts of the CTC program, with the reported recapture of 1,704 sailfish (1.65 percent of all releases).

Most releases occurred off southeast Florida, from north Florida to the Carolinas, the Gulf of Mexico, Venezuela, Mexico, the northern Bahamas and the U.S. Virgin Islands. Although the majority of sailfish recaptures were in the vicinity of release, there were a number of movements in excess of 2,000 km. One tagged and recaptured specimen traveled from Juno, FL to the Mid-Atlantic, a distance of 2,972 km (1,745 miles). The longest movement tracked by tagging was 3,861 km (2,084 miles) and the longest time at large was 6,658 days (18.2 years) (Ortiz et al., 2003). This demonstrates that sailfish have the ability to undertake extensive movements. During the winter, sailfish are restricted to the warmer parts of their range and move farther from the tropics during the summer. The summer distribution does not extend as far north as for marlins, especially white marlin, as sailfish specimens have been recovered only as far north as Cape Hatteras, NC.

Most sailfish examined that have been caught off Florida are under three years of age. Mortality is estimated to be high in this area, as most of the population consists of only two year classes. The longest period a recaptured-tagged animal was found to be at-large was 16.1 years. Unfortunately, the size at release is not available for this fish. Growth rate in older individuals is very slow (0.59 kg/yr or 1.3 lb/year). Sailfish are probably the slowest growing of the Atlantic istiophorids. Sexual dimorphic growth is found in sailfish, but it is not as extreme as with blue marlin (NMFS, 1999).

Sailfish spawn year-round over a wide area. The timing of spawning can differ, and occurs from late spring to early summer in the higher latitudes (Florida, southern Brazil) and in the winter months in the lower latitudes (Caribbean Sea, western Africa) (SCRS 2008). Female sailfish spawn at age three and are generally 13 – 18 kg and 157 cm (28.6 – 39.6 lb and 61.8 inches), whereas males generally mature earlier at 10 kg and 140 cm (22 lb and 55.1 inches). Spawning in U.S. waters takes place between April and October (de Sylva and Breder, 1997). Spawning has been reported to occur in shallow waters 9 – 12 m (30 – 40 ft) around Florida, from the Florida Keys to the region off Palm Beach on the east coast. Spawning is also assumed to occur, based on presence of larvae, offshore beyond the 100 m (328 feet) isobath from Cuba to the Carolinas, from April to September. However, these spawning activities have not been observed. Sailfish can spawn multiple times in one year, with spawning activity-moving northward in the western Atlantic as the summer progresses. Larvae are found in Gulf Stream waters in the western Atlantic, and in offshore waters throughout the Gulf of Mexico from March to October (NMFS, 1999). Serafy et al. (2003) found three larval sailfish in Exuma Sound, Bahamas, in the month of July indicating that there had been recent spawning activity in this vicinity. In the Pacific Ocean, sailfish spawn in waters between 27 – 30°C (Hernandez-H and Ramirez-H, 1998).

Sailfish are generally piscivorous, but also consume squid. Larvae eat copepods early in life. The diet of adult sailfish caught around Florida consists mainly of pelagic fishes such as little tunny (*Euthynnus alletteratus*), halfbeaks (*Hemiramphus* spp.), cutlassfish (*Trichiurus lepturus*), rudderfish (*Strongylura notatus*), jacks (*Caranx* spp.), pinfish (*Lagodon rhomboides*), and squids (*Argonauta argo* and *Ommastrephes bartrami)*. Sailfish are opportunistic feeders and there is evidence that they may feed on demersal species such as sea robin (*Triglidae*), cephalopods and gastropods found in deep water.

Sailfish collected in the western Gulf of Mexico contained a large proportion of shrimp in their stomachs in addition to little tunny, bullet tuna (*Auxis* spp.), squid, and Atlantic moonfish (*Vomer setapinnis*). Junior et al. (2004) determined that squid were actually the second most important food item in the southwestern Atlantic off the coast of Brazil. The number of food items per stomach ranged from 1-14, and 6 percent of the stomachs were empty upon collection (Junior et al., 2004). Adult sailfish are probably not preyed upon often, but predators include bottlenose dolphin (*Tursiops turncatus*), and sharks.

Participants from many nations target sailfish in both the western and eastern Atlantic Ocean. Sailfish are found predominantly in the upper reaches of the water column and are caught in directed sport fisheries (recreational), coastal artisanal fisheries, and as bycatch in the offshore longline fisheries for swordfish and tunas. In coastal waters, artisanal fisheries use many types of shallow water gear to target sailfish (NMFS, 2003). Kerstetter & Graves (2007) found that sailfish released from pelagic longline vessels in the southern Gulf of Mexico can survive the trauma resulting from interaction with pelagic longline gear, and that management measures promoting the live release of sailfish will reduce fishing mortality on the stocks.

2.4.3.2 Stock Status and Outlook

Sailfish and longbill spearfish landings have historically been reported together in annual ICCAT landing statistics. At present it is not possible to separate the catches of these two species. The most recent stock assessment was conducted in 2001 based on sailfish/spearfish composite catches and sailfish "only" catches. The assessment tried to address shortcomings of previous assessments by improving abundance indices and separating the catch of sailfish from that of spearfish in the offshore longline fleets. The 2001 assessment looked at catches reported between 1956 and 2000 and all the quantitative assessment models used produced unsatisfactory fits, therefore the SCRS recommended applying population models that better accounted for these dynamics in order to provide improved assessment advice. For the western Atlantic stock, annual sailfish catches have averaged about 700 mt (1,543,235 lb) over the past two decades and the abundance indices have remained relatively stable. The 2000 yield was 572 mt (1,261,044 lb). The reported catches of sailfish/spearfish combined (Task I) for 2007 were 920 mt (2,028,252 lb) and 1,060 mt (2,336,899 lb) for the west and east Atlantic, respectively. Recent analyses did not provide any information on the MSY or other stock benchmarks for the 'sailfish only' stock.

Although the 2001 attempts at quantitatively assessing the status of these two stocks (eastern and western sailfish) proved to be unsatisfactory, there were indications of early decreases in biomass for these two stocks. These decreases probably lowered the biomass of the stocks to levels that may be producing sustainable catches, but it is unknown whether biomass levels are below those that could produce MSY. There is no new information available to change the outlook presented in the 2001 assessment. It is still unknown if the western or eastern sailfish stocks are undergoing overfishing or if the stocks are currently overfished. Because no assessment has been conducted since 2001, no relative abundance indices are available after 2000. The SCRS stated that trends in abundance, catch, and CPUE are not very informative, and the outlook for both the eastern and western stock is uncertain. During a 2008 intercessional data preparatory meeting, the SCRS found that the available data had improved. The next sailfish assessment is scheduled for 2009.

Reports to ICCAT estimate that the Task I catch for 2007 was 1,060 t and 920 t, respectively for the east and west region. Task I catches of sailfish for 2007 are preliminary because they do not include reports from some important fleets.

A summary of Atlantic sailfish stock assessment data is given in Table 2.16. The reported Task I catches of sailfish/spearfish combined in the Atlantic from 1956 – 2006 for both east and west stocks is presented in Figure 2.17. The worldwide geographic distribution of sailfish catches by major gears from the period 2000 – 2006 is provided in Figure 2.18.

Table 2.16 **Summary of Atlantic Sailfish Stock Assessment Data. Weights are in metric tons, whole weight.** Source: SCRS, 2008.

ATLANTIC SAILFISH SUMMARY[1]		
	West Atlantic	**East Atlantic**
Maximum Sustainable Yield (MSY)	Not estimated	Not estimated
Recent Yield (2000)	506 t	969 t
2000 Replacement Yield	~ 600 t	Not estimated
Management Measures in Effect	None	None

[1]As estimated in 2001.

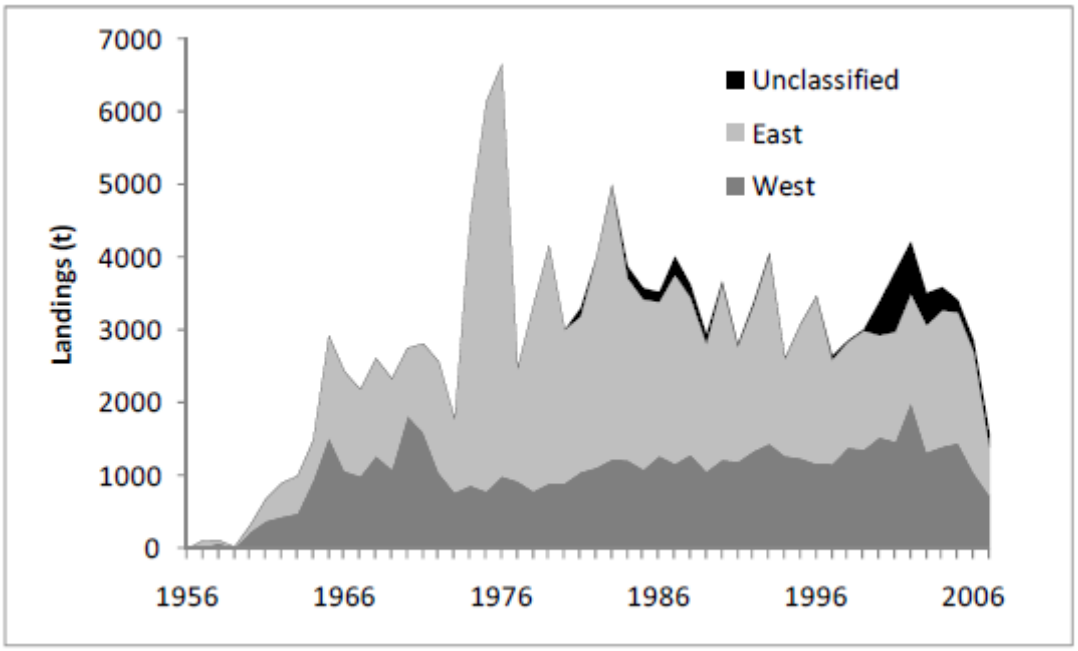

Figure 2.17 **Reported Task I catches of sailfish and spearfish combined in the Atlantic from 1956 to 2006 for the east and west stocks. Weights are in metric tons, whole weight.** Source: SCRS, 2008.

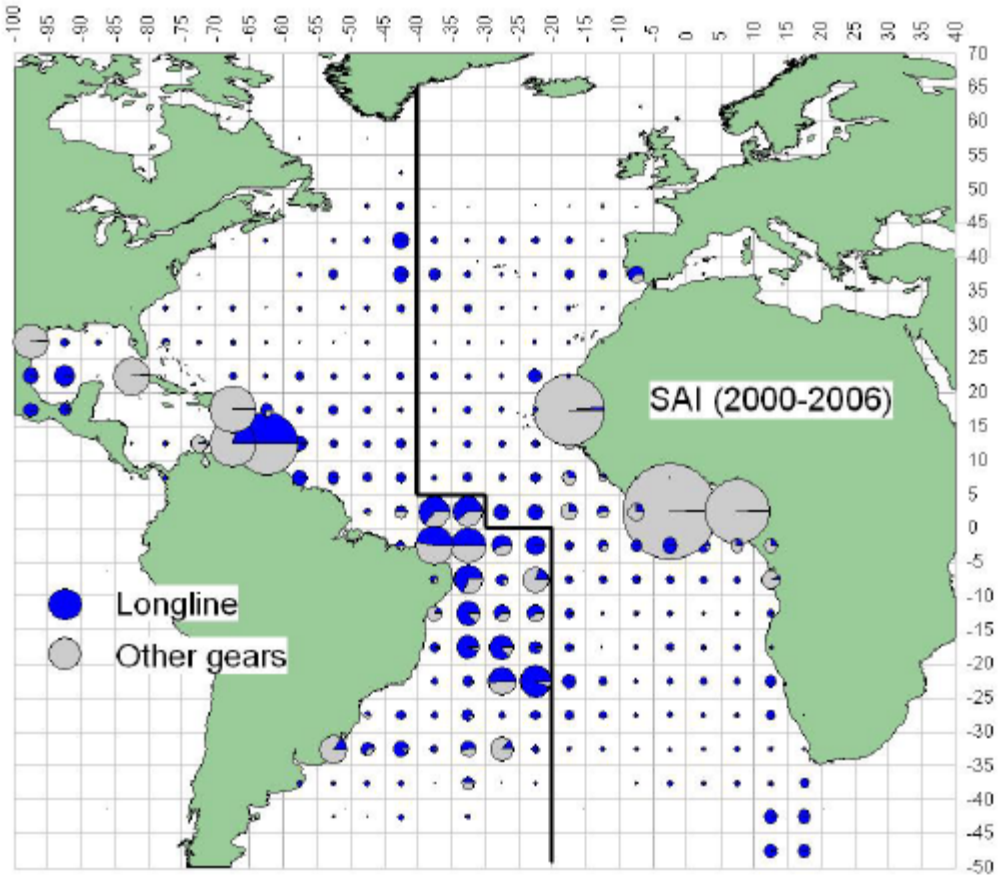

Figure 2.18 **Geographical distribution of the mean sailfish catches by major gears (all fleets) from 2000 - 2006.** Source: SCRS, 2008.

2.4.3.3 Effects of Regulations

<u>ICCAT Management Recommendations</u>

No ICCAT management regulations are currently in effect for Atlantic sailfish. Sailfish are managed as distinct eastern and western Atlantic stocks. This separation into two management units is based on life history information. General management recommendations made by the SCRS to ICCAT have remained consistent in recent years. These management recommendations indicated that ICCAT should consider methods for reducing fishing mortality rates, and that western Atlantic catches should not be increased above current levels. For the East Atlantic, the SCRS recommended that sailfish "only" catches should not exceed current levels and that ICCAT should consider practical and alternative methods to reduce fishing mortality and assure data collection systems. Furthermore, the SCRS expressed concern about the incomplete reporting of catches, particularly in recent years. Historical catches of unclassified billfish continue to be reported to ICCAT, thus making the estimation of sailfish catch difficult. The SCRS recommended that all countries landing sailfish/spearfish, or having dead discards, report these data to ICCAT. At an intercessional data workshop, the SCRS reviewed catch and CPUE data during 2008 in preparation for the next assessment in 2009. It found improved data available from West Africa, although there is still a need for further

analysis of CPUE data particularly for some of the longline fleets, and separation of spearfish/sailfish catches prior to the assessment. This data is expected to be available for the 2009 assessment (SCRS 2008).

Domestic Regulations

Please see the discussion of domestic regulations contained in Section 2.4.1.3 above.

Recent and Ongoing Research

Several papers were prepared for the 2001 sailfish/spearfish SCRS stock assessment. Document SCRS/01/97 presented updates of the catch data for sailfish caught by artisanal fisheries of the Ivory Coast. SCRS/01/102 described and estimated the bycatch of billfish (including sailfish and spearfish) in the Spanish swordfish longline fisheries. SCRS/01/138 presented new estimates of sailfish harvested by U.S. recreational fishermen, with various new sources of information (including the RBS, LPS, and MRFSS). SCRS/01/145 presented recent developments on billfish fishing in Venezuela. In 2001, many national reports updated their catch statistics, including the landing of sailfish and spearfish. Some of the updates were accepted with justifications as the improved Task I data. However, other data were not accepted, in many cases because of the inability to separate catches of sailfish and spearfish.

As the total catches of respective species are relatively small, unclassified catches can be an important part of total yield and could not be ignored. The SCRS agreed that it was imperative to develop a procedure to estimate catches and abundance estimates for sailfish only from offshore longline fleets so that the data could be incorporated into stock assessments. A procedure was adopted to provide a basis for the sailfish-only catch used in the 2001 assessment. The SCRS felt that a good achievement was obtained in 2001 by separating catches of sailfish and spearfish. However, the work was carried out during the ICCAT species group session, without any advance preparations and with little available time. Consequently, the group was not able to evaluate the assumptions used in the separation procedure. Items that needed to be re-examined include the east-west break, including the feasibility of division lines, and species separation.

The SCRS has stated that the procedures used in the 2001 assessment should be fully documented and reviewed in the future, as a priority, before another assessment is conducted. A Sailfish Data Preparatory Meeting was held in Madrid, May 19 to 24, 2008 to review the biological information, catch reports and relative abundance indices for Atlantic sailfish. New information on depth and temperature preferences of adult sailfish was presented. Biological samples conducted from some longline and artisanal fleets provide sex ratios in the catch and information on the spawning locations and the timing of spawning. Furthermore, recent research provides a description of the physical and biological characteristics of sailfish spawning habitat. New information was also provided on the survival of sailfish after release from longline gear. Analysis of reported catches generated new estimates of total catch for the eastern and western stocks. These analyses included disaggregation of catches reported as unclassified billfish and filling the gaps of the time series for fleets that had incomplete historical reports. Work on the separation of sailfish and spearfish catches of selected longline fleets was initiated by developing

a preliminary matrix of ratios of sailfish/spearfish by 5 degree grids. A number of relative abundance indices were presented at the meeting including updates of the U.S. recreational and longline, Venezuelan gillnet and longline and new indices for the Brazilian longline and recreational, and the artisanal Senegalese fleets. This review provided enough information to support the SCRS goal of assessing sailfish during a meeting in 2009.

2.4.4 Longbill Spearfish

2.4.4.1 Life History and Species Biology

Longbill spearfish (*Tetrapturus pfluegeri*) are the rarest of the Atlantic istiophorids, and were identified as a distinct species in 1963. There is relatively little information available on spearfish life history. A related istiophorid, the Mediterranean spearfish (*Tetrapturus belone*), is the most common representative of this family in the Mediterranean Sea. Longbill spearfish are known to occur in epipelagic waters above the thermocline, off the east coast of Florida, the Bahamas, the Gulf of Mexico, and from Georges Bank to Puerto Rico. Junior et al. (2004) captured spearfish off the coast of Brazil at depths ranging from 50 – 190 m (164 – 623 feet). The geographic range for this species is from 40°N to 35°S. There are seasonal variations and in general, spearfish are distributed mostly in the offshore area while sailfish are more coastal and hence the sailfish proportion is much higher in the coastal waters (SCRS 2007).

Spearfish spawn from November to May and females are generally 17 – 19 kg (37.4 – 41.8 lb) and 160 – 170 cm (63 – 66 inches) at first maturity. These fish are unique among istiophorids in that they are winter spawners. Larval spearfish have been identified from the vicinity of the Mid-Atlantic ridge from December to February, indicating that this species spawns in offshore waters (de Sylva and Breder, 1997).

Common prey items include fish and squid. Specifically, Junior et al. (2004) observed 37 stomachs and found that oceanic pomfret and squid comprised 63 percent of the items identified in stomachs. Most prey items were between 1 – 10 cm (0.39 – 3.9 inches) in length, with a mean length of 6.7 cm (2.63 inches). The maximum number of prey items found in any individual stomach was 33.

Similar to sailfish, spearfish are caught incidentally or as bycatch in offshore longline fisheries by many nations. There are also artisanal fisheries that take place in the Caribbean Sea and in the Gulf of Guinea. Directed recreational fisheries for spearfish are limited due to the fact that the fish are generally located further offshore than other istiophorids. For the western Atlantic stock, annual spearfish catches have averaged about 320 mt (705,479 lb) from 1981 – 2000. The estimated 2000 yield for western Atlantic spearfish was 367 mt (809,096 lb). The reported catches of sailfish/spearfish combined (Task I) for 2007 were 920 mt (2,028,252 lb) and 1,060 mt (2,336,899 lb) for the west and east Atlantic, respectively. Recent analyses did not provide any information on the MSY or other stock benchmarks for the 'spearfish only' stock. The 2001 – 2003 reported catch of unclassified billfish was 12 percent of the reported catch for all billfish and, for some fisheries, this proportion is much greater. This is a problem for species like spearfish for which there is already a paucity of data (SCRS, 2004).

2.4.4.2 Stock Status and Outlook

Initial stock assessments conducted on spearfish aggregated these landings with sailfish. As mentioned in the sailfish section (Section 2.4.3), the 2001 assessment included a 'sailfish only' assessment in addition to an aggregate sailfish/spearfish assessment. There is no new information available to change the outlook presented in the 2001 assessment. It is still unknown if the western or eastern spearfish stocks are undergoing overfishing or if the stocks are currently overfished. Because no assessment has been conducted since 2001, no relative abundance indices are available after 2000. The SCRS has recommended that Contracting Parties consider methods to reduce fishing mortality rates, overall, and that western Atlantic catches should not be increased above current levels. The SCRS recommends evaluating new methods to split sailfish and spearfish indices of abundance (SCRS, 2004). Spearfish catch levels through 2000 are shown in Figure 2.19.

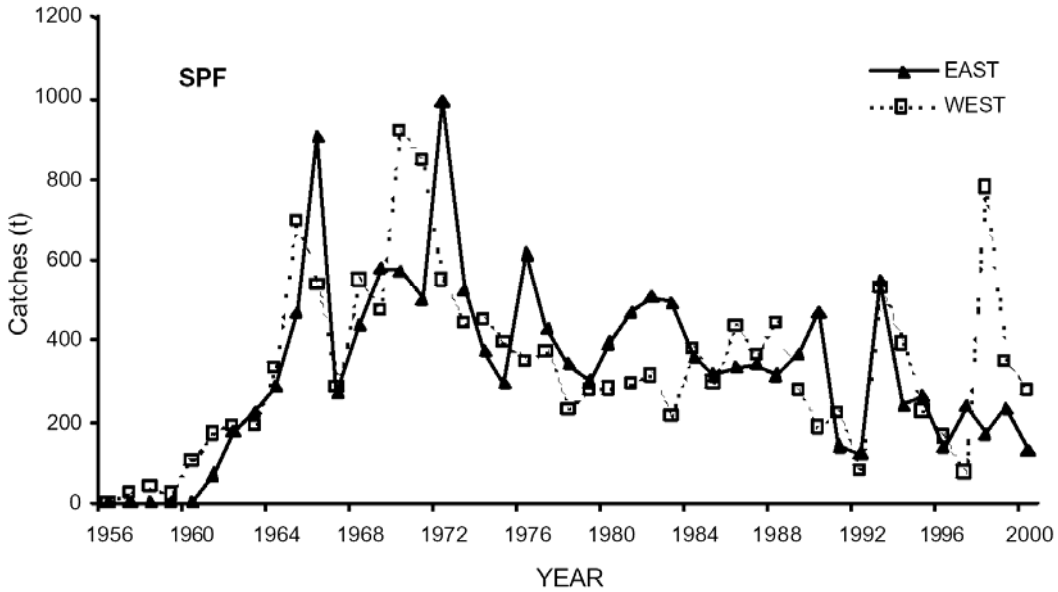

Figure 2.19 **Estimated spearfish "only" catches in the Atlantic based on the new procedure for splitting combined sailfish and spearfish catches from 1956-2000. Weights are in metric tons, whole weight.** Source: SCRS, 2005.

2.4.4.3 Effects of Regulations

ICCAT Management Recommendations

No ICCAT management regulations are currently in effect for Atlantic longbill spearfish. Management recommendations are similar to those listed for sailfish, including: consider methods for Contracting Parties to reduce mortality rates, encourage Contracting Parties to provide complete reporting of spearfish catches, evaluate new methods to split the sailfish and spearfish catch/index abundance, and assess sailfish independently of spearfish.

Domestic Regulations

Please see the discussion of domestic regulations contained in Section 2.4.1.3 above.

Recent and Ongoing Research

Please see the discussion of recent and ongoing research contained in Section 2.4.1.3 above.

2.5 Atlantic Sharks

2.5.1 Life History and 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 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 (*Carcharhinus leucas)* (Branstetter and Stiles, 1987), do not reach maturity until 12 to 18 years of age. Various factors determine this low reproductive rate: slow growth, late sexual maturity, one to two-year reproductive cycles, a small number of young per brood, and specific requirements for nursery areas. These biological factors leave many species of sharks vulnerable to overfishing.

There is extreme diversity among the approximately 350 species of sharks, ranging from tiny pygmy sharks of only 20 cm (7.8 in) in length to the giant whale sharks, over 12 meters (39 feet) in length. There are fast-moving, streamlined species such as mako (*Isurus* spp.*)* and thresher sharks (*Alopias* spp.), and sharks with flattened, ray-like bodies, such as angel sharks (*Squatina dumerili)*. The most commonly known sharks are large apex predators including the white (*Carcharadon carcharias*), mako, tiger (*Galeocerdo cuvier*), bull, and great hammerhead (*Sphyrna mokarran*). Some shark species reproduce by laying eggs, while others nourish their embryos through a placenta. Despite their diversity in size, feeding habits, behavior and reproduction, many of these adaptations have contributed greatly to the evolutionary success of sharks.

The most significant reproductive adaptations of sharks are internal fertilization and the production of fully developed young or "pups." These pups are large at birth, effectively reducing the number of potential predators and enhancing their chances of survival. During mating, the male shark inseminates the female with copulatory organs, known as claspers that develop on the pelvic fins. In most species, the embryos spend their entire developmental period protected within their mother's body, although some species lay eggs. The number of young

produced by most shark species in each litter is small, usually ranging from 2 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 (*Carcharhinus isodon)*, bull, lemon, and Atlantic 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 (*Squalus acanthias*) also occur along the U.S. coast, however management for this species is under the authority of the ASMFC as well as the New England and Mid-Atlantic Fishery Management Councils. Deep-water sharks and smooth dogfish 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) LCS, (2) SCS, (3) pelagic sharks, and (4) prohibited species (Table 2.17). As a result of Amendment 2 to the HMS FMP, sandbar sharks can only be taken commercially within a shark research fishery. In addition, sandbar and silky sharks can not be retained by recreational anglers.

Table 2.17 Common names of shark species included within the four species management units under the purview of the HMS management division.

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, sandtiger, 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

*sandbar sharks can only be retained commercially within a shark research fishery, and cannot be retained by recreational anglers

**silky sharks cannot be retained by recreational anglers

2.5.2 Stock Status and Outlook

NMFS is responsible for conducting stock assessments for the LCS and SCS complexes (Cortés, 2002; Cortés *et al*., 2002). The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has recently conducted assessments of three pelagic shark species. ICCAT's SCRS conducted stocks assessments for blue sharks (*Prionance glauca*) and shortfin mako (*Isurus oxyrinchus*) in 2008. Ecological risk assessements were also conducted by the SCRS for nine additional priority species of pelagic elasmobranchs. (Isurus paucus; Alopias superciliosus; Alopias vulpinus; Carcharhinus longimanus; C.falciformis; Lamna nasus; Sphyrna lewini; Sphyrna zygaena; and Pteroplatytrygon violacea). Stock assessments were conducted for the LCS complex, sandbar sharks (*Carcharhinus plumbeus*), and blacktip sharks in 2006 (NMFS, 2006a), and the SCS stock assessment was finalized during the summer of 2007 (NMFS, 2007a), which also assessed finetooth, Atlantic sharpnose, blacknose (*Carcharhinus acronotus*), and bonnethead sharks (*Sphyrna tiburo*) separately. NMFS also recently released a stock assessment for dusky sharks (*Carcharhinus obscurus)* (May 25, 2006, 71 FR 30123) (Cortés *et al*., 2006). Summaries of recent stock assessments and reports on several species of pelagic sharks (blue sharks, shortfin mako sharks, and porbeagle sharks (*Lamna nasus*) by COSEWIC and ICCAT are also included in this section.

A number of new shark stock assessments were conducted in 2005 - 2007 (see descriptions below) (Gibson and Campana, 2005; Cortés *et al*., 2006; NMFS, 2006a; NMFS, 2007a). Based on those assessments, NMFS has determined that sandbar, dusky, and porbeagle sharks are overfished; sandbar and dusky sharks have overfishing occurring; the status of the Atlantic blacktip shark population and the LCS complex is unknown; and the Gulf of Mexico blacktip shark population is healthy (November 7, 2006, 71 FR 65086). Based on the 2005 and

2006 stock assessments and these stock status determinations, NMFS has developed new management measures to rebuild sandbar, dusky, and porbeagle sharks while providing an opportunity for the sustainable harvest of blacktip and other sharks in the Gulf of Mexico. In addition, based on the 2007 SCS assessment, NMFS has determined that blacknose sharks are overfished with overfishing occurring (May 7, 2008, 73 FR 25665). NMFS is currently working on a new amendment to rebuild blacknose sharks and end overfishing.

2.5.3 Large Coastal Sharks

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

The latest 2005/2006 stock assessments for LCS in the Gulf of Mexico and Atlantic Ocean became available on July 24, 2006 (71 FR 41774). Unlike past assessments, the 2005/2006 LCS stock assessment determined that it is inappropriate to assess the LCS complex as a whole due to the variation in life history parameters, different intrinsic rates of increase, and different catch and abundance data for all species included in the LCS complex. Based on these results, NMFS changed the status of the LCS complex from overfished to unknown and is continuing to examine viable options to assess shark populations (November 7, 2006; 71 FR 65086) (Table 2.18).

Sandbar Sharks

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

Blacktip Sharks

The 2005/2006 stock assessment assessed blacktip sharks for the first time as two separate populations: a Gulf of Mexico and Atlantic population. The results indicate that the Gulf of Mexico stock is not overfished and overfishing is not taking place (November 7, 2006,

71 FR 65086), but the assessment Panel did not accept the absolute estimates of the stock status. The three abundance indices believed to be most representative of the stock were consistent with each other, suggesting that stock abundance has been increasing over a period of declining catch during the past 10 years. Based on life history characteristics, blacktip sharks are a relatively productive shark species, and a combination of these characteristics and recent increases in the most representative abundance indices, suggested that the blacktip stock is relatively healthy. There was no scientific basis, however, to consider increasing the catch or quota.

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

Dusky Sharks

The first dusky-specific shark assessment was released on May 25, 2006 (71 FR 30123) (Cortés *et al*., 2006). The 2006 dusky shark stock assessment included data through 2003 and indicated that dusky sharks are overfished (B_{2003}/B_{MSY} = 0.15 – 0.47) with overfishing occurring (F_{2004}/F_{MSY} = 1.68 – 1,810). The assessment concluded 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).

2.5.4 Small Coastal Sharks

On November 13, 2007, NMFS completed a SCS stock assessment following the SEDAR process (72 FR 63888). The SCS Data Workshop was held February 5-9, 2007 (December 7, 2006, 71 FR 70965). The SCS Assessment workshop was held May 7-11, 2007 (April 19, 2007, 72 FR 19701), and the SCS Review workshop was held on August 6-10, 2007 (July 19, 2007, 72 FR 39606). The assessment reviewed data and models for the SCS complex and for each individual species within the SCS complex, per recommendations in previous assessments. This allowed individual analyses, discussions, and stock status determinations for five separate assessments: 1) SCS complex, 2) Atlantic sharpnose shark, 3) bonnethead shark, 4) blacknose shark, and 5) finetooth sharks. These assessments are included in one report as many of the indices, data, and issues overlap among assessments. The Review Panel found that the data and methods used were appropriate and the best available; however, the panel recommended using the individual assessments for each species rather than the assessment on the SCS complex as a whole. The Review Panel also endorsed recommendations for future research contained in the Data Assessment workshop reports, added additional recommendations, and provided comments on the SEDAR process to consider in the future. Based on these assessments, NMFS determined that blacknose sharks are overfished with overfishing occurring; however, Atlantic sharpnose, bonnethead, and finetooth sharks are not overfished and overfishing is not occurring (May 7, 2008, 73 FR 25665) (Table 2.19).

SCS complex

According to the 2007 the SCS stock assessment, the SCS complex is not overfished and overfishing is not taking place (May 7, 2008, 73 FR 25665). The peer reviewed assessment provides an update from the 2002 stock assessment on the status of SCS stocks and projects future abundance under a variety of catch levels in the U.S. Atlantic Ocean, Gulf of Mexico, and Caribbean Sea. Because the species were individually assessed, the peer reviewers recommended using species-specific results rather than on the aggregrated SCS complex results. As a result of this recommendation, and because the stock assessment covered all SCS species, NMFS will no longer provide status updates or determinations on the SCS complex as a whole.

Atlantic sharponse

The 2002 SCS stock assessment found that Atlantic sharpnose sharks were not overfished and overfishing was not occurring. The 2007 assessment for Atlantic sharpnose sharks also indicated that the stock is not overfished ($SSF_{2005}/SSF_{MSY} = 1.47$) and that no overfishing is occurring ($F_{2005} / F_{MSY} = 0.74$) (Table 2.19). Based on these results, NMFS has determined that the Atlantic sharpnose sharks are not overfished with no overfishing occurring (May 7, 2008, 73 FR 25665). However, because estimates of fishing mortality from the assessment indicate that fishing mortality is close to, but presently below, F_{MSY} (*i.e.*, overfishing is not occurring), the peer reviewers suggest setting a threshold for fishing mortality to keep it below the F_{MSY} threshold to prevent overfishing in the future.

Bonnethead Sharks

Based on the bonnethead stock assessment, the peer reviewers determined that bonnethead sharks are not overfished ($SSF_{2005}/SSF_{MSY} = 1.13$). In addition, the estimate of fishing mortality rate in 2005 was less than FMSY, ($F_{2005} / F_{MSY} = 0.61$) (Table 2.19), thus overfishing was not occurring. As a result, NMFS has determined that bonnethead sharks are not overfished and no overfishing is occurring (May 7, 2008, 73 FR 25665). In addition, the assessment showed that there had been years of overfishing, and the main contributor of population mortality is the recreational fleet and the commercial gillnet fleet.

Blacknose Sharks

The 2002 assesment found blacknose sharks were not overfished and overfishing was not occurring. However, the 2007 assessment for blacknose shark indicates that spawning stock fecundity (SSF; *i.e.*, the number of reproductive-age individuals in a population) in 2005 and during 2001-2005 was smaller than SSF_{MSY} ($SSF_{2005}/SSF_{MSY} = 0.48$). Therefore, NMFS has determined that blacknose sharks are overfished. In addition, the estimate of fishing mortality in 2005 and the average from 2001-2005 was greater than $F_{MSY,}$ and the ratio was substantially greater than 1 in both cases ($F_{2005} / F_{MSY} = 3.77$). Based on these results, NMFS has determined that blacknose sharks are experiencing overfishing (May 7, 2008, 73 FR 25665). The assessment recommended a rebuilding plan with 70 percent probability of recovering to SSF_{MSY} by 2019. This recommended rebuilding time is 11 years from 2009. A constant TAC of 19,200

individuals would lead to rebuilding with 70 percent probability by 2027. The constant TAC also allows for rebuilding with 50 percent confidence by 2024. The assessment found that the majority of the mortality for blacknose sharks was occurring as bycatch in the Gulf of Mexico shrimp trawl fishery. In addition, the majority of mortality was occurring on juvenile and neonate blacknose sharks. Blacknose sharks mature around 91 cm total length and around 4.5 years of age.

Finetooth Sharks

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

Table 2.18 **Summary Table of Biomass and Fishing Mortality for Large Coastal Sharks (LCS).** Source: NMFS, 2006a.

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.

Table 2.19 Summary Table of Biomass and Fishing Mortality for Small Coastal Sharks (SCS) Source: NMFS, 2007a.

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

2.5.5 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 of 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 in 2008. All SCRS stock assessments can be found at http://www.iccat.es/assess.htm.

2008 ICCAT Shark Stock Assessment

In response to the Supplementary Recommendation by ICCAT Concerning the Conservation of Sharks caught in Association with Fisheries Managed by ICCAT [Rec. 06-10], an updated assessment of the stocks of blue shark (*Prionace glauca*) and shortfin mako (*Isurus oxyrinchus*) was conducted in 2008. Ecological risk assessments (ERA) were also conducted for nine additional priority species of pelagic elasmobranchs, for which available data are very limited (*Isurus paucus; Alopias superciliosus; Alopias vulpinus; Carcharhinus longimanus; C.falciformis; Lamna nasus; Sphyrna lewini; Sphyrna zygaena;* and *Pteroplatytrygon violacea*).

SCRS concluded that for both North and South Atlantic blue shark stocks, although the results are highly uncertain, biomass is believed to be above the biomass that would support MSY and current harvest levels below FMSY. Results from all models used were conditional on the assumptions made (*e.g*., estimates of historical catches and effort, the relationship between catch rates and abundance, the initial state of the stock in the 1950s, and various life-history parameters), and a full evaluation of the sensitivity of results to these assumptions was not possible during the assessment. Nonetheless, as for the 2004 stock assessment, the weight of available evidence does not support hypotheses that fishing has yet resulted in depletion to levels below the Convention objective (SCRS 2004).

Estimates of stock status for the North Atlantic shortfin mako obtained with the different modeling approaches were much more variable than for blue shark. For the North Atlantic, most model outcomes indicated stock depletion to about 50% of biomass estimated for the 1950s. Some model outcomes indicated that the stock biomass was near or below the biomass that would support MSY with current harvest levels above FMSY, whereas others estimated considerably lower levels of depletion and no overfishing. In light of the biological information that indicates the point at which BMSY is reached with respect of the carrying capacity which occurs at levels higher than for blue sharks and many teleost stocks. There is a non-negligible probability that the North Atlantic shortfin mako stock could be below the biomass that could support MSY. A similar conclusion was reached by the Committee in 2004, and recent biological data show decreased productivity for this species. Only one modeling approach could be applied to the South Atlantic shortfin mako stock, which resulted in an estimate of unfished biomass which was biologically implausible, and thus the Committee can draw no conclusions about the status of the South stock.

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

COSEWIC Stock Assessment on Porbeagle

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

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

assessment on porbeagle sharks. NMFS has reviewed the Canadian stock assessment and deems it to be the best available science and appropriate to use for U.S. domestic management purposes (NMFS, 2006b). 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) (Gibson and Campana, 2005). However, the Canadian assessment indicates that overfishing is not occurring (F_{2004}/F_{MSY} = 0.83) (Gibson and Campana, 2005). Based on these results, NMFS declared the status of porbeagle sharks as overfished, but overfishing is not occurring (71 FR 65086).

2.5.5.1 Effects of Regulations

ICCAT Management Recommendations

Internationally, sharks management measures are established through 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 included, among other measures: reporting of shark catch data by Contracting Parties, a ban on shark finning, a request for Contracting Parties to live-release sharks that are caught incidentally, a review of management alternatives from the 2004 assessment on blue and shortfin mako sharks, and a commitment to conduct another stock assessment of selected pelagic shark species no later than 2007. In 2005, additional measures pertaining to pelagic sharks were added to the 2004 ICCAT recommendation. Measures included a requirement for Contracting Parties that have not yet implemented the 2004 recommendation, to reduce shortfin mako mortality, and annually report on their efforts to the Commission.

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

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

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

Domestic Regulations

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

The regulations governing the recreational and commercial shark fisheries allow opportunities for participants to pursue sharks for leisure, subsistence, and/or commercial gain while maintaining compliance with statutes that include, but are not limited to, the MSA, ESA, MMPA, and NEPA. These regulations seek to minimize bycatch of non-target, prohibited shark species, and protected resources by a variety of measures, including, but not limited to: mandating the use of corrodible, non-stainless steel hooks; requiring possession of handling and release equipment for protected resources; conducting gillnet checks every two hours; mandatory observer coverage for commercial fisheries (if selected); limits on the deployment and operation of authorized gears; and, maintaining 19 species of shark on the prohibited species list (possession not authorized). Rebuilding overfished stocks is another objective of shark fishery regulations, and is accomplished through numerous measures, including, but not limited to: regional fishing quotas based on MSY; regional fishing seasons; commercial trip limits (4,000 lbs dw for LCS); recreational bag limits (1 shark/vessel/day for all authorized species except Atlantic sharpnose and bonnethead sharks (1 shark/person/day); and, recreational minimum size limits (>54" FL for all authorized species except Atlantic sharpnose and bonnethead sharks). Controlling fishing effort is accomplished by the requirement to possess a LAP for commercial shark fisheries and upgrading restrictions for transferred permits. Reducing fishing mortality of prohibited dusky sharks and juvenile sandbar sharks 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. In Amendment 1 to the 1999 FMP, NMFS revised the rebuilding timeframe for LCS to 26 years from 2004, and implemented several new regulatory changes. Management measures enacted in the amendment included, among other things: using MSY as a basis for setting commercial quotas; eliminating the commercial minimum size restrictions; implementing a commercial trip limit for LCS and SCS; imposing gear restrictions to reduce bycatch; and implementing a time/area closure off the coast of North Carolina effective January 1, 2005. Annual quotas established under Amendment 1 to the 1999 FMP were as follows: 1,017 metric tons (mt) dressed weight (dw) (2.24 million lbs dw) for LCS; 454 mt dw per year for SCS; 273 mt dw for blue sharks, 92 mt dw for porbeagle sharks, and 488 mt dw for pelagic sharks other than porbeagle and blue sharks.

An updated LCS stock assessment became available in 2006 and data workshops for an updated SCS stock assessment began in early 2007. Based on the 2006 LCS stock assessment, NMFS implememented Amendment 2 to the 2006 Consolidated HMS FMP to rebuild overfished sandbar, dusky, and porbeagle shark stocks and to end overfishing. The final rule for Amendment 2 published on June 24, 2008 (73 FR 35778) with a correction published on July 15, 2008 (73 FR 40658). The final rule became effective on July 24, 2008. In the final rule, NMFS focused on additional shark management measures. These included, but were not limited to, removing sandbar sharks from the LCS complex and establishing a non-sandbar LCS complex; setting new annual quotas for sandbar sharks (87.9 mt dw), non-sandbar LCS (Atlantic: 187.7 mt dw; Gulf of Mexico: 390.5 mt dw), and porbeagle sharks (1.7 mt dw); maintaining the annual SCS quota (454 mt dw), pelagic sharks quota (273 mt dw for blue sharks), and quota for pelagic sharks other than porbeagle and blue sharks (488 mt dw); establishing a sandbar shark research fishery with prohibition on the retention of sandbar sharks outside the shark research fishery; creating one region for SCS, sandbar, and pelagic sharks and two regions for non-sandbar LCS (Gulf of Mexico and Atlantic regions); creating eight marine protected areas as requested by the South Atlantic Fishery Management Council to prohibit the use of bottom longline gear in those areas; establishing new non-sandbar LCS retention limits for directed and incidental shark permit holders (33 non-sandbar LCS per vessel per trip for directed permit holders and 3 non-sandbar LCS per vessel per trip for incidental permit holders); establishing a fishing year for sharks that begins on January 1 of each year; limiting the carry over of underharvest to 50 percent of the base quota for shark stocks whose status are healthy and prohibiting the carry over of underharvest for shark stocks whose status are overfished, experiencing overfishing, or are determined to be unknown; deducting overharvests from the following fishing year, or multiple years (up to five year maximum), based on the level of overharvest; requiring HMS dealer reports to be received by NMFS within 10 days of the end of a reporting period; requiring sharks to landed with fins on; and, proportioning unclassified sharks out among each shark species/complex based on observer and dealer reports. Regulations are subject to change based on stock assessments, international obligations, litigation, and public sentiment.

2.5.5.2 Recent and Ongoing Research

Northeast Fisheries Science Center

Fishery Independent Survey for Coastal Sharks

The biannual fishery-independent survey of Atlantic LCS and SCS 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 age validation. Night and dusky sharks were prepared with cross 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.

Using the standard age and growth techniques, the Narragansett Laboratory is currently processing samples from mako and thresher sharks obtained from sportfishing tournaments, research cruises, and cooperating scientists and commercial fishermen in the Northeast. Additionally, a comprehensive validation study using bomb carbon techniques is being undertaken in cooperation with Dr. Greg Cailliet, Lisa Kerr, and graduate student Daniele Ardizzone of the Moss Landing Marine Laboratories. This study will attempt to validate the periodicity of band formation in the shortfin mako for both the Atlantic and Pacific Oceans, and perhaps elsewhere in the world.

Biology of the Thresher Shark

Life history studies of the thresher shark (*Alopias vulpinus*) continue. Reproductive organs from over 200 thresher sharks, ranging in size from 62 to 263 cm fork length (FL), caught

in the western North Atlantic Ocean are being examined to determine size at maturity and reproductive cycle. Preliminary evidence indicates that maturity in males is best indicated by an inflection in the relationship of clasper length to fork length when combined with clasper calcification. In females, all reproductive organ measurements related to body length show a strong inflection around the size of maturity. As in other lamnids, young are nourished through oophagy. Histological processing of a variety of reproductive organs is currently underway and will provide more detailed information on reproductive condition.

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 and Southeast Fisheries Science Centers, NMFS has updated EFH maps for sharks and other HMS using information from observer and tagging databases. NMFS is currently working on a new EFH amendment. 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 EFH for shark species in U.S. Atlantic and Gulf of Mexico waters. Research is being conducted on shortfin mako migration 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. Data from tagging programs, such as the NMFS CSTP, provide valuable information on migration and the extent of fish movements. The need for international cooperation in such work is underscored by the fact that many shark species have wide ranging distributions, frequently traverse national boundaries, and are exploited by multinational fisheries. The CSTP is also an important means to increase biological understanding of sharks and to obtain information for rational resource management. The tagging of sharks (and other aquatic animals) provides information on stock identity,

movements and migration (including rates and routes), abundance, age and growth (including verification/validation of age-determination methods), mortality, and behavior.

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.

Currently, 290 shortfin mako shark samples are being reprocessed and new counts generated using the standard age and growth techniques of the Narragansett Laboratory. To date, the total number of sharks sampled is 188, and 118 of these sharks had prey in their stomachs. The Narrgansett laboratory counted 235 prey items, 168 of which were bluefish. Some of the other prey items included mackerel, menhaden, tuna, triggerfish, and both long and short finned squid. In stomachs containing bluefish, 1 or 2 prey fish was the most common. In the first year of this study, bluefish made up 94.1 percent of the overall diet of inshore sharks by volume, compared to previous studies 20 years ago where bluefish made up 85 percent of the weight. Although this comparison is preliminary, it could elude to increased predation by makos on bluefish compared to 20 years ago.

Two shortfin mako sharks were tagged with pop-up archival transmitting tags off Martha's Vineyard and had moved south off the Delaware coastline when the transmitters popped up and began transmitting data. These data represent the first long-term and detailed record of the movements of mako sharks in the Atlantic. Currently, three more transmitters are scheduled to be deployed on mako sharks.

Blacktip Shark Migrations

Analysis is ongoing of movements of the blacktip shark (*Carcharhinus limbatu*s) 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 manages and coordinates this project, using researchers in major coastal Atlantic and Gulf of Mexico states from Massachusetts to Texas 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. The COASTSPAN participants published a special volume of an American Fisheries Society publication entitled Shark Nursery Grounds of the Gulf of Mexico and the East Coast Waters of the United States in December, 2007 (McCandless et al., 2007).

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*). Over the past four years over 1,150 sandbar sharks have been sampled, with approximately 55 percent of those sharks containing food. Preliminary analysis indicates a diet dominated by teleosts, but strong trends in ontogeny are evident. Gastric evacuation data has been collected, but only very preliminary analysis has been conducted.

However, gastric evacuation estimates for the digestion of menhaden appear to be shorter than those reported previously.

During this same period, over 350 dogfish stomachs have been sampled with nearly all of them containing food. The diet is composed of predominately crustaceans with some bivalves, annelids, mollusks, and fish. Some ontogeny is evident with bivalves, shrimp, annelids and other small invertebrates of importance to smaller sharks, with more and larger crabs becoming important to large juveniles and adults, which also begin to consume small quantities of fish.

Preliminary work has begun on a dietary and habitat study of smooth dogfish in coastal New England waters. This study will characterize the diet of the species in these waters, especially in relation to predation on large commercially important crustaceans. Habitat, geographic, seasonal, and ontogenetic aspects of the diet will be examined in detail, and related to previous research in other locales. 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.

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Southeast Fisheries Science Center

<u>Stock Assessments of LCS, SCS, and Prohibited Sharks</u>

The 2005/2006 assessment for the LCS Complex was run according to the SEDAR process. The SEDAR 11 Stock Assessment Report (NMFS, 2006a) compiles the new data used in the assessments, the report from the Assessment Workshop, and the final report by the peer reviewers (the Consensus Summary Report). This Stock Assessment Report constitutes the best

available science. The results of the assessment were released on July 24, 2006 (71 FR 41774). A stock assessment of dusky shark, a prohibited species and candidate for listing under the ESA, was also almost completed and was to be released on May 25, 2006 (71 FR 30123).

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

Update on Catches of Atlantic Sharks

An update on catches of large and small coastal and pelagic sharks in U.S. Atlantic, Gulf of Mexico, and Caribbean waters was generated in October 2006 (Cortés and Neer, 2005; LCS05/06-DW-16) and formed the basis of the catch scenarios included in the SEDAR Data Workshop report described above. Time series of commercial and recreational landings and discard estimates from several sources were compiled for the LCS complex and sandbar and blacktip sharks. In addition, recent species-specific commercial and recreational landings were provided for sharks in the large coastal, small coastal, and pelagic groups. Species-specific information on the geographical distribution of commercial landings by gear type and geographical distribution of the recreational catches was also provided. Trends in length-frequency distributions and average weights and lengths of selected species reported from three separate recreational surveys and in the directed shark bottom-longline observer program were also included. Another update on catches of Atlantic sharks was generated in 2007 for the SCS assessment (Cortés and Neer, 2007; SEDAR 13-DW-15). This document presented updated commercial and recreational landings of Atlantic SCS up to 2005. Species-specific information on the geographical distribution of commercial landings and recreational catches was presented along with the different gear types used in the commercial fisheries. Length-frequency information and average weights of the catches in three separate recreational surveys and in the directed shark bottom-longline observer program were also included.

Observer Programs: Shark Longline Program

From 1994 to 2004, the southeastern United States commercial shark BLL fishery was monitored by the University of Florida Commercial Shark Fishery Observer Program. In 2005, the responsibilities of the program were moved to the NOAA Fisheries Service Panama City Laboratory Shark Population Assessment Group in Panama City, FL. This program is designed to meet the intent of the ESA and the FMP for HMS. It was created to obtain better data on catch, bycatch, and discards in the shark BLL fishery. All observers are required to attend a 1-week safety training and species identification course prior to being dispatched to the fishery. While onboard the vessel, the observer records information on gear characteristics and all species caught, condition of the catch (*e.g.*, alive, dead, damaged, or unknown), and the final disposition of the catch (*e.g.*, kept, released, *etc.*). As of 2007, the target coverage level is 4-6 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 MMPA, ESA, and the 1999 revised FMP for HMS. It was also created to obtain better data on catch, bycatch, and discards in the shark fishery. The ALWTRP and the BiOp issued under Section 7 of ESA mandate 100 percent observer coverage during the right whale calving season (15 November - 1 April). Outside the right whale calving season (1 April - 14 November), observer coverage equivalent to 38 percent of all trips is maintained. Based on June 25, 2007 rule (72 FR 34632) shark gillnet vessels fishing between 29° 00' N and 26° 46.5' N have certain requirements as outlined 50 CFR § 229.32 from December 1 through March 31 of each year. These include vessel operators contacting the SEFSC Panama City Laboratory at least 48 hours prior to departure of a fishing trip in order to arrange for an observer. In addition, a recent rule (October 5, 2007, 72 FR 57104) amends restriction in the Southeast U.S. Monitoring Area from December 1 through March 31. In that area the 100 percent observer coverage has been replaced with VMS requirements found in 50 CFR 635.69. Similar to the shark longline observer program, all observers are required to attend a 1-week safety training and species identification course and while onboard the vessel record information on gear characteristics and all species caught, condition of the catch and the final disposition of the catch.

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

Keystone species, such as sharks, can play a central role in the structure and function of marine communities. There are conflicting views surrounding the ecological interactions between sharks and fisheries. One view suggests that removals of keystone species are thought to cause a cascading trophic effect within the remaining community. These effects may involve changes in species composition among the prey or changes in the preferred prey of the predator. An alternate view has been suggested that the high diversity of oceanic systems may oppose strong “top-down” effects. In light of the recent revelations on the reductions of higher trophic levels species and fishing down food webs, an improved understanding of the role of keystone predators in the Gulf of Mexico would be useful in evaluating the impacts of fishing on the marine ecosystem. An Ecopath with Ecosim model has been developed to model the Gulf of Mexico ecosystem dynamics (Carlson, 2007). Hypotheses regarding the depletion of apex predators, and their impact on predation mortality of major prey groups were examined. Further, hypotheses regarding the role of complementary niches among sharks were explored.

Elasmobranch Feeding Ecology and Shark Diet Database

Because there is little quantitative species-specific data on diet, competition, predator-prey interactions, and habitat requirements of sharks, several studies are currently under way describing the diet and foraging ecology, habitat use, and predator–prey interactions of elasmobranchs in various communities. Atlantic angel sharks (*Squatina dumerili*) have been collected for stomach content analysis from a trawl fishery in northeastern Florida since 2004.

Evidence suggests angel sharks consumed mostly teleost fishes, with Atlantic croaker (*Micropogonias undulatus*) being the most common fish species (Baremore *et al*., 2006). The diet of the roundel skate *Raja texana* from the northern Gulf of Mexico is also being examined (Bethea and Hale, 2006). A database containing information on quantitative 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 EFH requirements for sharks. The SEFSC Panama City Shark Population Assessment Group also initiated a juvenile shark abundance index survey in 1996. The index is based on random, depth-stratified gillnet sets conducted throughout coastal bays and estuaries in northwest Florida monthly from April to October. The species targeted for the index of abundance are juvenile sharks in the large and small coastal management groups. This index has been utilized as an input to various stock assessment models.

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 *et al*., 2006) 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.

Life History Studies of Elasmobranchs

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

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 EFH.

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 SCS across their known ranges to develop a time series for trend analysis. The surveys were designed to satisfy five important assessment principles: stockwide survey, synopticity, well-defined universe, controlling biases, and useful precision. The BLL surveys are the only long-term, nearly stock-wide, fishery-independent surveys of Western North Atlantic Ocean sharks conducted in U.S. and neighboring waters. Ancillary objectives were to collect biological and environmental data, and to tag-and-release sharks. Starting in 1997 and under the auspices of the MEXUS Gulf Program, 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

Shark Research Fishery

Amendment 2 to the Consolidated HMS FMP established a shark research fishery to maintain time series data for stock assessments and to help meet NMFS' shark research objectives. Each year, NMFS determines the research objectives for the upcoming shark

research fishery. The research objectives are developed by a shark board, which is comprised of representatives within NMFS including representatives from the Southeast Fisheries Science Center (SEFSC) Panama City Laboratory, Northeast Fisheries Science Center (NEFSC) Narragansett Laboratory, the Southeast Regional Office of Protected Resources Division (SERO\PRD), and the HMS Management Division. The research objectives of the shark research fishery are primarily based on the research needs identified in shark stock assessments. Many of the research objectives for 2008 and 2009 came from the SEDAR 11, 2005/2006 LCS stock assessment. These objectives were developed with input from non-governmental organizations, industry representatives, fishery managers, and academics present during the stock assessment workshops. In addition, the shark board identified additional needs for tagging studies, collection of genetic material, and controlled bottom longline (BLL) experiments to assess the impact of different hook types.

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3.0 ESSENTIAL FISH HABITAT

On September 19, 2008, NMFS published a Notice of Availability of Draft Amendment 1 to the Consolidated HMS FMP for Essential Fish Habitat (EFH). The purpose of Draft Amendment 1 is to update and revise existing HMS EFH as necessary, consider new Habitat Areas of Particular Concern (HAPCs), analyze fishing and non-fishing impacts on EFH, and consider measures to minimize fishing impacts, as necessary, if any gears are determined to have a negative effect on EFH. The Magnuson-Stevens Act regulations call for a review of all EFH information at least once every five years, and Amendment 1 constitutes the comprehensive review and update of EFH for all HMS. As described in the Draft Amendment 1 to the Consolidated HMS FMP, an internet-based mapping program (HMS EFH Evaluation Tool) is being used to demonstrate to the public proposed changes to EFH boundaries. Throughout the comment period, the site will also provide all of the original 1999 EFH boundaries for comparative purposes. Copies of the Draft EFH Amendment are available at http://www.nmfs.noaa.gov/sfa/hms/EFH.

Management History

NMFS began the comprehensive review of all HMS EFH in the Consolidated HMS FMP, which was released on July 14, 2006 (71 FR 40096). In that document, NMFS provided new information collected since the EFH boundaries were established in 1999. NMFS did not modify or update any of the existing EFH identifications, descriptions, or boundaries in the Consolidated HMS FMP or propose any new measures to minimize impacts from fishing gear. Rather, NMFS presented new EFH information and data collected since 1999, including an evaluation of fishing gear impacts, and requested public comment on any additional data or information that needed to be included in the review. The purpose of the EFH review was to gather any new information and determine whether modifications to existing EFH descriptions and delineations were warranted. While NMFS has presented new information relative to HMS EFH in the annual Stock Assessment and Fishery Evaluation (SAFE) reports in previous years, the Consolidated HMS FMP included the first comprehensive review of all new information related to EFH that had been completed since 1999.

On November 7, 2006 (71 FR 65088), NMFS published a Notice of Intent to prepare an Environmental Impact Statement (EIS) to examine alternatives for updating existing HMS Essential Fish Habitat (EFH), consider additional Habitat Areas of Particular Concern (HAPCs), analyze fishing gear impacts, and if necessary, identify ways to avoid or minimize, to the extent practicable, adverse fishing impacts on EFH consistent with the Magnuson-Stevens Act and other relevant Federal laws. At that time, NMFS requested new information not previously considered in the Consolidated HMS FMP, comments on potential HAPCs, and information regarding potential fishing and non-fishing impacts that may adversely affect EFH.

NMFS made available a Pre-Draft of Amendment 1 that included a general description of the approaches being considered to update EFH, to consider new HAPCs, and where applicable, to minimize fishing impacts. The Pre-Draft also served to obtain additional information and input from the public and Atlantic HMS Consulting Parties on potential options or alternatives to

consider prior to development of the formal Draft EIS for Amendment 1 to the Consolidated HMS FMP. The Pre-Draft included a summary of the purpose and need for updating and revising EFH boundaries and a general description of the ecological, social, and economic impacts of alternatives that NMFS was considering at that time. A summary of the comments received during the scoping period and on the Pre-Draft are provided in Appendix 1 of Draft Amendment 1.

NMFS solicited comments and advice from Atlantic HMS Consulting Parties on the range of alternatives and whether there were any additional alternatives that should be considered. Additionally, NMFS solicited comments on the impacts described for each of the alternatives. NMFS took into account comments received from the HMS AP and the public on how best to proceed with alternatives to update EFH. NMFS received a number of comments ranging from data considerations, extent of EFH, impacts on EFH, and concerns about HAPCs. Specific comments and responses were included in Appendix 1 of the DEIS. In addition, on March 30, 2007, NMFS received a request from the Tag-A-Giant Foundation (TAG) and the National Coalition for Marine Conservation (NCMC) to consider HAPCs for bluefin tuna spawning areas in the Gulf of Mexico.

As part of the comprehensive review, a search of all new literature and information was undertaken to assess habitat use and ecological roles of HMS EFH. Published and unpublished scientific reports, fishery dependent and independent datasets, and expert and anecdotal information detailing the habitats used by the managed species were evaluated and synthesized for inclusion in the review process in the Consolidated HMS FMP. Ongoing research on the biology, ecology, and early life history of Atlantic HMS and research and publications relating to HMS EFH were described in Chapter 10 of the Consolidated HMS FMP.

Based on the data collected and presented in the Consolidated HMS FMP, NMFS determined that modification to existing EFH for some species and/or life stages may be warranted, but that any changes to EFH, including new HAPCs and potential measures to minimize fishing impacts, should be considered in a separate amendment. NMFS also conducted a comprehensive review of all Federal and non-Federally managed fishing gears that will form the basis for further analysis on gear impacts in this amendment.

In order to consolidate all Atlantic HMS EFH into one document, all EFH text descriptions and maps previously provided in separate documents were combined in the Consolidated HMS FMP. Specifically, all the EFH descriptions and maps from the 1999 FMP for Tunas, Swordfish, and Sharks, Amendment 1 to the Billfish FMP (1999), and Amendment 1 to the FMP for Tunas, Swordfish, and Sharks (2003) were provided in the Consolidated HMS FMP. Maps in the Consolidated HMS FMP also depicted distribution data acquired through the review process and provided an opportunity for public comment on the need for any additional information to be considered. The original EFH descriptions and boundaries from the 1999 FMP, as well as updates from the 2003 FMP Amendment, may be found in Appendix B (Volume III) of the Consolidated HMS FMP. Table 3.1 lists the history of all previous HMS FMPs or FMP Amendments that identified or updated EFH.

Table 3.1 Management history for HMS EFH.

FMP or Amendment	Species for which EFH was identified
1999 FMP for Atlantic Tunas, Swordfish, and Sharks	EFH first identified and described for Atlantic tunas, swordfish and sharks
1999 Amendment 1 to the Billfish FMP	EFH first identified and described for Atlantic billfish
2003 Amendment 1 to the FMP for Atlantic Tunas, Swordfish and Sharks	EFH updated for five shark species (blacktip, sandbar, finetooth, dusky, and nurse sharks)
2006 Consolidated Atlantic HMS FMP	Comprehensive review of EFH for all HMS. EFH for all Atlantic HMS consolidated into one FMP No changes to EFH descriptions or boundaries
2008 Amendment 1 to the Consolidated Atlantic HMS FMP	EFH updated for all Atlantic HMS

4.0 FISHERY DATA UPDATE

In this section, HMS fishery data, with the exception of some data on Atlantic sharks, are analyzed by gear type; Section 4.8 provides a summary of landings by species. While HMS fishermen generally target particular species, the non-selective nature of most fishing gears warrants analysis and management on a gear-by-gear basis. In addition, issues such as bycatch and safety are generally better addressed by gear type. A summary of bycatch, incidental catch, and protected resource interaction statistics can be found in Section 8.0 of this document.

The revised list of authorized fisheries 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 List of Fisheries (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)." Authorized gear types include: swordfish handgear fishery – rod and reel, harpoon, handline, bandit gear, buoy gear; pelagic longline fishery – longline; shark drift gillnet fishery – gillnet; shark bottom longline fishery – longline; shark recreational fishery – rod and reel, handline; tuna purse seine fishery – purse seine; tuna recreational fishery– rod and reel, handline, speargun; tuna handgear fishery – rod and reel, harpoon, handline, bandit gear, greenstick; and Atlantic billfish recreational fishery – rod and reel only.

Due to the nature of SCRS data collection, Table 4.1 depicts a summary of U.S. and international HMS catches by species rather than gear type. International catch levels and U.S. reported catches for HMS, other than sharks, are taken from the 2008 Standing Report of the SCRS (SCRS, 2008). The U.S. percentage of regional and total catch of HMS species is presented (Table 4.1) to provide a basis for comparison of the U.S. catch relative to other nations/entities. Catch of billfish includes both recreational landings and dead discards from commercial fisheries; catch for bluefin tuna includes commercial landings and discards and recreational landings; and swordfish include commercial landings and discards. International catch and landings tables are included for the pelagic longline and purse seine fisheries in Sections 4.1 and 4.2 of this document. At this point, data necessary to assess the U.S. regional and total percentage of international catch levels for Atlantic shark species are unavailable.

Table 4.1 **Calendar Year 2007 U.S. vs International Catch of HMS (mt ww) other than sharks.** Source: SCRS, 2008.

Species	Total International Reported Catch	Region of U.S. Involvement	Total Regional Catch	U.S. Catch	U.S. Percentage of Regional Catch	U.S. Percentage of Total Atlantic Catch
Atlantic Swordfish	27,354* (includes N. & S. Atlantic)	North Atlantic	11,938*	2,666	22.33%	9.75%
		South Atlantic	15,416*	0	0%	
Atlantic Bluefin Tuna	34,030**	West Atlantic	1,632	758	46.44%	2.22%
Atlantic Bigeye Tuna	67,172	Total Atlantic	67,172	522	0.78%	0.78%
Atlantic Yellowfin Tuna	96,580	West Atlantic	22,648	5,529	24.41%	5.72%
Atlantic Albacore Tuna	48,127 (includes N. & S. Atlantic and Mediterranean)	North Atlantic	21,549	532	2.46%	1.11%
		South Atlantic	20,032	0	0.00%	
Atlantic Skipjack Tuna	150,848	West Atlantic	25,443	66	0.26%	0.04%
Atlantic Blue Marlin	2,303	North Atlantic	797	48	6.02%	2.08%
Atlantic White Marlin	302	North Atlantic	142	8	5.56%	2.61%
Atlantic Sailfish	1,980	West Atlantic	920	7	<1%	<1%

* Actual catches are likely higher given significant non-compliance with ICCAT reporting requirements.
** Significant non-compliance with ICCAT reporting requirements affects SCRS from estimating aggregate 2007 eastern Atlantic bluefin tuna catches accurately.

4.1 Pelagic Longline Fishery

4.1.1 Domestic History and Current Management

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

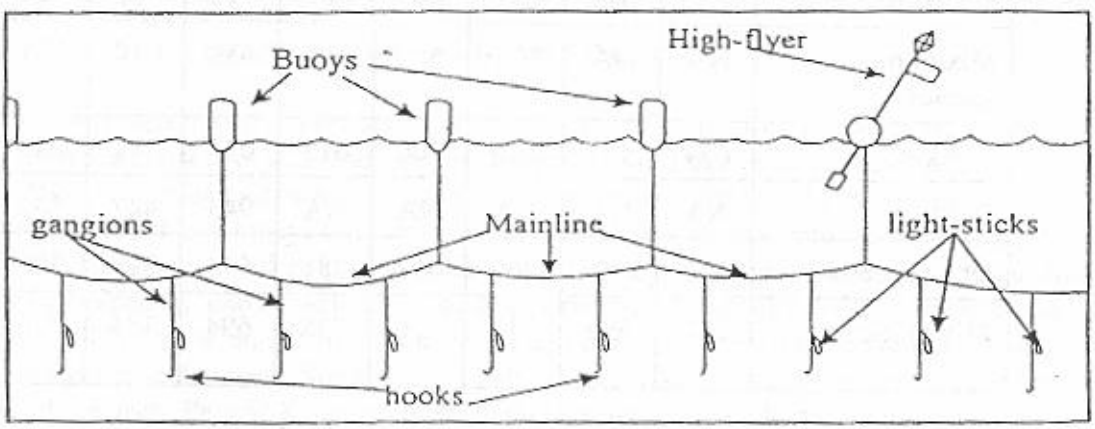


Figure 4.1 Typical U.S. Pelagic Longline Gear. Source: Arocha, 1996.

PLL gear is composed of several parts. 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 (Table 4.2) (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 additional information regarding green-sticks please refer to Section 4.8.

Table 4.2 Average Number of Hooks per PLL Set, 1999-2007. Source: PLL logbook data.

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

Figure 4.2 illustrates basic differences between swordfish (shallow) sets and tuna (deep) longline sets. Swordfish sets are buoyed to the surface, have few hooks between floats, and are relatively shallow. This same type of gear arrangement is used for mixed target sets. Tuna sets use a different type of float placed much further apart. Compared with swordfish sets, tuna sets have more hooks between the floats and the hooks are set much deeper in the water column. It is believed that because of the difference in fishing depth, tuna sets hook fewer turtles than the swordfish sets. In addition, tuna sets use bait only, while swordfish fishing uses a combination of bait and lightsticks. Compared with vessels targeting swordfish or mixed species, vessels specifically targeting tuna are typically smaller and fish different grounds.

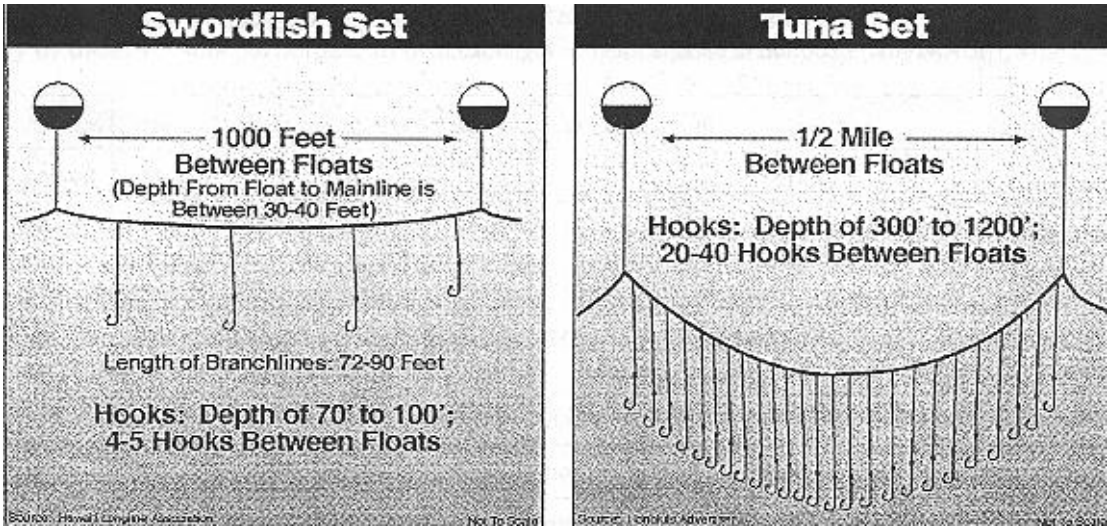


Figure 4.2 Different Pelagic Longline Gear Deployment Techniques. Source: Hawaii Longline Association and Honolulu Advertiser.

NOTE: This figure is only included to show basic differences in pelagic longline gear configuration and to illustrate that this gear may be altered to target different species.

Regional U.S. Pelagic Longline Fisheries Description

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

<u>The Gulf of Mexico Yellowfin Tuna Fishery</u>

Gulf of Mexico vessels primarily target yellowfin tuna year-round; however, a handful of these vessels directly target swordfish, either seasonally or year-round. Longline fishing vessels that target yellowfin tuna in the Gulf of Mexico also catch and sell dolphin, swordfish, other tunas, and sharks. During yellowfin tuna fishing, few swordfish are captured incidentally. Many of these vessels participate in other Gulf of Mexico fisheries (targeting shrimp, shark, and snapper/grouper) during allowed seasons. Home ports for this fishery include Madiera Beach, Florida; Panama City, Florida; Dulac, Louisiana; and Venice, Louisiana (NMFS, 1999).

For catching tuna, the longline gear is configured similarly to swordfish longline gear but is deployed differently. The gear is typically set out at dawn (between two a.m. and noon) and retrieved at sunset (4 p.m. to midnight). The water temperature varies based on the location of

fishing. However, yellowfin tuna are targeted in the western Gulf of Mexico during the summer when water temperatures are high. In the past, fishermen have used live bait, however, NMFS prohibited the use of live bait in the Gulf of Mexico in an effort to decrease bycatch and bycatch mortality of billfish (65 FR 47214, August 1, 2000). This rule also closed the Desoto Canyon area (year-round closure) to pelagic longline gear. In the Gulf of Mexico, and all other areas, except the NED, specific circle hooks (16/0 or larger non-offset and 18/0 or larger with an offset not to exceed 10 degrees) are currently required, as are whole finfish and squid baits.

The South Atlantic – Florida East Coast to Cape Hatteras Swordfish Fishery

Historically, South Atlantic pelagic longline vessels targeted swordfish year-round, although yellowfin tuna and dolphin fish were other important marketable components of the catch. In 2001 (65 FR 47214, August 1, 2000), the Florida East Coast closed area (year-round closure) and the Charleston Bump closed area (February through April closure) became effective.

Prior to these closures, smaller vessels used to fish short trips from the Florida Straits north to the bend in the Gulf Stream off Charleston, South Carolina (Charleston Bump). Mid-sized and larger vessels migrate seasonally on longer trips from the Yucatan Peninsula throughout the West Indies and Caribbean Sea, and some trips range as far north as the Mid-Atlantic coast of the United States to target bigeye tuna and swordfish during the late summer and fall. Home ports (including seasonal ports) for this fishery include Georgetown, South Carolina; Charleston, South Carolina; Fort Pierce, Florida; Pompano Beach, Florida; and Key West, Florida. This sector of the fishery consists of small to mid-size vessels, which typically sell fresh swordfish to local high-quality markets (NMFS, 1999).

The Mid-Atlantic and New England Swordfish and Bigeye Tuna Fishery

Fishing in this area has evolved during recent years to focus almost year-round on directed tuna trips, with substantial numbers of swordfish trips as well. Some vessels participate in directed bigeye/yellowfin tuna fishing during the summer and fall months and then switch to bottom longline and/or shark fishing during the winter when the large coastal shark season is open. In 1999, NMFS closed the Northeastern U.S. area in June to pelagic longline gear to reduce bluefin tuna discards (64 FR 29090, May 28, 1999). During the season, vessels primarily offload in the ports of New Bedford, Massachusetts; Barnegat Light, New Jersey; Ocean City, Maryland; and Wanchese, North Carolina (NMFS, 1999).

The U.S. Atlantic Distant Water Swordfish Fishery

This fishing ground covers virtually the entire span of the western north Atlantic to as far east as the Azores and the Mid-Atlantic Ridge. Approximately 12 large fishing vessels that fish in the distant water operate out of Mid-Atlantic and New England ports during the summer and fall months targeting swordfish and tunas, and then move to Caribbean ports during the winter and spring months. Many of the current distant water operations were among the early participants in the U.S. directed Atlantic commercial swordfish fishery. These larger vessels, with greater ranges and capacities than the coastal fishing vessels, enabled the United States to

become a significant participant in the north Atlantic fishery. In the past, these vessels have also fished for swordfish in the south Atlantic. In recent years, few, if any U.S. vessels, fish for swordfish in the South Atlantic. The distant water vessels traditionally have been larger than their southeast counterparts because of the distances required traveling to the fishing grounds, thus the trips in this particular fishery tend to be longer than in the other longline fisheries. Ports for this fishery range from San Juan, Puerto Rico through Portland, Maine, and include New Bedford, Massachusetts, and Barnegat Light, New Jersey (NMFS, 1999). This segment of the fleet was directly affected by the L-shaped closure in 2000 and the Northeast Distant Statistical Reporting Area (NED) closure implemented in 2001. A number of vessels have recently returned to this fishery when the NED was reopened with the issuance of the July 6, 2004, rule (69 FR 40734) to reduce sea turtle bycatch and bycatch mortality. Unlike in other areas, vessels fishing in the NED are required to use 18/0 or larger circle hooks with an offset not to exceed 10 degrees and whole mackerel or squid baits.

The Caribbean Tuna and Swordfish Fishery

This fleet is similar to the southeast coastal fishing fleet in that both are comprised primarily of smaller vessels that make short trips relatively near-shore, producing high quality fresh product. Both fleets also encounter relatively high numbers of undersized swordfish at certain times of the year. Longline vessels targeting HMS in the Caribbean use fewer hooks per set, on average, fishing deeper in the water column than the distant water fleet off New England, the northeast coastal fleet, and the Gulf of Mexico yellowfin tuna fleet. This fishery is typical of most pelagic fisheries, being truly a multi-species fishery, with swordfish as a substantial portion of the total catch. Yellowfin tuna, dolphin and, to a lesser extent, bigeye tuna, are other important components of the landed catch. Ports for this fishery include St. Croix, U.S. Virgin Islands; and San Juan, Puerto Rico. Many of these high quality fresh fish are sold to local markets to support the tourist trade in the Caribbean (NMFS, 1999).

Management of the U.S. Pelagic Longline Fishery

The U.S. Atlantic PLL fishery is restricted by a swordfish quota, divided between the North and South Atlantic (separated at 5°N. Lat.). Other regulations include minimum sizes for swordfish, yellowfin, bigeye, and bluefin tuna; bluefin tuna target catch requirements; shark quotas; protected species incidental take limits; reporting requirements (including logbooks); gear and bait requirements; limited access vessel permits, and mandatory workshop requirements. Current billfish regulations prohibit the retention of billfish by commercial vessels, or the sale of billfish from the Atlantic Ocean. As a result, all billfish hooked on PLL gear must be discarded, and are considered bycatch. PLL is a heavily managed gear type and, as such, is strictly monitored. Because it is difficult for PLL fishermen to avoid undersized or prohibited fish in some areas, NMFS has closed areas in the Gulf of Mexico and along the east coast. The intent of these closures is to decrease bycatch in the PLL fishery by closing those areas with the highest rates of bycatch. There are also time/area closures for PLL fishermen designed to reduce the incidental catch of bluefin tuna and sea turtles. In order to enforce time/area closures and to monitor the fishery, NMFS requires all PLL vessels to report positions on an approved Vessel Monitoring System (VMS).

In addition to the regulations mentioned above, vessels with PLL gear onboard, at all times, in all areas open to PLL fishing, excluding the NED, must possess onboard and/or use only 16/0 or larger non-offset circle hooks and/or 18/0 or larger circle hooks with an offset not to exceed ten degrees. Only whole finfish and squid baits may be possessed and/or utilized with allowable hooks. All PLL vessels must possess and use sea turtle handling and release gear in compliance with NMFS careful release protocols. Additionally, all PLL vessel owners and operators must be certified in the use of the protected species handling and release gear. Certification must be renewed every three years and can be obtained by attending a workshop. For more information pertaining to the certification, please see Chapter 8.

Permits

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

As of May 1, 2008, approximately 241 tuna longline limited access permits had been issued. In addition, approximately 181 directed swordfish limited access permits, 76 incidental swordfish limited access permits, 214 directed shark limited access permits, and 285 incidental shark limited access permits had been issued (see Chapter 9 for more information on permits). Vessels with limited access swordfish and shark permits do not necessarily use pelagic longline gear, but these are the only permits that allow for the use of pelagic longline gear in HMS fisheries.

Monitoring and Reporting

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

Commercial HMS fisheries are monitored through a combination of vessel logbooks, dealer reports, port sampling, cooperative agreements with states, and scientific observer coverage. Logbooks contain information on fishing vessel activity, including dates of trips, number of sets, area fished, number of fish, and other marine species caught, released, and retained. In some cases, social and economic data such as volume and cost of fishing inputs are also required.

Pelagic Longline Observer Program

During 2007, NMFS observers recorded 944 PLL sets for an overall fishery coverage of 10.8 percent. (Fairfield and Garrison, 2008) Table 4.3 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 4.3 **Observer Coverage of the Pelagic Longline Fishery.** Source: Yeung, 2001; Garrison, 2003b; 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
2006	568	-	-	7.5	-	-
2007	944	-	-	10.8	-	-

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

4.1.2 Recent Catch and Landings

U.S. PLL catch (including bycatch, incidental catch, and target catch) is largely related to vessel and gear characteristics, but is summarized for the whole fishery in Table 4.4. 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 4.4 **Reported Catch of Species Caught by U.S. Atlantic PLLs, in Number of Fish, for 2000-2007.** Source: PLL Logbook Data.

Species	2000	2001	2002	2003	2004	2005	2006	2007
Swordfish Kept	62,978	47,560	49,320	51,835	46,440	41,139	38,241	45,933
Swordfish Discarded	17,074	13,993	13,035	11,829	10,675	11,134	8,900	11,823

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

Table 4.5 **Reported Landings in the U.S. Atlantic Pelagic Longline Fishery (in mt ww) for 1999-2007.** Source: NMFS 2008.

Species	1999	2000	2001	2002	2003	2004	2005	2006	2007
Yellowfin Tuna	3,374	2,901	2,201	2,573	2,164	2,492	1746.2	2009.9	2387.9
Skipjack Tuna	2.0	1.8	4.3	2.5	1.4	0.7	0.6	0.2	0.0
Bigeye Tuna	929.1	531.9	682.4	535.8	283.9	310.1	311.9	520.6	374.5
Bluefin Tuna*	73.5	66.1	37.5	49.9	133.9	275.4	211.5	204.6	164.3
Albacore Tuna	194.5	147.3	193.8	155	107.6	120.4	108.5	102.9	126.1
Swordfish N.*	3,362.4	3,315.8	2,483	2,598.8	2,756.3	2,534.2	2,272.8	1,960.8	2,453
Swordfish S.*	185.2	143.8	43.2	199.9	20.5	15.7	0.0	0.0	0.0

* Includes landings and estimated discards from scientific observer and logbook sampling programs.

Marine Mammals

Of the marine mammals that are hooked by U.S. pelagic longline fishermen, many are released alive, although some animals suffer serious injuries and may die after being released. The observed and estimated marine mammal interactions for 1992 – 2007 are summarized in Table 4.6 and Table 4.7. Marine mammals are caught primarily during the third and fourth quarters in the Mid-Atlantic Bight (MAB) and Northeast Coastal (NEC) areas (Figure 4.3). In 2005, the majority of observed interactions were with pilot whales in the MAB area (Walsh and Garrison, 2006).

There were a total of 23 observed interactions with marine mammals in the pelagic longline fishery in 2006. The majority of these interactions were with pilot whales in the MAB area. During 2006, the pelagic longline fishery was estimated to have interacted with 275 pilot whales, 27 unidentified dolphins, 13 unidentified marine mammals, two Atlantic spotted dolphins, two beaked whales, and one bottlenose dolphin (Fairfield-Walsh and Garrison, 2007). In 2007, there were a total of 17 observed interactions with marine mammals in the pelagic longline fishery. The majority of these interactions were also with pilot whales. During 2007, the pelagic longline fishery was estimated to have interacted with 87 pilot whales, 20 Risso's dolphins, 13 bottlenose dolphin, two Atlantic spotted dolphin, two beaked whales, 22 unidentified marine mammals, and four unidentified dolphin (Fairfield and Garrison, 2008). NMFS monitors observed interactions with sea turtles and marine mammals on a quarterly basis and reviews data for appropriate action, if any, as necessary. In June 2005, NMFS convened the Pelagic Longline Take Reduction Team (PLTRT) to assess and reduce marine mammal takes, specifically pilot whales and Risso's dolphins, by the pelagic longline fishery. The PLTRT drafted a Take Reduction Plan which NMFS published along with a proposed rule to implement the TRP on June 24, 2008 (73 FR35623). The PLTRT recommended a suite of management strategies to reduce mortality and serious injury of pilot whales and Risso's dolphins in the Atlantic pelagic longline fishery. NMFS proposes the following three regulatory measures: (1) Establish a Cape Hatteras Special Research Area (CHSRA), with specific observer and research

participation requirements for fishermen operating in that area; (2) set a 20–nm (37.02–km) upper limit on mainline length for all pelagic longline sets within the MAB; and (3) develop and publish an informational placard that must be displayed in the wheelhouse and the working deck of all active pelagic longline vessels in the Atlantic fishery.

Table 4.6 Summary of Marine Mammal Interactions in the Pelagic Longline Fishery, 1992-1998. Source: Yeung, 1999a; Yeung, 1999b.

Year	Species	Total		Mortality		Alive	
		Obs	Est	Obs	Est	Obs	Est
1992	Risso's Dolphin	3	121	2	74	1	47
	Common Dolphin	1	24			1	24
	Dolphin	1	17			1	17
	Pilot Whale	12	420	3	105	9	319
1993	Risso's Dolphin	3	62	1	36	2	26
	Bottlenose Dolphin	2	29			2	29
	Pilot Whale	16	193	1	15	15	178
	Spotted Dolphin	1	11			1	11
1994	Atlantic Spotted Dolphin	1	17	1	17		
	Pantropical Spotted Dolphin	1	20			1	20
	Killer Whale	1	16	1	16		
	Pilot Whale	14	161	12	137	2	26
	Risso's Dolphin	7	87	7	87		
1995	Risso's Dolphin	5	101	4	85	1	16
	Unidentified Marine Mammal	1	22			1	22
	Pilot Whale	13	252	11	200	2	53
	Shortfin Pilot Whale	2	58	2	58		
1996	Risso's Dolphin	4	99	2	52	2	47
	Unidentified Marine Mammal	1	43			1	43
1997	Pilot Whale	1	29			1	29
	Short-Beaked Spinner Dolphin	1	16			1	16
1998	Beaked Whale	1	88			1	88
	Bottlenose Dolphin	2	46	1	31	1	15
	Risso's Dolphin	2	47	1	23	1	24
	Pilot Whale	1	24			1	24

Table 4.7 Summary of Marine Mammal Interactions in the Pelagic Longline Fishery, 1999-2005. Sources: Yeung, 2001; Garrison, 2003b; Garrison and Richards, 2004; Garrison, 2005; Walsh and Garrison, 2006; Fairfield-Walsh and Garrison, 2007; Fairfield and Garrison, 2008.

Year	Species	Total		Mortality		Serious Injury		Alive	
		Obs	Est	Obs	Est	Obs	Est	Obs	Est
1999	Risso's Dolphin	1	23	-	-	1	23	-	-
	Unidentified Marine Mammal	1	4	-	-	-	-	1	14
	Pilot Whale	5	385	1	94	4	291	-	-
2000	Common Dolphin	1	32	-	-	-	-	1	32
	Risso's Dolphin	3	93	1	41	1	23	1	29
	Pilot Whale	8	231	1	24	4	109	3	98
	Whale	1	19	-	-	1	19	-	-
	Pygmy Sperm Whale	1	28	-	-	1	28	-	-

Year	Species	Total		Mortality		Serious Injury		Alive	
		Obs	Est	Obs	Est	Obs	Est	Obs	Est
2001	Risso's Dolphin	8	83.6	1	24.4	6	48.9	1	14.3
	Pilot Whale	6	92.9	1	19.8	4	50.2	1	22.7
	Striped Dolphin	1	1	-	-	-	-	1	1
	Northern Bottlenose Whale	1	1	-	-	1	1	-	-
2002	Risso's Dolphin	10	87.2	-	-	4	11	6	59.6
	Pilot Whale	10	113.5	-	-	4	49.9	6	67.8
	Common Dolphin	1	1	-	-	-	-	1	1
	Unidentified Dolphin	2	2	-	-	1	1	1	1
	Unidentified Marine Mammal	1	1	-	-	1	1	-	-
2003	Beaked Whale	2	48.8	-	-	1	5.3	1	43.5
	Dolphin	1	16.2	-	-	1	16.2	-	-
	Atlantic Spotted Dolphin	1	29.8	-	-	1	29.8	-	-
	Bottlenose Dolphin	1	2	-	-	-	-	1	2
	Common Dolphin	2	45.6	-	-	-	-	2	45.6
	Risso's Dolphin	14	109.5	1	1	3	40.1	10	68.4
	Striped Dolphin	1	1	-	-	-	-	1	1
	Pilot Whale	4	32.1	-	-	2	21.4	1	11.3
	Baleen Whale	1	1	-	-	-	-	1	1
	Minke Whale	1	22.3	-	-	-	-	1	22.3
2004	Pilot Whale	8	107.5	-	-	6	74.1	2	33.8
	Common Dolphin	1	6.8	-	-	-	-	1	6.8
	Risso's Dolphin	3	49.4	-	-	2	27.5	1	21.9
2005	Pilot Whale	18	294.4	-	-	9	211.5	9	79.5
	Risso's Dolphin	2	42.1	-	-	-	2.9	2	39.2
	Common Dolphin		5.7	-	-	-	-	-	5.7
	Bottlenose Dolphin	1	5.2	-	-	-	-	1	5.2
	Beaked Whale		1	-	-	-	1	-	-
	Atlantic Spotted Dolphin	1	4.3	-	-	-	-	1	4.3
	Unidentified Marine Mammal	1	13.2	-	-	1	13.2	-	-
	Unidentified Whale		3.4	-	-	-	3.4	-	-
	Unidentified Dolphin	1	2.6	-	-	-	-	1	2.6
2006	Atlantic Spotted Dolphin		1.9	-	-	-	-	-	1.9
	Beaked Whale		2.2	-	-	-	-	-	2.2
	Bottlenose Dolphin		0.6	-	-	-	-	-	0.6
	Pilot Whale	20	274.5	1	15.5	12	168.6	7	90.4
	Unidentified Dolphin	2	26.5	-	-	2	26.5	-	-
	Unidentified Marine Mammal	1	12.6	1	12.6	-	-	-	-
2007	Atlantic Spotted Dolphin		1.4	-	-	-	-	-	1.4
	Bottlenose Dolphin	2	12.6	-	-	1	-	1	12.6
	Beaked Whale	1	1.5	-	-	-	-	1	1.5
	Pilot Whale	8	86.6	-	-	5	56.7	3	30.7
	Risso's Dolphin	2	20.3	-	-	1	9.3	1	11.0

Year	Species	Total		Mortality		Serious Injury		Alive	
		Obs	Est	Obs	Est	Obs	Est	Obs	Est
	Unidentified Dolphin	2	3.8	1	1.5	-	-	1	2.3
	Unidentified Marine Mammal	2	22.1	-	-	2	22.1	-	-

Sea Turtles

Historically, sea turtle interactions with pelagic longline gear have occurred throughout the range of the fishery. However, the majority of leatherback interactions have occurred in the Gulf of Mexico while most loggerhead interactions occur in the offshore Atlantic Ocean areas like the NED and NEC (Figure 4.3) Most of the sea turtles are released alive. In the past, the bycatch rates were highest in the third and fourth quarters. In general, sea turtle captures are rare, but takes appear to be clustered (Hoey and Moore, 1999).

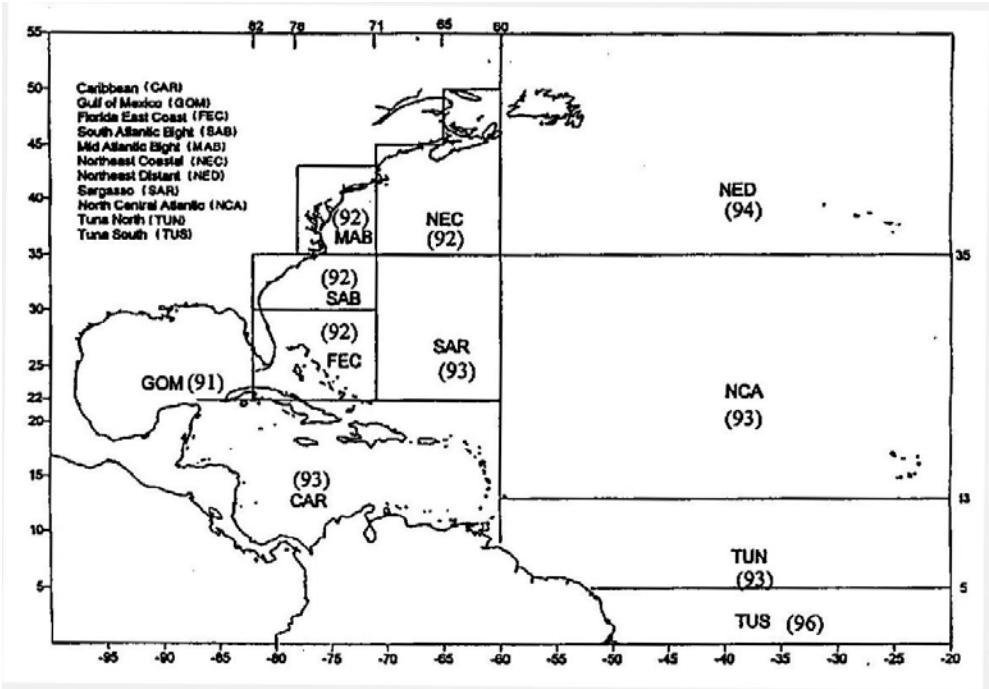


Figure 4.3 **Geographic Areas Used in Summaries of Pelagic Logbook Data.** Source: Cramer and Adams, 2000

The estimated take levels for 2000 were 1,256 loggerhead and 769 leatherback sea turtles (Yeung, 2001). The estimated sea turtle takes for regular fishing and experimental fishing effort for 2001 - 2007 are summarized in Table 4.8. The majority of leatherback interactions have occurred in the Gulf of Mexico. Loggerhead interactions are more widely distributed, however, the NED, and the NEC appear to be areas with high interaction levels each year.

In 2007, the pelagic longline fishery interacted with an estimated 499 leatherback sea turtles and 542 loggerhead sea turtles outside of experimental fishing operations. During 2007, the interactions with leatherback sea turtles were highest in the Gulf of Mexico (212 animals).

The majority of loggerhead sea turtle interactions occurred in the NED, and the MAB areas (Fairfield and Garrison, 2008). NMFS monitors observed interactions with sea turtles and marine mammals on a quarterly basis and reviews data for appropriate action, if any, as necessary.

Table 4.8 **Estimated number of loggerhead sea turtle interactions in the U.S. Atlantic pelagic longline fishery, 2001-2007 by statistical area.** Sources: Walsh and Garrison, 2006; Garrison, 2005; Garrison and Richards, 2004; Garrison 2003; Fairfield-Walsh and Garrison, 2007; Fairfield and Garrison, 2008.

Area	2001	2002	2003	2004	2005	2006	2007
CAR	27	43	36	61	40	16	7
GOM	0	170	135	45	19	17	10
FEC	0	99	137	99	0	40	83
SAB	39	22	52	194	34	18	34
MAB	43	94	18	92	54	70	155
NEC	117	147	241	150	67	135	48
NED	72	0	0	52	20	235	200
SAR	0	0	70	41	38	19	4
NCA	13	0	39	0	3	10	2
TUN	0	0	0	0	0	0	0
TUS	0	0	0	0	0	0	0
Total	312	575	728	734	275	559	543
NED exp'tal fishery (2001-03)	142	100	92	-	-	-	-
Exp'tal fishery (2004-05)	-	-	-	0	8	0	0
Total	454	675	820	734	283	559	543

Table 4.9 **Estimated number of leatherback sea turtle interactions in the U.S. Atlantic pelagic longline fishery, 2001-2007 by statistical area.** Sources: Walsh and Garrison, 2006; Garrison, 2005; Garrison and Richards, 2004; Garrison 2003; Fairfield-Walsh and Garrison, 2007; Fairfield and Garrison, 2008.

Area	2001	2002	2003	2004	2005	2006	2007
CAR	61	0	0	17	2	4	1
GOM	393	695	838	780	179	109	212
FEC	313	100	27	64	62	28	7
SAB	241	93	75	164	7	39	0
MAB	139	70	94	184	11	30	114
NEC	30	5	76	33	6	73	76
NED	32	0	0	98	63	116	84
SAR	0	0	0	18	20	14	5
NCA	1	0	2	0	0	1	0
TUN	0	0	0	0	0	0	0
TUS	0	0	0	0	0	0	0

Total	1208	962	1113	1359	351	415	499
Area	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
NED exp'tal fishery (2001-03)	77	158	79	-	-	-	-
Exp'tal fishery (2004-05)	-	-	-	3	17	-	-
Total	1285	1120	1192	1362	368	415	499

As a result of the increased sea turtle interactions in 2001 and 2002, NMFS reinitiated consultation for the pelagic longline fishery and completed a new BiOp on June 1, 2004. The June 2004 BiOp concluded that long-term continued operation of the Atlantic pelagic longline fishery is not likely to jeopardize the continued existence of loggerhead, green, hawksbill, Kemp's ridley, or olive ridley sea turtles, but is likely to jeopardize the continued existence of leatherback sea turtles. The BiOp included a reasonable and prudent alternative (RPA) and an incidental take statement (ITS) for the combined years 2004 – 2006, and for each subsequent three-year period (NMFS, 2004b).

From 2001 through 2003, NMFS worked with the commercial fishing industry to develop new pelagic longline fishing technology to reduce interaction rates and bycatch mortality of threatened and endangered sea turtles. The cooperative gear technology research investigated line configurations, setting and retrieving procedures, hook types, hook sizes, bait types, and release and disentanglement gears. Ultimately, specific hook designs and bait types were found to be the most effective measures for reducing sea turtle interactions. Large circle hooks and mackerel baits were found to substantially reduce sea turtle interactions over the use of the industry standard "J"-hooks and squid baits. The gears developed to remove hooks and line from hooked and entangled sea turtles are anticipated to reduce post-hooking mortality associated with those interactions not avoided. Since the conclusion of the NED research experiment, NMFS has continued to investigate pelagic longline bycatch mitigation techniques in the Gulf of Mexico, Atlantic Ocean, and the Caribbean Sea. Additionally, NMFS held a series of voluntary workshops for U.S. pelagic longline fishermen providing outreach and training in sea turtle handling and release techniques.

NMFS believes that the transfer of this information to other fishing countries will result in significant reductions in interaction rates and post-release mortalities of threatened and endangered sea turtles throughout their ranges. A final rule published in July 2004 (69 FR 40734) prohibited the possession of "J"-style hooks in the pelagic longline fishery and required the possession and use of specific sea turtle release and disentanglement gears, handling and release protocols, as well as requiring the use of specific circle hooks and baits. The Agency conducts mandatory protected species identification and safe handling workshops for vessel owner-operators and requires proof of certification prior to permit renewal.

Seabirds

Gannets, gulls, greater shearwaters, and storm petrels are occasionally hooked by Atlantic pelagic longlines. These species and all other seabirds are protected under the Migratory Bird Treaty Act. Seabird populations are often slow to recover from excess mortality as a consequence of their low reproductive potential (one egg per year and late sexual maturation).

The majority of longline interactions with seabirds occur as the gear is being set. The birds eat the bait and become hooked on the line. The line then sinks and the birds are subsequently drowned.

The United States has developed a National Plan of Action in response to the Food and Agriculture Organization of the United Nations (FAO) International Plan of Action to reduce the incidental takes of seabirds (www.nmfs.gov.gov/NPOA-S.html). Although Atlantic pelagic longline interactions will be considered in the plan, NMFS has not identified a need to implement gear modifications to reduce seabird takes by Atlantic pelagic longlines. Takes of seabirds have been minimal in the fishery, most likely due to the setting of longlines at night and/or fishing in areas where birds are largely absent.

Observer data from 1992 through 2007 indicate that seabird bycatch is relatively low in the U.S. Atlantic pelagic longline fishery (Table 4.10). Since 1992, a total of 141 seabird interactions have been observed, with 101 observed killed (71.6 percent). In 2007, a total of six seabirds were observed taken.

Observed bycatch has ranged from one to 18 seabirds observed dead per year and zero to 15 seabirds observed released alive per year from 1992 through 2007. More than half of the seabirds observed were not identified to species (n = 81, 57.5%). Gulls represent the largest group of seabirds identified (n = 42), followed by greater shearwaters (n = 28), and northern gannets (n = 8) (Table 4.11). Greater shearwaters experienced the highest mortality (89.3 percent), followed by gulls (76.2 percent), and unidentified seabirds (67.2 percent). Northern gannets had the lowest mortality rate (12.5 percent).

Preliminary estimates of expanded seabird bycatch and bycatch rates from 1995 – 2007, varied by year and species with no apparent pattern (Table 4.13). The estimated number of all seabirds caught and discarded dead ranged from zero to 1,109 per year, averaging about 210 per year. Live discards ranged from zero to 486 per year, averaging 60 per year. Estimates of dead discards of seabirds ranged from zero to 623 per year, averaging 150 per year. The annual bycatch rate of birds discarded dead ranged from zero to 0.015 birds per 1,000 hooks, while the rate of total seabird catch ranged from zero to 0.106 birds per 1,000 hooks.

Table 4.10 **Seabird Bycatch in the U.S. Atlantic Pelagic Longline Fishery, 1992-2007. Source**: NMFS, 2008; NMFS PLL fishery observer program (POP) data.

Year	Month [1]	Area	Type of Bird	Number observed	Status
1992	10	MAB	GULL	4	dead
1992	10	MAB	SHEARWATER GREATER	2	dead
1993	2	SAB	GANNET NORTHERN	2	alive
1993	2	MAB	GANNET NORTHERN	2	alive
1993	2	MAB	GULL BLACK BACKED	1	alive
1993	2	MAB	GULL BLACK BACKED	3	dead
1993	11	MAB	GULL	1	alive
1994	6	MAB	SHEARWATER GREATER	3	dead
1994	8	MAB	SHEARWATER GREATER	1	dead
1994	11	MAB	GULL	4	dead
1994	12	MAB	GULL HERRING	7	dead
1995	7	MAB	SEA BIRD	5	dead
1995	8	GOM	SEA BIRD	1	dead
1995	10	MAB	STORM PETREL	1	dead
1995	11	NEC	GANNET NORTHERN	2	alive
1995	11	NEC	GULL	1	alive
1997	6	SAB	SEA BIRD	11	dead
1997	7	MAB	SEA BIRD	1	dead
1997	7	NEC	SEA BIRD	15	alive
1997	7	NEC	SEA BIRD	6	dead
1998	2	MAB	SEA BIRD	7	dead
1998	7	NEC	SEA BIRD	1	dead
1999	6	SAB	SEA BIRD	1	dead
2000	6	SAB	GULL LAUGHING	1	alive
2000	11	NEC	GANNET NORTHERN	1	dead
2001	6	NEC	SHEARWATER GREATER	7	dead
2001	7	NEC	SHEARWATER GREATER	1	dead
2002	7	NEC	SEABIRD	1	dead
2002	8	NED	SHEARWATER GREATER	1	dead
2002	8	NED	SEABIRD	1	dead
2002	9	NED	SHEARWATER GREATER	3	dead
2002	9	NED	SEABIRD	3	alive
2002	9	NED	SHEARWATER SPP	1	dead
2002	10	NED	GANNET NORTHERN	1	alive
2002	10	NED	SHEARWATER SPP	1	dead
2002	10	NED	SEABIRD	2	dead
2002	10	MAB	GULL	3	alive

Year	Month [1]	Area	Type of Bird	Number observed	Status
2002	10	MAB	GULL	1	dead
2002	11	MAB	GULL	3	dead
2003	1	GOM	SEABIRD	1	alive
2003	8	NED	SEABIRD	1	dead
2003	9	MAB	SEABIRD	1	dead
2004	1	MAB	GULL	5	dead
2004	3	MAB	GREATER SHEARWATER	1	alive
2004	3	MAB	GREATER SHEARWATER	4	dead
2004	4	NED	SEABIRD	1	dead
2005	1	SAB	HERRING GULL	1	dead
2005	1	SAB	SHEARWATER	1	dead
2005	3 [2]	NEC	GREATER SHEARWATER	1	alive
2005	3 [2]	NEC	GREATER SHEARWATER	1	dead
2006	4	MAB	GREATER SHEARWATER	1	Dead
2006	4	NEC	SHEARWATER	1	Alive
2006	4	NED	GREATER SHEARWATER	1	Dead
2007	1	MAB	GREATER BLACKBACKED GULL	6	dead

[1] Beginning in 2004, reports based on Quarters not month.
[2] Experimental fishery takes.

Table 4.11 **Status of Seabird Bycatch in the U.S. Atlantic Pelagic Longline Fishery, 1992-2007.** Source: NMFS Pelagic longline fishery observer program (POP).

Species	Release Status		Total	Percent Dead
	Dead	Alive		
Greater shearwater	25	3	28	89.29
Cory's shearwater	1		1	100.00
Unidentified shearwater	2	1	3	66.67
Herring gull	8	-	8	100.00
Great black-backed gull	9	1	10	90.00
Laughing gull	1	1	2	50.00
Unidentified gull	14	8	22	63.64
Northern gannet	1	7	8	12.50
Storm petrel	1		1	100.00
Unidentified seabird	39	19	58	67.24
Grand Total	101	40	141	71.63

Table 4.12 Observed seabird bycatch in the U.S. Atlantic pelagic longline fishery, 1992-2007 (excluding the NED experiment of 2001-03). Source: NMFS, 2008.

			Number of seabirds		Catch rate	
Year	**Sets**	**Hooks**	**All**	**Dead**	**Per set**	**Per 1000 hooks**
1992	329	194,706	6	6	0.018	0.031
1993	817	526,501	9	3	0.011	0.017
1994	650	411,996	15	15	0.023	0.036
1995	686	472,105	10	7	0.015	0.021
1996	356	220,223	0	0	0	0
1997	451	311,520	33	18	0.073	0.106
1998	287	175,408	8	8	0.028	0.046
1999	424	285,083	1	1	0.002	0.004
2000	465	312,574	2	1	0.004	0.006
2001	398	284,198	8	8	0.02	0.028
2002	344	260,632	8	2	0.023	0.031
2003	551	427,575	2	1	0.004	0.005
2004	702	524,182	11	10	0.016	0.021
2005	796	577,354	4	3	0.005	0.007
2006	568	419,233	3	2	0.005	0.007
2007	944	734,110	6	6	0.006	0.008
Total	8,768	6,137,400	126	91	0.014	0.021

Table 4.13 **Expanded estimates of seabird bycatch (alive and dead) in the U.S. Atlantic pelagic longline fishery, 1992-2007.** Source: NMFS, 2008.

Taxa	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Avg.
Gulls	160	84	199	24	-	-	-	-	22	-	248	-	77	8	-	54	55
Gannets	-	83	-	48	-	-	-	-	22	-	-	-	-	-	-	-	10
Seabirds	-	-	-	140	-	1,109	380	28	-	-	36	39	6	-	-	-	109
Shearwaters	80	-	74	-	-	-	-	-	-	283	-	-	75	31	27	-	36
Storm-petrels	-	-	-	24	-	-	-	-	-	-	-	-	-	-	-	-	2
All	240	167	273	236	0	1,109	380	28	44	283	284	39	158	39	27	54	210

Table 4.14 **Expanded estimates of dead seabird bycatch in the U.S. Atlantic pelagic longline fishery, 1992-2007.** Source: NMFS, 2008.

Taxa	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Avg.
Gulls	160	50	199	0	-	-	-	-	0	-	36	-	77	8	-	54	37
Gannets	-	0	-	0	-	-	-	-	22	-	-	-	-	-	-	-	1
Seabirds	-	-	-	140	-	623	380	28	-	-	36	20	6	-	-	-	77
Shearwaters	80	-	74	-	-	-	-	-	-	283	-	-	61	19	16	-	33
Storm-petrels	-	-	-	24	-	-	-	-	-	-	-	-	-	-	-	-	2
All	240	50	273	164	0	623	380	28	22	283	72	20	144	27	16	54	150

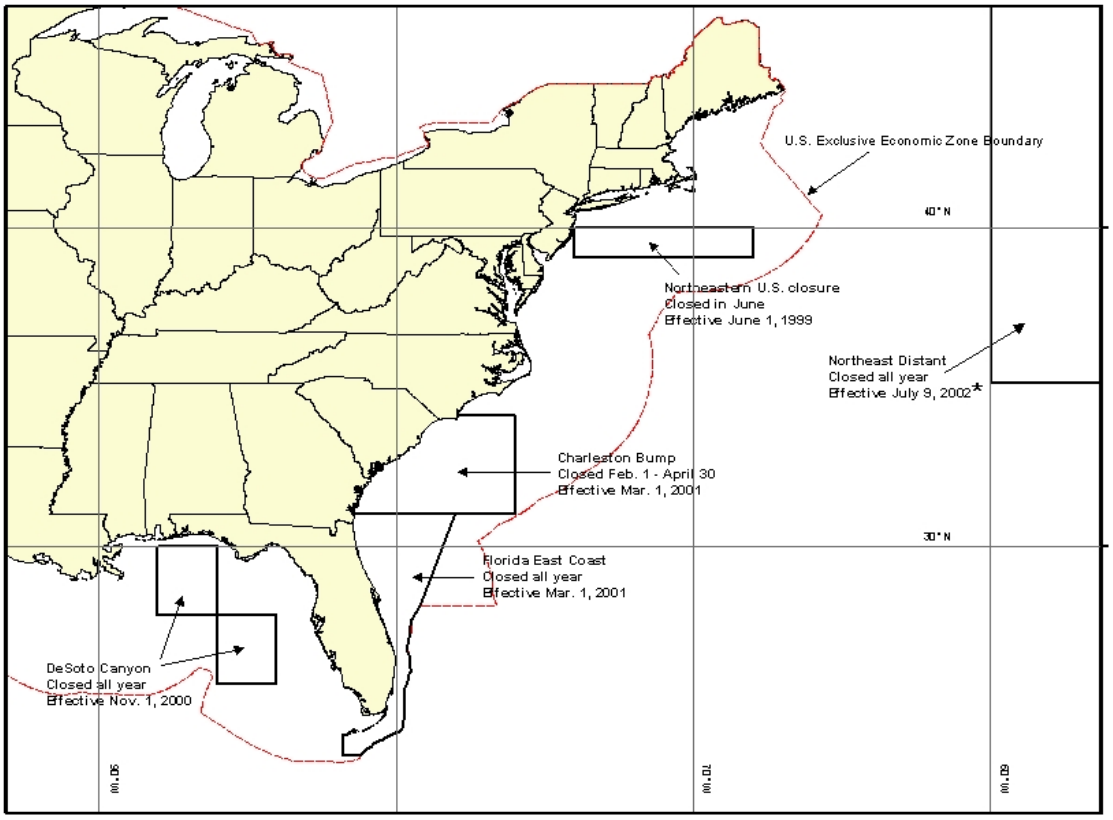
Finfish

In the U.S. pelagic longline fishery, fish are discarded for a variety reasons. Swordfish, yellowfin tuna, and bigeye tuna may be discarded because they are undersized or unmarketable (*e.g*., bitten by sharks). Blue sharks, as well as other species, are discarded because of a limited markets (resulting in low prices) and perishability of the product. Large coastal sharks are discarded during times when the shark season is closed. Bluefin tuna may be discarded because target catch requirements for other species have not been met. Also, all billfish are required to be released. In the past, swordfish have been discarded when the swordfish season was closed.

U.S. PLL catch (including bycatch, incidental catch, and target catch) is largely related to vessel and gear characteristics, but is summarized for the whole fishery in Table 4.4. 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). Additional U.S. landings and discard data are available in the 2008 U.S. National Report to ICCAT (NMFS, 2008).

At this time, direct use of observer data with pooling for estimating dead discards in this fishery represents the best scientific information available for use in stock assessments. Direct use of observer data has been employed for a number of years to estimate dead discards in Atlantic and Pacific longline fisheries, including billfish, sharks, and undersized swordfish. Furthermore, the data have been used for scientific analyses by both ICCAT and the Inter-American Tropical Tuna Commission (IATTC) for a number of years.

Bycatch mortality of marlins, swordfish, and bluefin tuna from all fishing nations may significantly reduce the ability of these populations to rebuild, and it remains an important management issue. In order to minimize bycatch and bycatch mortality in the domestic pelagic longline fishery, NMFS implemented regulations to close areas to this gear type (Figure 4.4) and has banned the use of live bait by pelagic longline vessels in the Gulf of Mexico.



* Closed except to vessels complying with specific conditions (see 50 CFR 635 for details).

Figure 4.4 Areas Closed to Pelagic Longline Fishing by U.S. Flagged Vessels

4.1.3 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.

4.1.4 International Issues and Catch

PLL fisheries for Atlantic HMS primarily target swordfish and tunas. Directed PLL fisheries in the Atlantic have been operated by Spain, the United States, and Canada since the

late 1950s or early 1960s. The Japanese PLL tuna fishery started in 1956 and has operated throughout the Atlantic since then (NMFS, 1999). Most of the 46 other ICCAT nations now also operate PLL vessels.

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

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

Nevertheless, ICCAT does report landings by gear type. Available data indicate that longline effort produces the second highest volume of catch and effort, and is the most broadly distributed (longitudinally and latitudinally) of the gears used to target ICCAT managed species (SCRS, 2004b). Purse seines produce the highest volume of catch of ICCAT managed species from the Atlantic (SCRS, 2004b). Figure 4.5 shows the aggregate distribution of hooks from all fishing fleets from 2000-2007. In 2007, international longline landings of HMS in fisheries in which the U.S. participated totaled 102,876 mt, which represented a continuation of the generally decreasing trend since 1999.

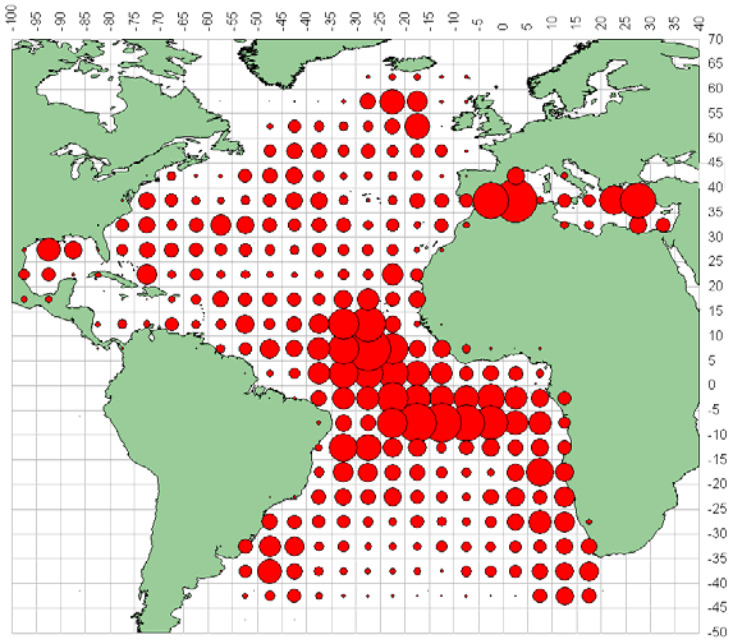


Figure 4.5 **Aggregate Distribution of Hooks Deployed by All ICCAT Parties 2000-2006.** Source: SCRS, 2008.

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

Highly Migratory Species

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

2002. Table 4.15 contains aggregate longline landings of HMS, other than sharks, for all countries in the Atlantic for the period 1999-2007.

Table 4.15 Estimated International Longline Landings of HMS, Other than Sharks, for All Countries in the Atlantic: 1999-2007 (mt ww). Source: SCRS, 2008; U.S. National Reports 2003 – 2008.

	1999	2000	2001	2002	2003	2004	2005	2006	2007
Swordfish (N. Atl + S. Atl)	27,267	27,090	24,728	24,242	23,703	25,882	26,423	26,635	28,085
Yellowfin Tuna (W. Atl)[2]	13,326	15,760	14,872	11,921	10,136	15,953	14,392	14,337	12,031
Bigeye Tuna	76,527	71,193	55,265	46,438	54,464	48,379	38,125	34,887	42,037
Bluefin Tuna (W. Atl.)[2]	914	859	610	730	186	644	425	565	423
Albacore Tuna (N. Atl + S. Atl)	27,330	31,719	35,411	27,851	28,317	21,644	19,815	23,008	17,645
Skipjack Tuna (W. Atl)[2]	58	23	60	349	95	206	207	287	52
Blue Marlin (N. Atl. + S. Atl.)[3]	3,049	2,640	1,907	1,309	1,674	1,362	1,553	1,228	1,707
White Marlin (N. Atl. + S. Atl.)[3]	1,407	1,174	779	722	587	522	529	318	239
Sailfish (W. Atl.)[4]	517	811	1,002	1,303	883	757	1,083	663	656
Total	150,395	151,269	134,634	114,865	120,045	115,349	108,552	101,928	102,876
U.S. Longline Landings (from 2003-2008 U.S. Natl. Reports) [5]	8,331	7,254	5,695	6,194	5,509	5,800	4,713	4,848	5,558
U.S. Longline Landings as a Percent of Total Longline Landings	5.5	4.8	4.2	5.4	4.6	5.0	4.6	4.8	5.4

[1]Landings include those classified by the SCRS as longline landings for all areas
[2]Note that the United States has not reported participation in the E. Atl yellowfin tuna fishery since 1983 and has not participated in the E. Atl bluefin or the E. Atl skipjack tuna fishery since 1982.
[3]Includes U.S. *dead discards and Brazilian live discards.*
[4]Includes U.S. *dead discards.*
[5]Includes swordfish, blue marlin, white marlin, and sailfish longline discards.

Atlantic Sharks

Data collection from international fisheries for Atlantic sharks has improved in recent years due to increasing reporting requirements adopted by ICCAT. At its annual meeting in New Orleans in 2004, ICCAT adopted *Recommendation 04-10 Concerning the Conservation of Sharks Caught in Association with Fisheries Managed by ICCAT.* Recommendation 04-10 required ICCAT CPCs to report task I and task II data for catches of sharks in accordance with ICCAT data reporting procedures to allow for assessment of stocks. Recommendation 04-01 also banned shark finning, requires vessels to fully utilize their entire catches of sharks, and encourages the release of live sharks that are caught incidentally and are not used for food.

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

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

In 2008, the SCRS assessed blue sharks, and shortfin mako sharks. SCRS concluded that blue sharks were not overfished or experiencing overfishing. SCRS concluded that shortfin mako sharks were at or slightly below levels that could support MSY and produced widely varying estimates of fishing mortality (0.48 to 3.77). Please see Section 2.5 for additional information on the status of Atlantic sharks. At the 2008 ICCAT annual meeting in Marrakech, Morocco, ICCAT adopted a recommendation requiring the live release of bigeye thresher sharks that are brought to the boat alive as well as reporting bycatch and live releases of bigeye thresher sharks. The most recent catch totals for blue, shortfin mako, and porbeagle sharks are presented in Table 4.16.

Table 4.16 Estimated International Landings of Pelagic Sharks for All Countries in the Atlantic: 1999-2007 (mt ww)[1]. Source: SCRS, 2008

	1999	2000	2001	2002	2003	2004	2005	2006	2007
Blue Shark (N. Atl + S. Atl + MED)	39,413	43,310	37,811	34,908	40,329	40,152	45,671	45,116	45,623
Shortfin Mako (N. Atl + S. Atl + MED)	3,982	4,750	4,618	4,939	7,205	6,956	6,566	6,419	6,452
Porbeagle (N. Atl + S. Atl + MED)	1,403	1,468	1,000	848	636	727	571	503	490
Total International Catches	**44,798**	**49,528**	**43,429**	**40,695**	**48,170**	**47,835**	**52,808**	**52,038**	**52,565**
U.S. Blue Shark Catches[1]	318	428	148	68	1	72	68	47	39
U.S. Shortfin Mako Catches[1]	159	456	395	415	142	411	187	130	215
U.S. Porbeagle Catches[1]	3	1	1	1	0	1	0	0	0
Total U.S. Catches[1]	**480**	**885**	**544**	**484**	**143**	**484**	**255**	**177**	**254**
U.S. Catches[1] as a Percent of Total International Catches	**1.1**	**1.8**	**1.3**	**1.2**	**0.3**	**1.0**	**0.5**	**0.3**	**0.5**

[1] Includes catches and discards

Sea Turtles

Sea turtle bycatch in the U.S. pelagic longline fishery has decreased significantly in the last decade. From 1999 to 2003, the U.S. pelagic longline fleet targeting HMS interacted with an average of 772 loggerhead and 1,013 leatherback sea turtles per year, based on observed takes and total reported effort. In 2004, the U.S. pelagic longline fleet was estimated to have interacted with 734 loggerhead and 1,359 leatherback sea turtles (Garrison, 2005). In 2005, the U.S. pelagic longline fishery was estimated to have interacted with 274 loggerhead and 351 leatherback sea turtles outside of experimental fishing operations (Walsh and Garrison, 2006). During 2006, there were an estimated 561 interactions with loggerhead sea turtles and 415 interactions with leatherback sea turtles (Fairfield-Walsh and Garrison, 2007). In 2007, the U.S. pelagic longline fishery was estimated to have interacted with 542 loggerhead sea turtles and 499 leatherback sea turtles (Fairfield and Garrison, 2008).

Although ICCAT adopted a resolution in 2003 (03-11) encouraging contracting parties, cooperating non-contracting parties, entities, or fishing entities to collect and provide the SCRS with all available information on sea turtle interactions in ICCAT fisheries, an exact assessment of basin-wide incidental catches is not available. However, high numbers of estimated sea turtle catches in foreign fleets have been described in other sources. Lewison, *et al*. (2004) estimated that a total of 210,000 – 280,000 loggerhead and 30,250 – 70,000 leatherback sea turtles were captured by pelagic longline fisheries each year throughout the Atlantic basin, including the Mediterranean Sea. More recently, a report by Lewison and Crowder (2007) indicates that applying bycatch rates to accurately estimate the number of turtles taken internationally by pelagic longline fleets is challenging because high variability in bycatch rates within and among fleets constrains the estimation. The report states that international sea turtle bycatch estimates are important, but given the high level of uncertainty, any precision beyond one or two significant digits is questionable. Given this caveat, Lewison and Crowder (2007) estimated that total annual sea turtle bycatch (all species) for pelagic longlines throughout the Atlantic basin, including the Mediterranean Sea, ranged from 28,180 to 39,080 interactions, which represents a notable decrease from 2004 estimates. The study suggested that pelagic longlines may not be the highest source of fishery-induced mortality but, because the gear interacts with older age classes, efforts to reduce sea turtle bycatch are warranted.

Mortality in the domestic pelagic longline fisheries is just one of several factors affecting sea turtle populations in the Atlantic (National Research Council, 1990). Many sources of anthropogenic mortality are outside of U.S. jurisdiction and control. If the U.S. swordfish quota was relinquished to other fishing nations, the fishing effort now expended by the U.S. fleet would likely be replaced by foreign effort. This could affect future ICCAT discussions and make the implementation of international conservation efforts more difficult. This would also reduce the opportunity for gear-based conservation experimentation to continue with the U.S. longline fleet, thus making it difficult to find bycatch reduction solutions which can be transferred to other nations and effect a greater global reduction in sea turtle takes in pelagic longline fisheries. The United States has, and will continue to make efforts to encourage the adoption of sea turtle conservation measures by international fishing fleets.

In addition to domestic rulemaking in various fisheries, NMFS works to reduce sea turtle bycatch in domestic and international fisheries through collaborative research programs and coordinated education and recovery efforts in partnership with Regional Fishery Management Organizations (RFMOs) and other international bodies, governments, universities, private institutions, and local communities in relevant areas throughout the world. Among these activities, NMFS conducts joint research and holds workshops for fishers and fisheries managers on sea turtle handling, release, and resuscitation methods; sea turtle biology and species identification; and measures to mitigate sea turtle interactions.

The United States introduced the NED sea turtle bycatch mitigation research at the November 2003, ICCAT meeting in Dublin, Ireland. A poster and video describing the NED research experiment and preliminary results were displayed, as well as many of the experimentally tested release gears. At the annual ICCAT meeting in New Orleans in November 2004, NMFS staff conducted a workshop discussing experimental results and the use of circle hooks, the use of dehooking devices, and safe handling and release techniques. In June 2004, NMFS staff gave a presentation promoting cooperative research and the use of circle hooks at a Symposium on Bycatch Reduction hosted by the National Fisheries Research and Development Institute (NFRDI) in Korea.

The first Technical Assistance Workshop on Sea Turtle Bycatch Reduction Experiments in Longline Fisheries was held in April 2005, in Honolulu. This workshop was held to provide technical assistance for participants from the FAO Technical Consultation Group to design programs for the development and testing of turtle bycatch reducing technology appropriate to the longline fisheries of participating nations.

At the Third International Fishers Forum (IFF) held in Yokahama, Japan in July 2005, and the Fourth IFF held in Coast Rica in 2007, the United States presented research results on sea turtle bycatch avoidance methods. In 2005, the United States assisted in designing experiments to evaluate sea turtle mitigation techniques and provided technical assistance for the following countries: Australia; Brazil; Costa Rica; Ecuador; Iceland; Italy; Japan; Korea; Taiwan; Mexico; Peru; Philippines; Spain; Uraquay; and, Vietnam.

From 2006 through 2008, NMFS funded and/or held numerous training and other cooperative programs regarding the protection and conservation of sea turtles in the Atlantic, including:

- A 2006 leatherback turtle research program in the Dominican Republic;
- Provision of laminated cards with sea turtle ID and handling guidelines and a sea turtle safe handling video to numerous countries, including Brazil, Spain, Mexico, Uruguay, Italy, Costa Rica, and Indonesia (the guidelines have been translated into Spanish and Vietnamese);
- Cooperative research with Spain concerning loggerhead turtles hooked with longline hooks in the Azores;
- Participation in a European technical meeting in June 2008 concerning bycatch in fisheries in the Canary Islands;

- Work with Spanish field trials assisting with tests of bait type with regard to sea turtle capture rates, including planned future work to test circle hooks in a Spanish swordfish fishery;
- Workshops on the use of circle hooks, dehookers and line cutters in artisanal and industrial longline fisheries in Morocco, in cooperation with the Universite Abdelmalek Essaadi, Department of Biology. Because Morocco's drift gill net fishery is changing to pelagic longline fishing, these were designed to teach techniques with sea turtle mitigation gear and circle hooks to ensure both the viability of the new fishery as well as protection for endangered and threatened sea turtles;
- Assistance for research to reduce sea turtle bycatch in longline fisheries, coordinating field trials in Brazil, Uruguay, and Italy, including provision of satellite tags to Brazilian and Uruguayan longline observers to investigate the post-hooking survivorship of turtles after their release from fishing gear;
- Training for Korean and Japanese representatives in sea turtle handling protocols used by NOAA Fisheries observers;
- Work with Korean fisheries scientists on statistical analysis of data gained from bycatch reduction experiments; and,
- Collaboration with World Wildlife Fund to test the use of circle hooks in both tuna and swordfish-directed fisheries in Italy.

Working with the Department of State, NMFS has also conducted several programs involving technology transfer and training for the protection and conservation of Atlantic sea turtles, including:

- Transfer of sea turtle mitigation technology to Spain, Canada, Mexico, Italy, Uruguay, and Venezuela; and,
- Provision of hooks designed to reduce sea turtle bycatch throughout Latin America.

Many other outreach, education, and research projects have been conducted and/or funded by NMFS regarding se turtle bycatch reduction in the Pacific Ocean.

4.2 Purse Seine

4.2.1 Domestic History and Current Management

Purse seine gear consists of a floated and weighted encircling net that is closed by means of a drawstring; known as a purseline, threaded through rings attached to the bottom of the net. The efficiency of this gear can be enhanced by the assistance of spotter planes used to locate schools of tuna. Once a school is spotted, the vessel, with the aid of a smaller skiff, intercepts and uses the large net to encircle it. Once encircled, the purseline is pulled, closing the bottom of the net and preventing escape. The net is hauled back onboard using a powerblock, and the tunas are removed and placed onboard the larger vessel. Economic and social aspects of the fisheries are described in Section 5.0 of this document.

Vessels using purse seine nets have participated in the U.S. Atlantic tuna fishery continuously since the 1950s; although a number of purse seine vessels did target and land BFT off the coast of Gloucester, MA as early as the 1930s. In 1958, continued commercial purse seining effort for Atlantic tunas began with a single vessel in Cape Cod Bay and expanded rapidly into the region between Cape Hatteras and Cape Cod during the early 1960s. The purse seine fishery between Cape Hatteras and Cape Cod was directed mainly at small and medium BFT, YFT, and at skipjack tuna, primarily for the canning industry. North of Cape Cod, purse seining was directed at giant BFT. High catches of juvenile BFT were sustained throughout the 1960s and into the early 1970s. These high catch rates by U.S. purse seine vessels are believed to have played a role in the decline in abundance during subsequent years. Currently these purse seine vessels focus their effort on giant BFT, versus other tunas, due to the international market that developed for giant BFT in the late 1970s. These fresh caught BFT are primarily flown directly to Japan for processing into sushi or sashimi. By the late 1980s, high ex-vessel prices and the increased importance of the Japanese market had increased effort on all size classes of BFT. In 1992, NMFS responded by banning the sale of school, large school, and small medium BFT (27 inches to less than 73 inches curved fork length).

A limited entry system with non-transferable individual vessel quotas (IVQs) for purse seining was established in 1982, effectively excluding any new entrants into this category. Equal baseline quotas of BFT are assigned to individual vessels by regulation; the IVQ system is possible given the small pool of ownership in this sector of the fishery, i.e., five qualified participants. In 1996 the quotas were made transferable among the five entities provided they notified NMFS in writing.

Vessels participating in the Atlantic tunas purse seine fishery are required to target the larger size class BFT, more specifically the giant size class (81 inches or larger) and are granted a tolerance limit for large medium size class BFT (73 to less than 81 inches), i.e., large medium catch may not exceed 15 percent by weight of the total amount of giant BFT landed during a season. These vessels may commence fishing starting on July 15 of each year and may continue through December 31, provided the vessel has not fully attained its IVQ. Over the last few years, the Purse seine category has not fully harvested its allocated quota. This can be attributed to a number of different reasons outside of the industry's or NMFS' control, such as lack of

availability, schools of mixed size classes, high operating costs, vessel sales, etc. NMFS has issued several EFPs to this sector of the fishery (to assist in archival tagging of BFT and other research projects) and will continue to assess current regulations and their impact on providing reasonable opportunities to harvest available quota.

4.2.2 Recent Catch and Landings

Table 4.17 shows purse seine landings of Atlantic tunas from 1999 through 2007. Purse seine landings historically have made up approximately 20 percent of the total annual U.S. landings of BFT (about 25 percent of total commercial landings), but recently only account for a small percentage. In the 1980s and early 1990s, purse seine landings of YFT were often over several hundred metric tons. Over 4,000 mt ww of YFT were recorded landed in 1985. In recent years, via informal agreements with other sectors of the tuna industry, the purse seine fleet has opted not to direct any effort on HMS other than BFT.

Table 4.17 Domestic Atlantic Tuna Landings for the Purse Seine Fishery: 1999-2007 (mt ww). Northwest Atlantic Fishing Area. Source: U.S. National Report to ICCAT: 2008.

Species	1999	2000	2001	2002	2003	2004	2005	2006	2007
Bluefin Tuna	247.9	275.2	195.9	207.7	265.4	31.8	178.3	3.6	27.9
Yellowfin Tuna	0	0	0	0	0	0	0	0	0
Skipjack Tuna	0	0	0	0	0	0	0	0	0

4.2.3 Safety Issues

Accidents that can occur on purse seine vessels include general injuries caused by handling fish (*e.g.*, poisoning from being stuck by fin spines), as well as accidents related to the vessels fishing operations themselves, such as, deploying the skiff or using cables and winches to move giant BFT from the net to the hold.

4.2.4 International Issues and Catch

The U.S. purse seine fleet has historically accounted for a small percentage of the total international Atlantic tuna landings. Table 4.18 shows that over the past nine years, the U.S. purse seine fishery has contributed to less than 0.15 percent of the total purse seine landings reported to ICCAT.

Table 4.18 Estimated International Purse Seine Atlantic Tuna Landings in the Atlantic and Mediterranean: 1999-2007 (mt ww). Source: SCRS, 2008.

Species	1999	2000	2001	2002	2003	2004	2005	2006	2007
Bluefin Tuna	16,760	18,462	18,973	20,575	19,055	21,002	24,270	21,357	22,053
Yellowfin Tuna	81,783	82,540	108,720	97,538	82,075	62,228	61,410	62,761	52,485
Skipjack Tuna	103,861	89,799	82,439	68,935	92,347	93,284	89,704	71,215	88,323
Bigeye Tuna	24,533	18,599	21,556	20,894	22,731	18,417	18,595	16,457	13,150
Albacore	239	242	289	158	998	708	915	3432	1276
Total	**227,176**	**209,642**	**231,977**	**208,100**	**217,206**	**195,639**	**194,894**	**175,222**	**177,287**
U.S. Total	**248**	**275**	**196**	**208**	**265**	**32**	**178**	**4**	**28**
U.S. Percentage	**0.11%**	**0.13%**	**0.08%**	**0.10%**	**0.12%**	**0.02%**	**0.09%**	**<0.01%**	**0.02%**

Since 1999, ICCAT has continued to implement a Fish Aggregation Device (FAD) closed area in the Gulf of Guinea. The closure (which became mandatory in mid-1999) was in response to concern over catches of juvenile and undersize tunas by non-U.S. internationally flagged purse seiners relying on FADs. At the 2004 ICCAT meeting, ICCAT adopted a revised recommendation that removed the minimum size measure for bigeye tuna and significantly changed the time area closure. This measure reduced the size of the closed area. The temporal coverage had also been reduced from three months to one month and instead of banning fishing on FADs, the measure established a complete fishing moratorium in the area by the surface fishery (bait boats and purse seines). The recommendation did not require that FADs be removed from the closed area during the month that surface fishing is not permitted.

4.3 Commercial Handgear

4.3.1 Domestic History and Current Management

Commercial handgears, including handline, harpoon, rod and reel, buoy gear and bandit gear are often used to fish for Atlantic HMS by fishermen on private vessels, charter vessels, and headboat vessels. Rod and reel gear may be deployed from a vessel that is at anchor, drifting, or underway (*i.e.*, trolling). In general, trolling consists of dragging baits or lures through, on top of, or even above the water's surface. While trolling, vessels often use outriggers to assist in spreading out or elevating baits or lures and to prevent fishing lines from tangling. Operations, frequency and duration of trips, and distance ventured offshore vary widely. Most of the vessels are greater than seven meters in length and are privately owned by individual fishermen.

The handgear fisheries are typically most active during the summer and fall, although in the South Atlantic and Gulf of Mexico fishing occurs during the winter months. Fishing usually takes place between eight and 200 km from shore and for those vessels using bait, the baitfish typically includes herring, mackerel, whiting, mullet, menhaden, ballyhoo, butterfish, and squid. The commercial handgear fishery for BFT occurs mainly in New England, and more recently off the coast of southern Atlantic states, such as Virginia, North Carolina and South Carolina, with vessels targeting large medium and giant BFT. The majority of U.S. commercial handgear fishing activities for bigeye, albacore, yellowfin, and skipjack tunas take place in the northwest Atlantic. Beyond these general patterns, the availability of Atlantic tunas at a specific location and time is highly dependent on environmental variables that fluctuate from year to year.

Currently the U.S. Atlantic tuna commercial handgear fisheries are managed through an open access vessel permit program. Vessels that wish to sell their Atlantic tunas must obtain a permit in one of the following categories: General (handgears include rod and reel, harpoon, handline, and bandit gear), Harpoon (harpoon only), or Charter/Headboat (rod and reel and handline). These vessels may also need permits from the states they operate out of in order to land and sell their catch. All commercial permit holders are encouraged to check with their local state fish/natural resource management office regarding these requirements. Permitted vessels are also required to sell their Atlantic tunas to federally permitted Atlantic tuna dealers. As the Atlantic tunas dealer permits are issued by the Northeast Region Permit Office, vessel owner/operators are encouraged to contact the permitting office directly, either by phone at (978) 281-9438 or via the web at http://www.nero.noaa.gov/ro/doc/vesdata1.htm, to obtain a list of permitted dealers in their area.

Vessels that are permitted in the General and Charter/Headboat categories commercially fish under the General category rules and regulations. For instance, regarding BFT, vessels that possess either of the two permits mentioned above have the ability to retain a daily bag limit of zero to three BFT, measuring 73 inches or greater curved fork length per vessel per day while the General category BFT fishery is open. The General category BFT fishery opens on January 1 of each year and remains open until January 31. The fishery reopens on June 1 and remains open until December 31, or until the quota is filled. Vessel owner/operators should check with the agency via websites (www.hmspermits.gov) or telephone information lines (1-888-872-8862) to

verify the BFT retention limit on any given day. The General category BFT quota receives approximately 47 percent of the U.S. quota.

Vessels that are permitted in the Harpoon category fish under the Harpoon category rules and regulations. For instance, regarding BFT, vessels have the ability to keep two bluefin measuring 73 inches to less than 81 inches curved fork length per vessel trip per day while the fishery is open. There is no limit on the number of BFT that measure longer than 81 inches curved fork length, as long as the Harpoon category season is open. The Harpoon category season also opens on June 1 of each year and remains open until November 15, or until the quota is filled. The Harpoon category BFT quota is approximately 3.9 percent of the U.S. quota.

U.S. commercial swordfish fishing in the Atlantic Ocean is reported to have begun in the early 1800s as a harpoon fishery off the coast of New England. This fishery traditionally consisted of harpoon vessels operating out of Rhode Island and Massachusetts where they took extended trips for swordfish north and east of the Hudson Canyon and particularly off Georges Bank, and could land as many as 20 to 25 large swordfish over a ten-day period. These fish primarily consisted of large fish that finned on the surface and were available to the harpoon gear, some weighing as much as 600 lbs dw, but averaging about 225 to 300 lbs dw at the turn of the century. Because of the limited effort directed towards large fish, the stock was sufficient to support a sustainable seasonal swordfish fishery for more than 150 years. Most swordfish caught in the United States in the early 1900s were harvested with harpoons; harpoon landings declined from the 1940s through the 1960s. Due to a decreased availability of the large swordfish in the northeast this fishery has essentially ceased to exist. However, in recent years, a new commercial swordfish handgear fishery has developed off the east coast of Florida.

For information regarding the commercial buoy gear fishery, refer to Section 4.7.

The shark commercial handgear fishery plays a very minor role in contributing to the overall shark landing statistics. For further information regarding the shark fishery refer to Section 2.5. Economic and social aspects of all the domestic handgear fisheries are described later in this document (Section 5.0).

4.3.2 Recent Catch and Landings

The proportion of domestic HMS landings harvested with handgear varies by species, with Atlantic tunas comprising the majority of commercial landings. Commercial handgear landings of all Atlantic HMS (other than sharks) in the United States are shown in Table 4.19 and Table 4.20.

In 2007, BFT commercial handgear landings accounted for approximately 16 percent of the total U.S. BFT landings, and almost 69 percent of commercial BFT landings.

Also in 2007, three percent of the total yellowfin catch, or six percent of the commercial yellowfin catch, was attributable to commercial handgear. Commercial handgear landings of skipjack tuna accounted for approximately 21 percent of total skipjack landings, or about 100 percent of commercial skipjack landings. For albacore, commercial handgear landings

accounted for approximately one percent of total albacore landings, or about four percent of commercial albacore landings. Commercial handgear landings of bigeye tuna accounted for approximately four percent of total bigeye landings and five percent of total commercial bigeye landings.

Updated landings for the commercial handgear fisheries by gear and by area for 1999 – 2007 are presented in the following tables.

Table 4.19 Domestic Landings for the Commercial Handgear Fishery, by Species and Gear, for 1999-2007 (mt ww). Source: U.S. National Report to ICCAT: 2008.

Species	Gear	1999	2000	2001	2002	2003	2004	2005	2006	2007
Bluefin Tuna	Rod and Reel	643.6	590.9	889.7	878.5	529.2	353.2	226.6	164.1	120.8
	Handline	15.5	3.2	9.0	4.5	2.5	1.5	2.3	0.3	0.0
	Harpoon	115.8	184.2	102.1	55.6	87.9	41.2	31.5	30.3	22.5
	TOTAL	**774.9**	**778.3**	**1,000.8**	**938.6**	**619.6**	**395.9**	**260.4**	**194.7**	**143.3**
Bigeye Tuna	Troll	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Handline	12.3	5.7	33.7	14.4	6.3	3.5	6.3	23.0	19.0
	TOTAL	**12.3**	**5.7**	**33.7**	**14.4**	**6.3**	**3.5**	**6.3**	**23.0**	**19.0**
Albacore Tuna	Troll	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Handline	4.4	7.9	3.9	6.6	4.3	8.2	4.2	3.1	6.0
	TOTAL	**4.4**	**7.9**	**3.9**	**6.6**	4.3	8.2	4.2	3.1	6.0
Yellowfin Tuna	Troll	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Handline	220.0	284.0	300.0	244.0	199.7	248.5	160.3	162.8	161.5
	TOTAL	**220.0**	**284.0**	**300.0**	**244.0**	199.7	248.5	160.3	162.8	161.5
Skipjack Tuna	Troll	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Handline	6.4	9.7	10.5	12.7	13.1	10.4	11.8	10.2	14.2
	TOTAL	**6.4**	**9.7**	**10.5**	**12.7**	13.1	10.4	11.8	10.2	14.2
Swordfish	Handline	5.0	8.9	8.9	11.7	20.6	22.7	34.7	32.6	129.1
	Harpoon	0.0	0.6	7.4	2.8	0.0	0.5	0.0	0.3	0.0
	TOTAL	**5.0**	**9.5**	**16.3**	**14.5**	**20.6**	**23.2**	**34.7**	**32.9**	**129.1**

Table 4.20 **Domestic Landings for the Commercial Handgear Fishery by Species and Region for 1999-2007 (mt ww).** Source: U.S. National Report to ICCAT: 2008.

Species	Region	1999	2000	2001	2002	2003	2004	2005	2006	2007
Bluefin Tuna	NW Atl	774.4	778.3	1,000.8	938.3	607.3	395.6	260.4	194.7	143.3
Bigeye Tuna	NW Atl	11.9	4.1	33.2	13.8	6.0	3.3	6.2	21.5	17.8
	GOM	0.2	0.1	0.5	0.6	0.3	0.2	0.1	1.5	1.2
	Caribbean	0.2	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Albacore Tuna	NW Atl	0.6	2.9	1.7	3.9	1.7	6.1	3.0	2.6	5.6
	GOM	≤ .05	0.0	0.0	0.0	≤ .05	0.0	0.1	0.1	0.2
	Caribbean	3.8	5.0	2.2	2.7	2.6	2.1	1.1	0.4	0.2
Yellowfin Tuna	NW Atl	192.0	235.7	242.5	137.0	149.1	213.2	105.1	105.1	118.1
	GOM	12.7	28.6	43.4	100.0	39.9	28.3	45.5	49.9	34.3
	Caribbean	14.5	19.4	14.3	7.0	10.7	7.0	9.7	7.8	9.1
Skipjack Tuna	NW Atl	0.2	0.2	0.2	0.2	0.2	0.6	0.9	0.2	0.3
	GOM	0.4	0.7	0.0	0.0	0.0	0.2	0.0	0.0	0.2
	Caribbean	5.8	8.8	10.3	12.5	12.9	9.6	12.9	10.0	13.7
Swordfish	NW Atl	5.0	8.3	16.0	11.6	10.8	19.2	34.4	32.8	126.0
	GOM	≤ .05	1.2	0.3	2.9	9.8	4.0	0.3	0.1	3.1

Handgear Trip Estimates

Table 4.21 displays the estimated number of rod and reel and handline trips targeting large pelagic species in 2001 through 2007. The trips include commercial and recreational trips, and are not specific to any particular species. It should be noted that these estimates are still preliminary and subject to change.

Table 4.21 **Estimated number of vessel trips targeting large pelagic species, 2001-2007.** Source: Large Pelagics Survey database.

Year	AREA							Total
	NH/ME	MA	CT/RI	NY	NJ (north)	NJ (south) + MD/DE	VA	
Private Vessels								
2001	1,944	3,641	497	2,039	3,040	2,675	910	14,746
2002	5,090	15,180	2,558	7,692	2,762	22,757	6,524	62,563
2003	4,501	13,411	2,869	12,466	3,214	21,619	5,067	63,147
2004	2,025	10,033	3,491	11,525	3,632	22,433	4,406	57,545
2005	4,607	12,052	7,603	8,051	2,446	19,759	4,631	59,148
2006	3,303	24,951	5,430	11,114	3,043	19,187	5,274	72,302
2007	5,929	25,139	6,020	6,809	5,875	17,712	5,012	72,496
Charter								

Year	AREA							Total
	NH/ME	MA	CT/RI	NY	NJ (north)	NJ (south) + MD/DE	VA	
Vessels								
2001	133	567	203	280	660	655	307	2,805
2002	1,132	3,357	937	1,686	1,331	6,300	1,510	16,253
2003	221	2,561	1,246	2,035	1,331	5,201	546	13,141
2004	312	2,021	1,564	2,285	1,094	5,080	1,579	13,935
2005	329	2,397	551	2,033	1,024	3,476	763	10,573
2006	96	1,294	677	1,057	891	3,452	828	8,296
2007	789	4,073	1,141	1,445	1,420	4,579	610	14,057

4.3.3 Safety Issues

The U.S. Coast Guard (USCG) conducts routine vessel safety inspections at sea on a variety of vessels throughout the year. During the busy General category BFT season, the USCG has been known to concentrate patrol activities on General category BFT boats. Boarding officers indicate that the majority of the commercial handgear vessels have the necessary safety equipment; however, many part-time fishermen operating smaller vessels do not meet the necessary safety standards. There have been several cases of vessels participating in the commercial handgear fishery that have capsized due to weight while attempting to boat commercial-sized BFT (measuring 73 inches or greater and weighing several hundred pounds).

Over the last few years, the USCG focused boardings on small vessels, especially those owned by "part-time" commercial handgear fishermen, and terminated several dozen trips due to the lack of safety equipment on board. If a vessel is boarded at sea and found to be lacking major survival equipment, the USCG will terminate the trip and escort the vessels back to port.

Currently, NMFS does not require proof of proper safety equipment as a condition to obtain a commercial handgear permit. Instead, NMFS informs permit applicants that commercial vessels are subject to the Fishing Vessel Safety Act of 1988 and advises them to contact their local USCG office for further information. The USCG District Boston office reports receiving 50 to 75 calls a week during the peak fishing season; officers speak with all callers to answer vessel questions. Since NMFS regulations do not require USCG inspection or safety equipment in order to obtain a commercial handgear permit, NMFS cannot be certain that all participants in the commercial handgear fisheries are adequately prepared for the conditions they may encounter. NMFS is concerned about the safety of all vessels participating in the commercial handgear fisheries and continues to work with the USCG to improve communication of vessel safety requirements to commercial handgear vessel operators.

It is unlawful for Atlantic tuna vessels to engage in fishing unless the vessel travels to and from the area where it will be fishing under its own power and the person operating that vessel brings any BFT under control (secured to the catching vessel or on board) with no assistance from another vessel, except when shown by the operator that the safety of the vessel or its crew was jeopardized or other circumstances existed that were beyond the control of the operator (50 CFR Part 635.71 (b)(1)). NMFS Enforcement and USCG boarding officers have recently encountered vessels participating in the BFT fishery that are unable to transit to and from the

fishing grounds due to their limited fuel capacity. Occasionally these smaller vessels will work in cooperation with a larger documented vessel to catch a BFT; others have been observed leaving lifesaving equipment at the dock to make room for extra fuel, bait, and staples. NMFS is concerned that use of such inadequately equipped vessels jeopardizes crew in that the vessel may not be able to safely return to shore without assistance of the larger vessel due to insufficient fuel or to adverse weather conditions.

Over the last couple of years, NMFS has received a number of vessel permit applications from kayak owner/operators. In addition to the requirement mentioned above, NMFS only issues permits to vessels that possess a USCG Documentation number, a state registration number, or a foreign registration number (recreational permit only). As kayaks typically do not require such documentation, NMFS has denied all applications for a kayak to date.

NMFS also has concerns regarding individuals embarking on HMS trips by themselves. Recently there have been a few incidents of fishermen either severely injuring themselves or dying while pursing HMS by themselves. Certain hazardous situations could be mitigated by having an additional person onboard the vessel while conducting a trip targeting large pelagic species. NMFS encourages vessel owner/operators to practice safe fishing techniques.

NMFS will consider all safety comments and information, including those from the USCG and NMFS Enforcement, when planning future General category effort control schedules and will discuss these issues in future meetings with the AP.

4.3.4 International Issues and Catch

SCRS data do not lend themselves to organize international landings into a commercial handgear category. While some countries report rod and reel landings, these numbers may include both commercial and recreational landings. International catches of all Atlantic HMS are summarized in Section 0.

4.4 Recreational Handgear

The following section describes the recreational portion of the handgear fishery, and is primarily focused upon rod and reel fishing.

4.4.1 Domestic History and Current Management

Atlantic tunas, swordfish, sharks, and billfish are managed under the 2006 Consolidated HMS FMP, as amended. These species are all targeted by domestic recreational fishermen using rod and reel gear. Since 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. Also, on January 7, 2003, a final rule establishing a mandatory reporting system for all non-tournament recreational landings of Atlantic marlins, sailfish, and swordfish was published in the Federal Register (68 FR 711). The reporting requirement became effective in March 2003. All HMS fishing tournaments are required to register with NMFS at least 4 weeks prior to the commencement of tournament fishing activities. If selected, tournament operators are required to report the results of their tournament to the SEFSC.

Recreational fishing for Atlantic HMS is managed primarily through the use of minimum size limits and bag limits. Recreational tuna fishing regulations are the most complex and include a combination of minimum sizes, bag limits, limited season-based quota allotment for bluefin tuna, and reporting requirements (depending upon the particular species and vessel type).

The recreational swordfish fishery is managed through the use of a minimum size requirement, trip limits, and landing requirements (swordfish may be headed and gutted but may not be cut into smaller pieces). For whole (head on) North Atlantic swordfish, the minimum size is 47” (119 cm) lower jaw fork length (LJFL). If the head or tail of the swordfish has been removed prior to landing, a minimum size of 29” (73 cm) from cleithrum to caudal keel, or a 33 lb (15 kg) minimum dressed weight shall be applied in all cases. Recreational anglers may not land South Atlantic swordfish (south of 5° N latitude). Effective July 9, 2007 (72 FR 31688, June 7, 2007) recreational swordfish retention limits were modified for HMS Angling and Charter/Headboat (CHB) permit holders. Vessel owners issued an HMS Angling category permit may retain one swordfish per person, up to four swordfish per vessel/trip. Vessel owners operating a charter vessel and issued a HMS CHB permit may retain one swordfish per paying passenger and up to six swordfish per vessel/trip. Vessel owners operating a headboat vessel and issued a HMS CHB permit may retain one swordfish per paying passenger and up to fifteen swordfish per vessel/trip.

The recreational shark fishery is managed using bag limits, minimum size requirements, and landing requirements (sharks must be landed with head and fins naturally attached). Additionally, the possession of 21 species of sharks is prohibited. Recreational fishermen are

allowed to keep non-ridgeback LCS, tiger sharks, pelagic sharks, and SCS. As of July 24, 2008, recreational fishermen may no longer keep sandbar or silky sharks.

Atlantic blue and white marlin have a combined annual landings limit (*i.e.*, a maximum of 250 fish that can be landed per year); however, the primary management strategy for the recreational billfish fishery is through the use of minimum size limits. For blue marlin, white marlin, and sailfish, the LJFL minimum sizes are 99" (251 cm), 66" (168 cm), and 63" (160 cm), respectively. There are no recreational retention limits for Atlantic sailfish, blue marlin, and white marlin. Recreational anglers may not land longbill spearfish.

ICCAT has made several recommendations to recover billfish resources throughout the Atlantic Ocean that are discussed in detail in Section 2.4.

4.4.2 Recent Catch and Landings

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 (RBS) tournament data, and the Recreational non-tournament swordfish and billfish landings database. Descriptions of these surveys, the geographic areas they include, and their limitations, were discussed in Section 2.6.2 of the 1999 FMP and Section 2.3.2 of the 1999 Billfish Amendment.

Historically, fishery survey strategies (including the MRFSS, LPS, and RBS) have not captured all landings of recreationally-caught swordfish. Although some swordfish handgear fishermen have commercial permits[1], many others land swordfish strictly for personal consumption. Therefore, NMFS has implemented regulations to improve recreational swordfish and billfish monitoring and conservation. These regulations stipulate that all non-tournament recreational landings of swordfish and billfish must be reported using either a toll-free call-in system (which became operational in 2003), or an Internet-based reporting portal (which became operational in 2008). Accordingly, all reported recreational swordfish landings are counted against the incidental swordfish quota.

Reported domestic landings of Atlantic bluefin tuna (1983 through 1998) and BAYS tuna (1995 through 1997) were presented in Section 2.2.3 of the 1999 FMP. Updated landings for all recreational rod and reel fisheries are presented below in Table 4.22 from 2000 through 2007. Recreational landings of swordfish are monitored by the LPS, MRFSS, RBS, and mandatory recreational reporting requirements (http://www.hmspermits.gov).

An ad hoc committee of NMFS scientists reviewed the methodology and data used to estimate recreational landings of Atlantic HMS during 2004. The Committee was charged with reviewing the 2002 estimates of U.S. recreational landings of bluefin tuna, white marlin and blue marlin reported by NMFS to ICCAT. The committee was also charged with recommending

[1] Access to the commercial swordfish fishery is limited; hand gear fishermen however may purchase permits from other permitted fishermen because the permits are transferable.

methods to be used for the estimation of 2003 recreational fishery landings of bluefin tuna and marlin. Although the Committee discovered and corrected a few problems with the raw data from the LPS and the estimation program used to produce the estimates, the Committee concluded that the estimation methods for producing the 2002 estimates were consistent with methods used in previous years. The report of the Committee is available at: http://www.nmfs.noaa.gov/sfa/hms/Tuna/2002-2003_Bluefin-Marlin_Report-120304.pdf.

Table 4.22 Updated Domestic Landings for the Atlantic Tunas, Swordfish and Billfish Recreational Rod and Reel Fishery, 2000-2007 (mt ww)*. Sources: NMFS, 2004; NMFS, 2005; NMFS, 2006; NMFS, 2007. (Rec. shark landings are in Table 4.25)

Species	Region	2000	2001	2002	2003	2004	2005	2006	2007
Bluefin Tuna**	NW Atlantic	449.5	242.9	519.4	314.6	329	254.4	158.2	398.6
	GOM	0.9	1.7	1.5	0	0	0.0	0.6	0.0
	Total	**450.4**	**244.6**	**520.9**	**314.6**	**329**	**254.4**	**158.8**	**398.6**
Bigeye tuna**	NW Atlantic	34.4	366.2	49.6	188.5	94.6	165.0	422.0	126.8
	GOM	0	0	0	0	6	0	24.0	0
	Caribbean		0	0	4.0	0	0	0	0
	Total	**34.4**	**366.2**	**49.6**	**192.5**	**100.6**	**165.0**	**446.0**	**126.8**
Albacore**	NW Atlantic	250.75	122.3	323.0	333.8	500.5	356.0	284.0	393.6
	GOM	0	0	0	0	0	0	0	0
	Total	**250.75**	**122.3**	**323.0**	**333.8**	**500.5**	**356.0**	**284.0**	**393.6**
Yellowfin tuna**	NW Atlantic	3,809.5	3,690.5	2,624	4,672	3,434	3,504.0	4,649.0	2,756
	GOM	52.3	494.2	200	640	247	147.0	258.0	227.6
	Caribbean	0	0.1	7.2	16	0	0	0	12.4
	Total	**3,861.8**	**4184.7**	**2,831.2**	**5,328**	**3,681**	3,651.0	**4,907.0**	**2,996**
Skipjack tuna**	NW Atlantic	13.1	32.9	23.3	34.0	27.3	8.0	35.0	27.4
	GOM	16.7	16.1	13.2	11.0	6.3	3.1	6.4	23.9
	Caribbean	0	0	13.2	15.7	40.4	4.0	8.0	0.2
	Total	**29.8**	**49.0**	**49.7**	**60.7**	**74.0**	**15.1**	**49.4**	**51.5**

Species	Region	2000	2001	2002	2003	2004	2005	2006	2007
Blue marlin***	NW Atlantic	13.8	9.0	-	-	-	-	-	-
	GOM	4.7	5.1	-	-	-	-	-	-
	Caribbean	5.7	2.3	-	-	-	-	-	-
	Total	**24.2**	**16.4**	**5.6**	**19**	**24**	**15**	**17**	**10**
White marlin ***	NW Atlantic	0.23	2.8	-	-	-	-	-	-
	GOM	0	0.3	-	-	-	-	-	-
	Caribbean	0	0	-	-	-	-	-	-
	Total	**0.23**	**3.1**	**5.6**	**0.6**	**0.8**	**0.8**	**1.1**	**0.9**
Sailfish***	NW Atlantic	1.75	61.2	-	-	-	-	-	-
	GOM	0.24	0.6	-	-	-	-	-	-
	Caribbean	0.06	0	-	-	-	-	-	-
	Total	**2.05**	**61.8**	**103**	**53**	**33**	**0.08**	**0.08**	**0.03**
Swordfish	**Total**	**15.6**	**1.5**	**21.5**	**6.1**	**25.2**	**53.1**	**52.7**	**68.2**

* Rod and reel catches and landings for Atlantic tunas represent estimates of landings and dead discards based on statistical surveys of the U.S. recreational harvesting sector.

** Rod and reel catch and landings estimates of bluefin tuna less than 73" curved fork length (CFL) based on statistical surveys of the U.S. recreational harvesting sector. Rod and reel catch of bluefin > 73" CFL are commercial and may also include a few metric tons of "trophy" bluefin (recreational bluefin 73").

*** Blue marlin, white marlin, and sailfish landings are based on prior U.S. National Reports to ICCAT and consist primarily of reported tournament landings.

Atlantic Billfish Recreational Fishery

Due to the rare nature of billfish encounters and the difficulty of monitoring landings outside of tournament events, reports of recreational billfish landings are sparse. However, the RBS provides a preliminary source for analyzing recreational billfish tournament landings. Table 4.23 below documents the number of billfish reported to the RBS that were landed in tournaments from 2000 – 2007.

Table 4.23 **Preliminary RBS Recreational Billfish Landings in Numbers of Fish (calendar year).** Source: NMFS Recreational Billfish Survey (RBS).

Species	2000	2001	2002	2003	2004	2005	2006	2007
Blue Marlin	117	75	84	96	110	64	72	46
White Marlin	8	22	33	20	25	26	36	31
Sailfish	18	11	14	24	9	3	4	1
Swordfish	-	-	16	48	168	385	207	274

In support of the most recent sailfish assessment conducted at the 2001 SCRS billfish species group meeting, document SCRS/01/106 developed indices of abundance of sailfish from the U.S. recreational billfish tournament fishery for the period 1973 – 2000. The index of weight per 100 hours fishing was estimated from numbers of sailfish caught and reported in the logbooks submitted by tournament coordinators and NMFS observers under the RBS, as well as available size information. Document SCRS/01/138 estimated U.S. sailfish catch estimates from various recreational fishery surveys.

In support of the most recent white and blue marlin stock assessments conducted at the 2006 SCRS billfish species group meeting, document SCRS/05/030 (Diaz & Ortiz, 2006) provided updated catch rates for these species from the U.S. recreational tournament fishery, as reported to the RBS. Figure 4.6 and Figure 4.7 below provide standardized catch per unit effort in weight and numbers of fish for white marlin and blue marlin respectively.

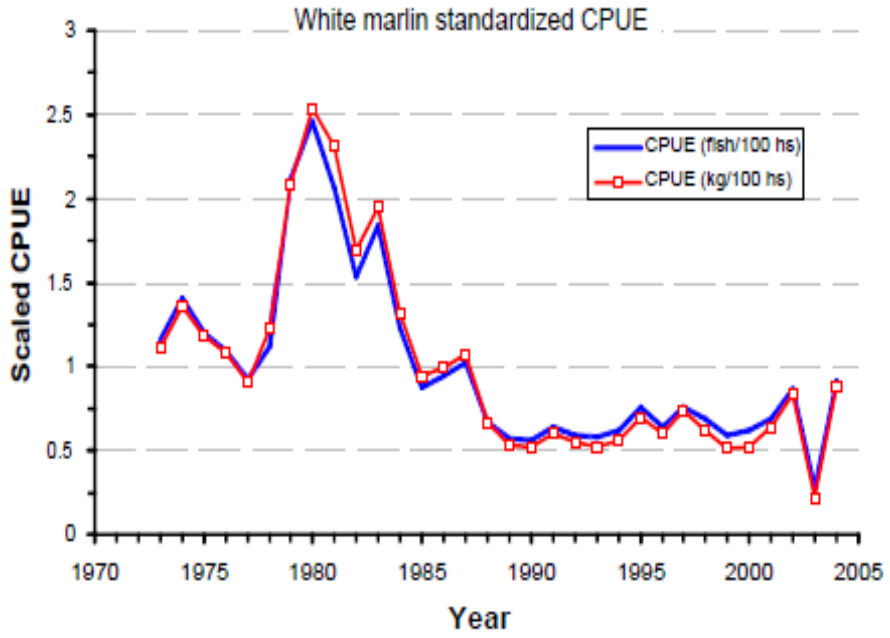


Figure 4.6 **Comparison of White Marlin Standardized CPUE in Weight and Number of Fish from 1973 – 2004.** Source: Diaz and Ortiz, 2006.

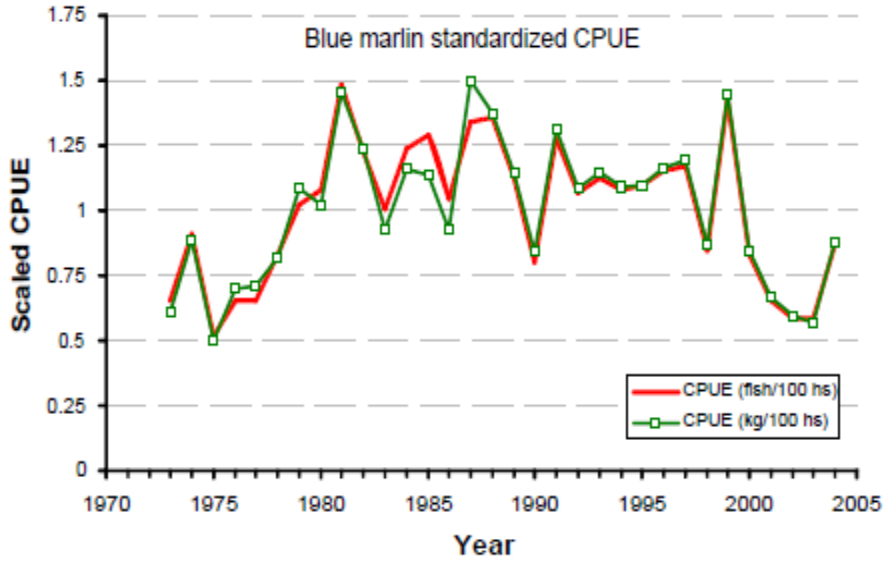


Figure 4.7 **Comparison of Blue Marlin Standardized CPUE in Weight and Number of Fish from 1973 – 2004.** Source: Diaz and Ortiz, 2006.

All recreational, non-tournament landings of billfish, including swordfish, must be reported within 24 hours of landing to NMFS by the permitted owner of the vessel landing the fish. This requirement is applicable to all permit holders, both private and charter/headboat vessels, not fishing in a tournament. In Maryland and North Carolina, vessel owners are required to report their billfish landings at state-operated landings stations. A landed fish means a fish that is kept and brought to shore. Table 4.24 provides a summary of non-tournament billfish

landings since 2004. However, due to potential large-scale non-compliance with the non-tournament reporting requirement, the landings in Table 4.24 are considered to be a minimum estimate of non-tournament billfish landings.

Table 4.24 Number of billfish reported to NMFS via call-in system by calendar year, 2004-2008.
Source: G. Fairclough, pers. comm.

Species	2004	2005	2006	2007	2008*
Blue Marlin	2	4	2	5	7
White Marlin	0	1	1	4	4
Sailfish	35	61	58	101	113
Swordfish	290	388	549	716	253

* 2008 landings as of Oct. 8, 2008

Swordfish Recreational Fishery

Table 4.23 above shows recreational tournament-caught swordfish landings reported to the RBS from 2000 – 2007. Table 4.24 above shows the number of billfish (including swordfish) reported to the NMFS recreational non-tournament reporting system from 2004 – 2008.

The recreational North Atlantic swordfish fishery had declined dramatically over the past twenty years, but has grown quite rapidly since 2003 as stock abundance has increased off the east coast of Florida and in the Mid-Atlantic Bight. In the past, the New York recreational swordfish fishery occurred incidental to overnight yellowfin tuna trips. During the day, fishermen targeted tunas, while at night they fished deeper for swordfish. This appears to have evolved into a year-round directed swordfish fishery off the east coast of Florida and a summer fishery off the coasts of New Jersey and New York. Fish have also occasionally been reported from Maryland, Virginia, Texas, Louisiana, South Carolina, and Rhode Island.

The Florida fishery has primarily occurred at night with fishermen targeting swordfish while drift fishing live or dead bait and using additional attractants such as lightsticks, LED lights, and light bars suspended under the boat. Notably, Florida recreational fishermen have recently begun targeting swordfish by fishing on the ocean bottom during the daytime in depths exceeding 1,600 ft. In general, swordfish captured using this method are much larger than those captured during nighttime drift fishing. These fishermen use highly specialized gear including braided lines, high capacity reels (with electric or manual retrieve), breakaway weights, and heavy duty rods.

Shark Recreational Fishery

Recreational landings of sharks are an important component of HMS fisheries. Recreational shark fishing with rod and reel is a popular sport at all social and economic levels, largely because the resource is accessible. Sharks can be caught virtually anywhere in salt water, depending upon the species. Recreational shark fisheries often occur in nearshore waters by private vessels and charter/headboats. However, there is also some shore-based fishing and

some offshore fishing. The following tables provide a summary of landings for each of the three species groups. Since 2003, the recreational fishery has been limited to rod and reel and handline gear only. Similar state regulations along the Atlantic seaboard are expected to be implemented through an ASMFC interstate fishery management plan in January 2009.

Table 4.25 **Estimates of Total Recreational Harvest of Atlantic Sharks: 1998-2007 (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**	**2006**	**2007**
LCS	169.6	92.3	140.0	137.2	82.8	88.8	66.6	86.2	59.4	68.7
Pelagic	11.8	11.1	13.3	3.8	4.7	4.3	5.0	5.4	16.5	9.0
SCS	175.1	125.7	199.9	212.5	153.8	133.7	126.0	119.1	119.5	172.4
Unclassified	8.0	6.9	10.9	24.5	5.4	18.1	27.9	47.4	7.3	23.8

Table 4.26 **Recreational Harvest of Atlantic LCS by Species, in number of fish: 1998-2007.** Sources: Cortés and Neer 2005, Cortés, pers. comm.

LCS Species	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Basking**	0	0	0	0	0	0	0	0	0	0
Bignose*	0	0	0	0	0	0	17	0	0	55
Bigeye sand tiger**	0	0	0	0	0	0	0	0	0	0
Blacktip	83,045	31,778	73,998	49,488	39,756	40,402	30,872	44,831	31,641	28,883
Bull	1,663	2,775	6,075	4,117	1,823	3,455	4,883	1,377	4,284	5,983
Caribbean Reef*	74	3	59	268	741	0	652	5	47	0
Dusky*	4,499	5,337	3,116	5,993	1,047	2,806	142	3,050	191	130
Galapagos*	0	0	0	0	0	0	0	0	0	0
Hammerhead, Great	476	555	925	3,446	4	47	9	162	139	813
Hammerhead, Scalloped	2,052	614	3,781	1,494	1,358	2,956	930	5,212	537	1,840
Hammerhead, Smooth	375	1	2	703	2	1	0	0	2	0
Hammerhead, Unclassified	390	0	3,691	0	5,247	0	0	2,676	1,099	807
Lemon	2,161	122	5,434	5,884	4,921	4,876	5,578	506	1,145	3
Night*	133	50	24	0	0	0	0	15	1	2
Nurse	2,455	1,429	2,214	4,934	2,562	563	3,463	2,341	1,553	334
Sandbar***	35,766	20,228	10,965	36,094	8,530	5,151	3,853	2,795	848	7,110
Sand tiger**	0	0	0	604	0	0	0	0	1,040	0
Silky***	5,376	361	6,233	3,928	1,741	1,943	399	3,589	2,042	1,980
Spinner	10,805	6,075	4,810	3,384	3,732	4,483	3,435	3,055	2,022	6,217
Tiger	1,380	7	1,480	732	126	110	1	1,321	1,309	1,815
Whale**	0	0	0	0	0	0	0	0	0	0
White**	0	0	0	0	0	0	0	0	0	0
Requiem shark unclassified	18,979	12,813	17,164	16,136	11,173	21,990	12,388	15,319	11,511	12,730
Total:	169,629	82,148	139,971	137,205	82,763	88,783	66,622	86,254	59,411	68,702

*indicates species that were prohibited in the recreational fishery as of July 1, 1999.
** indicates species that were prohibited as of April 1997.
*** indicates species that were prohibited as of July 2008.

Table 4.27 **Recreational Harvest of Atlantic Pelagic Sharks by Species, in number of fish: 1998-2007.** Sources: Cortés and Neer 2005, Cortés, pers. comm.

Pelagic Shark Species	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Bigeye thresher*	0	0	0	0	65	0	0	0	42	0
Bigeye sixgill*	0	0	0	0	0	0	0	0	0	0
Blue Shark	6,085	5,218	7,011	950	0	376	0	31	980	1,622
Mako, Longfin*	0	0	0	0	0	0	0	0	0	0
Mako, Shortfin	5,633	1,383	5,813	2,827	3,206	3,922	4,964	3,857	3,352	2,556
Mako, Unclassified	8	9	0	0	0	0	0	0	0	0
Oceanic whitetip	0	0	0	0	0	0	0	0	0	0
Porbeagle	0	0	0	0	0	0	0	0	0	0

Pelagic Shark Species	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Sevengill*	0	0	0	0	0	0	0	0	0	0
Sixgill*	0	0	0	0	0	0	0	0	0	0
Thresher	36	4,512	529	0	1,467	0	0	1,504	12,171	4,813
Total:	11,762	11,122	13,353	3,777	4,738	4,298	4,964	5,392	16,503	8,991

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

Table 4.28 **Recreational Harvest of Atlantic SCS by Species, in number of fish: 1998-2007.** Sources: Cortés and Neer 2005, Cortés, pers. comm.

SCS Species	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Atlantic Angel*	110	0	0	0	0	0	0	0	0	0
Blacknose	10,523	6,139	10,410	14,885	11,438	6,615	15,215	7,110	9,947	9,168
Bonnethead	29,147	37,341	56,436	59,017	51,048	40,066	42,050	31,369	24,234	43,006
Finetooth	139	78	1,390	6,628	3,027	1,758	286	2,847	268	3,935
Sharpnose, Atlantic	135,13	69,153	130,727	131,912	88,297	85,299	68,421	77,712	85,055	116,263
Sharpnose, Caribbean*	0	0	0	0	0	0	0	0	0	0
Smalltail*	0	4	973	70	0	0	71	35	0	0
Total:	175,05	112,71	199,936	212,512	153,810	133,738	126,043	119,073	119,504	172,372

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

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

The 1999 Billfish Amendment established a catch-and-release fishery management program for the recreational Atlantic billfish fishery. As a result of this program, all Atlantic billfish that are released alive, regardless of size, are not considered bycatch. NMFS believes that establishing a catch-and-release fishery in this situation solidifies the existing catch-and-release ethic of recreational billfish fishermen, and thereby increases release rates of billfish caught in this fishery. Current billfish release rates range from 89 to 99 percent. The recreational white shark fishery is by regulation a catch-and-release fishery only, and white sharks are not considered bycatch.

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

through the expansion of survey data derived from the LPS (dockside and telephone surveys). However, the actual numbers of fish discarded for many species are so low that presenting the data by area could be misleading, particularly if the estimates are expanded for unreported effort in the future. The number of kept and released fish reported or observed through the LPS dockside intercepts for 2000 – 2007 is presented in Table 4.29.

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

Table 4.29 **Observed or reported number of HMS kept 1 and released in the rod and reel fishery, Maine through Virginia, 2000-2007.** Source: Large Pelagic Survey (LPS) Preliminary Data.

	Number of Fish Kept [1]								Number of Fish Released Alive							
Species	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
White Marlin [2]	2	5	8	12	6	5	8	4	59	118	215	160	378	397	160	359
Blue Marlin[2]	0	1	0	4	5	3	2	2	17	14	30	39	80	52	42	69
Sailfish[2]	6	0	0	0	0	1	0	1	0	2	6	6	2	6	3	1
Swordfish	14	1	5	9	9	22	27	42	5	10	6	21	22	23	52	40
Giant Bluefin Tuna [3]	34	20	176	58	50	48	15	15	0	0	8	0	3	0	3	0
Large Medium Bluefin Tuna[3]	3	7	11	11	13	12	1	5	3	6	2	0	36	4	1	3
Small Medium Bluefin Tuna	30	87	62	83	30	22	48	69	37	5	8	13	21	30	18	32
Large School Bluefin Tuna	95	457	391	287	291	179	171	298	22	128	47	40	107	141	85	99
School Bluefin	151	338	556	509	927	638	84	314	159	58	200	174	1,297	1,917	290	347
Young School Bluefin	4	0	7	4	16	25	0	3	23	40	182	10	1,885	282	117	83
Bigeye Tuna	16	9	32	21	46	32	35	59	0	8	1	3	2	2	2	1
Yellowfin Tuna	2,366	2,423	2,595	3,216	3,858	3,700	3,572	2,988	97	74	328	200	1,093	502	351	171
Skipjack Tuna	32	100	117	681	197	79	104	34	69	130	250	526	362	105	129	17
Albacore	513	302	534	546	1,458	835	542	934	17	52	95	31	66	67	41	40
Thresher Shark	2	5	20	24	58	45	34	62	1	0	5	8	27	9	15	24
Mako Shark	49	27	72	141	216	99	111	143	114	65	120	208	350	142	177	190
Sandbar Shark	1	2	0	9	7	1	1	9	4	10	17	26	68	37	158	168
Dusky Shark	0	0	1	1	0	0	3	6	32	8	9	44	60	49	73	87
Tiger Shark	0	1	1	0	0	1	0	1	3	2	3	12	0	6	7	11

	Number of Fish Kept [1]								Number of Fish Released Alive							
Species	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Porbeagle	0	0	1	0	1	1	1	0	0	0	14	3	1	6	8	2
Blacktip Shark	0	1	0	1	0	1	1	0	0	0	6	0	1	19	9	31
Atlantic Sharpnose Shark	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0
Blue Shark	12	2	36	65	74	67	61	109	374	141	505	2,060	2,242	920	884	1,978
Hammerhead Shark	1	2	0	0	1	0	0	0	0	1	6	38	2	5	0	0
Wahoo	41	34	49	68	110	112	85	190	0	13	6	3	5	7	6	9
Dolphin	955	1,294	2,509	4,209	3,050	6,366	3,921	2,536	48	108	111	677	192	375	394	227
King Mackerel	289	19	36	66	11	376	170	82	24	10	5	5	1	7	20	3
Atlantic Bonito	194	77	704	315	410	96	262	283	27	49	176	282	389	231	114	60
Little Tunny	139	48	240	121	231	181	90	195	118	118	585	443	1,130	505	102	387
Amberjack	6	19	7	44	0	2	1	5	20	14	57	111	1	2	13	33
Spanish Mackerel	13	3	5	35	9	4	1	2	0	0	0	1	0	0	0	2

[1] NMFS typically expands these "raw" data to report discards of bluefin tuna by the rod and reel fishery to ICCAT. If sample sizes are large enough to make reasonable estimates for other species, NMFS may produce estimates for other species in future SAFE reports.
[2] Amendment One to the Atlantic Billfish FMP established billfish released in the recreational fishery as a "catch-and-release" program, thereby exempting these fish from bycatch considerations.
[3] Includes some commercial handgear landings.

4.4.4 Safety Issues

The USCG does not maintain statistics on boating accidents, rescue, or casualty data specifically pertaining to particular recreational fisheries as it does for the commercial industry. As a result, this document contains only minimal information regarding safety in recreational HMS fisheries. However, the USCG does compile statistics on the total number of recreational boating accidents and casualties, independent of the activity or fishery in which they are engaged (Table 4.30). Three common situations often place HMS recreational HMS anglers in potential danger. Individuals in small vessels often venture out farther than their vessels are designed to travel without proper navigational equipment, and may encounter rougher water than their boats are designed to withstand. Since fishermen targeting HMS species, particularly marlin, often travel 75 to 100 miles offshore, having a properly equipped, well-maintained vessel of adequate size is very important for the safety of recreational HMS constituents. Additionally, as the recreational swordfish fishery off the southeastern coast of Florida occurs at night and usually in small boats ranging from 23 to 40 feet in length, it presents other unique risks. Shipping traffic regularly transits through areas utilized by the recreational swordfish fleet, which can lead to collisions if someone is not on watch at all times. Finally, another frequent safety concern of the Coast Guard is the potential for someone to fall overboard when on the flying bridge.

Table 4.30 **Total 2007 Reported Boating Accident Types.** Source: USCG Boating Statistics, 2007. http://www.uscgboating.org/statistics/Boating_Statistics_2007.pdf

Accident Type	# Accidents	# of Fatalities	# of Injuries	Total Property Damage
Capsizing	398	204	284	$1,762,802
Carbon Monoxide	14	7	40	$0
Collision with Fixed Object	558	35	389	$9,206,067
Collision with Floating Object	143	4	97	$2,663,282
Vessel Collision	1,329	66	953	$11,498,216
Departed Vessel	69	33	35	$161,900
Ejected from Vessel	120	25	107	$483,410
Falls within Boat	211	1	229	$69,878
Falls on Vessel	10	0	10	$85,000
Fall Overboard	485	208	312	$257,181
Fire/Explosion (fuel)	113	3	63	$2,962,406
Fire/Explosion (other than fuel)	93	0	19	$7,164,222
Flooding or Swamping	285	35	71	$3,479,039
Grounding	324	4	228	$4,618,245
Other Casualty	111	15	98	$9,204,743

Accident Type	# Accidents	# of Fatalities	# of Injuries	Total Property Damage
Sinking	84	7	9	$863,903
Skier Mishap	492	11	502	$9,915
Struck by Boat	83	9	78	$41,540
Struck by Motor	80	7	75	$8,950
Struck Submerged Object	157	4	58	$6,893,544
Total	**5,159**	**678**	**3,657**	**$61,434,245.23**

Personal floatation devices (PFDs) can reduce the risk of death or serious injury when they are accessible and used properly. Table 4.31 provides information regarding boating accidents and the presence of PFDs onboard vessels.

Table 4.31 **Boating Accidents and Personal Floatation Device Usage in 2007.** Source: USCG Boating Statistics, 2007. http://www.uscgboating.org/statistics/Boating_Statistics_2007.pdf

		Vessels Involved	Deaths
Life Jackets on Vessels	**Approved, Accessible**	**2,760**	**229**
	Approved, Not Accessible	**5**	**4**
	Approved, Not Known if Accessible	**420**	**22**
	Not Onboard	**3,697**	**421**
	Unknown	**50**	**9**
Cause of Death and Life Jacket Usage Among Cause of Death Categories	**Cause of Death**	**PFD Worn**	
		Yes	**No**
	Carbon Monoxide Poisoning	0	6
	Drowning	49	427
	Hypothermia	7	11
	Trauma	52	85
	Other	8	3
	Unknown	6	31
	Totals	**122**	**563**

4.4.5 International Issues and Catch

Important directed recreational fisheries for HMS occur in the United States, Venezuela, the Bahamas, and Brazil. Many other countries and entities in the Caribbean and the west coast of Africa are also responsible for significant HMS recreational landings. Directed recreational fisheries for sailfish occur in the Western Atlantic and include the United States, Venezuela, the Bahamas, Brazil, Dominican Republic, Mexico, and other Caribbean nations. However, of these countries, the United States is the only country that currently reports recreational landings to

ICCAT. Therefore, a comparison of the percentage of U.S. landings relative to recreational fisheries in other countries is not possible. Further, because total landings data (including recreational landings) are incomplete, HMS stock assessments are often hampered.

As part of a 1997 SCRS survey, 12 ICCAT member countries as well as Chinese Taipei and Senegal provided information on the existence of, and level of data collection for, recreational and artisanal fisheries. The survey results indicated that Brazil, Canada, France, Italy, Morocco, UK, Bermuda, and the United States have recreational fisheries in the ICCAT area of concern. Levels of data collection have varied widely from country to country, making any comparison of catch levels difficult and potentially inaccurate. The wide range of recreational catches across nations and species continues to warrant further exploration of potential data sources and the feasibility of increased recreational monitoring. At this time only limited information is available regarding international HMS recreational catches.

At the 1999 ICCAT meeting in Rio de Janeiro, Brazil, the Commission adopted a resolution (99-7) to improve the quantity and quality of recreational data collection. Recreational fisheries were to be discussed and assessed in each country's National Report beginning in the year 2000. In addition, the SCRS was called upon to examine the impact of recreational fishing on tuna and tuna-like species.

At the 2004 ICCAT meeting in New Orleans, the Commission adopted a recommendation concerning prohibited gear in the sport and recreational fisheries in the Mediterranean Sea (04-12). Prohibited gear includes towed and encircling nets, seine sliding, dredgers, gill nets, trammel net and longline to fish for tuna and tuna-like species. The recommendation also prohibits the sale of sport and recreational tuna and tuna-like species and stipulates that data on these fisheries be collected and transmitted to the SCRS. At the 2005 ICCAT meeting, the Commission adopted a resolution (05-8) calling for research and exchange of information pertaining to circle hooks and their use in recreational and commercial fisheries. In 2006, the Commission passed a resolution (06-17) to form a recreational fisheries working group which would meet in 2007 and 2008 to discuss data and landings for recreational fisheries, management approaches, and the biological impacts of recreational fisheries on managed species. There were no resolutions or recommendations specific to recreational fisheries adopted at the 2007 or 2008 meetings. However, there was a decision to conduct an ICCAT Recreational Fisheries Working Group meeting in November 2009. This group is to report the results of their deliberations to ICCAT and, as appropriate, propose recommendations for the next steps to manage recreational and sport fishing activities in the ICCAT convention area.

4.5 Bottom Longline

4.5.1 Domestic History and Current Management

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

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

On November 30, 2004, NMFS issued a final rule (69 FR 69537), which established, among other things, new regional quotas based on updated landings information from 1999 – 2003. This final rule did not change the overall quotas for LCS, SCS, and pelagic sharks established in Amendment 1 to the 1999 HMS FMP, but did revise the percentages allocated to each of the regions. The updated information was based on several different databases, including the canvass and quota monitoring databases, the Northeast Commercial Fisheries Database (CFDBS), and the snapper grouper logbook. The new regional quotas and trimester seasons for the commercial Atlantic shark fishery became effective January 1, 2005.

The final rule for Amendment 2 to the 2006 Consolidated HMS FMP published on June 24, 2008 (73 FR 35778) with a correction published on July 15, 2008 (73 FR 40658). The final rule became effective on July 24, 2008. In the final rule, NMFS removed sandbar sharks from the LCS complex and established a non-sandbar LCS complex. In addition, NMFS established

two regions for the non-sandbar LCS: an Atlantic and Gulf of Mexico region. NMFS also implemented new annual adjusted quotas for sandbar sharks (87.9 mt dw), non-sandbar LCS (Atlantic: 187.7 mt dw; Gulf of Mexico: 390.5 mt dw), and a porbeagle shark commercial quota (1.7 mt dw). The sandbar shark and non-sandbar LCS quotas would increase to their annual base quotas of 116.6 mt dw for sandbar sharks, 188.3 mt dw for non-sandbar LCS in the Atlantic region, and 439.5 mt dw for non-sandbar LCS in the Gulf of Mexico region as of January 1, 2013, depending on overharvests. NMFS maintained the annual SCS quota (454 mt dw), pelagic sharks quota (273 mt dw for blue sharks), and quota for pelagic sharks other than porbeagle and blue sharks (488 mt dw).

Commercial shark fishing effort is generally concentrated in the southeastern United States and Gulf of Mexico (Cortés and Neer, 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 (Cortés, 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. BLL is the primary commercial gear employed in the LCS and SCS fisheries in all regions. Gear characteristics vary by region, but in general, an approximately ten-mile long BLL, containing about 600 hooks is fished overnight. Skates, sharks, or various fin fishes are used as bait. The gear typically consists of a heavy monofilament mainline with lighter weight monofilament gangions. Some fishermen may occasionally use a flexible 1/16 inch wire rope as gangion material or as a short leader above the hook.

4.5.2 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. At this time, NMFS selected approximately 40 - 50 vessels for observer coverage during each season. Vessels were randomly selected if they have a directed shark LAP, have reported landings from sharks during the previous year, and have not been selected for observer coverage during each of the three previous seasons.

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

information, by region, on catch rates, species composition, catch disposition, relative abundance, and size composition within species for the LCS and SCS BLL fisheries.

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

During 2004, five observers logged 196 sea days on 56 shark fishing trips aboard 11 vessels. Observers documented the catches and fishing effort during 120 longline sets that fished 90,980 hooks. In 2004 LCS comprised 66.7 percent of the total catch, and sandbar sharks were 26.6 percent of the catch. Regional differences in sandbar shark abundance were evident. For example, in the Carolina region, sandbar sharks comprised 67.4 percent of the total catch and 77.2 percent of the LCS catch. In the Florida Gulf region, sandbar sharks comprised 62.0 percent of the total catch and 66.5 percent of the LCS catch, whereas in the Florida East Coast region, sandbar sharks comprised only 17.2 percent of the total observed catch, and 37.1 percent of the LCS catch (Burgess and Morgan, 2003). Blacktip sharks comprised 13.9 percent of total observed catch and 20.3 percent of the large coastal catch (Burgess and Morgan, 2002). Tiger sharks comprised 7.5 percent of the total observed catch and 11.0 percent of the LCS catch. A majority of tiger sharks (71.7 percent) and nurse sharks (98.8 percent) were tagged and released.

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

From January to November 2007, the shark BLL observer program covered a total of 42 trips on 25 vessels with a total of 264 hauls. Gear characteristics of trips varied by area (Gulf of Mexico or the U.S. Atlantic Ocean) and target species (grouper/snapper or grouper/tilefish, shark or tilefish) (for more details, see Hale *et al*., 2007). There were no grouper/snapper-targeted trips observed in the U.S. Atlantic Ocean. No trips were observed in the northern U.S. Atlantic Ocean. Observers documented the catches and fishing effort on 179 hauls and 10 trips targeting snapper/grouper or grouper/tilefish in the Gulf of Mexico. There were 24 hauls on 7 trips observed targeting sharks in the Gulf of Mexico. In the U.S. Atlantic Ocean, 39 hauls on 21 trips were observed targeting shark, and 22 hauls on three trips were observed targeting tilefish.

In 2007 on the trips targeting shark in the Gulf of Mexico, 1,302 individual animals were caught. This consisted of 94.9 percent sharks, 4.1 percent teleosts, 0.5 percent invertebrates, and 0.2 percent batoids. LCS comprised the greatest amount of shark catch, at 69.5 percent, and SCS comprised 30.3 percent (Table 4.32). The prohibited dusky shark was also caught (0.1 percent)

(Table 4.32). Red grouper was the most caught teleost, while blacktip sharks were the most commonly caught shark (Hale *et al*., 2007).

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

On the trips targeting sharks in the South Atlantic in 2007, 2,735 individual animals were caught. This consisted of 95.7 percent sharks, 2.5 percent teleosts, 1.2 percent batoids, and 0.4 percent invertebrates. Large coastal shark species comprised 78.7 percent of the shark catch while SCS species comprised 19.2 percent of the shark catch. Sandbar sharks and tiger sharks were the most commonly caught LCS (Table 4.33). Other shark species caught were dusky sharks, sand tiger sharks, night sharks, and sixgill sharks (Table 4.33). Great amberjack, almaco jack, and great barracuda were the most commonly caughts teleosts (Hale *et al.*, 2007).

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

BLL for sharks has relatively low observed bycatch rates. For vessels targeting sharks in the Gulf of Mexico in 2007, four loggerhead turtles were observed caught in BLL gear. Of these, two were released alive, and two were released dead. For vessels targeting shark in the Atlantic, no loggerhead turtles were observed caught in BLL gear. However, three smalltooth sawfish were observed caught, with two being released alive and one released dead. For more information on bycatch see Section 0. More information on commercial shark landings can be found in Section 0.

The final rule for Amendment 2 to the Consolidated HMS FMP (73 FR 35778, June 24, 2008, corrected at 73 FR 40658, July 15, 2008) established, among other things, a shark research fishery to maintain time series data for future stock assessments. The shark research fishery also allows selected commercial fishermen the opportunity to earn revenue from selling more sharks, including sandbar sharks, than fishermen operating outside the research fishery. Only the commercial shark fishermen selected to participate in the shark research fishery are authorized to land/harvest sandbars subject to the sandbar quota available each year. The selected shark research fishery permittees also have access to the non-sandbar LCS, SCS, and pelagic shark quotas. Commercial fishermen not participating in the shark research fishery may land non-sandbar LCS, SCS, and pelagic sharks subject to retention limits and quotas per 50 CFR 635.24 and 635.27, respectively.

In 2008, selected vessels were allowed a trip limit of 2,750 lbs dw, of which no more than 2,000 lbs dw were allowed to be sandbar sharks. As of October 2008, vessels participating in the shark research fishery fished an average of 2 trips per month.

4.5.3 Bottom Longline Bycatch

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

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

The BiOp recognized that implementing 100 percent observer coverage in the shark research fishery would allow observer reports to be used to monitor interactions of directed shark fishing in near real-time, which would improve monitoring and increase the sample size available for evaluating important sea turtle and smalltooth sawfish interaction characteristics (*e.g.*, average life stage and genetic origin data). This would improve data acquisition and monitoring of protected resource interactions in the shark BLL fishery. Maintaining current levels of observer coverage outside the shark research fishery would continue to allow NMFS to observe the non-research bottom longline and gillnet fishing activities by vessels with directed and incidental shark permits at a level that would allow for statistically reliable monitoring. This would provide a better understanding of the changing dynamics of this fishery and its impacts on all marine resources. Time/area closures being implemented consistent with the South Atlantic

Fishery Management Council could provide additional protection for sea turtles and smalltooth sawfish within the marine protected areas; however, they were not likely to reduce the overall interactions between the fishery and protected species.

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

The BiOp included a revised Incidental Take Statement (ITS) consistent with the modifications to the fishery implemented under Amendment 2. The Atlantic shark fishery had been managed under a 5-year ITS previously, but was modified to three years. A 3-year ITS was provided because the 5-year time period is too long for meaningful monitoring given the frequency of changes in management and the uncertainty of how effort by gear type will shift in response to the proposed action. The BiOp's 3-year approach would reduce the likelihood of requiring re-initiation unnecessarily because of inherent variability in take levels, but would still allow for an accurate assessment of how the fishery is performing. There were three Reasonable and Prudent Measures (RPMs) that have been implemented to minimize the impacts of the actions implemented under Amendment 2 on protected resources and Terms and Conditions for implementing the RPMs. The Agency has implemented the RPMs and adheres to the terms and conditions of the ITS to ensure compliance with the ESA.

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

Loggerhead Sea Turtles

In the BLL fishery, a total of 79 sea turtles were observed caught from 1994 through 2007 (Figure 4.8 and Table 4.35). Seasonal variation indicates that most of the sea turtles were caught early in the year. Of the 79 observed sea turtles, 64 were loggerhead sea turtles, of which 33 were released alive. Another 14 loggerheads were released in an unknown condition and 17 were released dead. Based on extrapolation of observer data 784.3 loggerhead interactions with BLL gear occurred between 2004 and 2006. An additional 17.4 unidentified sea turtles were estimated to have been taken for this time period (NMFS, 2007b; Richards, 2007). No extrapolation has been conducted for 2007 or 2008.

Leatherback Sea Turtles

Of the 79 observed sea turtle interactions in the BLL fishery from 1994 – 2007, six were leatherback sea turtles of which one was dead and five were released with its condition unknown

(Figure 4.8 and Table 4.35). Based on extrapolated takes from observer data, it was estimated that 83.2 leatherback sea turtles were taken in the shark BLL fishery from 2004 through 2006 (NMFS, 2007b; Richards, 2007). Given the large number of turtles released in an unknown condition, these estimated take numbers do not discriminate between live and dead releases. However, leatherback mortality is usually low because it is known that leatherbacks rarely ingest or bite hooks, but are usually foul hooked on their flippers or carapaces, reducing the likelihood of post-hooking release mortality. However, leatherback-specific data for this fishery is not available. No extrapolation has been conducted for 2007 or 2008.

Smalltooth Sawfish

As of April 1, 2003, NMFS listed smalltooth sawfish as an endangered species (68 FR 15674) under the ESA. After reviewing the best scientific and commercial information, the status review team determined that the continued existence of the U.S. Distinct Population Segment of smalltooth sawfish was in danger of extinction throughout all or a significant portion of its range from a combination of the following four listing factors: the present or threatened destruction, modification, or curtailment of habitat or range; over-utilization for commercial, recreational, scientific, or educational purposes; inadequacy of existing regulatory mechanisms; and other natural or manmade factors affecting its continued existence. NMFS is in the process of designating critical habitat for smalltooth sawfish. A proposed rule regarding designation of critical habitat published on November 20, 2008 (73 FR 70290).

From 1994 through 2006, 12 smalltooth sawfish interactions have been observed (11 released alive, and one released in unknown condition) in shark BLL fisheries (Morgan pers. comm.; Burgess and Morgan, 2004; Hale and Carlson, 2007; Hale *et al*., 2007). In 2007, there were three observed smalltooth sawfish interactions with shark BLL gear (Hale *et al*., 2007). Two were released alive, and one was released dead. All three interactions occurred in the South Atlantic region. Based on extrapolated takes for 2004 through 2006, 60 smalltooth sawfish have been taken in the BLL fisheries (NMFS, 2007b; Richards, 2007). No mortalities were extrapolated based on the overall extrapolated takes from 2004 to 2006; however, one known mortality occurred in 2007. NMFS has not calculated the extrapolated takes since the mortality occurred.

Marine Mammals

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

Seabirds

Bycatch of seabirds in the shark BLL fishery has been virtually non-existent. A single pelican has been observed killed from 1994 through 2007. 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. com.). No expanded estimates of seabird bycatch or catch rates are available for the BLL fishery.

Table 4.32 Species composition of observed BLL catch during 2007 for BLL trips targeting sharks in the Gulf of Mexico. Source: Hale *et al*., 2007

Species	Total Number Caught	% Total Catch	% Kept	% Discarded Dead	% Discarded Alive
Blacktip shark	428	33.0	95.6	3.7	0.7
Blacknose shark	199	15.3	74.9	20.6	4.5
Atlantic sharpnose shark	174	13.4	57.5	42.5	0.0
Sandbar shark	160	12.3	98.8	0.0	0.0
Nurse shark	95	7.3	0.0	0.0	100
Spinner shark	56	4.3	96.4	0.0	1.8
Tiger shark	34	2.6	8.8	8.8	82.4
Lemon shark	32	2.5	84.4	3.1	0
Bull shark	29	2.2	96.6	0.0	0.0
Great hammerhead shark	21	1.6	61.9	0.0	38.1
Sharks	2	0.2	0.0	100	0.0
Scalloped Hammerhead shark	2	0.2	100	0.0	0.0
Dusky shark	1	0.1	0.0	0.0	100
Finetooth shark	1	0.1	100	0.0	0.0
Silky shark	1	0.1	0.0	100	0.0
Total	1235	95.1			

Table 4.33 **Species composition of observed BLL catch during 2007 for BLL trips targeting sharks in the South Atlantic.** Source: Hale *et al*., 2007

Species	Total Number Caught	% Total Catch	% Kept	% Discarded Dead	% Discarded Alive
Sandbar shark	827	30.3	98.9	0.1	0.1
Tiger shark	779	28.5	23.2	19.4	56.9
Atlantic Sharpnose shark	352	12.9	91.5	7.7	0.6
Blacktip shark	243	8.9	98.8	0.8	0.0
Blacknose shark	148	5.4	98	2	0.0
Nurse Shark	83	3.0	0.0	0.0	100
Scalloped hammerhead shark	37	1.4	91.9	2.7	2.7
Great hammerhead shark	29	1.1	100	0.0	0.0
Bull shark	21	0.8	90.5	4.8	0
Spinner shark	17	0.6	100.0	0.0	0.0
Silky shark	15	0.5	73.3	20.0	6.7
Smooth dogfish	14	0.5	71.4	0.0	28.6
Dusky shark	13	0.5	0.0	84.6	15.4
Sand tiger shark	10	0.4	0.0	0.0	100
Sharks	10	0.4	0.0	100	0.0
Lemon shark	9	0.3	100.0	0.0	0.0
Sixgill shark	7	0.3	0.0	0.0	100
Bonnethead shark	3	0.1	100	0.0	0.0
Night shark	1	0.0	0	100	0.0
Requim sharks	1	0.0	0	0	0
Total	2619	95.8			

Table 4.34 **Total Number of Observed Sea Turtle Interactions by Species by Month for Years 1994-2007 in the Shark BLL Fishery.** Source: Shark BLL Observer Program.

Month	Leatherback Sea Turtle	Loggerhead Sea Turtle	Other Sea Turtles	Total
Jan	1	16	1	18
Feb	3	10	6	19
Mar	-	7	-	9
Apr	-	4	-	4
May	1	-	-	1
Jun	-	-	-	-

Month	Leatherback Sea Turtle	Loggerhead Sea Turtle	Other Sea Turtles	Total
July	-	18	-	18
Aug	-	4	-	4
Sept	1	3	1	5
Oct	-	2	1	3
Nov	-	-	-	-
Dec	-	-	-	-
Total	6	64	9	79

Table 4.35 **Total number of Observed Sea Turtle Interactions by Year for Years 1994-2007 in the Shark BLL Fishery.** Source: Shark BLL Observer Program. Letters in parentheses indicate whether the sea turtle was released alive (A), dead (D), or in an unknown (U) condition.

Year	Leatherback Sea Turtle	Loggerhead Sea Turtle	Other Sea Turtle	Total
1994	1 (1U)	5 (5U)	6 (6U)	12
1995	-	4 (3A, 1D)	-	4
1996	1 (1U)	6 (3A, 2D, 1U)	-	7
1997	1 (1U)	5 (3A, 2U)	-	6
1998	-	2 (1A, 1D)	1 (1A)	3
1999	-	2 (2A)	-	2
2001	1 (1D)	2 (2A)	-	3
2002	-	5 (3A, 1D, 1U)	-	5
2003	-	7 (6A, 1D)	1 (1U)	8
2004	-	5 (3A, 2D)	-	5
2005	2 (1A, 1D)	4 (1A, 3D)	1 (1U)	7
2006	-	12 (3A, 4D, 5U),	-	12
2007	-	5 (3A, 2D)	-	5
Total	6	64	9	79

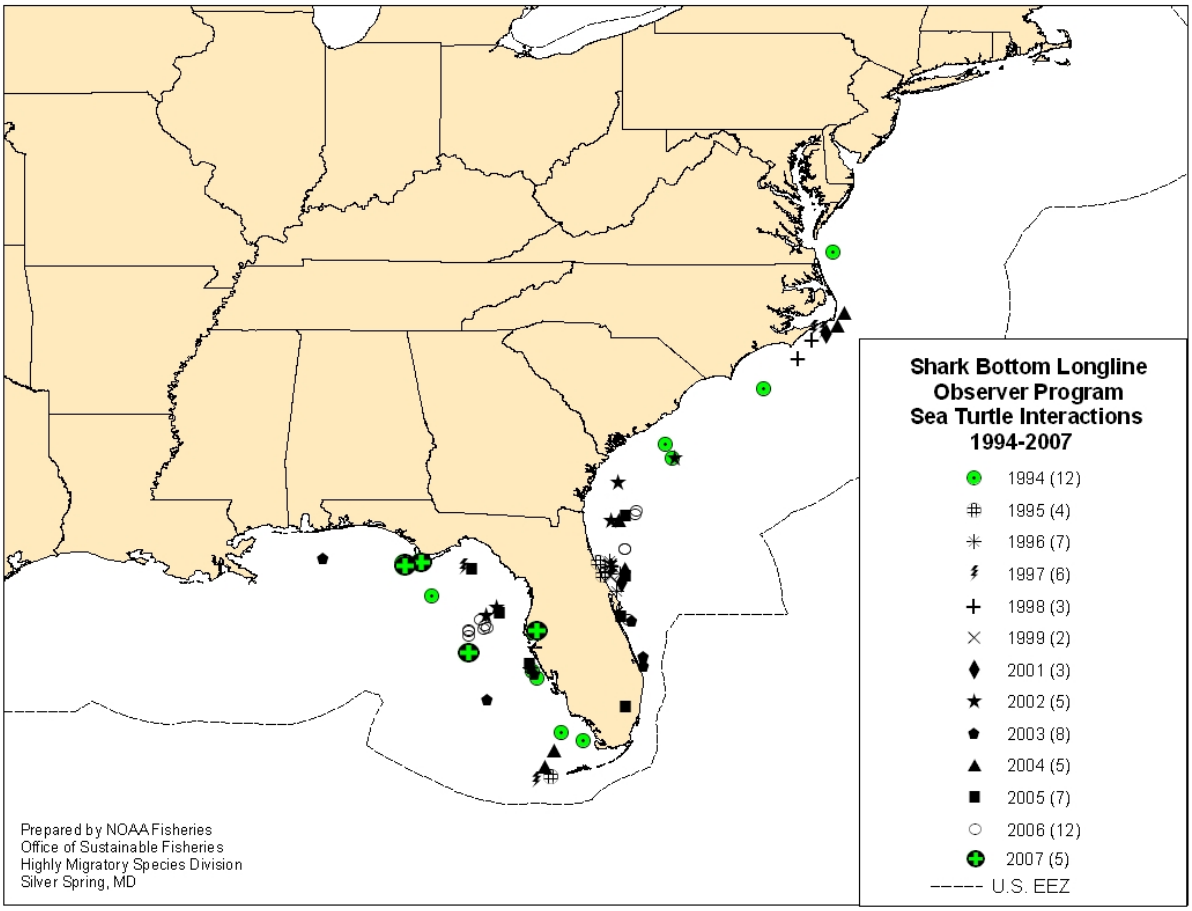


Figure 4.8 **Observed sea turtle interactions in the shark BLL fishery from 1994-2007.** Source: Commercial Shark Fishery Observer Program data (1994-1st season of 2005) and NMFS' Shark Observer Program data (2nd season 2005-2007).

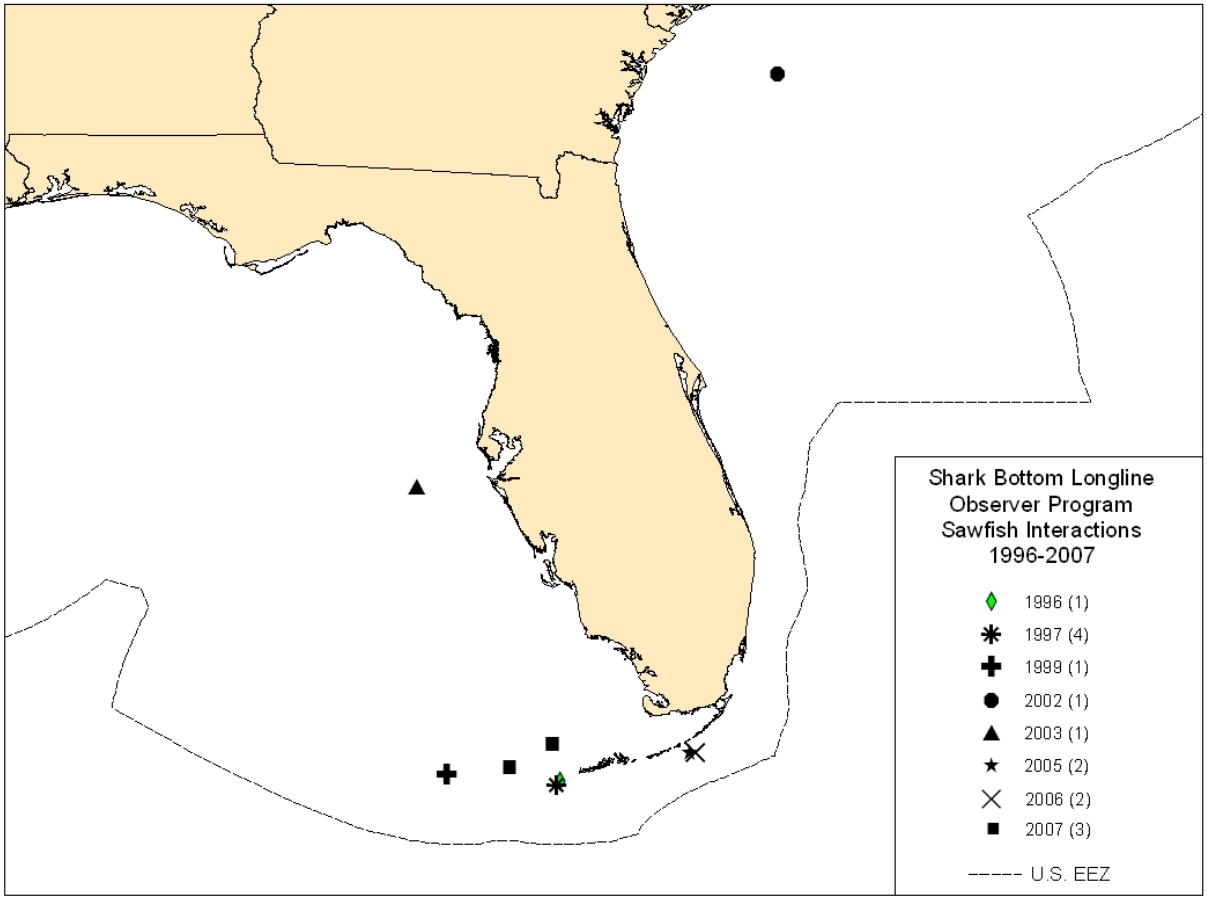


Figure 4.9 **Observed sawfish interactions and observed sets (smaller grey circles) in the shark BLL fishery from 1994-2007.** Source: Commercial Shark Fishery Observer Program data (1994-1st season of 2005) and NMFS' Shark Observer Program data (2nd season 2005-2007).

4.6 Gillnet Fishery

4.6.1 Domestic History and Current Management

The southeast shark gillnet fishery is comprised of several vessels based primarily out of ports in northern Florida (South Atlantic Region). These vessels use drift gillnet, strike gillnet, and sink gillnet gear. Set duration is generally 0.3 hours in depths averaging 20.9 m, and haulback averages 3.3 hours. The average time from setting the net through completion of haulback is 10.2 hours. Stretched mesh sizes measures from 12.7-25.4 cm (5 – 10 in). Strikenetters use the largest mesh size (22.9-30.4 cm; 9 – 12 in), and the set times are 3.2 hours, with nets approximately 364.8 meters long and 30.4 meters deep. Sink gillnets that are used to target sharks generally have a 7.3-20.3 cm (2.9 – 8 in) mesh size, and the process lasts for approximately 6.1 hours. This gear has also been observed while deployed to target non-HMS (teleosts). In those cases, sink gillnets use a stretched mesh size of 6.4-12.7 cm (2.5 – 5 in), and the entire process takes approximately 2.3 hours (Carlson and Bethea, 2007).

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

4.6.2 Recent Catch and Landings

The following section provides information on shark landings as reported in the shark gillnet observer program. For recent catch and landings data for the shark fishery as a whole, which includes landings from gillnet, BLL, and other gears combined, please refer to Section 0.

Gillnet Landings and Bycatch

<u>Strikenets</u> - The total observed strike gillnet catch consisted of eight species of sharks from 2005-2006. Finetooth and blacktip sharks made up the greatest percentage of catch in terms of total number caught in strike gillnets from 2005-2006 (Table 4.36). There were no strike gillnet trips observed in 2007.

In the strikenet fishery from 2005-2006, 99.7 percent of the observed catch were sharks with only 0.15 percent teleosts, and 0.07 percent non-shark elasmobranchs. Blacktip, finetooth,

and spinner shark comprised over 94 percent of the observed shark strikenet catch by number and weight. Tarpon and little tunny were the teleosts encountered most frequently (Carlson and Bethea, 2007).

Drift Gillnets - 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 (Carlson and Bethea, 2007).

In 2007, a total of five driftnet gillnet vessels were observed making 84 sets on 11 trips. Of those trips, there were 3 vessels observed that targeted sharks for a total of 4 trips and 4 hauls. The total observed catch composition for sets targeting sharks was 86.7 percent shark, 13.3 percent teleosts, zero percent non-shark elasmobranchs, and zero percent protected resources. Two species of sharks made up 98.1 percent of the observed shark catch: Atlantic sharpnose shark and blacknose shark (Table 4.37). By weight, the shark catch was composed of Atlantic sharpnose, followed by scalloped hammerhead shark, blacknose shark, and blacktip shark. Three species of teleosts made up approximately 97 percent by number of the overall non-shark species. These species were little tunny, king mackerel, and barracudas (Table 4.38) (Baremore *et al.*, 2007).

Total observed catch composition for sets targeting Spanish mackerel was 84.5 percent Spanish mackerel, 15.3 percent sharks, 0.1 percent non-shark elasmobranchs, and 0.05 protected resources. Three species of teleosts made up 96.6 percent of the total teleost catch: Spanish mackerel, bluefish, and menhaden. Shark catch was dominated by Atlantic sharpnose shark followed by bonnethead shark (Baremore *et al.*, 2007).

Sink Gillnets - 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 from 2005-2006 (Carlson and Bethea, 2007). 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 (Carlson and Bethea, 2007).

A total of 29 trips making 112 sink net sets on six vessels were observed in 2007. Of those, 17 trips making 60 sets targeted sharks, 3 trips making 27 sets targeted Spanish mackerel,

and 4 trips making 9 sets targeted Atlantic croaker, and 6 trips making 16 sets targeted other teleosts. Sink gillnets that targeted sharks caught 97.8 percent shark, 1.4 percent teleosts, 0.7 percent non-shark elasmobranchs, and 0.1 percent protected resources. By number, the shark catch was primarily bonnethead shark, finetooth shark, Atlantic sharpnose shark, and blacknose shark (Table 4.39). By weight the shark catch was made up mostly of finetooth shark, followed by bonnethead shark, blacknose shark, and spinner shark. Cobia made up 25.8 percent of the teleost catch, followed by Gulf kingfish and banded drum. Cownose ray and Atlantic guitarfish and other stingrays made up 100 percent of the non-shark elasmobranch catch (Baremore *et al*., 2007).

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

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

Loggerhead Sea Turtles

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

No loggerhead sea turtles were caught outside of the right whale calving season in 2002 (Carlson and Baremore, 2002b), and no loggerhead turtles were observed caught during or after the right whale calving season in 2003 or 2004 in the directed shark gillnet fishery (Carlson and Baremore, 2003; Carlson, pers. comm). In 2005, five loggerheads were observed caught, and in 2006, three loggerheads were observed caught (Table 4.40) (Carlson and Bethea, 2007). In 2007, 4 loggerhead sea turtles were observed, three were released alive, and one was released in an unknown condition (Baremore *et al*., 2007).

Leatherback Sea Turtles

In the shark gillnet fishery, leatherback sea turtles are sporadically caught. No leatherback sea turtles were observed caught with strikenets during the 2000 – 2002 right whale calving seasons (Carlson, 2000; Carlson and Baremore, 2001; Carlson and Baremore, 2002a). Leatherback sea turtles have been observed caught in shark drift gillnets, including 14 in 2001 and two in 2002 (Carlson, 2000; Carlson and Baremore, 2001; Carlson and Baremore, 2002a; Garrison, 2003a). NMFS temporarily closed the shark gillnet fishery (strikenetting was allowed)

from March 9 to April 9, 2001, due to the increased number of leatherback interactions that year (66 FR 15045, March 15, 2001).

From 2003 – 2004, no leatherback sea turtles were observed caught in gillnets fished in strikenet or driftnet methods (Carlson and Baremore, 2003; Carlson, pers. comm.). In 2005, one leatherback turtle was caught and released alive (Table 4.40) (Carlson and Bethea, 2007). In 2006 and 2007, no leatherbacks were observed caught in gillnets (Carlson and Bethea, 2007; Baremore *et al*., 2007; Table 4.40).

Smalltooth Sawfish

To date there has been only one observed catch of a smalltooth sawfish in shark gillnet fisheries. The sawfish was taken on June 25, 2003, in a gillnet off the west coast of Florida and was released alive (Carlson and Baremore, 2003). The sawfish was cut from the net and released alive with no visible injuries. This indicates that smalltooth sawfish can be removed safely if entangled gear is sacrificed. The set was characteristic of a typical drift gillnet set, with gear extending 30 to 40 feet deep in 50 to 60 feet of water. Prior to this event it was speculated that the depth at which drift gillnets are set above the sea floor may preclude smalltooth sawfish from being caught. From 2004-2007, there were no observed catches of smalltooth sawfish in shark gillnet fisheries (Table 4.41).

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

Given the high rate of observer coverage in the shark gillnet fishery, NMFS believes that smalltooth sawfish takes in this fishery are very rare. The fact that there were no smalltooth sawfish caught during 2001 when 100 percent of the fishing effort was observed indicates that smalltooth sawfish takes (observed or total) most likely do not occur on an annual basis. Based on this information, the 2008 BiOp permitted one incidental take of smalltooth sawfish (released alive) from 2008 through 2011 as a result of the use of all gillnets in this fishery (NMFS, 2008).

Marine Mammals

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

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

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

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

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

Table 4.36 Total Strike gillnet Shark Catch and Bycatch by Species in order of Decreasing Abundance for all Observed Trips, 2005-2006. Source: Carlson and Bethea, 2007.

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

Table 4.37 **Total Shark Catch by Species and Species Disposition in Order of Decreasing Abundance for all Observed Drift gillnet Sets in 2007.** Source: Baremore *et al*., 2007.

Species	Total Number Caught	Kept (%)	Discarded Alive (%)	Discarded Dead (%)
Atlantic sharpnose	1643	99.5	0.3	0.2
Blacknose	20	100	0.0	0.0
Scalloped Hammerhead	12	100	0.0	0.0
Bonnethead	8	100	0.0	0.0
Blacktip	7	85.7	14.3	0.0
Spinner	5	80.0	20.0	0.0
Total	**1,695**	**-**	**-**	**-**

Table 4.38 **Total bycatch in NMFS observed drift gillnet sets in order of decreasing abundance and species disposition for all observed trips, 2007.** Source: Baremore *et al*., 2007.

Species	Total Number Caught	Kept (%)	Discard Alive (%)	Discard Dead (%)
Little tunny	210	99.0	0.0	1.0
King mackerel	37	81.1	0.0	18.9
Barracuda	8	100	0	0
Moonfish	4	0.0	0.0	100
Remora family	2	0.0	50.0	50.0

Table 4.39 **Total Sink gillnet Shark Catch and Bycatch by Species in order of Decreasing Abundance for all Observed Trips, 2007.** Source: Baremore et al., 2007.

Species	Total Number Caught	Kept (%)	Discarded Alive (%)	Discarded Dead (%)
Bonnethead shark	1223	99.7	0.2	0.2
Finetooth	371	99.7	0.3	0.0
Atlantic Sharpnose	256	99.6	0.0	0.4
Blacknose	240	100	0.0	0.0
Spinner	40	60.0	10	30
Blacktip	26	38.5	26.9	34.6
Scalloped hammerhead	7	14.3	14.3	71.4
Nurse	1	100	0.0	0.0
Bull	1	100	0.0	0.0
Tiger	1	0.0	100	0.0
Cownose ray	10	0.0	0.0	100
Cobia	8	50	50	0.0

Species	Total Number Caught	Kept (%)	Discarded Alive (%)	Discarded Dead (%)
Gulf kingfish	5	100	0.0	0.0
Stingray family	4	0.0	100	0.0
Banded drum	2	0.0	0.0	100
Southern kingfish	4	100	0.0	0.0
Silver seatrout	3	0.0	0.0	100
Bluefish	2	50	0.0	50
Spanish Mackerel	2	50	0.0	50
Moonfish	2	0.0	0.0	100
Toadfish family	1	0.0	100	0.0
Southern flounder	1	100	0.0	0.0
Atlantic guitarfish	1	0.0	100	0.0
Red drum	1	0.0	100	0.0

Table 4.40 **Total number of Observed Sea Turtle Interactions by Year from 2000-2007 in the Shark Gillnet Fishery.** Source: Directed Shark Gillnet Observer Program. Letters in parentheses indicate whether the sea turtle was released alive (A), dead (D), or unknown (U).

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

Table 4.41 Observed Interactions of Protected Species with the Shark Gillnet Fishery from 2004-2007. Source: Directed Shark Gillnet Observer Program.

Observed Total Takes (2004-2007)				
Species	**Drift Gillnet**	**Strikenet**	**Sink Gillnet**	**Total Observed Takes/5 yr ITS (total takes)**
Loggerhead Sea Turtle	3	3	4	10/10
Leatherback Sea Turtle	1	0	0	1/22
Smalltooth Sawfish	0	0	0	0/1
Observed Dead Takes (2004-2007)				
Species	**Drift Gillnet**	**Strikenet**	**Sink Gillnet**	**Total Observed Takes/5 yr ITS (total takes)**
Loggerhead Sea Turtle	1	1	1	3/1
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 only under the 2003 BiOp. However, one dead loggerhead was encountered in the drift and sink gillnet and strikenet fisheries.

4.7 Buoy Gear

4.7.1 Domestic History and Current Management

In recent years, a commercial swordfish (SWO) handgear fishery has developed off the east coast of Florida and a detailed history of this fishery may be found in the 2006 Consolidated HMS FMP. Commercial buoy gear was authorized in 2006 for SWO Directed and Handgear permit holders. SWO Directed permit holders may retain SWO only if they have also been issued a Shark Directed or Incidental limited access permit and an Atlantic Tunas Longline permit. SWO Handgear permit holders are not required to be issued other permits to retain SWO. HMS CHB, Angling, and SWO Incidental permit holders may not fish with buoy gear.

Buoy gear means a fishing gear consisting of one or more floatation devices supporting a single mainline to which no more than two hooks or gangions are attached. The buoy gear fishery is usually prosecuted at night. Authorized permit holders may not possess or deploy more than 35 floatation devices, and may not deploy more than 35 individual buoy gears per vessel. Buoy gear must be constructed and deployed so that the hooks and/or gangions are attached to the vertical portion of the mainline. Floatation devices may be attached to one but not both ends of the mainline, and no hooks or gangions may be attached to any floatation device or horizontal portion of the mainline. If more than one floatation device is attached to a buoy gear, no hook or gangion may be attached to the mainline between them. Individual buoy gears may not be linked, clipped, or connected together in any way. Buoy gears must be released and retrieved by hand. All deployed buoy gear must have some type of monitoring equipment affixed to it including, but not limited to, radar reflectors, beeper devices, lights, or reflective tape. If only reflective tape is affixed, the vessel deploying the buoy gear must possess on board an operable spotlight capable of illuminating deployed floatation devices. If a gear monitoring device is positively buoyant, and rigged to be attached to a fishing gear, it is included in the 35 floatation device vessel limit and must be marked appropriately.

4.7.2 Recent Catch and Landings

Buoy gear effort and catch data are available for 2007 and through early October 2008 (Table 4.42 and Table 4.43). Prior to 2007, buoy gear catch data were included in handline catch data.

Table 4.42 **Buoy gear effort. For number of vessels and trips, the data for 2008 only includes January – October. For average number of buoy gears deployed per trip and average number of hooks deployed per gear, the data are combined for 2007 and 2008.** Source: NMFS Pelagic Logbook Program.

	2007	2008 (Jan.-Oct.)
Number of Vessels	42	39
Number of Trips	705	357
Avg. Buoy Gears Deployed per Trip	11	
Avg. Number Hooks per Gear	1.5	

Table 4.43 **Buoy gear catches in pounds dressed weight. Data for 2008 only includes January - October** (Source: NMFS Pelagic Logbook Program).

	2007	2008 (Jan.-Oct.)
Swordfish	190,649	74,401
Dolphin	707	375
Oilfish	389	132
Shortfin Mako Shark	313	117
Wahoo	63	142
Bigeye Tuna	207	0
Blacktip Shark	9	0
King Mackerel	0	10

4.7.3 Safety Issues

NMFS does not require proof of proper safety equipment as a condition to obtain a commercial permit. Instead, NMFS informs permit applicants that commercial vessels are subject to the Fishing Vessel Safety Act of 1988 and advises them to contact their local USCG office for further information. At this time, NMFS is not aware of any safety issues associated with this fishery.

4.7.4 International Issues and Catch

NMFS is not aware of international issues related specifically to the use of buoy gear as it is used in the U.S. fishery. International catches of all Atlantic HMS are summarized in Section 0.

4.8 Green-Stick Gear

4.8.1 Domestic History and Current Management

Effective October 23, 2008, Green-stick gear was specifically defined and authorized for the harvest of Atlantic tunas on Atlantic tunas General, HMS Charter/Headboat (CHB), and Atlantic tunas Longline permitted vessels (73 FR 54721, September 23, 2008). Green-stick gear (Figure 4.10) is defined as "an actively trolled mainline attached to a vessel and elevated or suspended above the surface of the water with no more than 10 hooks or gangions attached to the mainline. The suspended line, attached gangions and/or hooks, and catch may be retrieved collectively by hand or mechanical means. Green-stick does not constitute a pelagic longline or a bottom longline as defined in the EA or as described at § 635.21(c) or § 635.21(d), respectively." Green-stick gear may be used to harvest bigeye (BET), northern albacore (ALB), yellowfin (YFT), and skipjack tunas (SKJ)(collectively referred to as BAYS tunas) and bluefin tuna (BFT) aboard Atlantic Tunas General, HMS CHB, and Atlantic Tunas Longline permitted vessels.

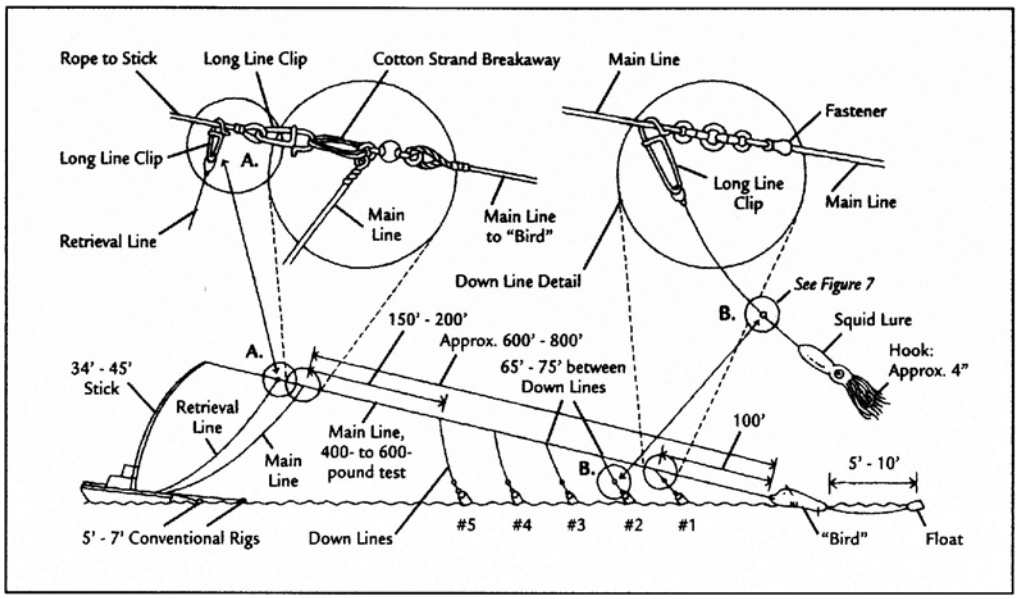


Figure 4.10 **A diagram of green-stick fishing gear.** Source: Wescott (1996).

Onboard Atlantic Tunas Longline permitted vessels, up to 20 J-hooks may be possessed for use with green-stick gear and no more than 10 J-hooks may be used with a single green-stick gear. J-hooks may not be used with pelagic longline (PLL) gear and no J-hooks may be possessed onboard a PLL vessel unless green-stick gear is also onboard. J-hooks possessed and used onboard PLL vessels may be no smaller than 1.5 inch (38.1 mm) when measured in a straight line over the longest distance from the eye to any other part of the hook.

Atlantic tuna fisheries, where green-stick gear is employed, are typically most active during the summer and fall, although in the South Atlantic and Gulf of Mexico fishing occurs

during the winter months. Fishing usually takes place between eight and two hundred km from shore. Baits used with green-stick gear may be artificial or natural with the most common bait being artificial squid. The use of green-stick gear is most common off the mid and south Atlantic states of North Carolina, South Carolina, and Georgia with some use also occurring off the New England states. A few vessels use green-stick gear in the northern Gulf of Mexico as well.

Commercial Atlantic tunas permits authorized to use green-stick gear are Atlantic tunas General, HMS CHB, and Atlantic tunas Longline. Atlantic tunas General and HMS CHB are open access. The Atlantic tunas Longline permit is limited access and, in order to be valid, a vessel must also hold a shark and swordfish limited access permit. These vessels may also need permits from the states they operate out of in order to land and sell their catch. All commercial permit holders are encouraged to check with their local state fish/natural resource management office regarding these requirements. Permitted vessels are also required to sell their Atlantic tunas to federally permitted Atlantic tuna dealers. As the Atlantic tunas dealer permits are issued by the Northeast Region Permit Office, vessel owner/operators are encouraged to contact the permitting office directly, either by phone at (978) 281-9438 or via the web at http://www.nero.noaa.gov/ro/doc/vesdata1.htm, to obtain a list of permitted dealers in their area.

Vessels that are permitted in the General and Charter/Headboat categories commercially fish under the General category rules and regulations. For instance, regarding BFT, vessels that possess either of the two permits mentioned above have the ability to retain a daily bag limit of zero to three BFT, measuring 73 inches or greater curved fork length per vessel per day while the General category BFT fishery is open. The General category BFT fishery opens on June 1 of each year and remains open until January 31 of the subsequent year, or until the quota is filled. Vessel owner/operators should check with the agency via websites (www.hmspermits.gov) or telephone information lines (1-888-872-8862) to verify the BFT retention limit on any given day.

4.8.2 Recent Catch and Landings

Green-stick gear has been used in the Atlantic commercial and recreational BET, ALB, YFT, SKJ, and BFT fisheries since the mid-1990s, but it was not originally added to the list of authorized HMS fishery gears (May 28, 1999; 64 FR 29090). Nevertheless, commercial landings of BAYS and BFT with green-stick gear continued in Atlantic Tunas General, Atlantic Tunas Longline, and HMS CHB categories. In the Consolidated HMS FMP (October 2, 2006; 71 FR 58058), NMFS clarified the allowable uses of green-stick gear, at that time, under certain configurations that met the definition of handgear or longline which are authorized for Atlantic tunas. The allowable use of green-stick gear changed most recently with authorization of green-stick gear in 2008, as described earlier in this section.

Recent Atlantic tuna landings are presented earlier in Sectoion 4. An unknown portion of these landings were made with green-stick gear as the gear has been used in the Atlantic tuna fisheries since the mid-1990s. Reporting mechanisms that are in place do not enable the number of vessels using green-stick gear to be quantified; although, limited data allow the catch to be characterized as discussed below. In the future, data on landings specific to green-stick gear may

improve because a green-stick gear code was designated for use in dealer reporting systems such as trip tickets in the southeast and electronic reporting programs in the northeast.

A portion, but not all, of green-stick gear landings has been reported via the NMFS Southeast Region's Coastal Logbook when Atlantic Tunas General, HMS CHB, or Atlantic Tunas Longline category fishermen also hold a NMFS Southeast Region fishing permit that requires logbook reporting. NMFS is unable to fully characterize the existing green-stick gear fishery with this information; however, the limited amount of self-reported data provides some useful insight on target catches and bycatch. Table 4.44 shows this information from 98 fishing trips from 1999-2007 in which green-sticks were used. Landings were dominated by YFT (82.9%), followed by BET (9.8%), BFT (2.3%), and little tunny (*Euthynnus alletteratus*) (2.0%) by weight. All of the landings were reported from the area off the mid-Atlantic states.

Table 4.44 Atlantic Commercial green-stick gear catch reported via NMFS coastal logbooks, 1999-2007 (number of trips = 98).

Species	Total Weight (lbs)	%
Yellowfin Tuna	66,325	82.9
Bigeye Tuna	7,833	9.8
Bluefin Tuna (unclassified)	1,838	2.3
Little Tunny	1,610	2.0
Dolphin	720	0.9
Blackfin Tuna	551	0.7
Mako Shark (unclassified)	410	0.5
Atlantic Bonito	232	0.3
King Mackerel	183	0.2
Wahoo	120	0.1
Skipjack Tuna	73	0.1
Blue Runner	38	<0.1
Lesser Amberjack	17	<0.1
Albacore Tuna	16	<0.1
Finfishes (Unclassified for Food)	15	<0.1
Cobia	10	<0.1
Total	79,990	100.0

Commercial green-stick gear catches reported in the PLL Logbook Program for 1999 – 2002 can be seen in Table 4.45. From 1999 - 2002, the PLL logbook format included a green-stick gear data field; however, this data field was eliminated beginning in 2003. Of the 45,712 PLL sets reported during this timeframe, 54 of these sets were reported as green-stick gear. Of the 54 green-stick gear sets reported, 53 of those were reported from the Mid-Atlantic Bight Statistical Area and one set was reported from the Northeast Coastal Statistical Area. Landings from this dataset were dominated by YFT (81.9%), followed by dolphin (6.9%) and other BAYS tunas (6.5%) by number. Several other species were reported including 4 BFT.

Table 4.45 Atlantic commercial green-stick gear catch reported via NMFS PLL logbooks, 1999-2002, in numbers of fish (number of sets = 54).

Species	1999	2000	2001	2002	Total	%
Yellowfin Tuna	0	344	232	102	678	81.9
Dolphin	0	8	2	47	57	6.9
Other BAYS Tunas	0	26	28	0	54	6.5
Pelagic Sharks	0	1	8	2	11	1.3
Swordfish	0	9	0	0	9	1.1
Wahoo	0	0	0	8	8	1
Bluefin Tuna	0	2	0	2	4	<0.1
Bigeye Tuna	0	2	2	0	4	<0.1
Large Coastal Sharks	0	0	3	0	3	<0.1

4.8.3 Safety Issues

NMFS does not require proof of proper safety equipment as a condition to obtain a commercial permit. Instead, NMFS informs permit applicants that commercial vessels are subject to the Fishing Vessel Safety Act of 1988 and advises them to contact their local USCG office for further information. At this time, NMFS is not aware of any safety issues associated with this fishery.

4.8.4 International Issues and Catch

SCRS data do not lend themselves to organize international landings into a green-stick gear specific category. International catches of all Atlantic HMS through 2007 are summarized in Section 0.

4.9 Fishery Data: Landings by Species

The following tables of HMS landings are taken from the 2008 National Report of the United States to ICCAT (ANN-043) (NMFS, 2008). The purpose of this section is to provide a summary of recent landings of HMS by gears and on a species by species basis for interannual comparisons. Landings for sharks were compiled from the most recent stock assessment documents.

Table 4.46 U.S. Landings (mt) of Bluefin Tuna by Gear and Area, 2000-2007. Source: NMFS, 2008.

Area	Gear	2000	2001	2002	2003	2004	2005	2006	2007
NW Atlantic	Longline**	22.8	17.7	7.8	36.1	106.2	72.7	104.4	70.7
	Handline	3.2	9.0	4.5	2.5	1.5	2.3	0.3	0.0
	Purse Seine	275.2	195.9	207.7	265.4	31.8	178.3	3.6	27.9
	Harpoon	184.2	101.9	55.5	87.9	41.2	31.5	30.3	22.5
	*Rod and reel (>145 cm LJFL)	632.8	993.4	1,008.4	676.4	387.4	170.4	217.2	235.4
	*Rod and reel (<145 cm LJFL)	49.5	249.3	519.3	314.6	329	254.4	158.2	398.6
	Unclassified	0.2	0.5	0.0	0.0	0.2	0.0	0.0	0.0
Gulf of Mexico	Longline	43.3	19.8	32.8	80.0	151.5	118.5	88.1	81.2
	*Rod and reel	0.9	1.7	1.5	0.0	0.0	0.0	0.6	0.0
NC Area 94a	Longline	0.0	0.0	9.3	17.8	17.7	20.3	12.1	12.4
All Areas	All Gears	**1,212.1**	**1,582.8**	**1,846.8**	**1,480.7**	**1,066.5**	**848.4**	**614.8**	**848.7**

* Rod and Reel catches and landings represent estimates of landings and dead discards when available based on statistical surveys of the U.S. recreational harvesting sector.
**from 2003-2007, this includes landings and estimated discards from scientific observer and logbook sampling programs.

Table 4.47 U.S. Landings (mt) of Yellowfin Tuna by Gear and Area, 2000-2007. Source: NMFS, 2008.

Area	Gear	2000	2001	2002	2003	2004	2005	2006	2007
NW Atlantic	Longline	734.5	631.8	400	275.3	658.5	394.2	701.7	752.8
	Rod and reel*	3,809.5	3,690.5	2,624	4,672.1	3,433.7	3,504.8	4,649.2	2,756.0
	Troll	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Purse seine	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Gillnet	0.2	7.6	5	0.9	3.2	0.1	4.7	4.2
	Trawl	1.8	2.7	0	2.2	1.6	0.2	0.7	2.4
	Harpoon	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Handline	235.7	242.5	137	149.1	213.2	105.1	105.1	118.1
	Trap	0.5	0.1	0.0	0.3	0	0.01	0.0	0.0
	Unclassified	1.3	6.8	**	0.1	10.6	3.9	3.9	7.0
Gulf of Mexico	Longline	2,133	1,505.5	2,109	1,835.8	1,811.9	1,210.9	1,128.5	1,377.7
	Rod and reel*	52.3	494.2	200	640	247.1	146.9	258.4	227.6
	Handline	28.6	43.4	100	39.9	28.3	45.5	49.9	34.3
	Gillnet	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Unclassified	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0
Caribbean	Longline	11.8	23.1	12	5.6	4.5	140.6	179.7	255.6
	Troll	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Handline	19.4	14.3	7	9	7	9.7	7.8	9.1
	Gillnet	0.1	0.3	0.0	0.02	0.06	0.0003	0.0	0.0
	Trap	0.3	0.3	0.0	0.2	0.1	0.001	0.4	0.0
NC Area 94a	Longline	2.1	3.5	0.0	5.2	0.08	0.5	0.0	1.8
SW Atlantic	Longline	19.8	36.2	52	42	16.8	0.0	0.0	0.0
All Areas	**All Gears**	**7,050.9**	**6,702.8**	**5,646**	**7,677.7**	**6,436.6**	**5,562.7**	**7,090.0**	**5,546.6**

* Rod and Reel catches and landings represent estimates of landings and dead discards based on statistical surveys of the U.S. recreational harvesting sector.
** $\leq$ 0.05 mt

Table 4.48 U.S. Landings (mt) of Skipjack Tuna by Gear and Area, 2000-2008. Source: NMFS, 2008.

Area	Gear	2000	2001	2002	2003	2004	2005	2006	2007
NW Atlantic	Longline	0.0	0.1	**	0.9	0.1	0.05	0.04	0.0
	Rod and reel*	13.1	32.9	23.3	34.1	27.3	8.1	34.6	27.4
	Troll	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Purse seine	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Gillnet	1.9	3.6	**	0.9	16.7	2.2	0.2	0.05
	Trawl	0.0	0.2	**	0.5	0.2	0.07	0.7	0.005
	Handline	0.2	0.2	0.2	0.2	0.6	0.9	0.2	0.3
	Trap	0.0	0.0	**	1.5	0.006	0.0	0.3	0.0
	Pound Net	0.0	0.0	0.0	0.1	0.0	0.0	0.5	0.002
	Unclassified	0.0	0.0	0.0	0.1	0.2	0.01	0.06	0.6
Gulf of Mexico	Longline	0.2	0.2	**	0.05	0.3	0.3	0.0	0.0
	Rod and reel*	16.7	16.1	13.2	11.1	6.3	3.1	6.4	23.9
	Handline	0.7	0.0	0.0	0.04	0.2	0.02	0.0	0.2
	Trap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Caribbean	Longline	1.6	4.0	2.5	0.4	0.3	0.2	0.2	0.002
	Gillnet	0.6	1.6	0.6	0.4	0.3	0.06	0.02	0.0
	Rod and Reel*	NA	NA	NA	15.7	40.4	3.9	7.7	0.2
	Harpoon	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Handline	8.8	10.3	12.5	12.9	9.6	10.9	10.0	13.7
	Trap	0.3	0.4	0.7	0.2	0.02	0.1	0.05	0.0
	Troll	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SW Atlantic	Unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All Areas	Longline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	All Gears	**44.1**	**69.6**	**53.0**	**79.1**	**102.5**	**29.9**	**61.0**	**66.4**

* Rod and Reel catches and landings represent estimates of landings and dead discards based on statistical surveys of the U.S. recreational harvesting sector.
** $\leq$= 0.05 mt

Table 4.49 U.S. Landings (mt) of Bigeye Tuna by Area and Gear, 2000-2007. Source: NMFS, 2008.

Area	Gear	2000	2001	2002	2003	2004	2005	2006	2007
NW Atlantic	Longline	333.2	506.1	328.6	169.2	267	272.9	469.4	325.7
	Rod and reel*	34.4	366.2	49.6	188.5	94.6	165.0	422.3	126.8
	Troll	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Gillnet	0.0	0.2	0.0	0.07	0.0	0.0	0.2	1.0
	Handline	4.1	33.2	13.8	6.0	3.3	6.2	21.5	17.8
	Trawl	1.7	0.4	0.5	0.03	0.9	0.6	0.0	0.4
	Unclassified	0.0	1.8	0.0	0.0	0.5	0.6	0.8	0.9
Gulf of Mexico	Longline	44.5	15.3	41.0	26.2	20.2	25.2	37.7	37.0
	Rod and reel*	0.0	0.0	0.0	0.0	6.0	0.0	24.3	0.0
	Handline	0.1	0.5	0.6	0.3	0.2	0.1	1.5	1.2
Caribbean	Longline	13.7	31.9	29.7	7.0	3.5	6.9	10.5	3.4
	Handline	1.5	0.0	0.0	0.0	0.0	0.04	0.0	0.0
NC Area 94a	Longline	63.1	61.0	45.2	36.9	5.0	6.9	3.0	8.4
SW Atlantic	Longline	77.4	68.2	91.3	44.6	14.4	0.0	0.0	0.0
All Areas	All Gears	**573.7**	**1,084.8**	**600.3**	**478.8**	**415.6**	**484.4**	**991.2**	**522.6**

* Rod and Reel catches and landings represent estimates of landings and dead discards based on statistical surveys of the U.S. recreational harvesting sector.
** $\leq$ 0.05

Table 4.50 U.S. Landings (mt) of Albacore Tuna by Gear and Area, 2000-2007. Source: NMFS, 2008.

Area	Gear	2000	2001	2002	2003	2004	2005	2006	2007
NW Atlantic	Longline	130.5	171.7	124.0	95.7	106.6	88.9	84.8	109.4
	Gillnet	0.8	3.3	2.6	0.1	4.9	6.0	2.1	1.0
	Handline	2.9	1.7	3.9	1.7	6.1	3.0	2.6	5.6
	Trawl	0.0	0.0	0.3	0.02	2.7	1.7	1.1	0.3
	Troll	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Rod and reel*	250.8	122.3	323.0	333.8	500.5	356.0	284.2	393.6
	Pound Net	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Unclassified	0.1	0.1	0.0	0.0	3.6	9.9	5.6	4.2
Gulf of Mexico	Longline	4.1	4.9	9.5	4.4	9.9	6.9	7.6	15.2
	Rod and reel*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Handline	0.0	0.0	0.0	0.01	0.0	0.1	0.07	0.2
Caribbean	Longline	9.2	8.7	8.4	3.9	3.2	12.1	10.5	1.2
	Troll	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Gillnet	0.1	0.5	**	0.04	0.005	0.002	0.0	0.0
	Trap	0.2	0.3	0.6	0.2	0.0	0.0	0.0	0.0
	Handline	5.0	2.2	2.7	2.6	2.1	1.1	0.4	0.2
NC Area 94a	Longline	2.6	6.1	4.8	1.6	0.2	0.6	0.03	0.3
SW Atlantic	Longline	0.9	2.4	8.3	2.0	0.5	0.0	0.0	0.0
All Areas	All Gears	**407.2**	**324.2**	**488.1**	**446.1**	**640.3**	**486.3**	**399.0**	**531.2**

* Rod and Reel catches and landings represent estimates of landings and dead discards based on statistical surveys of the U.S. recreational harvesting sector.
** $\leq$ 0.05 mt

Table 4.51 **U.S. Catches and Landings (mt) of Swordfish by Gear and Area, 2000-2007.** Source: NMFS, 2008.

Area	Gear	2000	2001	2002	2003	2004	2005	2006	2007
NW Atlantic	*Longline	1,547.6	1,220.8	1,132.8	1,341.3	1,169.7	1,096.2	1,165.2	1,630.8
	Gillnet	0.0	0.0	0.1	0.0	0.05	0.0	0.0	0.2
	Pair Trawl	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Handline	7.7	8.6	8.8	10.8	18.7	34.4	32.5	126.0
	Trawl	10.9	2.5	3.9	5.6	8.3	8.2	3.5	6.5
	Troll	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	*Unclassified	1.4	1.8	0.1	1.6	3.9	4.7	5.3	2.5
	Harpoon	0.6	7.4	2.8	0.0	0.5	0.0	0.3	0.0
	***Rod and Reel	15.6	1.5	21.5	5.9	24.3	53.1	50.6	65.9
	Trap	0.0	0.0	**	0.06	0.0	0.0	0.0	0.0
Gulf of Mexico	*Longline	631.7	494.6	549.1	507.6	453	480.9	328.1	455.7
	Handline	1.2	0.3	2.9	9.8	4.0	0.3	0.1	3.1
	Rod and Reel				0.03	0.5	1.5	2.1	2.3
	*Unclassified				3.4	0.03	4.1	2.7	5.4
Caribbean	*Longline	331.9	347.0	329.0	274.5	295.9	143.5	88.9	27.7
	Trap	0.3	**	0.1	0.0	0.0	0.0	0.0	0.0
	Rod and Reel				0.0	0.4	6.6	0.0	0.0
	Handline				0.02	0.006	0.0	0.0	0.0
	Unclassified				0.2	0.08	0.7	0.0	0.0
NC Atlantic	*Longline	804.6	420.6	587.9	632.8	599.9	552.2	378.6	338.8
SW Atlantic	*Longline	143.8	43.2	199.9	20.5	15.7	0.0	0.0	0.0
All Areas	All Gears	**3,497.3**	**2,548.3**	**2,838.9**	**2,814.13**	**2,594.9**	**2,386.4**	**2,057.9**	**2,665.9**

* Includes landings and estimated dead discards from scientific observer and logbook sampling programs.
** $\leq$ = 0.5 mt
*** Rod and Reel catches and landings represent estimates of landings and dead discards based on statistical surveys of the U.S. recreational harvesting sector.

Table 4.52 Commercial landings of LCS in lb dw: 1999-2007. Sources: Cortés 2003; Cortés and Neer 2002, 2005; Cortés pers. comm.

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

Large Coastal Sharks	1999	2000	2001	2002	2003	2004	2005	2006	2007
Sandbar	1,320,239	1,491,908	1,407,550	1,863,420	1,425,628	1,223,241	1,282,477	1,580,142	669,525
Sand Tiger**	6,401	6,554	1,248	409	624	1,832	5,167	4,321	210
Silky	9,961	31,959	14,197	30,731	51,588	11,808	17,646	16,173	16,496
Spinner	629	14,473	6,970	8,447	12,133	14,806	44,150	96,259	17,888
Tiger	30,779	24,443	26,973	16,115	18,536	30,976	33,477	53,706	17,500
Whale**	0	0	0	0	0	0	0	0	0
White**	82	1,201	26	0	1,454	58	0	122	88
Unclassified, assigned to large coastal	821,648	92,117	525,661	771,450	908,077	603,229	527,026	393,749	199,550
Unclassified, fins	116,570	87,820	23,988	142,565	181,431	137,375	110,613	146,037	102,615
Total (excluding fins)	**3,865,271 (1,753 mt dw)**	**3,713,125 (1,684 mt dw)**	**3,414,967 (1,549 mt dw)**	**4,151,594 (1,883 mt dw)**	**4,292,403 (1,947 mt dw)**	**3,213,896 (1,458 mt dw)**	**3,306,583 (1,500 mt dw)**	**3,852,124 (1,747 mt dw)**	**2,308,018 (1,047 mt dw)**

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

Table 4.53 **Commercial landings of small coastal sharks in lb dw: 1999-2007. Source: Cortés and Neer, 2002, 2005; Cortés, 2003; Cortés pers. comm.**

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

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

Table 4.54 Commercial landings of pelagic sharks in lb dw: 1999-2007. Sources: Cortés and Neer 2002, 2005; Cortés 2003; Cortés pers. comm.

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

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

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5.0 ECONOMIC STATUS OF HMS FISHERIES

The review of each rule, and of HMS fisheries as a whole, is facilitated when there is an economic baseline against which the rule or fishery may be evaluated. In this analysis, NMFS used the past eight years of data to facilitate the analysis of trends. It also should be noted that all dollar figures are reported in nominal dollars (*i.e.*, current dollars). If analysis of real dollar (*i.e.*, constant dollar) trends controlled for inflation is desired, price indexes for 2000 to 2007 are provided in Table 5.1. To determine the real price in base year dollars, divide the base year price index by the current year price index, and then multiply this result by the price that is being adjusted for inflation. From 1996 to 2004, the Consumer Price Index (CPI-U) indicates that prices have risen by 20.4 percent, the Gross Domestic Product (GDP) Implicit Price Deflator indicates that prices have risen 16.3 percent, and the Producer Price Index (PPI) for unprocessed finfish indicates a 20.8 percent rise in prices. From 2004 to 2005, the CPI, GDP Deflator, and the PPI for unprocessed finfish indicate prices rose by 3.4 percent, 3.2 percent, and 12.9 percent respectively. From 2005 to 2006, the CPI, GDP Deflator, and the PPI for unprocessed finfish indicate prices rose by 3.2 percent, 3.2 percent, and 32.2 percent respectively. From 2006 to 2007, the CPI, GDP Deflator, and the PPI for unprocessed finfish indicate prices rose by 2.6 percent, 2.7 percent, and -4.9 percent.

Table 5.1 **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
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	109.5	224.1
2005	195.3	113.0	253.1
2006	201.6	116.7	334.6
2007	207.3	119.8	318.1

5.1 Commercial Fisheries[2]

In 2007, the total commercial landings of all fish species by U.S. fishermen at ports in the 50 states were 9.2 billion pounds valued at $4.1 billion. In 2006, the total commercial landings

[2] All the information and data presented in this section were obtained from NMFS 2008b.

by U.S. fishermen at ports in the 50 states were 9.5 billion pounds and were valued at $4.0 billion. The overall value of landings between 2006 and 2007 had increased by two percent. The total value of commercial HMS landings in 2007 was $41.9 million (Table 5.4). The 2007 ex-vessel price index indicated that 21 of the 32 finfish species groups tracked had increasing ex-vessel prices, 9 species groups had decreasing ex-vessel prices, and 2 species groups remained unchanged since 2006. The total edible finfish ex-vessel price index for 2007 was up 9 percent from 2006.

The estimated value of the 2007 domestic production of all fishery products was $8.3 billion. This is $261.7 million less than the estimated value in 2006. The total import value of fishery products was $28.8 billion in 2007. This is an increase of $1.1 billion from 2006. The total import value in 1996 was $13.1 billion. By 2007, total import value has grown to $28.8 billion. The total export value of fishery products was $20.1 billion in 2007. This is an increase of $2.3 billion from 2006. In comparison, the total export value in 1996 was only $8.7 billion.

Consumers spent an estimated $68.4 billion for fishery products in 2007, including $45.8 billion at food service establishments, $22.1 billion in retail sales for home consumption, and $474.2 million for industrial fish products. The commercial marine fishing industry contributed $34.2 billion (in value added) to the U.S. Gross National Product in 2007. For comparison, in 1996 consumers spent an estimated $41.2 billion, including $27.8 billion at food service establishments, $13.2 billion for home consumption, and $283.9 billion for industrial fish products. The commercial marine fishing industry contributed $21.0 billion to the U.S. Gross National Product in 1996.

5.1.1 Ex-Vessel Prices

The average ex-vessel prices per pound dressed weight (dw) for 2000 to 2007 by area, Atlantic HMS, and major fishing gear types are summarized in Table 5.2. The average ex-vessel prices per lb dw for 2000 to 2007 by species and area are summarized in Table 5.3. 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 5.2 **Average Ex-vessel Prices per lb dw for Atlantic HMS by Gear and Area.** (Source: Dealer weighout slips from the Southeast Fisheries Science Center and Northeast Fisheries Science Center, and bluefin tuna dealer reports from the Northeast Regional Office. HND=Handline, harpoon, spears, trot lines, and trolls, PLL=Pelagic longline, BLL=Bottom longline, Net=Gillnets and pound nets, TWL=Trawls, SEN=Seines, TRP=Pots and traps, DRG=Dredge, and UNK=Unknown. Gulf of Mexico includes: TX, LA, MS, AL, and the west coast of FL. S. Atlantic includes: east coast of FL. GA, SC, and NC dealers reporting to Southeast Fisheries Science Center. Mid-Atlantic includes: NC dealers reporting to Northeast Fisheries Science Center, VA, MD, DE, NJ, NY, and CT. N. Atlantic includes: RI, MA, NH, and ME. For bluefin tuna, all NC landings are included in the Mid-Atlantic.)

Gulf of Mexico									
Species	**Gear**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Bigeye tuna	HND	$1.83	$1.82	$1.44	$1.25	$3.45	$1.40	$3.45	$2.00
	PLL	$2.82	$2.64	$5.09	$3.41	$4.58	$5.19	$4.58	$3.20
	BLL	$2.31	$0.50	$4.24	$3.53	$5.67	$6.00	$5.67	$4.21
Bluefin tuna	HND	$1.86	$1.25	$2.69	-	-	-	-	$1.73
	PLL	-	-	$6.40	$6.32	$4.64	$4.67	$4.39	$5.87
	BLL	-	-	$4.50	-	-	-	-	$3.00
Yellowfin tuna	HND	$2.48	$2.55	$2.83	$2.34	$2.56	$2.27	$2.56	$2.67
	PLL	$3.40	$3.25	$3.68	$3.64	$4.01	$4.00	$4.01	$3.93
	BLL	$3.68	$3.31	$3.23	$3.73	$4.01	$3.84	$4.01	$3.34
Other tunas	HND	$0.76	$0.79	$0.91	$0.87	$1.04	$1.06	$1.04	$1.21
	PLL	$0.72	$0.70	$0.79	$0.66	$0.58	$0.65	$0.58	$0.53
	BLL	$0.85	$0.74	$0.75	$0.55	$0.65	$0.85	$0.65	$0.63
	NET	$0.58	$0.33	$0.83	$0.29	$0.41	$0.41	$0.41	$0.53
	TWL	$0.61	$0.78	$0.40	$0.30	-	$0.24	-	-
	SEN	-	$0.61	$0.19	-	$0.21	$0.20	$0.21	$0.23
	TRP	-	-	$0.30	$0.30	-	$1.00	-	-
Swordfish	HND	$3.91	$2.84	$3.19	$3.68	$3.38	$3.98	$3.38	$4.08
	PLL	$3.33	$3.41	$2.94	$2.91	$3.32	$3.15	$3.32	$3.04
	BLL	$3.10	$3.25	$2.88	$2.67	$2.89	$2.37	$2.89	$2.52
Large coastal sharks	HND	$0.59	$0.51	$0.44	$0.45	$0.45	$0.58	$0.45	$0.72
	PLL	$0.48	$0.45	$0.36	$0.38	$0.53	$0.54	$0.53	$0.44
	BLL	$0.43	$0.44	$0.36	$0.38	$0.34	$0.44	$0.34	$0.43
	NET	$0.48	$0.50	$0.39	$0.43	$0.39	$0.45	$0.39	$0.56
	TWL	$0.15	$0.25	$0.25	$0.25	$0.25	$0.26	$0.25	-
Pelagic sharks	HND	$1.38	$1.48	$0.93	$1.04	$1.21	$1.25	$1.21	$1.39
	PLL	$1.27	$1.32	$1.06	$1.11	$1.08	$1.07	$1.08	$1.12
	BLL	$1.31	$1.42	$1.19	$1.15	$1.03	$1.14	$1.03	$1.16
Small coastal sharks	HND	$0.93	$0.37	$0.38	$0.32	$0.59	$0.51	$0.59	$0.56
	PLL	$0.47	$0.74	$0.32	$0.33	$0.37	$0.47	$0.37	$0.69
	BLL	$0.41	$0.61	$0.53	$0.50	$0.45	$0.51	$0.45	$0.54
	NET	-	$0.45	$0.46	$0.36	$0.50	$0.72	$0.50	$0.49
	TRP	-	$0.74	-	-	-	-	-	-
Shark fins	HND	$21.57	$15.90	$21.28	$13.97	$12.49	$16.62	$12.49	$12.09
	PLL	$15.65	$21.08	-	$15.21	$17.81	$14.31	$17.81	$14.58

	BLL	$15.89	$21.50	$22.72	$20.17	$21.95	$22.16	$21.95	$18.43
	NET	$15.50	$11.02	-	$6.05	$5.86	$6.91	$5.86	$10.42
	TWL	$9.17	-	-	-	-	-	-	-
South Atlantic									
Species	**Gear**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Bigeye tuna	HND	$1.02	$2.14	$2.29	$1.89	$2.97	$2.80	$2.97	$3.13
	PLL	$2.27	$2.78	$2.33	$2.26	$2.85	$3.41	$2.85	$3.42
	BLL	$1.87	$2.63	$2.74	$2.66	-	$3.04	-	$3.12
Bluefin tuna	HND	$7.99	$3.52	$3.35	-	$5.94	-	$11.35	$6.19
	PLL	$5.36	$4.82	$4.95	$4.11	$4.91	$4.60	$6.06	$7.07
	BLL	-	$3.61	$5.15	-	-	-	-	-
Yellowfin tuna	HND	$1.56	$1.41	$1.54	$1.54	$1.24	$1.52	$1.24	$1.80
	PLL	$2.23	$2.14	$1.89	$2.09	$2.00	$2.83	$2.00	$2.57
	BLL	$2.29	$2.45	$2.29	$2.60	$0.90	$1.19	$0.90	$1.42
	NET	-	$1.21	$1.12	-	-	$0.87	-	-
	TWL	-	-	$0.44	-	-	-	-	-
Other tunas	HND	$0.59	$0.61	$0.47	$0.58	$0.52	$0.53	$0.52	$0.59
	PLL	$1.31	$1.33	$1.09	$1.26	$1.28	$1.53	$1.28	$1.25
	BLL	$1.49	$1.86	$1.67	$1.13	$0.48	$0.67	$0.48	$0.30
	NET	$0.20	$0.23	$0.21	$0.21	$0.20	$0.31	$0.20	$0.37
	TWL	$0.25	$0.47	$0.26	-	$0.20	-	$0.20	$0.39
	TRP	-	$0.18	-	-	-	-	-	-
Swordfish	HND	$3.92	$4.24	$3.93	$3.91	$4.44	$4.72	$4.44	$4.47
	PLL	$3.12	$3.27	$2.84	$2.98	$3.18	$3.32	$3.18	$3.53
	BLL	$3.42	$3.14	$2.76	$3.19	-	$2.36	-	$3.61
	NET	-	-	$2.50	-	-	-	-	-
Large coastal sharks	HND	$0.59	$0.96	$1.01	$0.49	$0.43	$0.48	$0.43	$0.45
	PLL	$1.21	$1.69	$2.63	$0.35	$0.54	$0.55	$0.54	$0.62
	BLL	$0.78	$0.89	$1.10	$0.39	$0.44	$0.51	$0.44	$0.44
	NET	$0.91	$1.49	$1.59	$0.30	$0.35	$0.45	$0.35	$0.32
	TWL	$0.49	$0.51	$0.81	$0.41	$0.71	$0.43	$0.71	$0.64
	TRP	-	-	$0.23	-	-	$0.30	-	-
Pelagic sharks	HND	$0.78	$0.71	$0.68	$0.84	$0.97	$0.87	$0.97	$0.77
	PLL	$0.95	$0.95	$0.93	$0.93	$0.84	$0.96	$0.84	$1.18
	BLL	$0.90	$0.78	$0.75	$0.87	$0.81	$0.77	$0.81	$2.08
	NET	$0.35	$0.36	$0.34	$0.34	$0.29	$0.37	$0.29	$0.45
	TWL	$0.20	$0.26	$0.26	-	-	$0.22	-	$0.40
Small coastal sharks	HND	$0.40	$0.46	$0.53	$0.49	$0.44	$0.60	$0.44	$0.59
	PLL	$0.57	$0.63	$0.41	$0.24	-	$0.19	-	$0.69
	BLL	$0.56	$0.53	$0.54	$3.19	$0.61	$0.60	$0.61	$0.57
	NET	$0.48	$0.54	$0.54	$0.53	$0.65	$0.64	$0.65	$0.66
	TWL	$0.23	$0.23	-	-	-	$0.20	-	-
Shark fins	HND	$11.92	$19.75	$15.53	$17.17	$20.31	$18.71	$20.31	$17.30
	PLL	$10.34	$11.44	$6.81	$12.72	$9.91	$13.52	$9.91	$7.00
	BLL	$17.57	$22.21	$22.26	$17.83	$19.48	$22.85	$19.48	$21.86
	NET	$6.95	$10.60	$10.41	$12.85	$8.76	$8.89	$8.76	$7.40
	TWL	-	$12.17	$14.00	$10.77	$5.90	$10.85	$5.90	$10.38

Mid-Atlantic									
Species	**Gear**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Bigeye tuna	HND	$4.45	$4.32	$3.97	$3.79	$4.93	$4.57	$4.33	$4.92
	PLL	$4.30	$3.81	$4.12	$3.92	$4.48	$4.76	$4.49	-
	BLL	$3.45	$4.37	$2.84	$3.91	$4.34	$4.61	$5.02	$6.08
	NET	$5.55	$4.50	-	-	-	-	$3.99	$6.95
	TWL	$5.68	-	-	-	-	-	-	$5.33
	DRG	-	-	$1.50	-	-	-	-	$5.78
	UNK	-	-	$5.00	-	$5.36	$4.95	$5.40	
Bluefin tuna	HND	$6.60	$4.93	$4.06	$7.54	$10.25	$11.07	$10.40	$11.26
	PLL	$5.73	$6.83	$5.72	$6.25	$6.03	$5.41	$7.53	$7.09
	NET	-	$2.23	-	-	-	-	-	-
	BLL	-	$7.00	$7.00	-	-	-	-	-
Yellowfin tuna	HND	$2.14	$2.11	$2.00	$1.93	$1.76	$1.99	$2.33	$2.73
	PLL	$2.32	$2.30	$2.14	$2.00	$1.91	$2.20	$2.19	-
	BLL	$1.86	$2.11	$1.81	$1.89	$2.20	$2.40	$2.76	$2.88
	NET	$1.77	$1.49	$1.81	$1.50	$2.08	$2.23	$1.81	$2.34
	TWL	$1.56	$1.53	-	$1.48	-	$3.33	$1.95	$2.18
	TRP	-	-	$1.97	$1.57	$1.59	-	-	-
	DRG	-	-	$1.94	-	-	-	$4.22	$3.22
	UNK	-	-	$2.75	-	$2.62	$3.70	$2.57	$2.99
Other tunas	HND	$0.94	$0.89	$0.69	$0.66	$0.65	$0.74	$0.74	$0.75
	PLL	$1.03	$0.88	$0.86	$0.93	$1.09	$0.86	$0.92	$1.68
	BLL	$1.17	$0.78	$0.83	$1.08	$0.97	$0.91	$1.17	$1.21
	NET	$0.44	$0.49	$0.75	$0.48	$0.35	$0.66	$0.58	$0.59
	TWL	$0.70	$0.47	$0.42	$0.62	$0.52	$1.11	$0.62	$0.51
	TRP	-	-	$0.57	$0.47	$0.58	$0.60	$0.67	$0.55
	DRG	-	-	$1.00	-	-	-	$1.50	$1.25
	UNK	-	-	$1.03	$1.69	$0.65	$1.13	$0.74	$0.77
Swordfish	HND	$3.25	$3.70	-	-	-	$3.29	$3.52	$4.00
	PLL	$3.59	$3.47	$3.18	$2.97	$2.86	$3.60	$3.47	$5.25
	BLL	$2.91	$3.45	$4.00	-	$3.43	$3.80	$3.70	$4.33
	NET	-	$4.19	$3.51	-	-	$3.26	$3.59	$3.83
	UNK	-	-	-	-	-	$4.37	$3.49	$3.17
	TWL	$3.94	$2.86	$3.34	$3.21	$3.55	$3.31	$3.60	$3.89
Large coastal sharks	HND	$0.50	$0.88	$2.09	$2.19	$1.06	$1.60	$0.96	$0.60
	PLL	$0.45	$2.62	$2.78	$2.32	$3.37	$2.33	$2.19	-
	BLL	$0.41	$0.55	$1.11	$2.08	$2.32	$3.03	$4.01	$0.71
	NET	$0.53	$0.89	$1.02	$1.02	$1.52	$0.84	$1.37	$0.67
	TWL	$0.72	$0.55	$0.52	$0.50	$0.80	$1.67	$0.87	$0.56
	TRP	-	-	$2.50	-	-	-	-	-
	SEN	-	-	$1.26	-	-	-	-	$1.08
	UNK	-	-	$0.50	-	$0.68	$2.69	$0.85	$0.63
Pelagic sharks	HND	$1.41	$1.26	$1.41	$1.57	$1.26	$1.33	$1.38	$1.69
	PLL	$1.45	$1.56	$1.31	$1.32	$1.22	$1.40	$1.45	$1.57
	BLL	$1.24	$0.97	$1.12	$1.17	$1.41	$1.50	$1.82	$1.51

	NET	$1.02	$1.02	$0.97	$1.08	$1.32	$1.42	$1.03	$1.12
	TWL	$0.90	$0.69	$1.03	$0.88	$0.55	$1.08	$0.78	$0.94
	TRP	-	$0.40	-	$1.43	-	-	-	-
	DRG	-	$0.49	$2.00	-	-	-	-	-
	UNK	-	-	-	$0.57	$1.78	$1.22	$1.30	$1.52
Small coastal sharks	HND	$0.38	$0.51	$0.45	$0.36	$0.50	$0.44	$0.44	-
	PLL	$0.20	$0.44	$0.50	$0.39	-	$0.46	$0.44	-
	BLL	-	$0.95	-	-	-	-	$0.50	-
	NET	$0.40	-	$0.42	$0.39	$0.44	$0.39	$0.47	$0.75
	TWL	-	-	$1.26	-	-	-	-	-
North Atlantic									
Species	**Gear**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Bigeye tuna	HND	$4.22	$6.00	-	-	$4.89	-	$5.95	$4.51
	PLL	$4.39	$3.42	$4.08	$3.50	$3.79	$4.79	$5.06	-
	BLL	-	-	-	-	$4.30	$3.87	$3.97	$4.46
	NET	$0.42	-	-	-	-	-	-	-
	TWL	$3.87	$3.54	$3.76	-	-	$5.26	-	$7.54
Bluefin tuna	HND	$10.02	$8.21	$7.94	$6.33	$7.79	$8.03	$8.20	$8.63
	PLL	$5.65	$5.24	$5.96	$4.21	$5.38	$4.61	$5.24	$5.00
	NET	-	$4.26	-	-	-	-	-	-
	SEN	$7.80	$7.43	$6.61	$4.92	$5.92	$3.33	$5.24	$8.92
	TWL	-	$3.80	-	-	-	-	-	-
Yellowfin tuna	HND	$2.66	$2.87	$3.25	$1.90	$2.90	$3.35	$2.57	$3.69
	PLL	$2.77	$3.01	$2.76	$2.57	$2.89	$3.83	$2.93	$4.40
	BLL	$2.32	$3.77	-	-	$2.51	$3.18	$2.69	$2.95
	NET	-	-	$4.75	-	-	-	-	$2.50
	TWL	$2.31	$2.10	$2.19	$1.65	$3.25	$4.31	$2.87	$2.54
	TRP	-	-	$4.50	$3.10	-	$1.49	-	$2.29
Other tunas	HND	$1.59	$2.39	$2.03	$1.56	$1.78	$1.29	$1.00	$1.32
	PLL	$1.13	$0.70	$1.15	$1.00	$1.17	$1.25	$1.43	$1.11
	BLL	$0.50	$3.00	-	-	$0.66	$0.91	$1.24	$1.48
	NET	$0.50	$0.36	$0.70	$1.14	$0.44	$0.52	$0.71	$0.54
	TWL	$0.22	$0.80	$0.69	$0.37	$0.89	$0.75	$0.32	$1.03
	TRP	-	-	$0.34	$0.44	-	$0.75	$0.94	$0.41
	DRG	-	-	$3.00	-	-	-	-	-
Swordfish	HND	$8.00	$5.69	$5.32	-	$4.79	-	$4.39	$5.37
	PLL	$3.67	$3.58	$3.30	$3.36	$3.85	$4.20	$4.18	$4.07
	BLL	$2.00	-	-	-	$3.75	$3.73	$3.87	$4.36
	NET	-	-	$4.25	-	-	-	-	-
	TWL	$4.05	$4.75	$3.05	$3.18	$4.89	$3.64	$2.75	$2.39
	TRP	-	-	$3.74	-	-	-	-	-
Large coastal sharks	HND	-	$0.50	$0.45	$0.74	-	$0.20	-	-
	PLL	$1.00	$1.21	$0.29	$0.28	$1.03	$0.28	-	-
	BLL	$0.65	$1.43	$1.00	-	-	-	-	-
	NET	$1.06	$0.99	$0.89	$0.89	$0.68	$0.81	-	$0.47

	TWL	$1.08	$0.93	$0.86	$0.66	$0.56	$0.66	-	$1.08
	UNK	-	-	-	-	-	$0.95	$1.27	$0.98
	TRP	-	-	$0.28	$0.22	-	-	-	-
Pelagic sharks	HND	-	$1.38	$1.71	-	-	$5.77	$1.50	$0.76
	PLL	$1.38	$1.37	$1.31	$1.30	$1.34	$1.48	$1.48	$0.87
	BLL	$1.50	-	$0.65	-	$1.07	$1.46	$1.57	$1.28
	NET	$0.82	$0.98	$0.60	$1.30	$1.99	$0.78	$1.23	$0.60
	TWL	$0.97	$1.19	$0.81	$0.63	$0.78	$0.78	$0.75	$0.55
	UNK	-	-	-	-	-	$1.24	$1.47	$1.00
	TRP	-	-	$0.69	$0.68	-	-	-	-
Small coastal sharks	HND	-	-	-	-	-	-	-	-
	NET	-	$1.51	-	-	-	-	-	-
	TWL	-	-	$0.58	-	-	$0.50	-	-

Table 5.3 Average Ex-vessel Prices per lb for Atlantic HMS by Area.

Species	Area	2000	2001	2002	2003	2004	2005	2006	2007
Bigeye tuna	Gulf of Mexico	$2.26	$1.94	$4.33	$3.29	$4.54	$4.81	$4.58	$3.19
	S. Atlantic	$1.98	$2.57	$2.45	$2.24	$2.86	$3.32	$3.20	$3.36
	Mid-Atlantic	$4.39	$4.26	$3.82	$3.77	$4.56	$4.72	$4.73	$5.76
	N. Atlantic	$4.12	$4.32	$4.03	$3.45	$4.42	$4.65	$4.88	$4.87
Bluefin tuna	Gulf of Mexico	$1.86	$1.25	$5.56	$6.32	$4.64	$4.67	$4.39	$5.87
	S. Atlantic	$6.83	$4.00	$3.77	$4.11	$4.91	$4.60	$6.36	$7.07
	Mid-Atlantic	$5.98	$5.25	$4.70	$7.38	$9.62	$10.30	$9.81	$10.05
	N. Atlantic	$8.94	$5.79	$7.31	$5.71	$7.42	$5.57	$7.92	$8.31
Yellowfin tuna	Gulf of Mexico	$3.22	$2.98	$3.23	$3.31	$3.75	$3.60	$3.71	$3.65
	S. Atlantic	$1.88	$1.70	$1.73	$1.76	$1.53	$$2.10	$1.85	$2.22
	Mid-Atlantic	$2.12	$1.91	$2.02	$1.91	$1.98	$2.42	$2.53	$2.78
	N. Atlantic	$2.65	$2.93	$2.90	$2.38	$2.65	$3.15	$2.54	$3.38
Other tunas	Gulf of Mexico	$0.74	$0.76	$0.84	$0.75	$0.89	$0.92	$0.91	$0.97
	S. Atlantic	$0.58	$0.58	$0.49	$0.59	$0.49	$0.59	$0.53	$0.59
	Mid-Atlantic	$0.76	$0.70	$0.73	$0.70	$0.63	$0.81	$0.82	$0.80
	N. Atlantic	$0.93	$1.46	$1.17	$0.95	$0.94	$0.85	$0.84	$0.88
Swordfish	Gulf of Mexico	$3.25	$3.31	$2.91	$2.95	$3.31	$3.18	$3.06	$3.23
	S. Atlantic	$3.24	$3.43	$3.14	$3.26	$3.52	$3.73	$3.77	$3.96
	Mid-Atlantic	$3.67	$3.53	$3.25	$2.97	$3.37	$3.70	$3.62	$4.09
	N. Atlantic	$3.87	$4.67	$3.47	$3.33	$4.06	$3.78	$3.87	$4.22
Large coastal sharks	Gulf of Mexico	$0.43	$0.44	$0.36	$0.38	$0.37	$0.46	$0.43	$0.51
	S. Atlantic	$0.78	$1.12	$1.27	$0.39	$0.44	$0.50	$0.40	$0.45
	Mid-Atlantic	$0.53	$1.09	$1.56	$1.62	$1.93	$1.75	$1.71	$0.64
	N. Atlantic	$1.01	$1.02	$0.77	$0.72	$0.70	$0.74	$1.02	$0.70
Pelagic sharks	Gulf of Mexico	$1.31	$1.42	$1.11	$1.13	$1.08	$1.12	$1.21	$1.17
	S. Atlantic	$0.76	$0.68	$0.67	$0.71	$0.65	$0.73	$0.72	$0.86
	Mid-Atlantic	$1.20	$1.09	$1.17	$1.21	$1.29	$1.39	$1.38	$1.39
	N. Atlantic	$1.10	$1.23	$1.00	$1.12	$1.46	$1.40	$1.26	$0.97
Small coastal sharks	Gulf of Mexico	$0.52	$0.58	$0.48	$0.40	$0.45	$0.55	$0.53	$0.51
	S. Atlantic	$0.48	$0.52	$0.53	$0.51	$0.61	$0.62	$0.55	$0.63
	Mid-Atlantic	$0.38	$0.55	$0.48	$0.38	$0.44	$0.42	$0.45	$0.73
	N. Atlantic	-	$1.51	$0.58	-	-	$0.50	-	-
Shark fins	Gulf of Mexico	$15.99	$20.90	$22.64	$18.12	$17.93	$20.24	$20.76	$15.12
	S. Atlantic	$14.16	$18.43	$17.10	$15.85	$14.57	$16.12	$16.30	$12.55
	Mid-Atlantic	$4.90	-	-	-	-	-	-	-
	N. Atlantic	$6.83	-	-	-	-	-	-	-

Table 5.2 and Table 5.3 indicate that the average ex-vessel prices for bigeye tuna have generally increased since 2000. Price changes from 2006 to 2007 were on average moderate and varied in direction for all four regions. The gears used also influenced the average price of bigeye tuna.

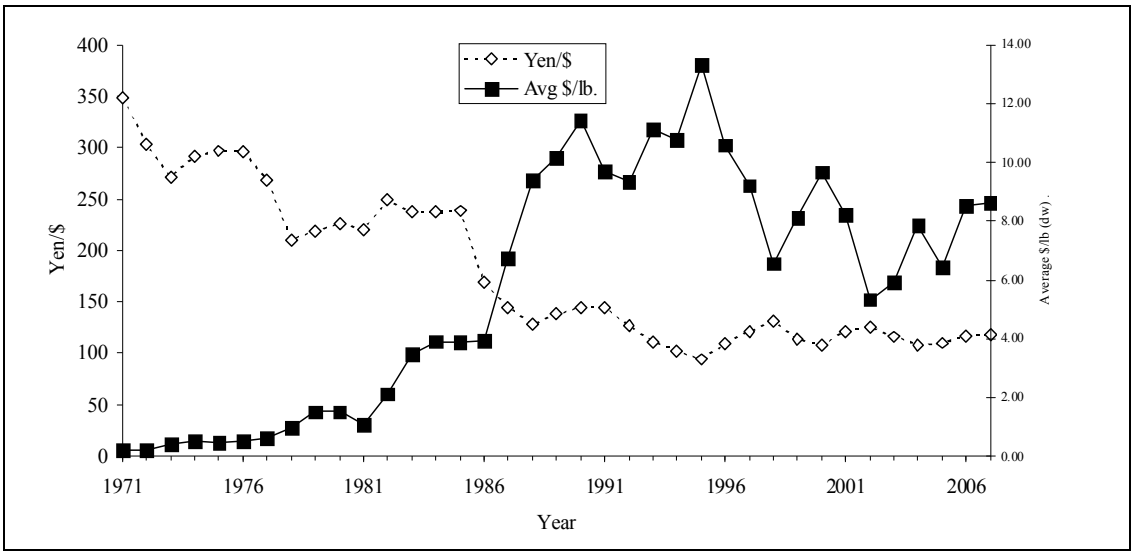

Figure 5.1 **Average Annual Yen/$ Exchange Rate and Average U.S. BFT Ex-vessel $/lb (dw) for All Gears: 1971-2003.** Source: Federal Reserve Bank (www.stls.frb.org) and Northeast Regional Office.

Average ex-vessel prices for bluefin tuna have not displayed a consistent trend since 2000. Since 2002, however, prices increased in all regions (Table 5.3). The gear used also made a difference in the ex-vessel price (Table 5.2). In the North Atlantic and Mid-Atlantic, bluefin tuna caught with handgear had higher average prices than those caught with longline. This trend has been fairly consistent over the years between 2000 and 2007. The ex-vessel prices for bluefin tuna can be influenced by many factors, including market supply and the Japanese Yen/U.S. Dollar (¥/$) exchange rate. Figure 5.1 shows the average ¥/$ exchange rate, plotted with average ex-vessel bluefin tuna prices, from 1971 to 2007.

The average ex-vessel prices for yellowfin tuna have increased in 2007 except in the Gulf of Mexico (Table 5.3). Yellowfin tuna caught with longline gear had higher average ex-vessel prices than fish caught with other gear types in 2007 (Table 5.2). The average ex-vessel price for other tunas increased in all regions in 2007 (Table 5.3). The average price of other tunas is lowest in the South Atlantic compared to other regions. The type of gear used did not appear to consistently influence the average ex-vessel prices of other tuna. Average ex-vessel prices for swordfish increased in 2007 in all regions (Table 5.3).

The average ex-vessel price for LCS slightly increased in the Gulf of Mexico and South Atlantic regions in 2007 (Table 5.3). The average ex-vessel prices for pelagic sharks decreased in the Gulf of Mexico and North Atlantic regions in 2007 (Table 5.3). The average ex-vessel prices for SCS increased from 2006 to 2007 in the South Atlantic and Mid-Atlantic regions, but decreased slightly in the Gulf of Mexico region (Table 5.3). Gear type did not consistently affect the ex-vessel price of small coastal sharks in 2007 (Table 5.2).

5.1.2 Revenues

Table 5.4 summarizes the average annual revenues of the Atlantic HMS fisheries based on average ex-vessel prices and the weight reported landed as per the U.S. National Report (NMFS, 2008), the information used in the shark stock assessments, information given to ICCAT (Cortes, 2008), as well as price and weight reported to the NMFS Northeast Regional Office by Atlantic bluefin tuna dealers. These values indicate that the estimated total annual revenue of Atlantic HMS fisheries has increased in 2007 to $41.9 million from $39.4 million in 2006. From 2006 to 2007, the tuna fishery's total revenue increased by $2 million. A majority of that increase can be attributed to increased commercial landings and ex-vessel price of yellowfin tuna. From 2006 to 2007, the annual revenues from shark decreased by 50 percent. In contrast, the annual revenues from swordfish from 2006 to 2007 increased by 42 percent.

Table 5.4 **Estimates of the Total Ex-vessel Annual Revenues of Atlantic HMS Fisheries.** Sources: NMFS, 1997; NMFS 2007a; Cortés pers. comm..; and bluefin tuna dealer reports from the Northeast Regional Office.

Species		2000	2001	2002	2003	2004	2005	2006	2007
Bigeye tuna	Ex-vessel $/lb dw	$3.18	$3.27	$3.66	$3.19	$4.10	$4.38	$4.35	$4.30
	Weight lb dw	950,986	1,139,510	810,087	433,353	530,972	563,375	960,895	697,693
	Fishery Revenue	$3,024,135	$3,726,198	$2,964,918	$1,382,396	$2,176,985	$2,467,583	$4,179,893	$3,000,080
Bluefin tuna	Ex-vessel $/lb dw	$9.66	$8.23	$5.33	$5.91	$7.86	$6.41	$8.51	$8.62
	Weight lb dw	1,930,720	1,653,820	2,255,241	1,963,172	1,010,599	816,592	643,750	635,108
	Fishery Revenue	$18,650,755	$13,610,939	$12,020,435	$11,602,347	$7,943,308	$5,234,355	$5,478,313	$5,474,631
Yellowfin tuna	Ex-vessel $/lb dw	$2.46	$2.38	$2.48	$2.34	$2.48	$3.06	$2.66	$3.01
	Weight lb dw	5,624,433	4,366,011	4,887,240	4,101,055	4,831,675	3,370,398	3,851,003	4,520,594
	Fishery Revenue	$13,836,105	$10,391,106	$12,120,355	$9,596,469	$11,982,554	$10,313,418	$10,243,668	$13,606,988
Other tunas*	Ex-vessel $/lb dw	$0.75	$0.87	$0.81	$0.75	$0.74	$0.79	$0.78	$0.81
	Weight lb dw	301,328	382,240	306,325	227,175	307,006	258,860	225,111	269,764
	Fishery Revenue	$225,996	$332,549	$248,123	$170,381	$227,184	$204,499	$175,587	$218,509
Total tuna	**Fishery Revenue**	**$35,736,992**	**$28,060,791**	**$27,353,831**	**$22,751,593**	**$22,330,032**	**$18,219,855**	**$20,077,460**	**$22,300,208**
Swordfish	Ex-vessel $/lb dw	$3.51	$3.74	$3.20	$3.13	$3.57	$3.60	$3.58	$3.88
	Weight lb dw	4,955,760	3,676,287	3,914,951	4,155,799	3,902,639	3,479,844	3,017,574	3,954,570
	Fishery Revenue	$17,394,718	$13,749,313	$12,527,843	$13,007,651	$13,932,421	$12,527,438	$10,802,915	$15,343,732
Large coastal sharks	Ex-vessel $/lb dw	$0.68	$0.91	$0.99	$0.78	$0.86	$0.86	$0.89	$0.58
	Weight lb dw	3,713,125	3,414,967	4,151,594	4,292,403	3,213,896	3,306,583	3,852,124	2,308,018
	Fishery Revenue	$2,524,925	$3,107,620	$4,110,078	$3,348,074	$2,763,951	$2,843,661	$3,428,390	$1,338,650
Pelagic sharks	Ex-vessel $/lb dw	$1.09	$1.11	$0.99	$1.04	$1.12	$1.16	$1.14	$1.10
	Weight lb dw	350,705	345,895	467,682	637,324	679,469	235,600	185,266	263,765
	Fishery Revenue	$382,268	$383,943	$463,005	$662,817	$761,005	$273,296	$211,203	$290,142
Small coastal sharks	Ex-vessel $/lb dw	$0.46	$0.79	$0.52	$0.43	$0.50	$0.52	$0.51	$0.63
	Weight lb dw	593,027	724,332	615,915	534,523	451,651	650,202	823,353	654,099
	Fishery Revenue	$272,792	$572,222	$320,276	$229,845	$225,826	$338,105	$419,910	$412,082
Shark fins (weight = 5% of all sharks landed)	Ex-vessel $/lb dw	$10.47	$19.67	$19.87	$17.09	$16.25	$18.18	$18.53	$13.84
	Weight lb dw	232,843	224,260	261,760	273,213	217,251	209,619	243,037	161,294
	Fishery Revenue	$2,437,865	$4,411,188	$5,201,162	$4,669,202	$3,530,326	$3,810,878	$4,503,478	$2,232,310
Total sharks	**Fishery Revenue**	**$5,617,851**	**$8,474,974**	**$10,094,521**	**$8,909,938**	**$7,281,107**	**$7,265,940**	**$8,562,982**	**$4,273,185**
Total HMS	Fishery Revenue	$58,749,560	$50,285,079	$49,976,196	$44,669,181	$43,543,560	$38,013,233	$39,443,357	$41,917,124

Note: Average ex-vessel prices may have some weighting errors, except for bluefin tuna which is based on a fleet-wide average. Other tunas includes skipjack and albacore.

5.2 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. The following information is taken from the Consolidated HMS FMP.

An economic survey done by the U.S. Fish and Wildlife Service in 2006 found that for the entire United States 7.7 million saltwater anglers (including anglers in state waters) went on approximately 67 million fishing trips and spent approximately $8.9 billion (USFWS, 2006). These participation rates are down from the 2001 survey which found 9.1 million saltwater anglers (including anglers in state waters) went on approximately 72 million fishing trips and spent approximately $8.4 billion (USFWS, 2001). The 2006 survey found saltwater anglers spent $5.3 billion on trip-related costs and $3.6 billion on equipment (USFWS, 2006). Expenditure on trip-related costs increased 17 percent from 2001, but equipment expenditures have declined 7 percent. These expenditures included lodging, transportation to and from the coastal community, vessel fees, equipment rental, bait, auxiliary purchases (e.g., binoculars, cameras, film, foul weather clothing, etc.), and fishing licenses. Approximately 79 percent of the saltwater anglers surveyed fished in their home state in 2006, compared to 76 percent in 2001 (USFWS, 2001).

Specific information regarding angler expenditures for trips targeting HMS species was extracted from the recreational fishing expenditure survey add-on (1998 in the Northeast, 1999 – 2000 in the Southeast) to the 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, 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 $686 per person per day on billfish directed trips (based on a low sample size), $85 on pelagic shark directed trips, $95 on LCS directed trips, $81 on SCS directed trips, and $106 on tuna directed trips.

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

At the end of 2004, NMFS collected market information regarding advertised charterboat rates. The analysis of this data collected focused on 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. 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.

In 2003, Ditton and Stoll published a paper that surveyed the literature regarding what is currently known about the social and economic aspects of recreational billfish fisheries. It was estimated that 230,000 anglers in the United States spent 2,136,899 days fishing for billfish in 1991. This is approximately 3.6 percent of all saltwater anglers over age 16. The states with the highest number of billfish anglers are Florida, California, North Carolina, Hawaii, and Texas, in descending order. Billfish anglers studied in the U.S. Atlantic, Puerto Rico, and Costa Rica fished between 39 and 43 days per year.

Billfish recreational anglers tend to spend a great deal of money on trips. Ditton and Stoll (2003) report that a 1990 study of U.S. total trip costs for a typical billfish angler estimated a mean expenditure of $2,105 per trip for the Atlantic and $1,052 per trip for Puerto Rico. The aggregate economic impact of billfish fishing trips in the U.S. Atlantic is conservatively estimated to be $22.7 million annually.

In addition to the economic impact of recreational billfish angling, Ditton and Stoll (2003), using a contingent valuation method, estimated consumer's surplus or net economic benefit to maintain current billfish populations in the U.S. Atlantic to be $497 per billfish angler per year in the U.S. Atlantic and $480 in Puerto Rico. They also estimate that the number of annual billfish anglers in the U.S. Atlantic to be 7,915 and 1,627 in Puerto Rico. The aggregate willingness-to-pay for maintaining current billfish populations is $3.93 million in the U.S. Atlantic and 0.78 million in Puerto Rico. The aggregate direct impact of billfish expenditures is estimated to be $15.13 million for the U.S. Atlantic and $32.40 million for Puerto Rico. Thus, the total aggregate economic value of billfish angler fishing is $19.06 million per year for the U.S. Atlantic and $33.18 million per year for Puerto Rico.

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 did not appear to be directly proportional to the number of anglers per team, but rather with the amount of money available for prizes and, possibly, the species being targeted. 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.

Cash awards distributed in HMS tournaments can be quite substantial. Several of the largest tournaments, some of which are described below, are part of the World Billfish Series Tournament Trail whereby regional winners are invited to compete in the World Billfish Series Grand Championship for a new automobile and a bronze sculpture. Other tournament series include the International Game Fish Association (IGFA) Rolex Tournament of Champions, and the South Carolina Governor's Cup. White marlin is a top billfish species from Cape Hatteras, North Carolina to the eastern tip of Georges Bank from June through October each year. The White Marlin Open in Ocean City, Maryland, which is billed as the "world's richest fishing tournament," established a new world record payout for catching a fish when it awarded $1.32 million in 2004 to the vessel catching the largest white marlin. The 21st Annual Pirates Cove Billfish Tournament in North Carolina awarded over $1 million in prizes in 2004, with the top boat garnering over $400,000 for winning in six categories. Total prize money awarded in the Big Rock Tournament in North Carolina has exceeded $1 million since 1998.

Blue marlin, sailfish, and tunas are also often targeted in fishing tournaments, including those discussed above. In 2004, blue marlin was the HMS most frequently identified as a prize category in registered HMS tournaments. Forty-five teams participated in the 2004 Emerald Coast Blue Marlin Classic at Sandestin, Florida, with over $482,000 in cash prizes and the top boat receiving over $58,000. The 34th Annual Pensacola (Florida) International Billfish Tournament indicated that it would award over $325,000 in cash and prizes in 2004. The World Sailfish Championship in Key West, Florida had a $100,000 guaranteed first prize for 2005. In South Carolina, the Megadock Billfishing Tournament offered a $1,000,000 prize for any boat exceeding the current blue marlin state record. The 2004 Florida Billfish Masters Tournament in Miami, Florida awarded over $123,000 in prize money, with the top boat receiving over $74,000. Sixty-two boats competed in the 2003 Babylon Tuna Club Invitational in Babylon, New York for over $75,000 in cash prizes, and the Mid-Atlantic Tuna Tournament sponsored by the South Jersey Marina in Cape May, New Jersey anticipates awarding over $25,000 in prizes in 2005.

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.

While fishing tournaments are an important component of Atlantic HMS recreational fisheries and provide socioeconomic benefits to associated communities, there are some organizations that oppose these tournaments. For the past several years, for example, the Humane Society of the United States has petitioned NMFS to halt all shark tournaments.

Swordfish tournaments have gained increased popularity in recent years, especially on the east coast of Florida, as the swordfish population has recovered. Events include the Islamorada Swordfish Tournament that began in 2004, and the Miami Swordfish Tournament that began in 2003. Both of these tournaments anticipated awarding over $30,000 in total cash and prizes, assuming that 50 boats would participate.

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. Fisher and Ditton (1992) found that the average angler who attended a billfish tournament spent $2,147 per trip (2.59 days), and that billfish tournament anglers spent an estimated $180 million (tournament and non-tournament trips) in 1989. Ditton and Clark (1994) estimated annual expenditures for Puerto Rican billfish fishing trips (tournaments and non-tournaments) at $21.5 million. More recently, Ditton *et al*., (2000) estimated that the total expenditure (direct economic impact) associated with the 1999 Pirates Cove Billfish Tournament, not including registration fees, was approximately $2,072,518. The total expenditure (direct economic impact) associated with the 2000 Virginia Beach Red, White, and Blue Tournament was estimated at approximately $450,359 (Thailing *et al*., 2001). These estimated direct expenditures do not include economic effects that may ripple through the local economy leading to a total impact exceeding that of the original purchases by anglers (i.e., the multiplier effect). 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.

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6.0 COMMUNITY PROFILES

This Chapter identifies and describes the HMS fishing communities as required under the Magnuson-Stevens Act and other laws. This Chapter consolidates all of the communities profiled in previous HMS FMPs or FMP amendments and updates the community information where possible. Of the communities profiled in this chapter, ten were originally selected due to the proportion of HMS landings in the town, the relationship between the geographic communities and the fishing fleets, the existence of other community studies, and input from the HMS and Billfish Advisory Panels. The remaining 14 communities, although not selected initially, have been identified as communities that could be impacted by changes to the current HMS regulations because of the number of HMS permits associated with these communities, and their community profile information has been incorporated into the document. See section 9.2.2 for more information regarding the current HMS community selection process.

6.1 Introduction

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 shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to: (1) provide for the sustained participation of such communities; and, (2) to the extent practicable, minimize adverse economic impacts on such communities." (§301(a)(8)). 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))

The National Standard guidelines expand upon the definition of a fishing community, and state that, "A fishing community is a social or economic group whose members reside in a specific location and share a common dependency on commercial, recreational, or subsistence fishing or on directly related fisheries-dependent services and industries (for example, boatyards, ice suppliers, tackle shops)" (50 CFR §600.345(b)(2)).

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.

6.2 Summary of New Social and Economic Data Available

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6.3 Methodology

6.3.1 Previous community profiles and assessments

NMFS contracted with Dr. Doug Wilson, from the Ecopolicy Center for Agriculture, Environmental and Resource Issues at Rutgers, the State University of New Jersey, to help develop the community profiles and social impact assessments for the 1999 HMS FMP and Amendment 1 to the FMP for Atlantic Billfish. Dr. Wilson and his colleagues completed their fieldwork in July 1998. This study covered Atlantic HMS commercial and recreational fisheries extending along the Atlantic and Gulf coasts from Maine to Texas and in the Caribbean. The study 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 for Atlantic Tunas, Swordfish, and Sharks and the 1999 Atlantic Billfish FMP Amendment 1, and because they are fairly evenly spread along the Atlantic and

Gulf coasts and the Caribbean. The study compiled basic sociological information from at least two coastal communities for each state or territory. These locations were visited for further analysis. In the 1998 study, towns were selected based on HMS landings data, the relationship between the geographic communities and the fishing fleets, and the existence of other community studies. The information in this document incorporates by reference the Wilson *et al.,* (1998) study of the HMS fishery and the work of McCay and Cieri (2000) for the Mid-Atlantic Fishery Management Council, "The Fishing Ports of the Mid-Atlantic."

Additionally, this Chapter uses the 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 HMS 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 HMS FMP focused on specific towns based on shark landings data, the size of the shark fishing fleet, the relationship between the geographic communities and the fishing fleets, and the existence of other community studies. While the recreational fishery is an important component in the overall shark fishery, the VIMS study did not profile the shark recreational fishery because participation and landings were not documented in a manner that permits community identification. The Wilson *et al*., study 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. To the extent that it is available, the information on the HMS-related recreational fisheries has been incorporated into the community profiles.

6.3.2 Information Used in this Assessment

Following the Consolidated HMS FMP, which published in 2006, NMFS contracted MRAG Americas, Inc. to create a report updating current HMS fishery community profiles. The report utilized HMS permit information and U.S. census data to rank communities according to the percentage of HMS permits, by permit category, in relation to their overall population, based on a methodology described by Sepez *et al*. (2005). Communities that met the mean percentage for at least one permit category were included and community profile information was created or updated accordingly. The report identified 14 communities that have not previously been included (Wakefield, Rhode Island; Montauk, New York; Cape May, New Jersey; Ocean City, Maryland; Atlantic Beach, Beaufort, and Morehead City, North Carolina; Apalachicola, Destin, and Port Salerno, Florida; Orange Beach, Alabama; Grand Isle, Louisiana; and Freeport and Port Arkansas, Texas), along with 10 communities that had been included in previous SAFE reports (Gloucester and New Bedford, Massachusetts; Barnegat Light and Brielle, New Jersey; Hatteras Village and Wanchese, North Carolina; Islamorada and Madeira Beach, Florida; and Dulac and Venice, Louisana). This list did not include four communities that had been included in assessments since the 1999 HMS FMP (Fort Pierce, Panama City Beach, and Pompano Beach, Florida; and Arecibo, Puerto Rico). All communities that have been identified by MRAG Americas, Inc. and ones that have been evaluated in the past are included in this assessment to update the most recent community profile information available and to ensure continuity with the 1999 HMS FMP and previous amendments.

The communities that are profiled are not intended to be an exhaustive list of every HMS-related community in the United States; rather the objective is to give a broad perspective of representative areas. The demographic profile tables in this chapter were modified from previous documents to include the same baseline information for each community profiled, and use both 1990 and 2000 Bureau of the Census data for comparative purposes. A profile for the U.S. Virgin Islands could not be created because the 1990 Census data were not available, and only some of the demographic information was available for 2000. Additionally, a descriptive profile for the Virgin Islands has not been developed for any previous HMS-related actions. The descriptive community profiles in this chapter include information provided by Wilson, *et al.* (1998) and Kirkley (2005), Impact Assessment, Inc. (2004, 2005), and recent information obtained from MRAG Americas, Inc. (2008). In this chapter, the community descriptions are organized by state.

This assessment also reviewed the available information on location of HMS permit holders to provide information about residence and to identify additional HMS-related fishing communities that may be profiled in the future. Four regional maps were created using Geographic Information Systems (GIS) to identify the communities where angling, charter/headboat, HMS dealer (tunas, shark, and swordfish dealers combined), commercial tuna (all gear categories combined), directed and incidental shark, and swordfish (directed, incidental, and handgear permits combined) permit holders reside. This permit holder information should continue to assist in identifying recreational industry community profiles in future assessments.

While geographic location is an important component of a fishing community, the transient nature of HMS may cause the permitted fishermen to shift location in an attempt to follow the fish. Because of this characteristic, management measures for HMS often have the most identifiable impacts on fishing fleets that use specific gear types. The geographic concentrations of HMS fisheries may also fluctuate from year to year, as the behavior of these migratory fish is variable. The relationship between these fleets, gear types, and geographic fishing communities is not always a direct one; however, they are important variables for understanding social and cultural impacts. As a result, the inclusion of typical community profiles in HMS management decisions is somewhat difficult, as geographic factors and use of a specific gear type have to be considered.

Several other chapters in this SAFE report include information that addresses the requirements described Section 6.1 and that is an integral part of this social impact assessment and fishery impact statement. Please refer to the summary of regulatory actions in Chapter 1, description of the fisheries in Chapter 4, the economic evaluation in Chapter 5, and the permit data in Chapter 9.

6.3.2.1 Community Impacts from Hurricanes

The impacts of both Hurricane Katrina (late August 2005) and Hurricane Rita (September 2005) have yet to be fully realized, but have had a devastating effect on many Gulf of Mexico communities. NMFS has conducted assessments of the commercial and recreational fishing sectors, as well as the coastal communities and the supporting marine infrastructure (NMFS, 2005). Economic losses to the commercial fishing industry in Louisiana and Mississippi from

Hurricane Katrina are estimated to be 13. billion and 484 million dollars, respectively (Impact Assessment, 2007).

Storm surge and/or broken levies destroyed many of the Gulf communities, such as Venice, Louisiana and areas south of Belle Chasse (Ingles, pers. com.). Many individuals involved with HMS fisheries, and their families, have lost their homes and have been displaced or are living in temporary structures with no electricity or running water and only minimal monetary assistance from Federal Emergency Management Agency (pers. com. with affected fisheries participants). In some instances, vessels have become the primary residence because their homes were destroyed. Rebuilding has been challenging because many people did not have insurance prior to the hurricanes. Those with insurance found that it covered only wind and not water damage. And others with basic coverage found that it was not enough to cover the boat, business, and home. As a result, the rebuilding after the hurricanes has added to the gentrification in many of the communities (Ingles, pers. com.).

In addition to their homes, the storms had a devastating impact on fishing vessels in the Gulf region. These impacts include, vessels sunk, displaced, piled up, or completely destroyed (Ingles, pers. com.). Even though some vessel did survive the hurricanes, there was a major impact to the supporting infrastructure that the commercial industries rely upon (*e.g.*, seafood dealers, processors, suppliers) and anglers require to go fishing (*e.g.*, bait shops, marinas, etc.) (NMFS, 2005). Where vessels escaped relatively unscathed by the hurricanes, but lost the supporting infrastructure to continue landing in their usual ports, fishermen chose to land their catch in Gulf ports located further west where the damage was not as great (Ingles, pers. com.).

The pelagic longline fishery was significantly impacted by the hurricanes since about 60 percent of the Eastern pelagic longline vessels were in the Gulf region when the hurricanes arrived (National Fishermen, 2006). The number of sets made in 2005 declined compared to 2004 with a majority of that decline attributable to the Gulf of Mexico area (National Fishermen, 2006). About 22 percent of the active PLL fleet showed no activity during third quarter of 2005, likely due to the impact of Hurricane Katrina; and about 14 percent of the active fleet showed no activity in the fourth quarter, possibly a result of Hurricane Rita. More than half the longline vessels operating out of Louisiana were fishing again by March 2006 with the remainder of the vessels severely damaged or being used for housing, rather than fishing (National Fishermen, 2006). Fuel costs are fairly consistent across the Gulf of Mexico; therefore, limiting travel to fishing grounds and to offload catch is important in keeping fuel costs down. Loss of infrastructure to support commercial fisheries operations may force fishermen who cannot afford to travel far from home to land fish to relocate to areas where they can reduce their travel expenses. (Ingles, pers. com.).

While the impacts of Hurricanes Katrina and Rita were devastating to many Gulf communities, at least half of the inactive permit holders in the second half of 2005 had renewed their permits as of March 2006 (Preliminary Logbook Data, 2005). Though this does not necessarily indicate that these vessels are actively fishing, it at least indicates that the permit holders are hopeful about using the permits again. According to interviews conducted by Ingles and McIlvaine-Newsad (2007), many individuals that were displaced from commercial fishing and related activities in the Louisiana area by the hurricanes plan to return to the fishing industry.

In comparing areas in Louisiana damaged by Hurricanes Katrina, the Empire-Venice area received more damage than the Grand Isle area; therefore, recovery in Empire-Venice should be slower than in Grand Isle (Ingles and McIlvaine-Newsad, 2007).

Hurricanes Gustav and Ike caused damage to Gulf Coast communities in 2008, with damage to the fishing industry in Louisiana estimated to be $300,000,000 (Times-Picayune, 2008). Impacts to fishing communities along the Texas coast, particularly in the Galveston area where Hurricane Ike made landfall, still need to be thoroughly evaluated. These impacts, along with high fuel costs and a slowing economy, may detrimentally affect HMS fishery operations in this region.

6.4 United States Demographic Profile

In 1990, the United States had a total population of 248.7 million (Table 6.1). The population increased to 281.4 million in 2000. Throughout the previous decade, the population was roughly half female and half male. Individuals between 20 and 44 years of age comprised the largest proportion of the population in both 1990 and 2000. The dominant race was white. Ninety-two million total households, in 1990, grew to 105.5 million households in 2000. The average household and family size remained about the same between the two decades. The number of high school graduates, ages 25 and older, increased between 1990 and 2000 by about five percent (Table 6.1). Between 1990 and 2000, the total number of business establishments in the United States increased from 6.2 to 7.1 million. While unemployment decreased by half in 2000, the individuals below the poverty line decreased by less than one percent. In 1990, employment in farming, fishing, forestry, and mining industries accounted for 3.3 percent collectively; whereas in 2000, collective employment in these industries accounted for less than two percent.

Table 6.1 Demographic Profile of the United States. Source: U.S. Census, 1990 and 2000.

Demographics	1990	2000
Total Population	248,709,873	281,421,906
Sex		
Male	48.7%	49.1%
Female	51.3%	50.9%
Age		
< 20	25.6%	28.6%
20 - 44	43.2%	36.9%
45 - 64	18.6%	22.0%
> 65	12.6%	12.4%
Race		
White	80.3%	75.1%
Black or African American	12.1%	12.3%
American Indian and Alaska Native	0.8%	0.9%
Asian	2.8%	3.6%
Native Hawaiian and Other Pacific Islander	0.1%	0.1%
Other	3.9%	5.5%
Household		
Total	**91,947,410**	**105,480,101**
Family households	70.2%	68%
Nonfamily households	29.8%	32%
Average household size	3	2.59
Average family size	3.16	3.14
Housing Occupancy		
Total housing units	102,263,678	115,904,641
Vacant housing units	10.1%	9.0%
Housing Tenure		
Owner-occupied housing units	64.2%	66.2%
Renter-occupied housing units	35.8%	33.8%

UNITED STATES	1990
Population:	281,421,906
Education:	
High school graduates (25 years or older)	75.2%
Economic Characteristics	
Labor force (16 years and over)	65.3%
Unemployed	6.3%
Median Household Income	$ 30,056
Individuals below the poverty line*	13.1%
Employment in some industry sectors:	
Managerial/professional	26.4%
Technical, Administrative, & Sales	31.7%
Construction, Production, Maintenance, & Transportation	26.2%
Farming, fishing, forestry, & mining	2.5%
Industry	
Farming, fishing, forestry & mining	3.3%
Construction	6.2%
Manufacturing	17.7%
Wholesale trade	4.4%
Retail	16.8%
Education, health & social services	23.3%
Arts, recreation, lodging & food services	1.4%

6.5 State and Community Profiles

6.5.1 Maine

Between 1990 and 2000, the population in the state of Maine increased by about 4.6 percent (Table 6.2). The number of high school graduates, ages 25 years and older, has increased over the past decade. The unemployment rate decreased, while the percentage of individuals below the poverty line remained the same. Employment in the farming, fishing, forestry, and mining industries remained about the same with education, health, and social services industries providing the greatest source of employment for the state's residents.

As of August 2008, three commercial shark and three commercial swordfish fishing permits were issued in Maine (Table 6.52 and Table 6.53), along with 439 commercial tuna permits (Table 6.50). Maine also has eight licensed dealers for tunas, sharks, and swordfish; ten of the dealers reside in Portland (Table 6.51 and Figure 9.12). Maine has the third greatest number of commercial tuna permit holders with 10.2 percent of the total (Table 6.50).

Vessels homeported in Maine sometimes participate in shark fisheries in southern waters and make landings in Florida and other states; therefore, landings are not always indicative of a community's involvement in a fishery. Sharks are often taken incidentally during tuna fishing trips. The incidental nature of shark catches off Maine in the commercial fishery is also true for the recreational fishery. There is, however, a small group of anglers who fish with light tackle for blue shark, mako, and porbeagle in the Gulf of Maine. To date, no HMS-related community profiles have been developed for the State of Maine, as there are no significant concentrations of HMS-related fisheries in any particular community.

In 2007, an estimated 447,000 sportfishermen made 1,222,000 fishing trips in marine waters off Maine (NMFS, 2008-U.S. Fisheries). Of these anglers, about 58 percent were from out of state. Less than two percent of the HMS angling category permit holders live in the state of Maine (Table 6.48 and Figure 9.9). The American Sportfishing Association (ASA) estimated that all saltwater recreational fishing in Maine in 2006 generated almost $76 million in direct and indirect retail sales. Employment in marine recreational fishing services was estimated to be 1,192 jobs (Southwick Associates, 2007). An indication of recreational interest in shark fishing is that charterboats advertise for shark fishing trips from York Harbor, Sheepscot, Casco Bay, Saco Bay, Bath, Damariscotta, and Old Orchard Beach. Eighty-eight charter/headboats in Maine held HMS permits as of May 2008 (Table 6.49 Number and Percentage of HMS Charter/Headboat Permits by State and Country as of May 2008.). These Maine charter operations are seasonal, typically from Memorial Day to Labor Day, and some of the operators advertise that they move to Florida, or the Caribbean, to run charters during the Florida season from November to May.

Table 6.2 **Maine Demographic Profile.** Source: U.S. Census, 1990 and 2000.

Maine	1990	2000
Population:	**1,227,928**	**1,274,923**
Education:		
High school graduates (25 years or older)	78.8%	85.4%
Employment:		
Labor force (16 years and over)	65.6%	65.3%
Unemployment Rate	6.6%	4.8%
Median Household Income	$27,854	$37,240
Individuals below the poverty line*	10.8%	10.9%
Employment in some industry sectors:		
Farming, fishing, forestry & mining	2.8%	2.6%
Construction	7.3%	6.9%
Manufacturing	19.7%	14.2%
Wholesale trade	3.6%	3.4%
Retail	18.4%	13.5%
Education, health & social services	24.8%	23.2%
Arts, recreation, lodging & food services	0.9%	7.1%

*U.S. Census uses data from 1989 and 1999 to estimate these values.

6.5.2 New Hampshire

New Hampshire's population increased by about 10.3 percent between 1990 and 2000 (Table 6.3). The number of high school graduates, ages 25 years and older, increased slightly. The unemployment rate decreased, while the percentage of individuals below the poverty line remained the same. Employment in the farming, fishing, forestry, and mining industries declined by six percent with education, health, and social services industries continued to provide the greatest source of employment for the state's residents.

New Hampshire's commercial shark fishery is very small, with only 2 commercial permits issued in 2008 (Table 6.52), and largely incidental to the take of other species. Only one commercial swordfish permit was issued in New Hampshire in 2008 (Table 6.53). There are 5 HMS dealers in the state of New Hampshire (Table 6.51). New Hampshire has the seventh greatest number of commercial tuna permit holders (Table 6.50). Slightly greater than one percent of the angling category permit holders reside in New Hampshire (Table 6.48). Because of the relatively small size of the HMS fisheries, community profiles were not developed for New Hampshire ports.

The recreational fishery for sharks in New Hampshire waters is largely incidental, on a very small scale, and similar to that of Maine. Occasionally caught close to shore, most shortfin makos are taken in water reaching depths over 20 fathoms. There are 67 charterboat operators in Portsmouth, Rye, Seabrook, Hampton, as well as a few other towns, that held HMS permits in 2008 (Table 6.49). Many of these charterboats advertise shark fishing trips offshore from June

through September, with the best fishing in June and July. Target species for these trips are mako, blue, thresher and porbeagle sharks.

In 2007, 173,000 anglers made 538,000 fishing trips to the marine waters off New Hampshire (NMFS, 2008). Of these saltwater anglers, approximately 36 percent were visitors from out-of-state. In 2006, it is estimated that saltwater anglers generated over $43 million in direct and indirect retail sales related to their fishing in New Hampshire (Southwick Associates, 2007), and the marine recreational fishing services sector provided for 661 jobs.

Table 6.3 **New Hampshire Demographic Profile.** Source: U.S. Census, 1990 and 2000

New Hampshire	1990	2000
Population:	**1,109,252**	**1,235,786**
Education:		
High school graduates (25 years or older)	82.2%	87.4%
Employment:		
Labor force (16 years and over)	71.9%	70.5%
Unemployment Rate	6.2%	3.8%
Median Household Income	$36,329	$49,467
Individuals below the poverty line*	6.4%	6.5%
Employment in some industry sectors:		
Farming, fishing, forestry & mining	1.5%	0.9%
Construction	7.1%	6.8%
Manufacturing	22.5%	18.1%
Wholesale trade	4.0%	3.6%
Retail	17.6%	13.7%
Education, health & social services	22.6%	20.0%
Arts, recreation, lodging & food services	1.2%	6.9%

*U.S. Census uses data from 1989 and 1999 to estimate these values.

6.5.3 Massachusetts

Commercial fisheries in the Commonwealth of Massachusetts are diverse, and range from small-scale inshore small-boat fisheries for lobster and clams, to offshore scallops, groundfish dragging, and longline fishing for HMS species. In 2007, New Bedford, Massachusetts ranked ninth in the United States for the weight of fish landed, and first for value with ex-vessel sales, bringing in 268 million dollars (NMFS, 2008). In the same year, Gloucester ranked fifteenth in weight of fish landed and fourteenth in ex-vessel value. Due to the number of HMS permit holders and the relative importance of commercial and recreational fisheries to the Commonwealth, community profiles for both New Bedford and Gloucester were originally developed for the 1999 HMS FMP and have been included below.

The population in the Commonwealth of Massachusetts increased from 6 million people to 6.3 million people from 1990-2000 (Table 6.4). The majority of individuals 25 years and older have a high school diploma and/or a graduate level degree. The percentage of employed individuals and individuals below the poverty line has remained about the same from 1990-2000,

but there has been a slight decline in the unemployment rate, almost two percent. Employment in the farming, fishing, forestry, and mining industries has declined over this time period. The arts, recreation, lodging, and food services industries are the only industries that expanded.

Massachusetts holds the greatest number of commercial tuna permits with 1,897 vessels permitted in 2008 (Table 6.50). Massachusetts is ranked fourth in the greatest number of swordfish permit holders, with over seven percent of the total swordfish permit holders residing in Massachusetts in 2008 (Table 6.53). In addition to swordfish, there are 17 directed and incidental shark permit holders (Table 6.52). Boston has the greatest concentration of HMS permitted dealers with New Bedford and New York City in second and third for the greatest number of HMS dealers (Figure 9.10 and Table 6.51).

Table 6.4 **Massachusetts Demographic Profile.** Source: U.S. Census, 1990 & 2000

Massachusetts	1990	2000
Population:	**6,016,425**	**6,349,097**
Education:		
High school graduates (25 years or older)	80.0%	84.8%
Employment:		
Labor force (16 years and over)	67.8%	66.2%
Unemployment Rate	6.7%	4.6%
Median Household Income	$36,952	$50,502
Individuals below the poverty line*	8.9%	9.3%
Employment in some industry sectors:		
Farming, fishing, forestry & mining	1.2%	0.4%
Construction	5.5%	5.5%
Manufacturing	18.1%	12.8%
Wholesale trade	4.1%	3.3%
Retail	16.2%	11.0%
Education, health & social services	28.0%	23.7%
Arts, recreation, lodging & food services	1.1%	6.8%

*U.S. Census uses data from 1989 and 1999 to estimate these values.

In 2007, marine recreational fishing in Massachusetts attracted an estimated 1,308,000 anglers making 4,710,000 fishing trips in both state and Federal waters (NMFS, 2008). Approximately, 36 percent of the anglers were from out of state. Direct and indirect retail sales generated by marine recreational fishermen in Massachusetts in 2006 were estimated to be $494.6 million (Southwick Associates, 2007), and the marine recreational fishing industry provided for 9,279 jobs during that time. Recreational shark fishing, largely catch-and-release using light tackle, takes place in offshore waters (NMFS, 2003). These vessels often travel 50-100 miles out to their fishing grounds and most shark trips are 10-12 hours in duration, with some trips extending to up to three days. Massachusetts residents held 649 charter/headboat permits in 2008 (Table 6.49), the second most in the country. Sharks are most often taken incidentally in the recreational bluefin tuna fishery, but a number of charterboat operators advertise directed shark fishing trips. The target shark species South and East of Cape Cod are shortfin mako, blue, and porbeagle sharks.

HMS fishing tournaments are promoted, and participated in, by some charterboat operators (NMFS 2003). Examples of these tournaments include Boston Big Game and Monster Shark Tournaments (Oak Bluffs); Nantucket Angler's Club (Nantucket); Fisherman Outfitter's Cutty Hunk Shootout (Cutty Hunk); and Giant Bluefin Tournament (Hyannis). Charterboat operations advertising shark fishing trips are based in Newburyport, Rockport, Gloucester, Boston, Quincy, Chatham, Harwich Port, South Yarmouth, Hyannis, Mashpee, East Falmouth, Oak Bluffs, Edgartown, Vineyard Haven, Menemsha, Mattapoisett, Fairhaven, New Bedford, and Westport Point.

6.5.3.1 Gloucester, Massachusetts

Gloucester is a community which has one of the richest fishing traditions in the United States. Established in 1623, it is the oldest functioning fishing community in the country, is home to Gorton's, the largest frozen seafood company in the United States, and has many community landmarks based around fishing (MRAG Americas, Inc., 2008). Commercial and recreational fishermen both target HMS, mainly focusing on swordfish and tunas.

In 1990, the population of Gloucester was 28,716. There was a minimal population increase of approximately 1,500 individuals between 1990 and 2000 (Table 6.5). Forty percent of the population was between the ages 20-44 years old in 2000. The median age of the Gloucester population has increased by five years, rising to 40 years old in 2000. There is a slightly larger percentage of females in the Gloucester population, 48 percent males to 52 percent females. In 2000, the number of households was two and half times greater than in 1990, but the total number of housing units increased only slightly, from 13,125 to 13,958.

A greater percentage of the 16 years and older population was an active part of the labor force during 2000 (Table 6.5). While the percentage of unemployed declined, the percentage of individuals below the poverty line increased from 1990-2000. The greatest source of employment in 1990 was the technical and administrative industries. In 2000, 36 percent of the population was employed in the managerial and professional industries. The number of businesses engaged in the forestry, fishing, hunting, mining, and agriculture industries declined over the last decade from 3.9 percent to 2.5 percent. The greatest percentage of businesses was engaged in education, health, and social service.

Fishermen that identify Gloucester as their home port hold a large number of General category commercial tuna permits, with 145 permits issued in 2007, and recreational HMS Angling category permits, with 145 issued in 2007 (Table 6.55; MRAG, 2008). The Atlantic bluefin tuna purse seine fishery lasts for a short period of time each year and is limited by regulation to five vessels. One purse seine vessel operates out of Gloucester. The economic health of the purse seine fishery is heavily dependent on bluefin tuna availability, prices and, concomitantly, on the value of the Japanese yen. Finding crew is not a problem; many of the current crew members have had their berths for years. The owner and many of the crew of purse seine vessels, even some who do not reside in the community, are well-integrated through kinship ties into the fishing community. They see themselves as responsible for creating the bluefin tuna fishery and the fleet enjoys the respect of the extended fishing communities in Gloucester (Wilson *et al*., 1998).

There are also a large number of HMS dealers in the Gloucester area, licensed to purchase and sell tuna, sharks, and swordfish (Figure 9.12 and Table 6.55). There were 12 tuna dealer permits issued in the Gloucester in 2006 (Table 6.55). Bluefin tuna dealers in Gloucester work with a large number of vessels of various types, including purse seine vessels. Most bluefin tuna are sold on consignment, and some dealers give a minimum guarantee on fish they take. Personal networks are very important and the competition can be intense. During the bluefin tuna season, some transient dealers come to Gloucester.

Table 6.5 Demographic Profile of Gloucester, Massachusetts. Source: U.S. Census, 1990 and 2000.

Demographics	1990	2000
Total Population	28,716	30,273
Sex		
Male	48.2%	47.9%
Female	51.8%	52.1%
Age		
Median Age	**35.5**	**40.2**
< 20	25.2%	23.9%
20 - 44	39.3%	34.4%
45 - 64	20.2%	26.1%
> 65	15.4%	15.6%
Race		
White	99.4%	97.0%
Black or African American	0.2%	0.6%
American Indian & Alaska Native	0.1%	0.1%
Asian	0.2%	0.7%
Other	0.1%	0.5%
Household		
Total	**11,550**	**29,913**
Family households	66.1%	62.7%
Nonfamily households	33.9%	37.3%
Average household size	2.49	2.38
Average family size	3.11	3.00
Housing Occupancy		
Total housing units	13,125	13,958
Vacant housing units	11.8%	9.8%
Housing Tenure		
Owner-occupied housing units	57.8%	59.7%
Renter-occupied housing units	42.2%	40.3%

Gloucester, Massachusetts	1990	2000
Population:	28,716	30,273
Education:		
High school graduates (25 years or older)	75.6%	85.7%
Economic Characteristics		
Labor force (16 years and over)	62.6%	66.1%
Unemployed	4.5%	3.2%
Median Household Income	$ 32,690	$ 47,722
Individuals below the poverty line	7.5%	8.8%
Employment in some industry sectors:		
Managerial/professional	26.8%	36.1%
Technical/administrative	28.0%	25.4%
Construction, Production, Maintenance, & Transportation	2.8%	21.4%
Farming, fishing, forestry, & mining	13.0%	2.0%
Industry		
Forestry, fishing, hunting, mining, and agriculture	3.9%	2.5%
Construction	5.5%	7.1%
Manufacturing	22.1%	16.7%
Wholesale trade	4.7%	3.6%
Retail trade	16.2%	10.8%
Education, health & social services	14.1%	20.2%
Arts, recreation, lodging & food services	1.4%	9.2%

Commercial rod and reel tuna fishing (with General category permits) as well as recreational rod and reel tuna fishing (with Angling category permits) drive a large shoreside economy, including the sale and repair of tackle, vessels, and engines, and the sale of supplies such as bait and ice. The rod and reel fishery also supports general tourist services such as restaurants and hotels. This community is competing with many other possible tourist destinations for tuna fishermen, increasing their dependence on the recreational bluefin tuna fishery as a prominent attraction. Vulnerabilities stem from the seasonal nature of tuna fishing in Gloucester and the general dependence of tuna fishing on the health of the economy. According to those interviewed, seasonality makes business planning, as well as finding and retaining trained employees, more difficult (Wilson, *et al*., 1998).

Gloucester commercial landings of HMS in 2006 were heavily weighted towards swordfish, which made up over 60 percent of the total HMS catch (Table 6.54). Tunas made up approximately 28 percent of the total HMS landings, with bigeye tuna making up the majority of the catch followed by albacore, yellowfin, and bluefin tuna, respectively. The remainder of HMS landings came from shortfin mako shark (Table 6.54; MRAG Americas, Inc., 2008).

The bluefin tuna rod and reel fishery attracts wealthier fishermen than the fisheries for many other species. The bluefin tuna fishing experience is not always a family activity, but it is often the attraction that brings an adult, and hence the rest of the family, to the community. It attracts experienced and amateur fishermen alike, as well as adventure seekers who are often outdoors enthusiasts in other arenas. Gloucester used to have an annual bluefin tuna tournament organized by the largest of the recreational marinas. However, limited availability of fish has canceled the tournament in past years (Wilson *et al*., 1998). In 2008, a tag and release tournament to contribute to bluefin tuna research was established (University of New Hampshire, 2008). Most fishing tourists who come to Gloucester are from the northeastern United States. These "weekend warrior" bluefin tuna fishermen have an important impact on the community's economy, particularly weekend fuel sales (Wilson, *et al*., 1998).

The Gloucester charter fleet follows a standard policy that, when a commercial size class bluefin tuna is landed, the fish belongs to the vessel and the charter for the day is free, because the vessel operator may sell the fish to the dealer (Wilson *et al*., 1998). Serious customers want to target bluefin tuna, even though there is a low probability that they will catch them. When the General category is open, charter captains will often take an extra mate and fish for bluefin tuna without paying passengers, as they believe that having amateurs on board reduces their chances of landing a bluefin tuna.

According to Wilson *et al*., only one of the three retail tackle shops in Gloucester specializes in offshore fishing. Eighty-five percent of its business is related to both commercial and recreational bluefin tuna fishing. Bluefin tuna and shark fishing gear is very expensive; reels cost $800 to $1,000 and are useful for shark and bluefin tuna only. Fishermen in Gloucester often choose high quality gear and show little concern about price (Wilson *et al*., 1998).

6.5.3.2 New Bedford, Massachusetts

New Bedford is a long and narrow city along the coast of southern Massachusetts, facing the city of Fairhaven across the water. New Bedford faces problems associated with its urban setting, such as low education levels and high unemployment. The working waterfront and its industry have become increasingly important economically as the manufacturing base of the city has declined. With multiplier effects, the city's economy may benefit from the fishing industry by $500 million (Wilson *et al*., 1998). Thousands of people are employed in supporting services such as processing, manufacturers of equipment, transport companies, supply houses, oil companies, welders, pipe fitters, stores, and settlement houses. Once the "whaling capital of the world," New Bedford still possesses one of the largest fishing fleets in the eastern United States (NOAA, 1996). New Bedford ranked ninth in the United States for the weight of seafood landed in 2007, and first in value with ex-vessel sales bringing in 268 million dollars (NMFS, 2008). Ex-vessel sales have been driven by the scallop industry, where landings and prices have been high over the last several years (NMFS, 2008).

New Bedford has learned a great deal about how to survive crises in fisheries. In the 1980s, high landings created a booming fishing industry, which led to investments in new vessels and technology. Depleted fish stocks and increasing Federal regulations in the 1990s resulted in

lower catches and a government-funded vessel buyback program to reduce overfishing and offer struggling fishermen a financial incentive to leave the fishery (MRAG Americas, Inc., 2008). Seventy-two vessels were purchased during the buyback, but because there were no restrictions on inactive vessels, the buyback resulted in 62 additional vessels becoming active fishery participants (Georgianna and Shrader, 2005). Many of the members of the New Bedford fishing community are descended from Portuguese fishing families and kinship networks are an extremely important influence on employment patterns in the fishing industry (NMFS, 1999a). These families are very close and many trace their lineages back to fishermen in Portugal. The Fishermen's Family Assistance Center opened in 1994, with help from the Federal government, in response to the collapse in the groundfish fishery. Thirty-two vessels in New Bedford were removed through the buyback program. With help from the Center, ex-fishermen are finding jobs, particularly in the marine trade, computer, and trucking industries. The marine trade jobs tend to be in New York, New Jersey, and Massachusetts. Other industries in New Bedford have been supportive of the fishermen through the crisis and extended family networks have helped minimize social impacts (Wilson, *et al*., 1998).

Between 1990 and 2000, New Bedford experienced a decrease in its population of over 6,000 individuals, from 99,922 in 1990 to 93,768 in 2000 (Table 6.6). The median age of the population increased slightly, from 33 to 36 years old. The 2000 age distribution was relatively similar to the age distribution in 1990 with the greatest percentage of individuals in the 20 to 44 years age group. The percentage of females in the population is larger than the percentage of males in both 1990 and 2000 by 6 percent. The number of total households increased by 42 percent in the last decade, which could be attributed to an increase in the number of non-family households.

The number of high school graduates increased by almost 8 percent in the 1990s (Table 6.6). The size of the 16 year and older labor force increased, and the percentage of unemployed declined, but the percentage of individuals below the poverty line increased by almost 4 percent. A large percentage of New Bedford residents are employed in the construction, production, maintenance, and transportation industries. This was a significant increase over the last decade in this sector, where the greatest percentage of employment was in the technical, administrative, and sales industries throughout the 1990s. The percentage of businesses engaged in the forestry, fishing, hunting, and agriculture industries declined by almost a third throughout the 1990s. In 2000, the major industries were manufacturing and education, health, and social services.

Table 6.6 **Demographic Profile of New Bedford, Massachusetts.** Source: U.S. Census, 1990 and 2000.

Demographics	1990	2000
Total Population	99,922	93,768
Sex		
Male	46.7%	47.1%
Female	53.3%	52.9%
Age		
Median Age	**32.6**	**35.9**
< 20	29.1%	27.4%
20-44	35.4%	35.6%
45- 64	18.0%	20.1%
> 65	17.4%	16.7%
Race		
White	87.8%	78.9%
Black or African American	3.8%	4.4%
American Indian and Alaska Native	0.4%	0.6%
Asian and Pacific Islander	0.3%	0.7%
Other	7.6%	9.5%
Household		
Total	**38,646**	**91,782**
Family households	69.0%	63.1%
Nonfamily households	31.0%	39.9%
Average household size	2.59	2.40
Average family size	3.15	3.01
Housing Occupancy		
Total housing units	41,760	41,511
Vacant housing units	7.1%	8.0%
Housing Tenure		
Owner-occupied housing units	43.8%	43.8%
Renter-occupied housing units	56.2%	56.2%

New Bedford, Massachusetts	1990	2000
Population:	99,922	93,678
Education:		
High school graduates (25 years or older)	49.7%	57.6%
Economic Characteristics		
Labor force (16 years and over)	52.1%	57.7%
Unemployed	7.2%	5.0%
Median Household Income	$ 22,647	$ 27,569
Individuals below the poverty line	16.8%	20.2%
Employment in some industry sectors:		
Managerial/professional	17.0%	20.8%
Technical, Administrative, & Sales	27.2%	23.6%
Construction, Production, Maintenance, & Transportation	2.6%	34.9%
Farming, fishing, forestry, & mining	11.9%	1.0%
Industry		
Forestry, fishing, hunting, mining, and agriculture	3.16%	1.1%
Construction	6.1%	7.1%
Manufacturing	27.8%	20.7%
Wholesale trade	4.3%	4.4%
Retail trade	17.0%	12.1%
Education, health & social services	15.4%	20.9%
Arts, recreation, lodging & food services	0.7%	7.4%

Commercial HMS landings in New Bedford consist of swordfish, tunas, and shark. Swordfish was the highest landed HMS by weight in 2006, followed by yellowfin tuna and bigeye tuna (MRAG Americas, Inc., 2008; Table 6.54). Bluefin was landed in the lowest volume among all tuna species, although it is the highest value tuna species. The majority of sharks landed were shortfin mako sharks, with hammerhead (unidentified), tiger, silky, and sandbar sharks comprising about 16 percent of shark landings (MRAG Americas, Inc., 2008; Table 6.54).

New Bedford also has a large number of residents with a commercial tuna permit (Table 6.56 and Figure 9.7). All pelagic longline vessels that land HMS in New Bedford are large "distant water" vessels. The fleet consists of large vessels that follow swordfish throughout their migrations. These vessels make long trips, are relatively expensive to operate, and are highly specialized to distant water fishing (*i.e.*, they have large holds and additional fuel capacity). Respondents to the Wilson *et al*. study report that these large distant water vessels have developed a minimal history in other U.S. fisheries, though it is fairly easy for both the vessels and captains to find work in foreign longline fisheries. Many of these vessels already moved from the Atlantic Ocean to the Pacific Ocean, and others are currently for sale (Wilson *et al*., 1998). In summer months, the remaining large distant water vessels fish on the Grand Banks and land swordfish in New England and Canadian ports.

While some members of the distant water fleet, their suppliers, and their customers live in the New Bedford area, the distant water fleet is not attached to a geographical community in the same sense as other fleets. Participants in this fleet tend to be fairly isolated within the

communities where they live, even when those communities are strongly integrated fishing communities like New Bedford. The wives of captains and crew who participate in the distant water fishery generally do not know each other well. New Bedford has a fishermen's wives association but it is mainly for older Portuguese women whose husbands are scallopers and draggers "who do only 14-day trips" (Wilson *et al*., 1998). New Bedford respondents not associated with the distant water fleet report that they see it as socially distant from the rest of the community. This isolation from other fishing people, and the length of the trips, has placed a strain on the family life of participants.

The distant water fleet has used its longer reach to recruit crew members from overseas, particularly the West Indies, thus avoiding crew supply problems typical of other sectors of the longline fleet. The range of these vessels over many different waters makes them particularly dependent on the skill and experience of their captains. New Bedford does not offer these captains alternative employment outside of the fishing industry at comparable income levels (Wilson, *et al*., 1998).

When fishing is disrupted through closures, the dealers experience large labor fluctuations. Even the increased reliance on imports has not completely solved this problem. When they make an effort to buy from U.S. vessels in distant waters, special arrangements and timing are required to get the fish to market and maintain vessels. The fishermen have to unload close to an international airport with lift capacity, which in the Caribbean means San Juan. The dealers have to hire people to unload any vessel landings in San Juan, and send supervisors so that the fish is kept cold, weighed properly and counted correctly. Then they need to arrange for cargo departure and negotiate freight weight. These activities can be easily disrupted by short notice of seasonal closures and other regulatory decisions.

Of the five entities that are authorized to fish in the bluefin tuna purse seine fishery, four are associated with New Bedford while the fifth has been associated with Gloucester. Of the four that are associated with New Bedford, one is a resident while the three others are non-residents. All four land their catch in New Bedford and have crew members who live in the city. The owners and many of the crew of the purse seine vessels, even some who do not reside in the community, are well integrated through kinship ties into the fishing community. They are generally thought of as being responsible for creating the bluefin tuna fishery, and the fleet enjoys the respect of extended fishing communities in New Bedford (Wilson *et al*., 1998). Many of these crew members are family and almost all have been with these vessels for a long time. The average age is considerably older than that of most fishing crews. When the vessels are tied up, the crew members collect unemployment and do odd jobs. In recent years, there have been reduced landings of bluefin tuna in the purse seine fishery, and to date in 2008 there have been no landings.

The recreational tuna fishing industry in New Bedford is a highly diverse one, with an increasing emphasis on providing an enjoyable fishing experience for all ages. Fishery participants feel that bluefin tuna fishing is an adventure, and the prize is an important aspect of the experience. It attracts experienced and amateur fishermen alike, as well as adventure seekers who are often outdoors enthusiasts in other arenas. Most charterboats in the New Bedford area are owner-operated. Respondents report that it can be hard to find suitable crew members

because the business is seasonal and they are unwilling to hire unemployed commercial fishermen (Wilson *et al*., 1998).

Recreational fishing in these communities drives a much larger economy, including the marine trades (*e.g.*, tackle, vessels, engines), suppliers of bait and ice, and general tourist services such as restaurants and hotels. These communities are competing with many other possible tourist destinations, increasing their dependence on large, well-known fish that act as prominent attractions. Economic vulnerabilities stem from the seasonal nature of recreational fishing in these communities and recreational fishing's general dependence on the health of the economy. The seasonality of this fishery makes business planning, as well as training and keeping employees, more difficult. Respondents emphasized that these communities depend on potential customers' expectation that they will have a reasonable chance to land a fish (Wilson *et al*., 1998).

Shark tournaments are also an important component in promoting business in the New Bedford area, attracting numerous repeat customers. They bring in curious people because sharks are considered a dangerous and exciting fish. Recreational shark fishing in New Bedford is mainly catch-and-release (Wilson *et al*., 1998). However, respondents argue that New Bedford is not the appropriate area for catch-and-release tournaments, because the length of the trip (100 miles) makes taking observers impractical. Although shark fishing is comparatively less important to recreational fishermen in this community, some customers are attracted by the particular challenge of shark fishing.

6.5.4 Rhode Island

Rhode Island's population increased from just over one million people in 1990 to 1.1 million people in 2000 (Table 6.7). The percentage of individuals 25 years and older with a high school diploma and/or some graduate level degree has increased by three percent. The percentage of employed individuals and the unemployment rate declined slightly, but the number of individuals below the poverty line increased from 9.6 percent to almost 12 percent. Employment in the farming, fishing, forestry, and mining industries has declined with the education, health, and social services industries providing the greatest employment opportunities in 2000. Due to the relatively low involvement in the HMS fisheries in the past, there are no community profiles describing the relationship of HMS fisheries to any Rhode Island communities.

Over four percent of the commercial tuna permit holders reside in Rhode Island (Table 6.50) with a concentration of permit holders residing in Wakefield (Figure 9.7). In 2008, seven shark permit holders and 18 swordfish permit holders are located in the state of Rhode Island (Table 6.52 and Table 6.53). Communities involved with the commercial fisheries are Warwick, Little Compton, Newport, Tiverton, Block Island, Narragansett, Peace Dale, Point Judith, South Kingstown, Wakefield and West Kingstown. Rhode Island also has 47 HMS dealers, operating in Newport, Point Judith, Middletown, Wakefield, Narragansett, Peace Dale, South Kingstown, and Block Island (Table 6.51 and Figure 9.10).

Table 6.7 **Rhode Island Demographic Profile.** Source: U.S. Census, 1990 and 2000

Rhode Island	1990	2000
Population:	**1,003,464**	**1,048,319**
Education:		
High school graduates (25 years or older)	72.0%	78.0%
Employment:		
Labor force (16 years and over)	66.1%	64.6%
Unemployment Rate	6.6%	5.6%
Median Household Income	$32,181	$42,090
Individuals below the poverty line*	9.6%	11.9%
Employment in some industry sectors:		
Farming, fishing, forestry & mining	1.3%	0.5%
Construction	5.7%	5.4%
Manufacturing	22.7%	16.4%
Wholesale trade	3.7%	3.4%
Retail	17.5%	12.1%
Education, health & social services	25.0%	23.0%
Arts, recreation, lodging & food services	1.2%	8.6%

*U.S. Census uses data from 1989 and 1999 to estimate these values.

In 2007, approximately 400,000 anglers took 1,545,000 saltwater fishing trips for all species in Rhode Island (NMFS, 2008). Of these marine anglers, about 57 percent were from out-of-state (NMFS, 2008). As of May 2008, 507 Rhode Island residents held an HMS angling category permit (Table 6.48). It is estimated that saltwater anglers generated over $128 million in retail sales, and the marine recreational fishing industry provided 2,127 jobs in Rhode Island in 2006 (Southwick Associates, 2007). Recreational shark fishing from Rhode Island is seasonal between late June and October, with a peak in late August (NMFS 2003). A variety of shark species are available with the most common being shortfin mako sharks between 60-100 pounds. After shortfin mako, thresher, blue, dusky and sandbar sharks are the most common species caught by anglers. Light tackle is the gear preferred for shark fishing by the charter operators and most private boat fishermen, and catch-and-release is normal in the fishery.

In Rhode Island, the number of charter/headboat permit holders increased from 94 in 2003 to 142 in 2008 (Table 6.49). Charter operators offering shark fishing trips are based in Block Island, Point Judith, Little Compton, Warwick, West Greenwich, Newport, and Westerly. Charter trips for sharks are usually to the deep waters South of Rhode Island and the eastern tip of Long Island, last at least 10 hours and, in August, are often overnight trips. On the ten-hour trips with five anglers onboard, the average fee was on the order of $800 in 2003 (NMFS, 2003). This fee is comparable to those charged in the other New England states. Fees for participation in a five-day fishing tournament are on the order of $4,500 for a fully rigged and provisioned boat with skipper and mate (the angler is responsible for the payment of the tournament fees, which can be in excess of $5,000 per angler).

6.5.4.1 Wakefield, Rhode Island

Wakefield, RI was considered a Census Designated Place (CDP), and was combined with several other small villages for the 2000 census. The community had 8,468 people in 2000 (Table 6.8), and lacks any substantial commercial fishing infrastructure; therefore, commercial fishing generally takes place in neighboring Narragansett and Point Judith (MRAG Americas, Inc., 2008). The charter fishing fleet is based at the Snug Harbor Marina, and there are several marinas that cater to the recreational fishing industry in the area. Although there are HMS commercial fishing and dealer permits attributed to Wakefield, no commercial HMS landings were recorded in 2006 (MRAG Americas, Inc., 2008). According to MRAG Americas, Inc. (2008), in 2006, the permits issued in the highest number in Wakefield was the HMS angling category permit, HMS General category, and charter/headboat permits, respectively (Table 6.57).

Table 6.8 Demographic Profile of Wakefield, Rhode Island

Factor	1990	2000
Total population	7134	8468
Gender Ratio M/F (Number)	3368 / 3766	3958 / 4510
Age (Percent of total population)		
Under 18 years of age	25.06	2401
18 to 64 years of age	59.94	4945
65 years and over	15	1122
Ethnicity or Race (Percent)		
White	6631	90.3
Black or African American	182	2
American Indian and Alaskan Native	257	3.1
Asian	64	1.2
Native Hawaiian and other Pacific Islander		<0.1
Some other race	0	0.6
Two or more races		2.8
Hispanic or Latino (any race)		1.6
Educational Attainment (Population 25 and over)		
Percent with less than 9th grade	3.9	3
Percent high school graduate or higher	62.6	89.8
Percent with a Bachelor's degree or higher	22.7	41.9
Language Spoken at Home (Population 5 years and over)		
Percent who speak a language other than English at home	3.7	5.9
And Percent who speak English less than very well		1.2
Household income (Median $)	39,500	50,313
Poverty Status (Percent of population with income below poverty line)		5.4
Percent female headed household	4.3	13.1
Home Ownership (Percent)		
Owner occupied		71.3
Renter occupied		28.7
Value Owner-occupied Housing (Median $)	143400	151,700
Monthly Contract Rent (Median $)	530	427
Employment Status (Population 16 yrs and over)		
Percent in the labor force		70.4
Percent of civilian labor force unemployed		3.2

Factor	1990	2000
Occupation (Percent in workforce)**		
Management, professional, and related occupations		42.2
Service occupations		23.3
Sales and office occupations		21.2
Farming, fishing, and forestry occupations		0.7
Construction, extraction, and maintenance occupations		5.6
Production, transportation, and material moving occupations		6.9
Industry (Percent in workforce)**		
Agriculture, forestry, fishing, hunting and mining		1.2
Manufacturing		9.4
Percent government workers		23.9

6.5.5 Connecticut

Connecticut's population has increased by 3.5 percent between 1990 and 2000 (Table 6.9). The percentage of individuals 25 years and older with a high school diploma and/or a graduate level degree has increased by about five percent. The percentage of employed individuals has declined, and correspondingly, the unemployment rate and individuals below the poverty line have increased over the past decade. Employment in the farming, fishing, forestry, and mining has declined with the education, health, and social services industries providing the greatest employment opportunities in 2000.

In general, Connecticut's involvement in the commercial fishery has been minimal. There are 140 commercial tuna permit holders living in the state in 2008 (Table 6.50) with three shark and three swordfish permit holders (Table 6.52 and Table 6.53). Only three HMS permitted dealers are located in Connecticut in 2008 (Table 6.51). The communities involved in the commercial shark fishery are New London and Old Lyme. Due to the relatively minimal involvement with HMS fisheries, there are no community profiles for the state of Connecticut.

In 2007, approximately 363,000 anglers took 1,579,000 saltwater fishing trips for all species in Connecticut (NMFS, 2008). Of these marine anglers, about 17 percent were from out-of-state. In 2008, 857 Connecticut residents held an HMS angling category permit (Table 6.48). It is estimated that saltwater anglers generated over $125 million in retail sales, and the marine recreational fishing industry provided 1,881 jobs in Connecticut in 2006 (Southwick Associates, 2007). Recreational shark fishing is conducted throughout Long Island Sound, but primarily from the eastern ports in the state from which offshore waters can be easily reached. The number of charter/headboats permit holders in Connecticut has increased from 62 in 2003 to 114 in 2008 (Table 6.49). Charterboats advertising shark fishing trips operate from Milford, New London, Norwalk, Old Lyme, Saybrook, Stonington and Westport. The recreational fishery is principally a catch-and-release fishery using light tackle.

Table 6.9 **Connecticut Demographic Profile.** Source: U.S. Census, 1990 and 2000

Connecticut	1990	2000
Population:	**3,287,116**	**3,405,565**
Education:		
High school graduates (25 years or older)	79.2%	84.0%
Employment:		
Labor force (16 years and over)	69.0%	66.6%
Unemployment Rate	5.4%	5.3%
Median Household Income	$41,721	$53,935
Individuals below the poverty line*	6.8%	7.9%
Employment in some industry sectors:		
Farming, fishing, forestry & mining	1.3%	0.4%
Construction	5.9%	6.0%
Manufacturing	20.5%	14.8%
Wholesale trade	4.2%	3.2%
Retail	15.4%	11.2%
Education, health & social services	24.8%	22.0%
Arts, recreation, lodging & food services	1.1%	6.7%

*U.S. Census uses data from 1989 and 1999 to estimate these values.

6.5.6 New York

The state of New York's population increased by nearly one million people in the decade between 1990 and 2000 (Table 6.10). The percentage of individuals 25 years and older with a high school diploma and/or some graduate level degree has increased by about five percent. The percentage of employed individuals has declined slightly, while both the unemployment rate and individuals below the poverty line have increased over the past decade. Employment in the farming, fishing, forestry, and mining industries has declined with the education, health, and social services industries providing the greatest employment opportunities in 2000.

Fifteen and seventeen HMS shark and swordfish permits were issued to New York addresses in 2008, respectively (Table 6.52 and Table 6.53). In addition to the shark and swordfish permit holders, there are also 261 commercial tuna permit holders in New York (Table 6.50). New York has the third greatest number of HMS dealer permit holders (82 total) with a large concentration of dealers located in New York City and the surrounding areas (Table 6.51 and Figure 9.10). The communities participating in the shark commercial and recreational fisheries include Freeport, Lawrence, Ammagansett, Brightwaters, East Hampton, East Quogue, Greenport, Hampton Bays, Islip, Montauk, Oakdale, Brooklyn, Riverhead, Seaford, Port Jefferson, Babylon, Hauppauge, Staten Island, Southold, and Wantagh.

Table 6.10 **New York Demographic Profile.** Source: U.S. Census, 1990 and 2000

New York	1990	2000
Population:	**17,990,455**	**18,976,457**
Education:		
High school graduates (25 years or older)	74.8%	79.1%
Employment:		
Labor force (16 years and over)	63.6%	61.1%
Unemployment Rate	6.9%	7.1%
Median Household Income	$40,927	$43,393
Individuals below the poverty line*	13.0%	14.6%
Employment in some industry sectors:		
Farming, fishing, forestry & mining	1.3%	0.6%
Construction	5.2%	5.2%
Manufacturing	14.7%	10.0%
Wholesale trade	4.2%	3.4%
Retail	14.9%	10.5%
Education, health & social services	27.9%	24.3%
Arts, recreation, lodging & food services	1.5%	7.3%

*U.S. Census uses data from 1989 and 1999 to estimate these values.

In 2007, 1,067,000 anglers took 6,218,000 saltwater fishing trips for all species of fish in both state and Federal waters off of New York (NMFS, 2008). Residents of New York State made up approximately 86 percent of the recreational marine anglers during that time. In 2008, New York had the fifth greatest number of HMS angling category permit holders with 2,025 permitted vessels (Table 6.48) and a large concentration of these anglers residing in New York City (Figure 9.9). It is estimated that recreational saltwater angling in the state of New York generated over $373 million in retail sales and 6,396 jobs in 2006 (Southwick Associates, 2007). Shark fishing by anglers appears to be largely catch-and-release, using light tackle, and tends to be incidental to tuna and billfish fishing offshore. In New York State, 369 charter/headboats were permitted for HMS fishing in 2008 (Table 6.49). A number of charterboat operators advertise shark fishing as part of their offerings. A large percentage of the 41 charterboats operating out of Montauk advertise shark fishing either as an occasional exciting catch or offering shark fishing trips offshore. Montauk is positioned well for offshore trips as it lies only 20-40 miles from the edge of deep water and Gulf Stream eddies. Connecticut and Rhode Island boats on the other hand have to travel at least 60-100 miles to reach the prime fishing waters for tunas and sharks.

6.5.6.1 Montauk, New York

The village of Montauk is the largest commercial fishing port in New York, mainly due to its location to important commercial and recreational fishing grounds, along with its harbor that provides a large natural protective barrier (MRAG Americas, Inc., 2008). Population increased from 1990 to 2000, and 23 percent of the Montauk population of 3,851 residents in

2000 were of Hispanic decent, which is nine percent higher than the national average (MRAG Americas, Inc., 2008; Table 6.11). Fishing is closely tied to the community, which holds a number of fishing-related events such as the blessing of the fleet and multiple fishing tournaments. Shark tournaments primarily target blue, shortfin mako, and thresher sharks. There are a number of commercial pelagic longline vessels that fish for tuna and swordfish, but the commercial HMS fishery in Montauk is limited by dock space, which is increasingly utilized for recreational purposes. Regulations implemented in 2004 to reduce sea turtle bycatch and bycatch mortality, require pelagic longline fishermen to use circle hooks and have specific sea turtle handling and release equipment onboard. Other changes resulting from the Consolidated FMP in 2006, require that vessel operators actively participating in HMS gillnet, pelagic longline, and bottom longline fisheries attend a safe handling and release workshop. Commercial landings of HMS in 2006 consisted of approximately 3,000 lb of tunas (yellowfin, bigeye, and albacore), 848 lb of swordfish, and 157 lb of shortfin mako shark (MRAG Americas, Inc., 2008; Table 6.54). According to MRAG 2008, over half of the HMS permits issued in 2006 in Montauk were recreational HMS angling category, slightly over 20 percent were charter/headboat, and the rest were various commercial permits (Table 6.58).

Table 6.11 Demographic Profile of Montauk, New York

Factor	1990	2000
Total population	3,001	3,851
Gender Ratio M/F (Number)		1976/1875
Age (Percent of total population)		
Under 18 years of age		20
18 to 64 years of age		65.5
65 years and over	14.9	14.5
Ethnicity or Race (Percent)		
White		87
Black or African American		0.9
American Indian and Alaskan Native		0.1
Asian		0.8
Native Hawaiian and other Pacific Islander		<0.1
Some other race		9.8
Two or more races		1.4
Hispanic or Latino (any race)		23.9
Educational Attainment (Population 25 and over)		
Percent with less than 9th grade	7	7.6
Percent high school graduate or higher	88.5	84
Percent with a Bachelor's degree or higher	25.7	24.8
Language Spoken at Home (Population 5 years and over)		
Percent who speak a language other than English at home	17.6	30.3
And Percent who speak English less than very well	8.2	15.6
Household income (Median $)	31,849	42,329
Poverty Status (Percent of population with income below poverty line)	2.9	7.7
Percent female headed household	6.7	8.7
Home Ownership (Percent)		
Owner occupied		65.7
Renter occupied		34.3
Value Owner-occupied Housing (Median $)		290,400
Monthly Contract Rent (Median $)	804	863

Factor	1990	2000
Employment Status (Population 16 yrs and over)		
Percent in the labor force	70.1	61.5
Percent of civilian labor force unemployed	5	7.7
Occupation (Percent in workforce)**		
Management, professional, and related occupations	23.5	20.3
Service occupations		23.3
Sales and office occupations	25.7	27.9
Farming, fishing, and forestry occupations	9	5.8
Construction, extraction, and maintenance occupations		19
Production, transportation, and material moving occupations		3.6
Industry (Percent in workforce)**		
Agriculture, forestry, fishing, hunting and mining	8	6.1
Manufacturing	1.8	2
Percent government workers	8.4	11.8

6.5.7 New Jersey

Between the 1990 Census and the 2000 Census, New Jersey's population increased from 7.7 million people to 8.4 million people, respectively (Table 6.12). The percentage of individuals 25 years and older with a high school diploma and/or some graduate level degree has increased by about five percent. The percentage of employed individuals has declined slightly, while the unemployment rate remained about the same and individuals below the poverty line increased over the past decade. As with many of the other states, employment in the farming, fishing, forestry, and mining industries has declined, whereas the education, health, and social services industries provided the greatest employment opportunities in 2000.

While both Barnegat Light and Brielle have already been profiled for HMS fisheries, NMFS may want to also consider an HMS profile for Cape May due to the number of HMS angling, charter/headboat, shark and swordfish permits located in the community.

In 2008, there were 292 commercial tuna permit holders in the state of New Jersey (Table 6.50). New Jersey has the second greatest number of shark permit holders living within the state, second to Florida (Table 6.52) with significant concentrations of shark permit holders living in Barnegat Light and Cape May (Figure 9.4). New Jersey is also home to 50 swordfish permit holders (Table 6.53) with many of these permit holders in Barnegat Light and Cape May (Figure 9.1 and Figure 9.2). Thirty-eight HMS dealers are also located in New Jersey (Table 6.51).

Marine recreational fishing attracted 1,427,000 participants to New Jersey in 2007 (NMFS, 2008). Of the 7,436,000 recreational saltwater fishing trips taken in 2007, approximately 36 percent were from out-of-state anglers. In 2008, New Jersey had the third highest number of HMS angling category permit holders at 3,200 (Table 6.48) with large concentrations of these anglers residing in Point Pleasant Beach, Brick, Toms River, Forked River, and Tuckerton (Figure 9.9). It is estimated that recreational saltwater fishing industry in New Jersey generated retail sales over $643 million and provided approximately 9,912 jobs in New Jersey in 2006 (Southwick Associates, 2007).

Table 6.12 **New Jersey Demographic Profile.** Source: U.S. Census, 1990 and 2000

New Jersey	1990	2000
Population:	**7,730,188**	**8,414,350**
Education:		
High school graduates (25 years or older)	76.9%	82.1%
Employment:		
Labor force (16 years and over)	67.4%	64.1%
Unemployment Rate	5.7%	5.8%
Median Household Income	$40,927	$55,146
Individuals below the poverty line*	7.6%	8.5%
Employment in some industry sectors:		
Farming, fishing, forestry & mining	1.2%	0.3%
Construction	6.0%	5.6%
Manufacturing	16.9%	12.0%
Wholesale trade	5.4%	4.4%
Retail	15.2%	11.3%
Education, health & social services	23.4%	19.8%
Arts, recreation, lodging & food services	1.7%	6.9%

*U.S. Census uses data from 1989 and 1999 to estimate these values.

The recreational fishery for sharks is primarily incidental to fishing for tuna and billfish. New Jersey ranks third in the number of HMS charter/headboats permit holders with 553 permitted vessels in 2008 (Table 6.49). Many of the angling communities are also home to the charter/headboat permit holders, but also Cape May, and Ocean City (Figure 9.8). Of these party and charterboats, some advertise shark trips using light tackle during the summer and early fall (July-October) (NMFS, 2003). These trips go offshore between 25 and 60 miles to the heads of the canyons, and thus are full-day or overnight trips.

6.5.7.1 Barnegat Light, New Jersey

Barnegat Light is one of eleven municipalities on Long Beach Island, a large "barrier beach" island that helps form the seaward boundary of Barnegat Bay. This small town measures less than one square mile and is located on the northern end of the barrier island. The town is named after its famous lighthouse that guided ships for generations along the New Jersey coast. This lighthouse was replaced in 1855 with the second-tallest lighthouse in the United States operating until 1927 (NMFS, 2003). The building continues as both a community landmark and a navigation mark. The name Barnegat originates from "Barende-gat," a Dutch name meaning "inlet of breakers" (NMFS, 1999a). Prior to 1820, fishing operations and maritime trade were conducted in the small settlements on the mainland inside the chain of islands and sand bars fringing the New Jersey Coast (NMFS, 2003). Barnegat Inlet was one of the important channels to the open ocean, with a sheltered anchorage immediately inside the inlet, and ample resource for a fishing community. A lighthouse was built in 1824 to mark the entrance to the inlet. In 1995, the infamous inlet's fierce currents were tamed by a $45 million Army Corps of Engineers project that constructed a South jetty along with a three-quarter-mile beach and a fishing pier (NMFS, 1999a).

Barnegat Light has grown and changed in the decade between the 1990 and 2000 Censuses. The changes are reflected in two demographic dimensions. The first is a shift to higher education and higher qualification occupations and the second is a continued shift to an older, retired population. The change in age structure also signifies a change in the workforce and the source of household earnings. In 2000, there were 371 households with an average size of 2.05 persons per household (Table 6.13). Of these households, 233 (62.8 percent) received income in the form of earnings, while 202 households (54.4 percent) received income from Social Security (NMFS, 2003), and 130 households received retirement income (35.0 percent). For households receiving income from earnings, the average income was $63,373 in 1999[1]. The average Barnegat Light household with retirement income received $22,168 (plus appropriate Social Security payments). In comparison with New Jersey as a whole, employment earnings were less than the state average, while retirement income was above the state average. However, the median household income in Barnegat Light ($52,361) in 1990 was some $2,800 lower than the statewide median household income.

Table 6.13 Demographic Profile of Barnegat Light. Source: U.S. Census, 1990 and 2000.

Demographics	1990	2000
Total Population	681	764
Sex		
Male	52.0%	50.9%
Female	48.0%	49.1%
Age		
Median Age	**50.9**	**54.9**
< 20	12.8%	15.4%
20-44	29.8%	20.9%
45-64	27.0%	29.4%
> 65	30.4%	34.3%
Race		
White	99.6%	98.3%
Black or African American	0.4%	0.5%
American Indian and Alaska Native	0.0%	0.0%
Asian and Pacific Islander	0.0%	0.6%
Other	0.0%	0.4%
Household		
Total	**342**	**371**
Family households	62.0%	62.0%
Nonfamily households	38.0%	38.0%
Average household size	1.99	2.05
Average family size	2.42	2.60
Housing Occupancy		
Total housing units	1,167	1,207
Vacant housing units	71.0%	69.3%
Housing Tenure		
Owner-occupied housing units	82.6%	87.9%
Renter-occupied housing units	17.4%	12.1%

Barnegat Light, New Jersey	1990	2000
Population:	681	764
Education:		
High school graduates (25 years or older)	84.9%	92.1%
Economic Characteristics		
Labor force (16 years and over)	52.6%	46.9%
Unemployed	0.5%	1.2%
Median Household Income	$ 37,955	$ 52,361
Individuals below the poverty line	7.2%	4.7%
Employment in some industry sectors:		
Managerial/professional	32.4%	40.8%
Technical, Administrative, & Sales	31.4%	23.3%
Construction, Production, Maintenance, & Transportation	10.4%	16.4%
Farming, fishing, forestry, & mining	13.9%	6.5%
Industry		
Forestry, fishing, hunting, mining, and agriculture	12.6%	8.2%
Construction	12.6%	10.3%
Manufacturing	7.4%	4.8%
Wholesale trade	1.3%	1.7%
Retail trade	21.0%	9.2%
Education, health & social services	7.4%	16.8%
Arts, recreation, lodging & food services	2.9%	11.0%

Barnegat Light is a vacation and retirement destination. Of the 1,207 housing units available in 2000, 781 units (64.3 percent) were vacation homes, and 371 homes were occupied year-round (NMFS, 2003). Some 69.3 percent of the homes were unoccupied at the time of the 2000 census. About one-quarter of the resident population had lived in Barnegat Light for less than five years in 2000, and most of the new residents moved to the town from other parts of New Jersey. Of the population of Barnegat Light in 2000, 55 percent (430 persons) had been

[1] Income and earnings data reported in the decennial Censuses is for the previous year, *i.e.* the income reported in the 1990 Census is for 1989, for the 2000 Census it is for 1999.

born in New Jersey, while 41 percent were born elsewhere in the United States (Table 6.13). There is a "community stickiness" factor among persons resident in Barnegat Light, since 70 percent had lived there prior to 1995, but there is also evidence of change that could affect the lifestyle and culture of the community. One of the elements of "community stickiness" is that many of the "new" residents are retirees who have converted their former vacation homes to year-round residences.

In 1881, the Barnegat City Improvement Company was formed and developed the present-day town as a resort and recreation area, with the town owning all the beaches and dunes (NMFS, 2003). The mix of tourism and fishing has continued to the present. Fishing operations are now linked to their markets by road and there is a tight mesh between the winter and summer economies. Local shops and services are sustained by the fishing activities in the winter months, and it is estimated that 52 percent of the 300 person civilian workforce in 2000 had direct employment in fisheries and fishing services. This number does not agree with the Census Bureau's data of fisheries employment of 6.5 percent, probably due to failure of respondents to complete census forms or undercounting because fishermen were at sea.

There are five marinas in Barnegat Light in addition to 44 municipal boat slips and a municipal ramp (NMFS, 2003; MRAG Americas, Inc., 2008). There are approximately 36 fulltime resident commercial vessels that dock at the two largest marinas (MRAG Americas, Inc., 2008). The three remaining docks cater mainly to recreational vessels, with each dock able to accommodate 30 to 35 vessels (MRAG Americas, Inc., 2008). Recreational boats generally stay for only part of the year, usually from May through October (MRAG Americas, Inc., 2008). The marinas and slips are on the bayside of Long Beach Island and extend southwards some 18 blocks from the inlet. Commercial fishing docks and fishhouses also line Bayview Avenue, but are clustered towards the southern end of the street. Five bait and tackle shops, three of which also provide boat rentals, provide services to local and visiting fishermen. The charter fleet working from Barnegat Light is estimated to be 20 boats, including eight vessels with HMS permits. About half this fleet is active year-round in Barnegat Light, while the other vessels at least fish elsewhere in the winter months. Some of the boats fish for tuna off North Carolina in the winter and spring, while others fish from November through April from ports in Florida.

One dock is completely occupied by privately-owned, commercial vessels, including seven scallopers, ten longliners that fish for tunas, swordfish, and tilefish, and about nine inshore net vessels. Three offloading stations are part of this dock. Five or six locally hired full-time employees, the vessel captain, and the crew perform the offloading. Additional dock hands are hired locally for the busy season. The owners of the dock sell some of the catch to fresh fish markets in Boston, Philadelphia, Maryland, and New York with the remaining being sold to local restaurants, retailers, wholesalers or at their own fish market, which is open from April to October (McCay, 1993).

Some of the fisheries organizations in Barnegat Light include Blue Water Fishermen's Association; Forked River Tuna Club; Jersey Devils Fishing Club; Beach Haven Marlin and Tuna Club; Long Beach Island Fishing Club; and United National Fishermen's Association.

The Barnegat Light port is known for its pelagic longline fishery. Today, the fleet targets yellowfin and bigeye tunas for most of the year and swordfish for part of the year. Pelagic and large coastal sharks are important incidental catches and some species like shortfin mako and porbeagle sharks are usually kept and sold. There are a large number of residents that hold a commercial permit for sharks (22 permits Table 6.52) and swordfish (19 permits; Table 6.59). In 2006, 313,030 lb of tuna was commercially landed, with yellowfin tuna comprising 65 percent of that total (MRAG Americas, Inc., 2008; Table 6.54). Other HMS landings in 2006 consisted of swordfish (146,859 lb) and sharks, primarily shortfin mako (13,660 lb) (MRAG Americas, Inc., 2008; Table 6.54). During the winter, a few vessels continue to bottom longline for tilefish in the deep waters of the outer continental shelf and canyons. Some captains from this port have begun to fish off the coasts of other countries. Pelagic longline crews are increasingly from other regions, such as Nova Scotia and some of the southern states. Some of the pelagic longline fishermen from Barnegat Light have become distant-water operators, going to the Grand Banks off Newfoundland, the waters off Greenland, as well as the Caribbean, Brazil, and other distant fishing grounds. The owner of one major fleet (six longline vessels) has left Barnegat Light to fish for HMS in the Pacific Ocean (Wilson *et al*., 1998). Regulations implemented in 2004 to reduce sea turtle bycatch and bycatch mortality, require pelagic longline fishermen to use circle hooks and have specific sea turtle handling and release equipment onboard. Other changes affecting the HMS pelagic longline fleet resulting from the Consolidated FMP in 2006 require vessel operators to attend a safe handling and release workshop. According to MRAG Americas, Inc. 2008, over 75% of HMS permits issued in 2006 to Barnegat Light were strictly commercial, with recreational angling and charter/headboat permits comprising less than 25 percent of the total (Table 6.59).

Other captains of pelagic longline vessels strongly prefer to work closer to home or to take shorter trips. The options of those who resist going to other ports are far more restricted. Distant water fishing is very disruptive to families and the community. Some local vessels are now converting from pelagic longline fishing to monkfishing, although many who have tried to convert to other fisheries have failed to meet deadlines for limited entry. Another concern of local residents is that the demise of commercial fisheries is likely to transform the use of the waterfront, bringing in condominium development where marinas are now located, an outcome that many long-term residents find undesirable.

6.5.7.2 Brielle, New Jersey

Brielle is located in the southernmost region of Monmouth County, and borders the Manasquan River of central New Jersey. For the purposes of this document, the community will include Brielle/Point Pleasant. This is an area where recreational fishermen are as traditional as commercial fishermen, and recreational fishermen have been distressed about the management of tunas and sharks.

Brielle experienced a modest population increase between 1990 and 2000 from 4,406 to 4,893 individuals (Table 6.14). The percent of males and females remained virtually unchanged between 1990 and 2000 with 48 percent of the population comprised of males and 52 percent females. The age distribution of the Brielle population remained virtually the same for the past decade. The age distribution is fairly even between the under 20 years old, 20-44, and 45-64 years old. The over 65 year olds are the smallest age group, comprising approximately 18

percent of the total population. Whites accounted for over 93 percent of the population in both 1990 and 2000. The percent of other races, however, declined between 1990 and 2000. The largest industry in 1990 was retail trade (21.4 percent), which dropped significantly by 2000 (7.3 percent). In 2000, the largest industries in Brielle were education, health, and social services. In both 1990 and 2000, the greatest source of employment was managerial and professional related jobs. Employment in the farming, fishing, forestry, and mining declined from 6.8 percent in 1990 to 0.7 percent in 2000.

The Brielle/Point Pleasant port is one of the most important inlet ports along the barrier beach complex that makes up the New Jersey coast. It has been a center of both recreational and commercial fishing since the early 1800s. It is estimated that up to 100 working charterboats used this port historically. Today, it is estimated that there are 17 charter/headboats utilizing three marinas in the area (MRAG Americas, Inc., 2008). The majority of vessels that fish offshore are private vessels. It is reported that although these vessels actively fish for tunas and are thus required to have an Atlantic tunas permit, many of these vessels do not hold the necessary permit.

New Jersey, and in particular Brielle, recreational fishermen (private and charter/headboats) have historically targeted school bluefin tuna (measuring 27 inches to less than 47 inches). There is documentation back to the 1890s regarding the bluefin tuna recreational fishery. According to respondents in the Wilson *et al.*, study, New Jersey vessels landed nearly 20,000 bluefin tuna during one month in 1939.

Table 6.14 Demographic Profile of Brielle, New Jersey. Source: U.S. Census, 1990 and 2000.

Demographics	1990	2000
Total Population	4,406	4,893
Sex		
Male	48.2%	47.4%
Female	51.8%	52.6%
Age		
Median Age	**42.7**	**42.9**
< 20	23.2%	25.2%
20 - 44	28.6%	27.9%
45 - 64	29.1%	29.1%
> 65	19.2%	17.8%
Race		
White	93.8%	93.1%
Black or African American	5.4%	3.5%
American Indian and Alaska Native	0.8%	0.1%
Asian and Pacific Islander	0.0%	0.7%
Other	0.0%	2.7%
Household		
Total	**1,735**	**1,938**
Family households	74.6%	73.0%
Nonfamily households	25.4%	27.0%
Average household size	2.54	2.52
Average family size	3.00	3.00
Housing Occupancy		
Total housing units	1,986	2,123
Vacant housing units	12.6%	8.7%
Housing Tenure		
Owner-occupied housing units	82.3%	83.4%
Renter-occupied housing units	17.7%	16.6%

Brielle, New Jersey	1990	2000
Population:	4,406	4,893
Education:		
High school graduates (25 years or older)	91.3%	94.8%
Economic Characteristics		
Labor force (16 years and over)	58.6%	59.4%
Unemployed	4.4%	2.1%
Median Household Income	$ 53,485	$ 68,368
Individuals below the poverty line	2.3%	3.9%
Employment in some industry sectors:		
Managerial/professional	44.7%	56.0%
Technical, Administrative, & Sales	31.5%	21.8%
Construction, Production, Maintenance, & Transportation	0.9%	11.3%
Farming, fishing, forestry, & mining	6.8%	0.7%
Industry		
Forestry, fishing, hunting, mining, and agriculture	1.6%	0.7%
Construction	5.9%	7.4%
Manufacturing	11.7%	8.4%
Wholesale trade	6.7%	2.5%
Retail trade	21.4%	7.3%
Education, health & social services	18.7%	23.1%
Arts, recreation, lodging & food services	2.1%	7.8%

Here, as elsewhere in New York and New Jersey, HMS fisheries often take place in the "canyons" and around eddies and at the edge of the continental shelf. In the past, bluefin tuna

could be caught on day trips in coastal waters, rather than the canyons, and they were the major source of profit for the charter/headboat fleet here (and elsewhere in New Jersey and the larger Mid-Atlantic). Today, the canyon fisheries for tunas are thought of as additional opportunities for most charter/headboat captains, who regularly take clients fishing for bluefish, fluke, or other tunas.

At one time, the full-time canyon fishermen included hundreds of inshore bluefin tuna vessels, and "six-pack" boats (smaller vessels certified to carry no more than six passengers; also known as uninspected vessels). Respondents to the 1998 Wilson *et al*. study indicated that they must steam 80 miles offshore to reach the canyons, and are therefore limited by weather. A similar trend is found in Cape May, New Jersey, where anglers fish in the Baltimore Canyon. The Hudson Canyon offshore fishery started 15 to 20 years ago, and the Brielle/Point Pleasant fleet rely heavily on the canyon for the fall fishery. This fishery has diminished, and the smaller, less powerful vessels are gone. The majority of the private vessels purchased in the Cape May area are built in New Jersey; therefore, these purchases contribute to the local economy. There are eight tackle shops in the Brielle/Point Pleasant area.

Charter/headboat captains indicate that in 1998, they were generally unable to book tuna trips, because passengers do not like to take trips when the bluefin tuna retention limit is low or when retention is prohibited. One of the charterboat owners said that in 1991, the four busiest captains averaged 30 to 35 tuna trips each, but that the average number of trips dropped to approximately 12 in 1996 (Wilson *et al*., 1998). The argument for more liberal retention limits includes the idea that it is necessary to keep people interested in the gambling aspect of the fishery. Although people may not actually land more fish, customers are attracted by the possibility. Charterboat captains emphasize that reasonable recreational retention limits are important to their clients, who wish to bring fish home to eat and share with others.

Due to landings restrictions on bluefin tuna, bluefish generally replaced the tunas as the important inshore/offshore fishery in northern New Jersey. The Brielle/Point Pleasant charter/headboat fishermen, like most other people involved in the sport fisheries, would like to see the economic value of their fisheries documented. In this light, a recent study done in Virginia found that 30 percent of the fisheries income in the state came from the offshore recreational fisheries. Respondents emphasized that the figure is likely to be much larger for New Jersey (Wilson *et al*., 1998).

Sharks are comparatively less important to recreational fishermen in Brielle than bluefin tuna. Sharks play an important role in the fishing industry, and, while other fish may be available, some customers are attracted by sharks in particular. Shortfin mako sharks have the greatest economic importance to the recreational fishery in New Jersey. Mako tournaments are popular and several impose catch restrictions on participants. Researchers reported that the shark fishery in Brielle is being strongly affected by a decrease in its historical tuna fishery and is therefore more vulnerable to negative impacts.

Charter/headboat permits made up approximately 60 percent of the HMS fishing permits issued in Brielle in 2006, and the other 40 percent of fishing permits are almost split evenly between recreational and commercial permits (MRAG Americas, Inc., 2008; Table 6.60). The

MRAG Americas, Inc. (2008) study did not attribute any commercial HMS landings to Brielle in 2006.

6.5.7.3 Cape May, New Jersey

Commercial fishing is the second largest industry behind seasonal tourism in Cape May (MRAG Americas, Inc., 2008). It is the largest commercial fishing port in New Jersey, and one of the largest on the East Coast (MRAG Americas, Inc., 2008). A variety of HMS are landed commercially in Cape May, with yellowfin tuna, swordfish, and bigeye tuna comprising the highest landings in 2006 (Table 6.54). Other tunas (*i.e.*, albacore, bluefin) and a variety of sharks (*i.e.*, sandbar, blue, shortfin mako, tiger, and hammerhead *sp.*) were also landed in Cape May during 2006. The 2000 U.S. census recorded the Cape May population at 4,034 residents, which was slightly lower than the 1990 population (Table 6.15). There are numerous charter fishing vessels in the area, with 88 HMS charter/headboat permits issued to Cape May addresses in 2006, but the vast majority (over 79 percent) issued to the area were recreational angling permits (Table 6.61). There are also several fishing tournaments that take place from June through August, which target HMS species (MRAG Americas, Inc., 2008). Although there are diverse recreational and commercial fishing sectors, both are feeling pressure from dwindling waterfront resources, as much of the area is being sited for residential purposes (MRAG Americas, Inc., 2008).

Table 6.15 Demographic Profile of Cape May, New Jersey

Factor	1990	2000
Total population	4,668	4,034
Gender Ratio M/F (Number)		1,987/2,047
Age (Percent of total population)		
Under 18 years of age		16.3
18 to 64 years of age		55.2
65 years and over	25	28.5
Ethnicity or Race (Percent)		
White		91.3
Black or African American		5.3
American Indian and Alaskan Native		0.2
Asian		0.4
Native Hawaiian and other Pacific Islander		<0.1
Some other race		1.3
Two or more races		1.5
Hispanic or Latino (any race)		3.8
Educational Attainment (Population 25 and over)		
Percent with less than 9th grade	3.8	2.6
Percent high school graduate or higher	84.4	87.6
Percent with a Bachelor's degree or higher	25.2	30.8
Language Spoken at Home (Population 5 years and over)		
Percent who speak a language other than English at home	4.7	8.9
And Percent who speak English less than very well	0.7	2.9
Household income (Median $)		33,462
Poverty Status (Percent of population with income below poverty line)		9.1

Factor	1990	2000
Percent female headed household		7
Home Ownership (Percent)		
Owner occupied		56.8
Renter occupied		43.2
Value Owner-occupied Housing (Median $)		212,900
Monthly Contract Rent (Median $)		564
Employment Status (Population 16 yrs and over)		
Percent in the labor force	63.8	57.5
Percent of civilian labor force unemployed	2.7	3.8
Occupation (Percent in workforce)**		
Management, professional, and related occupations	40.9	33.7
Service occupations	16.9	21
Sales and office occupations	26	33.3
Farming, fishing, and forestry occupations	2.1	0.9
Construction, extraction, and maintenance occupations		5.9
Production, transportation, and material moving occupations		5.2
Industry (Percent in workforce)**		
Agriculture, forestry, fishing, hunting and mining	1.7	0.4
Manufacturing	5.5	2.4
Percent government workers	26.5	20.2

6.5.8 Delaware

Between 1990 and 2000, Delaware's population increased by 15 percent (Table 6.16). The percentage of individuals 25 years and older with a high school diploma and/or a graduate level degree has increased by about five percent. The percentage of employed individuals has declined slightly, while both the unemployment rate and individuals below the poverty line increased over the past decade. As with many of the other states, employment in the farming, fishing, forestry, and mining industries has declined, whereas the education, health, and social services industries provided the greatest employment opportunities in 2000.

Table 6.16 **Delaware Demographic Profile.** Source: U.S. Census, 1990 and 2000

Delaware	1990	2000
Population:	**666,168**	**783,600**
Education:		
High school graduates (25 years or older)	77.50%	82.60%
Employment:		
Labor force (16 years and over)	68.3%	65.7%
Unemployment Rate	4.0%	5.2%
Median Household Income	$34,875	$47,381
Individuals below the poverty line*	8.7%	9.2%
Employment in some industry sectors:		
Farming, fishing, forestry & mining	2.3%	1.1%
Construction	8.0%	7.4%
Manufacturing	18.8%	13.2%
Wholesale trade	3.5%	2.6%

Delaware	1990	2000
Retail	2.1%	11.6%
Education, health & social services	23.0%	19.4%
Arts, recreation, lodging & food services	10.4%	7.7%

*U.S. Census uses data from 1989 and 1999 to estimate these values.

Forty-two commercial tuna permit holders lived in Delaware during 2008 (Table 6.50). The two HMS dealer permits issued in Delaware during 2008 were both tuna permits (Table 6.51 and

Table 9.5). There was one shark and one swordfish permit holder in the state of Delaware during 2008 (Table 6.52 and Table 6.53).

The recreational fishery in Delaware Bay and offshore is popular because of the diversity of species and habitats available to anglers. In 2007, Delaware's recreational fisheries attracted 374,000 saltwater anglers of whom approximately 60 percent were from out-of-state. In total, the anglers made 1,545,000 fishing trips in 2007 (NMFS, 2008). In 2008, Delaware was home to 737 HMS angling permit holders (Table 6.48) with a significant concentration of anglers in Millsboro, Delaware. The retail sales generated by recreational marine anglers in Delaware were estimated to be almost $62 million and the marine recreational fishing service sector provided 724 jobs in 2006 (Southwick Associates, 2007). One hundred and twenty one HMS charter/headboats permits were issued to Delaware addresses in 2008 (Table 6.49). Communities where these HMS-permitted charter/headboats are registered include Bethany Beach, Cedar Creek, Dagsboro, Dewey Beach, Dover, Fenwick Island, Georgetown, Indian River, Lewes, Long Neck, Middletown, Milford, Millsboro, Ocean View, Rehoboth Beach, and Wilmington (NMFS, 2003). To date, no HMS community profiles have been developed for any Delaware communities due to the relatively low level of involvement with HMS fisheries.

6.5.9 Maryland

Maryland's population increased from 4.8 million people in 1990 to 5.3 million people in 2000 (Table 6.17). The percentage of individuals 25 years and older with a high school diploma and/or some graduate level degree has increased by about five percent. The percentage of employed individuals, ages 16 and older, has declined slightly, while both unemployment rate and individuals below the poverty line remain approximately the same over the past decade. As with many of the other states, employment in the farming, fishing, forestry, and mining industries has declined, whereas the education, health, and social services industries provided the greatest employment opportunities in 2000.

In Maryland, there are 46 commercial tuna permit holders (Table 6.50) in 2008. In addition, six shark permit holders and six swordfish permit holders reside in Maryland (Table 6.52 and Table 6.53). To support these HMS fisheries, there are 13 dealers permitted for tuna, sharks and swordfish (Table 6.51).

Table 6.17 **Maryland Demographic Profile.** Source: U.S. Census, 1990 and 2000

Maryland	1990	2000
Population:	**4,781,468**	**5,296,486**
Education:		
High school graduates (25 years or older)	78.4%	83.8%
Employment:		
Labor force (16 years and over)	70.6%	67.8%
Umemployment Rate	4.3%	4.7%
Median Household Income	$39,386	$52,868
Individuals below the poverty line*	8.3%	8.5%
Employment in some industry sectors:		
Farming, fishing, forestry & mining	1.7%	0.6%
Construction	7.9%	6.9%
Wholesale trade	3.8%	2.8%
Retail	15.0%	10.5%
Manufacturing	10.3%	7.7%
Education, health & social services	25.8%	20.6%
Arts, recreation, lodging & food services	1.2%	6.8%

*U.S. Census uses data from 1989 and 1999 to estimate these values.

In 2007, 1,456,000 anglers took a total of 4,045,000 recreational fishing trips in the marine waters off of Maryland, with approximately 36 percent of these anglers originating from out-of-state (NMFS, 2008). In 2008, Maryland was home to 1,455 HMS angling permit holders (Table 6.48) The ASA estimated that saltwater anglers generated over $354 million in retail sales, and the marine recreational fishing industry provided 5,548 jobs in Maryland in 2006 (Southwick Associates, 2007).

The recreational fishery for sharks is largely offshore, although sharks are found in the lower reaches of the Chesapeake Bay. The offshore fishery takes place at least 15 miles out to sea and charterboats often run 60 to 70 miles offshore to areas of deep water. In Maryland, the number of HMS charter/headboat permit holders increased from 155 in 2003 to 162 in 2008 (Table 6.49). Most of these vessels are registered in Ocean City, which is known as the "White Marlin Capital of the World". This hotspot for recreational fishing industry is home to the Annual White Marlin Open, which brings approximately $1 million as the top prize for the tournament. Other communities involved with the HMS charter/headboat industry include Annapolis, Baltimore, Cambridge, Chesapeake City, Chester, Conowingo, Edgewater, Glen Burnie, Ocean Pines, Pasadena, Pocomoke, Salisbury, Severna, St. Michaels, Stevensville, Tilghman, White Hall, and White Haven.

6.5.9.1 Ocean City, Maryland

Ocean City is a major tourist destination and is generally considered the only substantial fishing community in Maryland. There is a large charter boat presence at a variety of marinas, while most of the commercial activity takes place in West Ocean City on the mainland (MRAG Americas, Inc., 2008). The 2000 census recorded the Ocean City population at 7,173, which was

higher than the 1990 census (Table 6.18). Known as the "white marlin capitol of the world", Ocean City is a popular destination for recreational anglers targeting HMS. Recreational anglers also target tunas and sharks, and there are a variety of annual tournaments that target white marlin, tunas, and sharks (MRAG Americas, Inc., 2008). The Consolidated HMS FMP limited the amount of blue and white marlin that could be landed recreationally (250 combined per year), and required billfish tournament participants to use non-offset circle hooks when using natural baits or natural bait/artificial lure combinations. According to MRAG Americas, Inc. (2008), recreational angling and charter/headboat permits made up 80.7 percent and 13.3 percent, respectively, of all the HMS permits issued to Ocean City in 2006 (MRAG Americas, Inc., 2008; Table 6.62). Those 777 permits illustrate how popular HMS sportsfishing is in the Ocean City area. The bulk of commercial HMS landings in 2006 came from yellowfin tuna, swordfish, and bigeye tuna, along with sandbar and shortfin mako sharks (MRAG Americas, Inc., 2008; Table 6.54).

Table 6.18 Demographic Profile of Ocean City, Maryland

Factor	1990	2000
Total population	5,074	7,173
Gender Ratio M/F (Number)	2415 / 2659	3,680 / 3,493
Age (Percent of total population)		
Under 18 years of age		21.3
18 to 64 years of age		63.5
65 years and over		25.2
Ethnicity or Race (Percent)		
White	4852	95.3
Black or African American	143	2.5
American Indian and Alaskan Native	33	0.1
Asian	46	0.7
Native Hawaiian and other Pacific Islander		<0.1
Some other race	0	0.3
Two or more races		0.9
Hispanic or Latino (any race)		1.2
Educational Attainment (Population 25 and over)		
Percent with less than 9th grade	4.8	2.6
Percent high school graduate or higher	61	87.1
Percent with a Bachelor's degree or higher	13.4	28
Language Spoken at Home (Population 5 years and over)		
Percent who speak a language other than English at home	4.1	7
And Percent who speak English less than very well		2.9
Household income (Median $)	33350	35,772
Poverty Status (Percent of population with income below poverty line)		8.4
Percent female headed household	3.7	6.4
Home Ownership (Percent)		
Owner occupied		67.4
Renter occupied		32.6
Value Owner-occupied Housing (Median $)	136100	152,200
Monthly Contract Rent (Median $)	517	640
Employment Status (Population 16 yrs and over)		

Factor		1990	2000
	Percent in the labor force		60.4
	Percent of civilian labor force unemployed		9.3
Occupation (Percent in workforce)**			
	Management, professional, and related occupations		31.6
	Service occupations	18	24.1
	Sales and office occupations		29.2
	Farming, fishing, and forestry occupations		0.3
	Construction, extraction, and maintenance occupations		9.5
	Production, transportation, and material moving occupations		5.2
Industry (Percent in workforce)**			
	Agriculture, forestry, fishing, hunting and mining		0.5
	Manufacturing		2.4
	Percent government workers		11.3

6.5.10 Virginia

Virginia's population increased from 6.2 million people in 1990 to 7.1 million people in 2000 (Table 6.19). The percentage of individuals 25 years and older with a high school diploma and/or some graduate level degree has increased by six percent. The percentage of employed individuals, ages 16 and older, has declined slightly, while both the unemployment rate and individuals below the poverty line remained approximately the same over the past decade. Employment in the farming, fishing, forestry, and mining industries has declined, whereas the education, health, and social services industries provided the greatest employment opportunities in 2000.

Virginia ranked second for the quantity of commercial fishery landings at its Reedville port and third for the value of the commercial landings in the Hampton Roads area in 2004 (NMFS, 2005a). Virginia has 85 commercial tuna permit holders (Table 6.50). The Virginia commercial HMS fisheries have 14 licensed dealers, with two or more dealers operating in Chincoteague, Hampton, Newport News, Norfolk, and Virginia Beach (Table 6.51 and Figure 9.12). Five shark and four swordfish permit holders live in the Commonwealth of Virginia (Table 6.52 and Table 6.53). The commercial landings of tuna, sharks, and swordfish are not as significant as the total commercial landings coming into the state; therefore, HMS fisheries are not significantly tied to any particular Virginia community and no HMS-specific community profiles have been developed for Virginia.

In 2007, the Virginia recreational saltwater fishery attracted 836,000 anglers, of whom approximately 36 percent were from out-of-state (NMFS, 2008). Collectively, these anglers made 3,723,000 recreational fishing trips in 2007. In 2008, Virginia was home to 1,285 HMS angling category permit holders (Table 6.48) with a large concentration of angling category permit holders living in Virginia Beach and Chesapeake (Figure 9.9) It is estimated that these saltwater anglers generated over $304 million in retail sales in Virginia in 2006 and their activity provided 5,541 jobs in the marine recreational fishing industry (Southwick Associates, 2007). Principal species sought were striped bass, flounder, bluefish, weakfish (sea trout) and drum. Offshore fishing was principally for mackerels, tuna, dolphin fish, and billfish.

The Virginia recreational fishery for sharks is similar to that of Delaware and Maryland. There is a very small directed shark fishery in the private boat sector, but most sharks are taken incidentally to the catch of other species. There are 148 charter/headboats in Virginia with HMS permits in 2008 (Table 6.49). The communities with the greatest number of charterboats with HMS permits were Virginia Beach, Norfolk, Chincoteague, Wachapreague, and Portsmouth. The principal shark fishing season for recreational anglers is June through October.

Table 6.19 **Virginia Demographic Profile.** Source: U.S. Census, 1990 and 2000

Virginia	1990	2000
Population:	**6,187,358**	**7,078,515**
Education:		
High school graduates (25 years or older)	75.2%	81.5%
Employment:		
Labor force (16 years and over)	68.9%	66.8%
Unemployment Rate	4.5%	4.2%
Median Household Income	$33,328	$46,677
Individuals below the poverty line*	10.2%	9.6%
Employment in some industry sectors:		
Farming, fishing, forestry & mining	2.6%	1.3%
Construction	7.8%	7.3%
Wholesale trade	3.4%	2.7%
Retail	16.1%	11.4%
Manufacturing	15.1%	11.3%
Education, health & social services	23.2%	18.3%
Arts, recreation, lodging & food services	1.1%	7.2%

*U.S. Census uses data from 1989 and 1999 to estimate these values.

6.5.11 North Carolina

The population in North Carolina increased by nearly 18 percent between 1990 and 2000 (Table 6.20). The percentage of individuals 25 years and older with a high school diploma and/or some graduate level degree has increased by eight percent. The percentage of employed individuals, ages 16 and older, has remained roughly the same, while the unemployment rate increased and the individuals below the poverty line declined slightly over the past decade. As with many of the other states, employment in the farming, fishing, forestry, and mining industries has declined, whereas the manufacturing industry provided the greatest employment opportunities in 2000.

North Carolina's commercial fishery has a distinctive split between the North and South with Cape Hatteras as the dividing point as a result of the local oceanographic conditions. The Gulf Stream, as it skirts the Cape Hatteras shoals, is twenty miles offshore. This is the closest it approaches land after leaving the Cape Canaveral area. The cold Labrador Current influences the waters North of Cape Hatteras. The area off Dare and Hyde Counties, North Carolina is where these two water bodies mix and provides very rich fishing grounds. South and West of Cape Hatteras, the coast curves away to the West forming the relatively shallow Carolina Bight. Vessels operating in this area have further to travel from shore to the Gulf Stream and do not

have the same diversity and richness found in the fisheries immediately to the North of Cape Hatteras.

North Carolina has the fourth largest number of HMS angling permit holders with 2,148 permits issued to its residents (Table 6.48). In 2007, NMFS estimated that 1,908,000 anglers fished in North Carolina's marine waters making a total of 6,979,000 recreational fishing trips (NMFS, 2008). Of these fishermen, approximately 57 percent were from out-of-state and approximately 14 percent were from non-coastal counties in North Carolina (NMFS, 2008). Marine recreational fishing is thus an important element in the life and economies of coastal counties. In 1996, expenditures by saltwater anglers in North Carolina were approximately $673 million, accounting for nearly eight percent of the total U.S. expenditures by saltwater anglers. Saltwater fishing in North Carolina incurred expenditures of nearly $1.3 billion (about five percent of the U.S. total), generated wages and salaries of approximately $357 million and created over 19,000 jobs (ASA, 1997 cited by Wilson, 1998). In 2006, ASA estimated that saltwater recreational fisheries generated almost $559 million in retail sales and the marine recreational fishing industry provided 9,735 jobs (Southwick Associates, 2007).

Table 6.20 **Demographic Profile of North Carolina.** Source: U.S. Census, 1990 and 2000

North Carolina	1990	2000
Population:	**6,628,637**	**8,049,313**
Education:		
High school graduates (25 years or older)	70.0%	78.1%
Employment:		
Labor force (16 years and over)	67.6%	65.7%
Unemployment Rate	4.8%	5.3%
Median Household Income	$26,647	$39,184
Individuals below the poverty line*	13.0%	12.3%
Employment in some industry sectors:		
Farming, fishing, forestry & mining	2.9%	1.6%
Construction	7.0%	8.2%
Wholesale trade	4.2%	3.4%
Retail	16.1%	11.5%
Manufacturing	26.7%	19.7%
Education, health & social services	20.3%	19.2%
Arts, recreation, lodging & food services	1.0%	6.9%

*U.S. Census uses data from 1989 and 1999 to estimate these values.

The marine recreational fisheries in North Carolina fall into three groups by species, gear and access. First, the recreational fishery in the Sounds and behind the barrier islands is typically a small, open boat fishery for flounder, croaker and drum, spot and sea trout. Striped bass (rockfish) forms an important fishery in Albemarle Sound and around the northern inlets. Second, the inshore and ocean beach fisheries target the same species but also include striped bass, bluefish, and king and spanish mackerel. These inshore fisheries require larger boats and heavier gear, but the boats operate within sight of land. Third, the offshore recreational fisheries target billfish, tunas (bluefin, yellowfin and blackfin), mackerels, dolphin fish (mahi mahi),

wahoo, and, in the southwestern area, shark. In the area north of Hatteras and around Cape Lookout, recreational fishermen view sharks as a nuisance in their pursuit of other fish, particularly tuna, marlin, and swordfish. Typically, the boats are 22 feet long or longer, have electronic navigation systems, and are powered by an inboard engine. Generally, heavy tackle is used, and fighting chairs are usually installed for the billfish and giant tuna fishing. The offshore boats normally fish 15 to 60 miles offshore. North Carolina marine recreational fisheries are seasonal, but fishing is year-round as fish species move through the area.

In 2008, North Carolina had the fourth largest fleet of charter/headboats holding HMS permits with 431 vessels (Table 6.49). A significant percentage of these boats operated from communities North of Cape Hatteras. Some of these charterboats were highly specialized, for seeking only billfish for example. The vessels specializing in tunas usually began the year fishing off Dare or Hyde counties, and then moved North to operate off New Jersey and then later off Cape Cod. Vessels specializing in billfish fisheries would fish off North Carolina in the summer months and then head to the Caribbean for the winter season. Other charterboats, and some headboats, would fish in North Carolina waters from April through November, and then travel south to Florida to fish from December through March. From the advertising materials distributed by charter operations, it would appear that from 12 to 15 percent of the fleet changed their operating base during the fishing year.

An unusual feature of the North Carolina charter/headboat fleet is the number of boats built locally. This appears to be particularly true for vessels over 35 feet in length and fishing offshore. Similarly, information about captains and crew of the charter fleet emphasized their local connections, and often relatives of different generations fished together. While this information has not been gathered systematically, it appears that community linkages between North Carolina captains and crews are stronger than those in many of the other states.

North Carolina has historically been an important commercial shark fishing state with 35 to 60 percent of all South Atlantic region landings coming from North Carolina in recent years. The time/area closure implemented in January 2005, to protect essential fish habitat for sandbar and dusky sharks has forced commercial shark fishermen to seek out other fisheries or other gears to target sharks and other species. Many fishermen claim that the closure has hurt their business. After North Carolina's petition to NMFS reopen Federal waters or adjust the Mid-Atlantic shark closure was denied, the State of North Carolina decided to reopen state waters to the commercial shark fishery in 2006.

In addition to recreational and for-hire industries, North Carolina residents hold the second largest number of commercial tuna permits with 645 permitted vessels in 2008 (Table 6.50). In 2008, 30 North Carolina residents held shark permits and 16 residents held swordfish permits (Table 6.52 and Table 6.53). There are 58 dealers authorized to purchase and sell tunas, sharks, and swordfish in the area, ranking North Carolina as fourth in the number of HMS dealers behind Florida, Massachusetts, and New York (Table 6.51).

6.5.11.1 Atlantic Beach, North Carolina

Fishing effort for HMS in Atlantic Beach is primarily recreational in nature, as no commercial vessels homeport in the area (MRAG Americas, Inc., 2008). According to MRAG Americas, Inc. (2008), HMS Angling and HMS charter/headboat permits comprised approximately 84 percent of permits issued in Atlantic Beach in 2006, while commercial HMS permits only made up approximately 16 percent of that total (

Table 6.63). There are various charter boat operations that fish for HMS, which cater to seasonal tourists. They mainly target bluefin tuna from November–February, and yellowfin tuna and marlin the rest of the year (MRAG Americas, Inc., 2008). Census data for the year 2000 recorded 1,781 residents in Atlantic Beach, with an increasing trend in people aged 65 and up (Table 6.21). This increasing trend in the senior population may indicate that the area is becoming a destination for retirees with disposable incomes, which may have led to recent growth in the charter fishing sector and may bode well for the charter fishing industry in the future (MRAG Americas, Inc., 2008).

Table 6.21 Demographic Profile of Atlantic Beach, North Carolina

Factor	1990	2000
Total population	1,938	1,781
Gender Ratio M/F (Number)		941 / 840
Age (Percent of total population)		
Under 18 years of age		9.8
18 to 64 years of age		72
65 years and over	12.5	18.2
Ethnicity or Race (Percent)		
White		98
Black or African American		0.6
American Indian and Alaskan Native		0.2
Asian		0.7
Native Hawaiian and other Pacific Islander		<0.1
Some other race		<0.1
Two or more races		0.4
Hispanic or Latino (any race)		0.7
Educational Attainment (Population 25 and over)		
Percent with less than 9th grade	3	2.8
Percent high school graduate or higher	85.1	90
Percent with a Bachelor's degree or higher	24.1	30.7
Language Spoken at Home (Population 5 years and over)		
Percent who speak a language other than English at home	2.6	3.9
And Percent who speak English less than very well	1	1
Household income (Median $)		38,312
Poverty Status (Percent of population with income below poverty line)		7.3
Percent female headed household		5
Home Ownership (Percent)		
Owner occupied		64.7
Renter occupied		35.3
Value Owner-occupied Housing (Median $)		207,800
Monthly Contract Rent (Median $)		582
Employment Status (Population 16 yrs and over)		

Factor		1990	2000
	Percent in the labor force	69.8	63.3
	Percent of civilian labor force unemployed	2.9	3.2
Occupation (Percent in workforce)**			
	Management, professional, and related occupations	27	36.6
	Service occupations	11.1	8.8
	Sales and office occupations	23.7	35.4
	Farming, fishing, and forestry occupations	2.6	0.5
	Construction, extraction, and maintenance occupations		14.8
	Production, transportation, and material moving occupations		3.8
Industry (Percent in workforce)**			
	Agriculture, forestry, fishing, hunting and mining	2.7	0.7
	Manufacturing	7.6	2.2
	Percent government workers	17.6	17.6

6.5.11.2 Beaufort, North Carolina

Beaufort is located near Morehead City and Atlantic Beach on the North Carolina outer banks, and is home to both commercial and recreational HMS fishing activities. Commercial landings of HMS in 2006 primarily consisted of swordfish, yellowfin tuna, sandbar shark, and shortfin mako shark (MRAG Americas, Inc., 2008; Table 6.54). According to MRAG Americas, Inc. (2008), HMS Angling and HMS charter/headboat permits comprised approximately 84 percent of permits issued in Beaufort in 2006, while commercial HMS permits only made up approximately 16 percent of that total (Table 6.64). Commercial vessels can be found on Radio Island, which is located between Beaufort and Morehead City, along with three fish house and other commercial docking facilities in Beaufort. Charter fishing is becoming increasingly popular, as the industry is fueled by seasonal visitors and increasing numbers of retirees in the area (MRAG Americas, Inc., 2008). The area is also home to recreational fishing tournaments that target HMS. Census data for the year 2000 recorded 3,771 residents in Beaufort, a slight decrease from 1990 (Table 6.22).

Table 6.22 Demographic Profile of Beaufort, North Carolina

Factor		1990	2000
Total population		3,808	3,771
Gender Ratio M/F (Number)			1,755 / 2,016
Age (Percent of total population)			
	Under 18 years of age		18.3
	18 to 64 years of age		61.9
	65 years and over	19.1	19.8
Ethnicity or Race (Percent)			
	White		75.9
	Black or African American		20
	American Indian and Alaskan Native		0.1
	Asian		0.4
	Native Hawaiian and other Pacific Islander		0.1
	Some other race		2.4
	Two or more races		1.2
	Hispanic or Latino (any race)		3.8

Factor	1990	2000
Educational Attainment (Population 25 and over)		
Percent with less than 9th grade	45	6.2
Percent high school graduate or higher	85.1	78.9
Percent with a Bachelor's degree or higher	24.1	21.7
Language Spoken at Home (Population 5 years and over)		
Percent who speak a language other than English at home	2.6	7
And Percent who speak English less than very well	1.1	2.7
Household income (Median $)	21,532	28,763
Poverty Status (Percent of population with income below poverty line)	17.4	16.6
Percent female headed household	23.8	15.3
Home Ownership (Percent)		
Owner occupied		56.1
Renter occupied		43.9
Value Owner-occupied Housing (Median $)		119,200
Monthly Contract Rent (Median $)	373	502
Employment Status (Population 16 yrs and over)		
Percent in the labor force	60	56.3
Percent of civilian labor force unemployed	8.1	4.7
Occupation (Percent in workforce)**		
Management, professional, and related occupations	22	26.9
Service occupations	14.1	18.6
Sales and office occupations	15.8	28.7
Farming, fishing, and forestry occupations	0.9	1.2
Construction, extraction, and maintenance occupations		14.9
Production, transportation, and material moving occupations		9.7
Industry (Percent in workforce)**		
Agriculture, forestry, fishing, hunting and mining	3	2.4
Manufacturing	10.9	7.6
Percent government workers	25.3	13.5

6.5.11.3 Hatteras, North Carolina

Hatteras Township is located on the Outer Banks of North Carolina, and includes the villages of Avon, Buxton, Frisco and Hatteras. Hatteras Village is a rural community at the southern end of Hatteras Island on North Carolina's Outer Banks. Hatteras Island is a dynamic barrier island, bordered by the Atlantic on the East and Pamlico Sound on the West. In the 18th century, Hatteras established itself as a seaport community, where activities included whaling and exporting/importing. Since World War II, the economy of the Hatteras community has depended on charter and commercial fishing (Wilson *et al*., 1998).

According to the 1990 and 2000 Census data, the population decreased from 2,675 in 1990 to 2,596 in 2000 (Table 6.23). The population decline can be attributed to mortality and out-migration exceeding births and in-migration. The number of males and females were approximately equal in 1990 and 2000. The age structure of the population has changed; the population has aged markedly, with consequences for educational attainment and other demographic indicators. In 1990, 37 percent of the population was 45 years or older, while in 2000 some 57 percent of the year-round residents were aged 45 years or older. The racial

composition of the township has not changed significantly between the 1990 and 2000 censuses with the majority of the township Caucasian and European ancestry predominant. The number of households has increased from 1,078 in 1990 to 1,171 in 2000, while the average size of households has dropped from 2.46 persons to 2.20 persons/household. These trends are consistent with an aging and declining population as "empty-nesters" and retirement couples and widows/widowers make up a higher proportion of households. The farming, fishing, forestry, and mining industries employed about 34 percent of the Hatteras population, a significant increase from 1990, and the greatest sources of employment (Table 6.23). One of the most prominent fishing organizations is the Hatteras-Ocracoke Auxiliary of the North Carolina Fishermen's Association (Wilson *et al*, 1998).

Table 6.23 Demographic Profile of Hatteras, North Carolina Source: U.S. Census, 1990 and 2000

Demographics	1990	2000
Total Population	2,675	2,596
Sex		
Male	51.6%	49.2%
Female	48.4%	50.8%
Age		
Median Age	**35.1**	**42.1**
< 17	23.9%	20.4%
18 - 44	39.6%	33.7%
45 - 64	25.4%	39.6%
> 65	11.1%	17.2%
Race		
White	98.8%	97.1%
Black or African American	0.4%	0.0%
American Indian and Alaska Native	0.8%	0.0%
Asian and Pacific Islander	0.0%	0.0%
Other	0.0%	2.3%
Household		
Total	**1,078**	**1,171**
Family households	69.7%	78.1%
Nonfamily households	30.3%	21.4%
Average household size	2.46	2.20
Average family size	2.97	2.73
Housing Occupancy		
Total housing units	1,919	2,156
Vacant housing units	43.4%	45.7%
Housing Tenure		
Owner-occupied housing units	72.3%	79.1%
Renter-occupied housing units	27.7%	20.9%

Hatteras Township, North Carolina	1990	2000
Population:	2,675	2,596
Education:		
High school graduates (25 years or older)	74.4%	68.1%
Employment:		
Labor force (16 years and over)	67.3%	83.1%
Unemployed	2.80%	4.6%
Median Household Income	$ 24,667	$ 39,881
Individuals below the poverty line	6.4%	4.7%
Employment in some industry sectors:		
Managerial/professional	28.4%	23.2%
Technical, Administrative, & Sales	29.9%	23.3%
Construction, Production, Maintenance, & Transportation	16.6%	10.8%
Farming, fishing, forestry, & mining	6.7%	33.8%
Industry		
Forestry, fishing, hunting, mining, and agriculture	6.4%	10.4%
Construction	16.2%	15.5%
Manufacturing	3.4%	2.4%
Wholesale trade	2.7%	4.0%
Retail trade	26.1%	14.9%
Education, health & social services	11.3%	14.0%
Arts, recreation, lodging & food services	1.2%	13.4%

Fishing from Hatteras is a year-round activity, subject to weather conditions. The cycle of the offshore fishery begins in December, when giant bluefin tuna are passing through the area through March. This catch-and-release fishery is followed by the availability of yellowfin tuna, dolphin, and wahoo from March through December. In the summer months, a catch-and-release fishery for blue and white marlin, swordfish and sailfish takes place between May and September. If ocean conditions are poor, fishermen are able to fish in the sheltered waters behind the barrier islands and in Pamlico Sound for striped bass, drum, sea trout and redfish.

Commercial fishing is a major occupation on Hatteras Island, where there are approximately 500 to 600 part-time and full-time commercial and charterboat fishermen (Wilson *et al*., 1998). The 2000 Census indicates that 34 percent of the population is employed in the farming, fishing, forestry and mining industry (Table 6.23). Since fishermen are customarily self-employed either as owner-operators of vessels or as crew/independent contractors receiving a share of the catch or tips as payment for their services, Wilson's estimate of 500-600 part-time and full-time commercial and charterboat fishermen is considered to be accurate for 2003 (NMFS, 2003).

Tourism and recreational fishing are also major industries in Hatteras in terms of seasonal employment. There are three economic "seasons" in Hatteras (NMFS, 1999a). In the spring, weekend and holiday travelers cause an increase in revenue; several vessels from the commercial fleet become active in charter fishing beginning in April. During the second season, June through August, family vacations provide tourist income. The third season is the fall, when fishing, surfing, and windsurfing are the dominant activities.

There are five seafood wholesalers, one retail market, and three marinas (Wilson *et al*., 1998). The three marinas in Hatteras provide dockage for as many as 56 offshore charter/headboats, some 15 inshore boats that can fish along the coast, and six charterboats that fish only in the Sounds. In addition, there are approximately 210 berths for private boats. Some commercial boats use the marinas during the late fall and winter months, but otherwise dock at fish houses and the fishermen's private docks. According to MRAG Americas, Inc. (2008), HMS charter/headboat permits issued to Hatteras vessels comprised approximately 60 percent of all HMS permits issued to the area in 2006 (Table 6.65).

The three marinas each have a charterboat fleet of independent owner/operators, and each maintains a booking and information system for its fleet. The charterboats operate with a captain and mate or crewman, and often have a second relief captain available for peak seasons when the boat will be making trips every day. The captain takes his profits (pay) from the revenues earned by the boat, and the mate customarily receives a tip of 15-20 percent of the charter fee from the client. In many cases, the boat will retain the sale rights to fish caught by clients and if the right is exercised, the ex-vessel price is apportioned between boat, captain, and mate (crew). At the height of the summer season, the recreational fisheries and fishing services (*e.g.*, marinas, bait and tackle shops) in Hatteras provide employment for approximately 205 persons.

The recreational rod and reel fishery for pelagic fish flourishes in Hatteras. A bluefin tuna fishery during winter months is intense but somewhat unpredictable. Early in the spring, fishermen target offshore yellowfin tuna, dolphin, and wahoo, followed by marlin and sailfish fishing in the summer. Other species caught seasonally include king mackerel and striped bass. Fly-fishing has become more popular, although it still comprises a small number of offshore trips from Hatteras. Captains say it is very hard to find a year-round mate because college students work summers only and most skilled fishermen want their own vessels (Wilson *et al*., 1998).

About half of fishing parties are all male and the other half are families, some of which participate in other tourist activities while the others fish. "Make-up charters", where marinas organize the parties, are becoming increasingly common (Wilson *et al*., 1998). One captain estimated that his marina did 140 make-up charters in the past year. The majority of the charter customers want to fish offshore. Customers are often willing to accept retention limits imposed by the captain, although the possibility of landing at least one fish is important to many anglers. Changes in fishing conditions including weather conditions and the availability of fish affect charter bookings almost instantly, and there is not much customer loyalty to Hatteras. Clients cancel trips when they hear a species has moved out of the area. Because Hatteras attracts top sport fishermen from around the world, the issues of minimum sizes and trophy fish take on special significance. Many fishermen are interested in setting records by catching smaller bluefin tuna on fly rods.

While some of the charterboats operating in Hatteras are local, many are from other areas. They come for the winter bluefin tuna fishery but stay year-round. Researchers report tension between the local charterboats and the transient charterboats because of increased competition for both fish and customers. There is also tension with private recreational fishermen who follow the charter/headboats to see where they fish (Wilson *et al*., 1998).

The status of the relatively new winter bluefin tuna fishery is an important aspect of HMS fisheries in Hatteras. In their study of the 1997 bluefin tuna fishing season, Ditton *et al*. (1998) found that bluefin tuna anglers spent $3.6 million dollars in Hatteras in two and one-half months in the 1997 winter season. They estimate that this meant a $7.6 million impact on the output of the Hatteras area economy and support of 170 jobs. Dare County unemployment estimates indicate that the bluefin tuna fishery may have reduced unemployment by eight percent during the first quarter of 1997. Unemployment in Dare County in March 1998, a year when the bluefin tuna did not show up in numbers anywhere near the 1997 level, was 29 percent higher than in March 1997.

Respondents view and react to the winter fishery very differently, even disagreeing on the year it started. Because of the unpredictability of the appearance of bluefin tuna and the duration of their stay, there is uncertainty among local businesses about whether or not to invest resources to stay open during winter months. Those who now have winter jobs, and those who hire them, have a different perspective. Businesses are generally pleased to retain year-round employees rather than hiring and training seasonally. Finding a place to live on Hatteras Island is already difficult for low wage workers. Many people, especially fishermen, did not think the winter fishery would last (Ditton *et al*., 1998).

Sandbar shark has dominated commercial HMS landings in Hatteras. According to MRAG Americas, Inc. (2008), sandbar shark comprised over 97 percent of HMS landings in 2006 (Table 6.54). This percentage may change in the near term due to recent regulations implemented by Amendment 2 to the HMS FMP that have significantly reduced sandbar shark harvest. Prior to Amendment 2, the Consolidated HMS FMP (2006) required vessel owners and operators of longline (bottom and pelagic) fishing vessels to attend a safe handling and release workshop and Amendment 1 to the FMP for Atlantic Tunas, Swordfish, and Sharks (2004) required release equipment on board shark fishing vessels, as well as the use of non-stainless steel corrodible hooks. The Mid-Atlantic Closure area was established in 2005, and prohibits bottom longline shark fishing off of North Carolina annually from January through July.

6.5.11.4 Morehead City, North Carolina

Although there are commercial docks in the area, recreational fishing is more prominent in Morehead City, similar to fishing activities in neighboring Atlantic Beach and Beaufort. According to MRAG Americas, Inc. (2008), HMS angling category and HMS charter/headboat permits comprised approximately 80 percent of permits issued in Morehead City in 2006, while commercial HMS permits only made up approximately 20 percent of that total (Table 6.66). The recreational fishing industry as grown, as the town's economy has become more reliant on tourism in recent years (MRAG Americas, Inc., 2008). Charter vessels target HMS seasonally, similarly to Atlantic Beach and Beaufort, and there are also large billfish tournaments held in the area from June-August (MRAG Americas, Inc., 2008). The Consolidated HMS FMP limited the amount of blue and white marlin that could be landed recreationally (250 combined per year), and required billfish tournament participants to use non-offset circle hooks when using natural baits or natural bait/artificial lure combinations. Population in Morehead City increased 27.2 percent between 1990 and 2000, and the area's economy is becoming increasingly reliant on tourism (MRAG Americas, Inc., 2008; Table 6.24).

Table 6.24 Demographic Profile of Morehead City, North Carolina

Factor	1990	2000
Total population	6,046	7,691
Gender Ratio M/F (Number)		3,507 / 4,184
Age (Percent of total population)		
Under 18 years of age		20.2
18 to 64 years of age		59
65 years and over	16.7	20.8
Ethnicity or Race (Percent)		
White		81.7
Black or African American		14
American Indian and Alaskan Native		0.7
Asian		0.8
Native Hawaiian and other Pacific Islander		<0.1
Some other race		1.1
Two or more races		1.7
Hispanic or Latino (any race)		2.3
Educational Attainment (Population 25 and over)		
Percent with less than 9th grade	11.9	8.1
Percent high school graduate or higher	70.6	80.1
Percent with a Bachelor's degree or higher	13.2	20.8
Language Spoken at Home (Population 5 years and over)		
Percent who speak a language other than English at home	3.9	4.7
And Percent who speak English less than very well	1.4	1.4
Household income (Median $)	20,041	28,737
Poverty Status (Percent of population with income below poverty line)	19.1	14.6
Percent female headed household	25.4	13.7
Home Ownership (Percent)		
Owner occupied		55.5
Renter occupied		44.5
Value Owner-occupied Housing (Median $)		106,400
Monthly Contract Rent (Median $)	376	507
Employment Status (Population 16 yrs and over)		
Percent in the labor force	59.4	60.2
Percent of civilian labor force unemployed	3.6	4.6
Occupation (Percent in workforce)**		
Management, professional, and related occupations	21.3	33.1
Service occupations	17.4	19.7
Sales and office occupations	27.1	21
Farming, fishing, and forestry occupations	3.4	1.1
Construction, extraction, and maintenance occupations		14.4
Production, transportation, and material moving occupations		10.7
Industry (Percent in workforce)**		
Agriculture, forestry, fishing, hunting and mining	3	1.1
Manufacturing	8.9	7.4
Percent government workers	15.7	18.1

6.5.11.5 Wanchese, North Carolina

Wanchese is located on the southern part of Roanoke Island, in the northern Outer Banks. The village continues to revolve around fishing and fish processing. The first seafood dealership in Wanchese was opened in 1936 by a family that still operates two seafood businesses in the community. The Wanchese Seafood Industrial Park was constructed in 1980 by the state. It has 30 acres of leasable land, a 15-acre deep-water harbor, and 1,500 feet of commercial-style concrete docks, and seven seafood-related businesses (CNCSS, 1993). The industrial park is also the scene of the annual blessing of the fleet, which is organized by the Oregon Inlet Users Association. Although commercial fishing has historically been a major industry, there has been an increasing emphasis on recreational angling and tourism.

Between 1990 and 2000, the population increased from 1,374 to 1,527 individuals (Table 6.25). The population is roughly divided between males and females. The population of Wanchese is about 98 percent Caucasian, and mostly of European ancestry. The largest age group is the 18-44 year old individuals and continues to remain about the same over the past two decades. The most dramatic shifts in the population distribution have been the decline in the percent of individuals under 20 and increase in the 45-64 year old group. In 1990, there were 503 households in Wanchese, with an average of 2.73 persons per household. The number of households had grown to 614 in 2000, with an average of 2.49 persons per household.

Table 6.25 Demographic Profile of Wanchese, North Carolina. Source: U.S. Census 1990 & 2000

Demographics	1990	2000
Total Population	1,374	1,527
Sex		
Male	51.2%	50.7%
Female	48.8%	49.3%
Age		
Median Age	**27.7**	**37.2**
< 20	36.8%	25.9%
20 - 44	35.7%	37.9%
45 - 64	20.2%	24.1%
> 65	7.2%	12.0%
Race		
White	98.5%	98.1%
Black or African American	0.0%	30.0%
American Indian and Alaska Native	1.5%	0.6%
Asian and Pacific Islander	0.0%	0.1%
Other	0.0%	0.5%
Household		
Total	**503**	**614**
Family households	76.1%	70.5%
Nonfamily households	23.9%	29.5%
Average household size	2.73	2.49
Average family size	3.25	2.96
Housing Occupancy		
Total housing units	574	690
Vacant housing units	10.8%	11.0%
Housing Tenure		
Owner-occupied housing units	72.1%	89.0%
Renter-occupied housing units	27.9%	11.0%

Wanchese, North Carolina	1990	2000
Population:	1,374	1,527
Education:		
High school graduates (25 years or older)	67.3%	76.5%
Employment:		
Labor force (16 years and over)	70.7%	66.6%
Unemployed	7.8%	1.8%
Median Household Income	$ 25,977	$ 39,250
Individuals below the poverty line	9.3%	8.1%
Employment in some industry sectors:		
Managerial/professional	17.0%	24.3%
Technical, Administrative, & Sales	24.6%	21.9%
Construction, Production, Maintenance, & Transportation	18.8%	36.0%
Farming, fishing, forestry, & mining	12.6%	9.5%
Industry		
Forestry, fishing, hunting, mining, and agriculture	19.7%	8.2%
Construction	5.0%	9.9%
Manufacturing	9.5%	13.1%
Wholesale trade	6.6%	6.9%
Retail trade	19.1%	11.7%
Education, health & social services	8.5%	22.0%
Arts, recreation, lodging & food services	2.9%	7.2%

In 1990, the largest industries in Wanchese were forestry, fishing, hunting, mining, and agriculture with retail trade as a close second (Table 6.25). The 2000 Census data show a significant decline in the forestry, fishing, hunting, mining, and agriculture industry and a marked increase in the education, health and social services industries (Table 6.25). The decline in the farming, fishing, forestry, and mining industry is also noticeable in the employment estimates. Some of these declines can be attributed to difficulties in hiring and managing crew for pelagic longline vessels, especially for the larger vessels that need people to stay on for longer trips (Wilson *et al*., 1998). There is a lot of turnover in fishing crews, particularly when vessels shift to other fisheries and revenue drops. Many of the larger vessels have already left, and experienced fishermen are finding work overseas and other captains and vessel owners are searching for alternatives to commercial fishing. Some have switched to carpentry and building and others have gone into the charter fishing business. Finding alternative permanent work may prove difficult for many fishermen who are highly skilled in their profession but have less formal education than the average worker (Wilson *et al*., 1998).

Fishing related associations include the Oregon Inlet Users Association and the North Carolina Fisheries Association. The former is involved with supporting the plans for jetties at Oregon Inlet and are responsible for organizing both the Wanchese Seafood Festival and the Blessing of the Fleet. The latter is a trade organization of seafood dealers and commercial fishermen from the state; two members of the 18-member Board of Directors are from Wanchese (CNCSS, 1993).

Recent growth in tourism and recreational fishing has sparked competition for a restricted resource. However, commercial and recreational fishermen still see themselves as being part of the same fishing-based community and many come from the same families. Members of the non-fishing public are generally supportive of the fishing industry. Unlike the surrounding communities, and in distinct contrast to Hatteras Township, Wanchese has very little seasonal variation in employment resulting from tourism; what seasonal fluctuations do exist are caused by the availability of the fisheries resources and are countered by the flexibility and opportunistic nature of the Wanchese fishermen (CNCSS, 1993).

Wanchese is not a community linked to tourism in the way that most other Outer Banks and Dare County communities are. According to MRAG Americas, Inc. (2008), HMS Angling and HMS charter/headboat permits only comprised approximately 42 percent of permits issued in Wanchese in 2006, while commercial HMS permits made up approximately 58 percent of that total (Table 6.67). Of the housing stock, only eleven percent was rental properties in 2000 (Table 6.25). The marinas and boatyards in Wanchese cater to transient boats and the charterboat fleets, but recreational fishing from Wanchese is more likely to be done by local fishermen in the Albemarle, Currituck, or Pamlico Sounds, rather than by tourists fishing offshore in private or charterboats. The reason for this is the distance to Oregon Inlet, and the presence of the Oregon Inlet Fishing Center with extensive recreational boat docks, facilities for charterboats, and launching ramps with large parking areas close to the inlet.

A large number of commercially important marine fish are landed in Wanchese, including inshore and offshore species. Many fishermen emphasized that they have to be versatile due to sudden changes in water temperature and therefore in availability of species in the area (Wilson *et al*., 1998). The species that longline fishermen target off the mid-Atlantic coast include swordfish, sharks, and tunas (primarily, yellowfin and bigeye). In 2006, the top three HMS species landed in Wanchese by weight were yellowfin tuna, bigeye tuna, and swordfish, respectively (MRAG Americas, Inc., 2008; Table 6.54).

Although targeting bluefin tuna with longline gear is prohibited, there is an incidental catch allowance of bluefin tuna as part of other fishing operations. Fishermen aboard large longline vessels fish for swordfish, tunas, and dolphin. Because of the weather, tunas and swordfish are accessible to the medium-sized vessels that gillnet for other species and longline in the summer. Respondents explained that they also gillnet for dogfish, bluefish, and Spanish mackerel (in spring and fall), and trout and croaker (in winter). They also bottom fish for bass and grouper. There are a number of vessels that gillnet in some seasons and then switch over to charterboat fishing in the summer. Other fishing activities in Wanchese include trawling trips for squid in the summer, and fishing for weakfish, croaker, and flounder in the winter. Market considerations are crucial in deciding which species are targeted by longline vessels (Wilson *et al*., 1998).

Researchers found pressure on this sector of the longline fishery to be substantial (Wilson *et al*., 1998). Regulations implemented in 2004 to reduce sea turtle bycatch and bycatch mortality, require pelagic longline fishermen to use circle hooks and have specific sea turtle handling and release equipment onboard. Other changes affecting the HMS pelagic longline fleet resulting from the Consolidated FMP in 2006 require vessel operators to attend a safe

handling and release workshop. The Mid-Atlantic Closure area was established in 2005, and prohibits bottom longline shark fishing off of North Carolina annually from January through July.

6.5.12 South Carolina

The population in South Carolina has increased by 13.1 percent between 1990 and 2000 (Table 6.26). The number of individuals with a high school diploma or greater has increased from 68.3 percent in 1990 to 76.3 percent in 2000. The unemployment rate has remained about the same and the number of individuals below the poverty line declined by just over one percent. Employment in the farming, fishing, forestry, and mining industries has declined slightly with the only significant increase in employment taking place in the arts, recreation, lodging, and food services industries, from 1.1 percent in 1990 to 8.3 percent in 2000.

Table 6.26 **South Carolina Demographic Profile.** Source: U.S. Census, 1990 and 2000

South Carolina	1990	2000
Population:	**3,486,703**	**4,012,012**
Education:		
High school graduates (25 years or older)	68.3%	76.3%
Employment:		
Labor force (16 years and over)	66.0%	63.4%
Unemployment Rate	5.6%	5.9%
Median Household Income	$26,256	$37,082
Individuals below the poverty line*	15.4%	14.1%
Employment in some industry sectors:		
Farming, fishing, forestry & mining	2.3%	1.1%
Construction	7.9%	8.3%
Wholesale trade	3.6%	3.3%
Retail	16.6%	11.9%
Manufacturing	25.7%	19.4%
Education, health & social services	19.9%	18.6%
Arts, recreation, lodging & food services	1.1%	8.3%

*U.S. Census uses data from 1989 and 1999 to estimate these values.

South Carolina has 89 commercial tuna permit holders, holding 1.7 percent of the total commercial tuna permits (Table 6.50). Additionally, there are 32 dealers for tunas, shark, and swordfish in the state of South Carolina. With 25 shark permits (directed and incidental), South Carolina holds the fifth greatest number of shark permits. Due to the relatively small number of HMS permit holders and landings in South Carolina, no community profiles have been developed at this time.

In 2008, South Carolina was home to 955 HMS angling category permit holders (Table 6.48). About 941,000 marine anglers fished in South Carolina's waters making 2,577,000 recreational fishing trips in 2007 (NMFS, 2008). Of these recreational fishermen, approximately 59 percent were from out-of-state and 12 percent were from non-coastal counties within South Carolina. The 2006 recreational marine fishery in South Carolina generated over $680 million in

retail sales and created 11,896 jobs (Southwick Associates, 2007). Anecdotal information suggests that the shark fishery is incidental to other fisheries, and is primarily catch-and-release.

In 2008, South Carolina had a fleet of 159 charter/headboats with HMS permits, many of which fish the Gulf Stream for tuna and billfish, dolphin and wahoo, and take shark as incidental catch (Table 6.49). There is a directed fishery by charter/headboats for sharks in South Carolina. Shark fishing trips, including night fishing, are offered by a number of charter operators. Sharks are taken, in the directed fishery, from near-shore waters, inlets, and from around breakwaters and jetties. Shark fishing is said to be particularly good from May to December, but sharks are available year-round. Principal species targeted are blacktip, hammerhead, lemon, and tiger shark. The International Game Fish Association (IGFA) world-record tiger shark was caught off Cherry Grove Beach, SC, near Myrtle Beach. Charterboat operators advertising shark fishing as special trips or part of general near-shore fishing are found in the communities of Myrtle Beach, North Myrtle Beach, Hilton Head, Georgetown, Pawley's Island, Murrell Inlet, Edisto Beach, Isle of Palms, Seabrook Island, Charleston, Mount Pleasant, Beaufort, and Little River.

6.5.13 Georgia

The population in Georgia has increased quite a bit in the last decade, from 6.5 million people in 1990 to 8.2 million people in 2000 (Table 6.27). The labor force (ages 16 and older) and unemployment has remained the same over the past decade, but there was a slight decline in the percentage of individuals below the poverty line. Employment in the farming, fishing, forestry, and mining industries has declined slightly since 1990; there has been only a slight employment increase in the art, recreation, lodging, and food services industries, from one percent to seven percent.

Table 6.27 **Georgia Demographic Profile.** Source: U.S. Census, 1990 and 2000

Georgia	1990	2000
Population:	**6,478,216**	**8,186,453**
Education:		
High school graduates (25 years or older)	70.9%	78.6%
Employment:		
Labor force (16 years and over)	66.1%	66.1%
Unemployment Rate	5.5%	5.5%
Median Household Income	$29,021	$42,433
Individuals below the poverty line*	14.7%	13.0%
Employment in some industry sectors:		
Farming, fishing, forestry & mining	2.7%	1.4%
Construction	6.9%	7.9%
Wholesale trade	5.1%	3.9%
Retail	16.5%	12.0%
Manufacturing	18.9%	14.8%
Education, health & social services	20.4%	17.6%
Arts, recreation, lodging & food services	1.0%	7.1%

*U.S. Census uses data from 1989 and 1999 to estimate these values.

Commercial shark fishing in Georgia has traditionally been only a very small segment of the commercial fisheries in the state. In 2008, only three vessels that held shark permits in Georgia (Table 6.52). Both Darien and Townsend, in McIntosh County, have been involved with the commercial shark fishery. There are three dealers permitted to sell HMS such as tunas, sharks, and swordfish (Table 6.51). Nineteen vessels are permitted to participate in the commercial tuna fisheries (Table 6.50). The number of HMS charter/headboat permits operating in Georgia increased from 27 in 2003 to 35 in 2008 (Table 6.49). Some of the active charter/headboat communities are Columbus, Brunswick, Marietta, Savannah, Atlanta, Alpharetta, and St. Simons Island.

In 2008, Georgia residents held 244 HMS angling category permits (Table 6.48). In 2007, marine recreational fishing in Georgia attracted 309,000 anglers, of whom approximately 15 percent were from out-of-state and approximately 37 percent from non-coastal counties (NMFS, 2008). Collectively, these anglers made 926,000 recreational fishing trips in 2007. The 2006 recreational marine fishery in Georgia generated over $132 million in retail sales and created 2,010 jobs (Southwick Associates, 2007). Principal recreational fisheries are for tarpon and snook inshore, and billfish and tunas offshore. Sharks are taken incidental to these fisheries but there are targeted shark fisheries inshore on spinner, sandbar, and lemon sharks.

6.5.14 Florida

Florida's population increased by more than 3 million people between 1990 and 2000 (Table 6.28). The percentage of individuals 25 years and older with a high school diploma and/or a graduate level degree has increased by almost five percent in the last decade. The percentage of employed individuals has declined slight, whereas the unemployment rate and percentage of individuals below the poverty line remained about the same through the nineties. As with many of the other states, employment in the farming, fishing, forestry, and mining industries has declined, whereas the education, health, and social services industries provided the greatest employment opportunities in 2000. Employment in the arts, recreation, lodging, and food services industries has been on the rise in the last decade.

Florida's fishing industry is one of the largest and most diverse in the region. Florida residents hold more than half of the commercial shark permits with 277 permit holders residing in the state (Table 6.52). Some of the large concentrations of permit holders are in Fort Pierce, St. Petersburg, Key West, and Panama City, Florida (Figure 9.4). Florida is also home to the greatest number of swordfish permit holders with 144 permitted vessels (Table 6.53). The large numbers of swordfish permit holders are found in Fort Pierce, Pompano Beach, St. Petersburg, and Panama City. Florida residents hold about six percent of the commercial tuna permits, and are generally spread out along the entire coast of Florida (Table 6.50 and Figure 9.7). Since the East Florida Coast pelagic longline closure was implemented in 2001, there has been a shift in commercial swordfishing effort in this area to the commercial handgear sector. In 2006, NOAA Fisheries defined and authorized buoy gear for the commercial swordfish handgear fishery. Prior to buoy gear being authorized, the swordfish handgear fishery fished free-floating handlines allowed under the NMFS definition of handline. Currently, the swordfish buoy gear fishery consists of approximately 40 vessels that generally fish one night trips out of ports ranging from Fort Pierce to the upper Florida Keys. For information on buoy gear regulations and recent catches, please see Section 0.

Florida residents also have the greatest number of HMS dealer permits with 137 dealers permitted to purchase and sell tunas, sharks, and swordfish (Table 6.51). A large number of these dealers can be found in Miami, Fort Lauderdale, Key West, and St. Petersburg.

Florida has the largest marine recreational fisheries in the United States. In 2007, approximately 7,261,000 saltwater anglers fished in the waters off Florida and made 31,568,000 fishing trips during that year (NMFS, 2008). Of these fishermen, approximately 44 percent were from out-of-state. More specifically to recreational HMS fisheries, Florida has the greatest number of HMS angling permits in the United States, with 4,276 permitted individuals in 2008 (Table 6.48). A large concentration of HMS anglers reside in Jupiter, West Palm Beach, Pompano Beach, Fort Lauderdale, and Miami, Florida (Figure 9.9). ASA estimates that the 2006 recreational marine fishery in Florida generated almost $3 billion in retail sales and created 51,588 jobs (Southwick Associates, 2007). The recreational swordfish fishery in Florida has grown since 2003 and is discussed in greater detail in Section 4.4.2. Sharks are an incidental catch for many fishermen, but some private boat fishermen have a directed fishery for sharks, including lemon, hammerhead, blacktip and tiger sharks.

As with the recreational anglers, Florida is also the number one state for HMS charter/headboat permit holders with 699 permitted vessels (Table 6.49). Many of these charter/headboat operators are from Key West, Islamorada, Miami, and Destin, Florida (Figure 9.8). It should be noted that these 634 charterboats/headboats permit holders refer to Florida residents and do not account for the transient vessels traveling to Florida for the winter and spring fishing seasons.

Table 6.28 **Florida Demographic Profile.** Source: U.S. Census, 1990 and 2000

Florida	1990	2000
Population:	**12,937,926**	**15,982,378**
Education:		
High school graduates (25 years or older)	74.0%	79.9%
Employment:		
Labor force (16 years and over)	60.4%	58.6%
Unemployment Rate	5.8%	5.6%
Median Household Income	$27,483	$38,819
Individuals below the poverty line*	12.7%	12.5%
Employment in some industry sectors:		
Farming, fishing, forestry & mining	3.1%	1.3%
Construction	7.8%	8.0%
Wholesale trade	4.6%	3.9%
Retail	19.6%	13.5%
Manufacturing	10.5%	7.3%
Education, health & social services	21.4%	18.1%
Arts, recreation, lodging & food services	2.3%	10.5%

*U.S. Census uses data from 1989 and 1999 to estimate these values.

6.5.14.1 Apalachicola, Florida

Low levels of HMS fishing activity take place in Apalachicola, with only three HMS commercial fishing permits, five HMS Angling fishing permits, and one HMS charter/headboat permits issued in Apalachicola in 2006 (MRAG Americas, Inc., 2008; Table 6.68). Apalachicola is located at the mouth of the Apalachicola River and East Bay in Florida, and is home to 2,334 residents according to 2000 census data (MRAG Americas, Inc., 2008), of which 25% percent were living below the poverty level (Table 6.29). The area has historically been a fishing village (currently it produces a majority of Florida's oyster crop); however, the community is rapidly changing due to an influx of development taking place in Franklin County (MRAG Americas, Inc., 2008). This new development could lead to increased levels of tourism to the Apalachicola area, and could result in opportunities for the development of HMS charter boat operations in the future (MRAG Americas, Inc., 2008).

Table 6.29 Demographic Profile of Apalachicola, Florida

Factor	1990	2000
Total population	2,707	2,334
Gender Ratio M/F (Number)		1,107 / 1,227
Age (Percent of total population)		
Under 18 years of age		21.9
18 to 64 years of age		57.6
65 years and over	16.3	20.5
Ethnicity or Race (Percent)		
White		63.4
Black or African American		34.9
American Indian and Alaskan Native		0.2
Asian		0.4
Native Hawaiian and other Pacific Islander		<0.1
Some other race		0.5
Two or more races		0.6
Hispanic or Latino (any race)		1.7
Educational Attainment (Population 25 and over)		
Percent with less than 9th grade	21.9	9.1
Percent high school graduate or higher	52.9	69.2
Percent with a Bachelor's degree or higher	12	15.3
Language Spoken at Home (Population 5 years and over)		
Percent who speak a language other than English at home	2.3	2.6
And Percent who speak English less than very well	1.2	1
Household income (Median $)	12,813	23,073
Poverty Status (Percent of population with income below poverty line)	34.6	25.3
Percent female headed household	23.3	15
Home Ownership (Percent)		
Owner occupied		69
Renter occupied		31
Value Owner-occupied Housing (Median $)		83,800
Monthly Contract Rent (Median $)	285	393
Employment Status (Population 16 yrs and over)		
Percent in the labor force	48.7	50.5

Factor		1990	2000
	Percent of civilian labor force unemployed	3.8	3.6
Occupation (Percent in workforce)**			
	Management, professional, and related occupations	16.8	25.4
	Service occupations	21.6	27.5
	Sales and office occupations	24.7	21.2
	Farming, fishing, and forestry occupations	4.6	5.9
	Construction, extraction, and maintenance occupations		5.6
	Production, transportation, and material moving occupations		14.4
Industry (Percent in workforce)**			
	Agriculture, forestry, fishing, hunting and mining	5.4	4
	Manufacturing	5	2.9
	Percent government workers	22.5	20.3

6.5.14.2 Destin, Florida

Destin is a major tourist destination located on the Florida Panhandle in Oskaloosa County. The Destin population of 11,119 residents according to 2000 census data was approximately a 37 percent increase from the 1990 survey (Table 6.30). Touted as the self proclaimed "billfish capital of the Gulf", Destin is home to a variety of HMS fishing tournaments throughout the year and recreational fishing for blue and white marlin that generally occurs from August-October (MRAG Americas, Inc., 2008). The Consolidated HMS FMP limited the amount of blue and white marlin that could be landed recreationally (250 combined per year), and required billfish tournament participants to use non-offset circle hooks when using natural baits or natural bait/artificial lure combinations. According to MRAG Americas, Inc. (2008), recreational angling and charter/headboat permits made up 57.4 percent and 23.7 percent, respectively, of all the HMS permits issued to Destin in 2006 (Table 6.69). While not as prolific as sportfishing in the area, the commercial HMS fishery landed 23,634 lb in 2006, consisting mainly of sandbar shark, yellowfin tuna, and swordfish (MRAG Americas, Inc., 2008; Table 6.54).

Table 6.30 Demographic Profile of Destin, Florida

Factor		1990	2000
Total population		8,080	11,119
Gender Ratio M/F (Number)			5,610/5,509
Age (Percent of total population)			
	Under 18 years of age		19.4
	18 to 64 years of age		63.6
	65 years and over	13.2	17
Ethnicity or Race (Percent)			
	White		96.2
	Black or African American		0.4
	American Indian and Alaskan Native		0.4
	Asian		0.1
	Native Hawaiian and other Pacific Islander		0.1
	Some other race		0.4
	Two or more races		1.5
	Hispanic or Latino (any race)		2.7

Factor	1990	2000
Educational Attainment (Population 25 and over)		
Percent with less than 9th grade	1.6	2.3
Percent high school graduate or higher	88.1	91.9
Percent with a Bachelor's degree or higher	24.9	31.4
Language Spoken at Home (Population 5 years and over)		
Percent who speak a language other than English at home	4.3	6.8
And Percent who speak English less than very well	0.9	2.4
Household income (Median $)	32,712	53,042
Poverty Status (Percent of population with income below poverty line)	7	5.5
Percent female headed household	10.9	8
Home Ownership (Percent)		
Owner occupied		75.3
Renter occupied		24.7
Value Owner-occupied Housing (Median $)		153,800
Monthly Contract Rent (Median $)	506	774
Employment Status (Population 16 yrs and over)		
Percent in the labor force	66.6	60
Percent of civilian labor force unemployed	1.8	3.8
Occupation (Percent in workforce)**		
Management, professional, and related occupations	28.6	36.3
Service occupations		14.6
Sales and office occupations	28.3	28.4
Farming, fishing, and forestry occupations	4.7	2
Construction, extraction, and maintenance occupations		10.7
Production, transportation, and material moving occupations		8.1
Industry (Percent in workforce)**		
Agriculture, forestry, fishing, hunting and mining	4.3	1.2
Manufacturing	5.5	4.2
Percent government workers	11.5	9.1

6.5.14.3 Pompano Beach, Florida

Pompano Beach is a small city directly adjacent to Fort Lauderdale. The Fort Lauderdale area is known as the "Yachting Capital of the World" and the "Venice of America" because of the vast canal system, which extends throughout Broward County and creates 165 miles of waterfront in the region. Recreational fishing is a very important activity in Pompano Beach, mainly targeting billfish. The Consolidated HMS FMP limited the amount of blue and white marlin that could be landed recreationally (250 combined per year), and required billfish tournament participants to use non-offset circle hooks when using natural baits or natural bait/artificial lure combinations. In contrast to many Florida communities, local people in addition to tourists support a substantial amount of the recreational fishing industry. Many small fishing tournaments attract about 75 percent local people and 25 percent tourists. Pompano Beach is also a globally important manufacturing center for commercial longlining equipment with its own small commercial longline fleet (Wilson *et al.*, 1998). As a community, Pompano Beach owes its current infrastructure and social and economic lifestyle to the arrival of the railroad in 1896 to a small coastal settlement. The proximity of good fishing and other natural

resources encouraged the town and region's development as tourism and retirement center. The local chamber of commerce sponsors three marine festivals every year.

Between 1990 and 2000, the population increased from 72,411 to 78,191 individuals (Table 6.31). The male to female ratio in the Pompano population changed only slightly in the past decade with a slight decrease in the number of females (48:52 to 49:51). The percent of the total population by each age group remained relatively constant between 1990 and 2000. Since the 1990 Census, the ethnic and racial population of Pompano Beach has shifted to increase the number of 'other' ethnicities in the population. In 1990, the population was 70 percent Caucasian and 29 percent Black-American. Twenty percent of the population was of Hispanic ancestry. In 2000, the population consisted of 67 percent Caucasians, 25 percent Black-Americans, and eight percent of people of other ethnicities. The proportion of the population with Hispanic ancestry had dropped to ten percent.

The number of households increased from 31,891 in 1990 to 35,197 in 2000 (Table 6.31). The average household size in Pompano Beach decreased from 2.2 persons per household in 1990 to 2.1 persons per household in 2000. Of the households in 2000, some 69 percent were in receipt of earned income. Some 36 percent of the households received Social Security payments, while 16 percent of households were in receipt of retirement income from pensions (NMFS, 1999a). This suggests that some 30 percent of households were retired and living on fixed incomes. The per capita income for Pompano Beach in 1989 was $17,382, and greater than the state average by $2,684 per annum. In 2000, per capita income in Pompano Beach was $23,938, and greater than the state average income by $2,381. The technical, administrative, and sales industries provide the greatest source of employment, with managerial and professional positions a close second. Employment in the farming, fishing, forestry and mining industries declined from almost 12 percent in 1990 to less than one percent in 2000.

Pompano Beach has a proud longlining heritage and there are several successful businesses that are still involved to some degree with the fleet (Wilson *et al*., 1998). This gives the current small vessel fleet and other longline business some networks of support. At the same time, Pompano Beach is now increasingly a recreational fishing community. In fact, Pompano Beach has the second largest concentration of HMS angling permit holders with 303 residents participating in the HMS recreational fishery (Figure 9.9). Virginia Beach has 316 permit holders. There is a great deal of tension between the recreational fishermen and the longliners. At the present time, researchers found that the longline fleet is not receiving community support beyond that supplied from within their own industry. Both sides acknowledge a problem with overfished stocks, but each often blames the other side.

Pompano Beach has a small pelagic longline fleet, remnant of a much larger fleet, which mainly targets tunas and swordfish. A large number of swordfish permit holders reside in Pompano Beach (Figure 9.1 and Figure 9.3). Effort in the swordfish pelagic longline fishery along the east coast of Florida has shifted towards buoy gear, since it became an authorized gear type for swordfish in 2006. There is also some shark fishing farther North along the coast. There are eleven HMS longline permit holders residing in Pompano Beach, Florida. The most intensive local fishing takes place December through April. The longline fleet conducts business with three Pompano Beach dealers permitted for shark and swordfish and one Dania shark and

swordfish permitted dealer. The development of the Pompano Beach area for yachting and recreational fishing has made dockage and access to the water more expensive (NMFS, 1999b).

Wilson *et al.* (1998) noted that commercial respondents reported increased difficulty in getting quality crew. The smaller vessels take two crew members plus the captain. Owner-operators often try to have at least one consistent crew member, and then find anyone they can for particular trips. The end result of all of these factors has been a substantial reduction of the Pompano Beach longline fleet. Pompano Beach's remaining pelagic and bottom longline fleet is considered, by both its owners and suppliers, to be in major trouble (Wilson *et al*., 1998). Skilled captains were seeking employment in the Bahamas, as well as with the growing longline fleets in South Africa and South America, while the longline supply business has shifted its emphasis to supplying foreign fleets. In the urban economy of Pompano Beach, non-fishing alternatives for fishermen do exist. However, the work force is fairly well-educated, so finding employment could be competitive (Table 6.31). Commercial fishing employment alternatives for vessels and crew are minimal because of limited entry programs in other fisheries.

Table 6.31 Demographic Profile of Pompano Beach, Florida. Source: U.S. Census 1990 and 2000.

Demographics	1990	2000
Total Population	72,411	78,191
Sex		
Male	48.2%	49.3%
Female	51.8%	50.9%
Age		
Median Age	**39.8**	**42.2**
< 20	19.8%	19.7%
20 - 44	35.0%	34.5%
45 - 64	19.9%	22.5%
> 65	25.3%	23.4%
Race		
White	70.1%	67.8%
Black or African American	28.6%	25.4%
American Indian and Alaska Native	0.1%	0.2%
Asian and Pacific Islander	0.3%	0.8%
Other	0.9%	2.0%
Household		
Total	**31,981**	**35,197**
Family households	57.9%	52.4%
Nonfamily households	42.1%	47.6%
Average household size	2.26	2.13
Average family size	2.90	2.85
Housing Occupancy		
Total housing units	42,179	44,496
Vacant housing units	24.7%	20.9%

Pompano Beach, Florida	1990	2000
Population:	72,411	78,191
Education:		
High school graduates (25 years or older)	73.7%	77.2%
Employment:		
Labor force (16 years and over)	52.1%	53.8%
Unemployed	3.5%	3.6%
Median Household Income	$ 29,683	$ 36,073
Individuals Below the Poverty Line	16.0%	17.0%
Employment in some industry sectors:		
Managerial/professional	24.8%	28.6%
Technical, Administrative, & Sales	31.8%	30.0%
Construction, Production, Maintenance, & Transportation	3.2%	11.4%
Farming, fishing, forestry, & mining	11.6%	0.5%
Industry Code Description		
Forestry, fishing, hunting, mining, and agriculture	3.1%	0.5%
Construction	10.4%	9.8%
Manufacturing	8.5%	7.1%
Wholesale trade	5.4%	4.7%
Retail trade	18.6%	13.6%
Education, health & social services	13.2%	14.9%
Arts, recreation, lodging & food services	2.3%	11.0%

6.5.14.4 Fort Pierce, Florida

Fort Pierce is located in St. Lucie County, a rapidly developing area in South Florida. St. Lucie County is known as a center for citrus growing, particularly grapefruit. Fort Pierce is on the site of an Army fort built in 1838, and remained an isolated outpost until the railroad reached the town in 1900. Fort Pierce was incorporated in 1901, and soon developed as a center for industry and agribusiness. At the junction of the Florida Turnpike and Interstate 95, Fort Pierce is a thriving intermodal transportation center, distribution point, and tourist stopover point.

Fort Pierce is a community in transition. The community grew rapidly between 1960 and 1990, from a population of 24,857 to 36,830 (Table 6.32). Between 1990 and 2000, the population grew by only two percent, increasing by about 800 people. Changing from a predominantly white community in 1950, the white portion of the population declined to less than half the total in 2000. The black or African American population made up just over 40 percent of the Fort Pierce population. No other ethnic or racial groups dominate the remaining 11 percent of the population. About 30 percent of the population is under 20 years old, whereas another 33 percent is between 20 and 44. The median age in 2000 was 35.4 years old.

Table 6.32 Demographics of Fort Pierce, Florida. Source: U.S. Census 1990 and 2000.

Demographics	1990	2000
Total Population	36,830	37,516
Sex		
Male	47.1%	49.3%
Female	52.9%	50.7%
Age		
Median Age	**34.2**	**35.4**
< 20	30.4%	30.3%
20 - 44	30.8%	32.7%
45 - 64	18.8%	19.6%
> 65	20.0%	17.5%
Race		
White	53.8%	49.5%
Black or African American	42.5%	40.9%
American Indian and Alaska Native	0.2%	0.3%
Asian and Pacific Islander	0.4%	0.9%
Other	3.1%	5.4%
Household		
Total	**14,283**	**14,407**
Family households	64.4%	61.2%
Nonfamily households	35.6%	38.8%
Average household size	2.58	2.56
Average family size	3.21	3.19
Housing Occupancy		
Total housing units	17,250	17,170
Vacant housing units	17.8%	16.6%
Housing Tenure		
Owner-occupied housing units	53.3%	53.2%
Renter-occupied housing units	46.7%	46.8%

Fort Pierce, Florida	1990	2000
Population:	36,830	37,516
Education:		
High school graduates (25 years or older)	56.9%	59.7%
Employment:		
Labor force (16 years and over)	48.2%	55.1%
Unemployed	6.8%	4.9%
Median Household Income	$ 18,913	$ 25,121
Individuals Below the Poverty Line	29.2%	30.9%
Employment in some industry sectors:		
Managerial/professional	16.8%	19.9%
Technical, Administrative, & Sales	28.0%	20.5%
Construction, Production, Maintenance, & Transportation	9.7%	9.0%
Farming, fishing, forestry, & mining	10.4%	31.3%
Industry		
Forestry, fishing, hunting, mining, and agriculture	9.8%	7.8%
Construction	8.2%	12.6%
Manufacturing	7.1%	8.0%
Wholesale trade	4.1%	4.8%
Retail trade	21.0%	12.5%
Education, health & social services	17.1%	16.9%
Arts, recreation, lodging & food services	1.1%	10.8%

There were 14,407 households in Fort Pierce, with an average household size of 2.56 persons, in 2000. The population is relatively mobile, since only 46 percent lived in the same house in 2000 as they did in 1995. It is also a relatively poor community, with median household income of $25,121 in 2000, and 31 percent of the population living below poverty level. Per capita income in Fort Pierce in 2000 was $14,345, compared to the statewide average per capita income of $21,557, and $9,593 less than the per capita income in Pompano Beach. These earnings data reflect the unskilled and seasonal nature of jobs in agribusiness, packing plants and transportation businesses in and around Fort Pierce.

Locals refer to Fort Pierce as the “gateway to the Bahamas” because of the number of sport fishing and other vessels which use Fort Pierce as their departure point for the Bahamas and its associated Gulf Stream fisheries for HMS and other species of fish, including shark. In 2003, Fort Pierce hosted 15 fishing tournaments and related marine activities. The city’s marina, in conjunction with other marinas and docks along the Indian River, Indian River Lagoon, and Intracoastal Waterway, provides sufficient dockage for recreational boaters and fishermen and

for a commercial fishing fleet, principally longliners, but also the shark gillnetters. Fifteen shark and nine swordfish permit holders reside in Fort Pierce (Figure 9.4 and Figure 9.1).

The commercial fishing fleet in Fort Pierce has grown in the past decade due to lost dock space for commercial fleets in nearby ports. With the exception of the gillnet fleet unique to Fort Pierce, the commercial fishery is similar to the commercial fishery of Pompano Beach and is principally conducted during the fall and winter seasons. Smaller vessels switch gears and target species throughout the year, while larger vessels move with the fish stocks and retain the same gear configurations. Dealers and fish processors have also consolidated buying and packing operations in Fort Pierce because of the high cost of doing business in the tourism-related coastal communities North and South of Fort Pierce. Effort in the swordfish pelagic longline fishery has shifted towards buoy gear, since it became an authorized gear type for swordfish in 2006. The shark bottom longline fishery has been impacted by a variety of regulations since 2004. Amendment 1 to the FMP for Atlantic Tunas, Swordfish, and Sharks required release equipment on board shark fishing vessels, as well as the use of non-stainless steel corrodible hooks, and divided the fishing year into three shark seasons instead of two. The Consolidated HMS FMP required vessel owners and operators of longline (bottom and pelagic) fishing vessels to attend a safe handling and release workshop, and that second dorsal and anal fins remain attached through landing. Amendment 2 to the HMS FMP changed the commercial trip limit to 33 non-sandbar large coastal sharks, established a Shark Research Fishery, and requires that all sharks must be landed with their fins naturally attached.

6.5.14.5 Madeira Beach, Florida

Madeira Beach is part of the Tampa Bay urban complex, one of several beach suburbs of St. Petersburg. The area is the home of the West-central Florida shark bottom longline fleet. Madeira Beach is also home to a thriving recreational HMS fishery. In terms of revenue, tourism is the number one industry in Pinellas County. Annually, four million visitors contribute about two billion dollars to the economy. The tourism industry also employs almost 60,000 of the residents either directly or indirectly, adding up to $720 million in wages (St. Petersburg-Clearwater Visitors Bureau brochure, 1998). The state of the economy since September 2001 has dampened the tourism industry, and Pinellas County Chamber of Commerce reported that the 2002 visitor and expenditure statistics were similar to those of 1998 (PCCC Report, March, 2003).

The Madeira Beach economy has changed with increases in the tourism industry. A sign of the times is the renovation of much of the waterfront along St. John's Pass from a working waterfront of docks, fish houses and chandleries to a boardwalk lined with restaurants and boutiques. Many of the slips remaining are assigned to recreational vessel docking and storage. The once-dominant fishing industry is now a shadowy presence in much of Madeira Beach.

The population in Madeira Beach increased by about six percent from 1990 to 2000 (Table 6.33). In 2000, 97 percent of the population was Caucasian. The number of people in the population claiming German ancestry rose from 11 percent in 1990 to 19.7 percent in 2000 (Table 6.33), although 92 percent of the population of Madeira Beach was born in the United States. Median age increased from 34.2 in 1990 to 47.6 in 2000. The number of households in Madeira Beach increased from 2,230 in 1990 to 2,523 in 2000, but the average number of

persons in a household declined from 1.88 persons in 1990 to 1.78 in 2000. In 2000, almost 28 percent of the housing units in Madeira were seasonal or recreational units vacant at the time of the Census.

Per capita income in Madeira Beach in 1989 was $17,301; in 1999, per capita income had risen to $30,097, $8,000 more than the state average per capita income and $15,752 more than the average per capita income in Fort Pierce. Individuals living at or below poverty level comprised 9.8 percent of the Madeira Beach population. Seventy-two percent of Madeira Beach households received earnings from wages or salaries. Twenty-three percent of the households were in receipt of retirement funds or pensions, while 31 percent of the households received income from Social Security. The jobs in farming, fishing, forestry, and mining industries declined over the last decade from just over ten percent to less than one percent (Table 6.33). The industry itself also declined, whereas the arts, recreation, lodging and food services related industries increased from 2.5 percent to over 21 percent.

The offshore fishing industry in Madeira Beach started as a bandit (reel fixed to transom) fishery before it shifted to bottom longlining. Grouper is the traditional fishery for the community. In the 1960s, there were two dealers supported by charterboats selling fish and a small commercial fleet targeting kingfish and grouper. Many species that are now sold in Madeira Beach, such as amberjack, were considered trash fish in earlier years. As demand for seafood began to grow, higher prices accompanied by investment programs led to substantial investment in commercial fishing within this community.

Table 6.33 Demographic Profile for Madeira Beach, Florida. Source: U.S. Census 1990 and 2000.

Demographics	1990	2000
Total Population	4,225	4,500
Sex		
Male	50.9%	52.0%
Female	49.1%	48.0%
Age		
Median Age	**34.2**	**47.6**
< 20	11.2%	9.5%
20 - 44	35.3%	32.5%
45 - 64	28.0%	36.0%
> 65	25.6%	21.9%
Race		
White	99.8%	97.4%
Black or African American	0.0%	0.0%
American Indian and Alaska Native	0.0%	0.8%
Asian and Pacific Islander	0.2%	0.0%
Other	0.0%	1.8%
Household		
Total	**2,230**	**2,523**
Family households	50.5%	59.8%
Nonfamily households	49.5%	40.2%
Average household size	1.89	1.78
Average family size	2.49	2.39
Housing Occupancy		
Total housing units	3,788	3,971
Vacant housing units	41.1%	36.5%

Madiera Beach, Florida	1990	2000
Population:	4,225	4,500
Education:		
High school graduates (25 years or older)	83.8%	87.3%
Employment:		
Labor force (16 years and over)	56.9%	61.5%
Unemployed	1.6%	2.7%
Median Household Income	$ 24,748	$ 36,671
Individuals Below the Poverty Line	8.4%	9.8%
Employment in some industry sectors:		
Managerial/professional	35.3%	30.4%
Technical, Administrative, & Sales	31.2%	28.9%
Construction, Production, Maintenance, & Transportation	1.4%	17.8%
Farming, fishing, forestry, & mining	10.3%	0.7%
Industry		
Forestry, fishing, hunting, mining, and agriculture	1.4%	0.0%
Construction	8.8%	7.0%
Manufacturing	7.5%	11.3%
Wholesale trade	4.5%	4.1%
Retail trade	30.7%	11.4%
Education, health & social services	11.4%	7.9%
Arts, recreation, lodging & food services	2.5%	21.6%

Longline vessels began to target swordfish in the 1970s, using cloth and nylon line before monofilament longlines were commonly used. The bottom longline fishery in Maderia began after local availability of swordfish rapidly declined. This prompted a group of vessels to head

north to search for fish. While heading back they discovered a significant amount of shark, tilefish and yellowedge grouper by setting longline gear in deep water (Wilson *et al*., 1998). Marginal swordfish vessels began to experiment with various techniques such as straight hooks, auto-baiters and circle hooks. The Madeira Beach fleet is currently 95 percent bottom longline vessels. There are three seafood dealers in this community, two of which were permitted to sell HMS species in 2005. One dealer estimated that before restrictions on shark fishing his business used to be 45 percent grouper, 45 percent shark, and ten percent swordfish and tuna; now it is 75 percent grouper, ten percent shark and 15 percent swordfish and tuna (Wilson *et al.,* 1998). With the imposition of the live-bait ban in 2000, the swordfish and tuna landings have decreased appreciably.

Sharks and grouper are both caught commercially with bottom longline gear. For this reason, the majority of longline fishermen hold permits for multiple fisheries. Commercial grouper fishermen are subject to limited access, a minimum size, area restrictions, seasonal closures, and a quota, while commercial shark fishermen are subject to similar types of restrictions except for minimum sizes.

Overall, the Madeira Beach bottom longliners are becoming fewer and more isolated from the rest of the fishing community (Wilson *et al*., 1998). Respondents say that antagonism and competition among dealers has gotten worse in recent years as vessels drop out of fishing, often being sold outside of the country. Many of these crews are living trip to trip and often need credit for engine repair, ice, fuel, household and personal items. Both the fishermen and an engine supplier reported that the commercial fleet is spending more on maintaining existing gear and vessels rather than buying new equipment. Traditional patterns of dealers building relationships by extending services and credit to vessels are giving way to price-based competition to gain access to vessels (NMFS, 1999a).

Fishermen in this community have experienced restrictions on gear, harvest, and capacity in many of its important fisheries. Wilson *et al.* found that alternative employment outside of the fishery is available through expanding opportunities in the tourism and recreational fishing industries. However, this relatively ready supply of alternative employment threatened the stability of the labor pool for the fishing industry. Some reported that the best captains are leaving the country or moving on to other jobs. Like many other fishing communities, the longline fleet in Madeira Beach is experiencing market competition from imports of their target species (Wilson *et al*., 1998; NMFS, 1999a).

When the shark bottom longline fishery began in Florida it was easy to catch sharks, but the catch from the bottom longline fishery has become marginal due to restrictions and increased distance to the fishing grounds (Wilson *et al*., 1998). Members of the fishing and supply industries reported price fluctuations in the shark fishery, which they attributed to the difficulty in maintaining steady supplies under derby-style quota management. The fins bring the most money and are exported to Asian nations. Shark trips have to be kept as short as possible to maintain good quality meat. Respondents suggest that regulations, particularly the 4,000-pound shark commercial retention limit, had turned the fishery into a small vessel fishery (NMFS, 1999a). In 2008, Amendment 2 to the HMS FMP created a stricter commercial shark retention limit by replacing the 4,000 pound trip limit with a 33 large coastal shark trip limit. Amendment

2 also prohibited the harvest of sandbar shark (*Carcharhinus plumbeus*) unless fishing within the newly established Shark Research Fishery. Some fishermen keep both grouper and shark gear on board and will participate in both fisheries, sometimes on the same fishing trip.

Besides changes in harvest limits, regulations since 2004 have directly impacted the shark bottom longline fishery. Amendment 1 to the FMP for Atlantic Tunas, Swordfish, and Sharks required release equipment on board shark fishing vessels, as well as the use of non-stainless steel corrodible hooks, and divided the fishing year into three shark seasons instead of two. The Consolidated HMS FMP required vessel owners and operators of longline (bottom and pelagic) fishing vessels to attend a safe handling and release workshop, and that second dorsal and anal fins remain attached through landing. As well as changing the shark trip limit and restricting the harvest of sandbar sharks, Amendment 2 to the HMS FMP also requires that all sharks must be landed with their fins naturally attached.

Approximately 50 to 60 charter/headboats participated in the recreational fisheries of Madeira Beach during the 1990s, and more than 48,000 pleasure vessels were registered in Pinellas County (Florida Bureau of Vessel Titling and Registration, 1996 and 1997). Researchers found tension and distance between the recreational and commercial fishing communities to be high, and recreational fishermen tend to maintain that commercial fishing is to blame for the declining shark populations (Wilson *et al*., 1998). Shark fishing is comparatively less important to recreational fishing in Madeira Beach than other HMS, although researchers reported that the local recreational shark fisheries are very healthy (NMFS, 1999a).

The renewal and renovation of the town's waterfront, particularly on John's Pass, removed many of the berths and infrastructure, which supported both the charterboat fleet and the commercial fishing fleet. In 2006, there was one HMS charter/headboat permits issued to Madeira Beach (MRAG Americas, Inc., 2008; Table 6.71). Additionally, the Madeira Beach shark tournaments, which were mostly sponsored by a vessel or engine manufacturer, are no longer held due to loss of this infrastructure. Stores sell very little shark tackle, but some maintain the industry is beginning to come back. The miles-long remainder of the old Sunshine Skyway bridge is now used as a pier for recreational shark fishing. It is estimated that recreational shark fishing in this community is 90 percent catch-and-release (NMFS, 1999a).

6.5.14.6 Panama City, Florida

Panama City is located on the Gulf of Mexico in the Florida Panhandle. Panama City is one of the Florida's top fishing centers offering surf fishing, pier fishing, and charter/headboat fishing, according to the Panama City Tour Guide (NMFS, 2003). According to the Florida Bureau of Vessel Titling and Registration, the county has a total of 16,865 registered vessels with 15,359 pleasure and 1,433 commercial vessels. Headboats are an important part of Panama City's tourism. People enjoy bringing children along since these trips are shorter than charterboat trips. Panama City is a summer resort, with little tourist activity in the winter, as well as an important commercial fishing port.

During the winter, recreational fishermen target bottom fish and bluefish. In March, the season begins for Spanish mackerel, cobia, snapper, bonito, little tunny, amberjack, snapper, red porgies, rudder fish, blue runner, bluefish, and redfish. By summer, they also fish for king

mackerel, dolphin fish, wahoo, little tunny, and barracuda. White marlin, blue marlin, and sailfish are caught recreationally in late summer. The Consolidated HMS FMP limited the amount of blue and white marlin that could be landed recreationally (250 combined per year), and required billfish tournament participants to use non-offset circle hooks when using natural baits or natural bait/artificial lure combinations. Some charterboats will go shark fishing at night for extra income. In September, the fishery is very mixed, and in October, king mackerel and bonito are popular. Tourists are mainly interested in bottom fishing. Motivations have changed; people used to be interested in catching a lot of fish and taking it home to eat or sell, but now people are satisfied to catch anything (Wilson *et al*., 1998; NMFS, 1999a).

Between 1990 and 2000, Panama City experienced a modest increase in its population from 34,378 in 1990 to 36,417 in 2000 (Table 6.34). Since 1990, there has been an increase in the male population with a corresponding decrease in the female portion of the total population; males: 47 to 49 percent and females: 53 to 51 percent. The Panama City population did get older in the past decade the median age increased from 34 years old to about 37 years old. Correspondingly, the greatest portion of the population in both decades was in the 20-44 years old age bracket.

Panama City had 14,033 households in 1990, and the number of households grew to 14,819 in 2000 (Table 6.34). The average household size decreased from 2.37 persons in 1990 to 2.30 persons in 2000, indicating that there might be an increase in "empty nesters" and retiree households. The percentage of individuals below the poverty line decreased slightly over the past decade from almost twenty to seventeen percent. In 1989, the per capita income in Panama City was $12,169 and was significantly lower than the state average per capita income of $14,698. This situation persisted in 1999, when the Panama City per capita income had increased to $17,830, but continued to be less than the Florida average of $21,557 per capita.

Like Fort Pierce, Panama City is a transportation hub and has an agricultural and industrial base in addition to its fisheries. Panama City's commerce rests on a supply of unskilled labor able to service agribusiness, transportation services, and the tourism industry. Panama City has two city marinas in addition to private commercial operations. The Panama City marina is located downtown on the Intracoastal Waterway and provides 240 berths for recreational, commercial and charter/headboat vessels. The second municipal marina, St. Andrews, lies on St. Andrews Bay, closer to the Gulf of Mexico, and provides docking and other facilities for much of the commercial fishing fleet. This fleet is chiefly composed of shrimp boats. Seven charter/headboats are based in the city marinas. There are thirty Panama City residents with an HMS charter/headboat permit (Figure 9.8). While the largest local employers are hospitals and resort hotels, two shipyards between them employed 650 persons in 2003 (Panama City/Bay County Chamber of Commerce, 2003).

Table 6.34 Demographic Profile for Panama City, Florida. Source: U.S. Census 1990 and 2000.

Demographics	1990	2000
Total Population	34,378	36,417
Sex		
Male	46.7%	48.6%
Female	53.3%	51.4%
Age		
Median Age	**33.9**	**37.2**
< 20	28.6%	25.6%
20 - 44	34.9%	36.8%
45 - 64	19.6%	21.7%
> 65	16.9%	16.0%
Race		
White	76.1%	73.6%
Black or African American	21.0%	21.5%
American Indian and Alaska Native	0.7%	0.6%
Asian and Pacific Islander	1.6%	1.6%
Other	0.6%	0.8%
Household		
Total	**14,033**	**14,819**
Family households	69.2%	61.0%
Nonfamily households	30.8%	39.0%
Average household size	2.37	2.30
Average family size	2.90	2.92
Housing Occupancy		
Total housing units	15,928	16,548
Vacant housing units	11.8%	10.4%
Housing Tenure		
Owner-occupied housing units	58.3%	57.8%
Renter-occupied housing units	41.7%	42.2%

Panama City Beach, Florida	1990	2000
Population:	34,378	36,417
Education:		
High school graduates (25 years or older)	70.3%	79.2%
Employment:		
Labor force (16 years and over)	54.0%	53.9%
Unemployed	4.6%	3.1%
Median Household Income	$ 21,881	$ 31,572
Individuals Below the Poverty Line	19.6%	17.2%
Employment in some industry sectors:		
Managerial/professional	25.9%	32.2%
Technical, Administrative, & Sales	32.2%	27.7%
Construction, Production, Maintenance, & Transportation	1.5%	19.0%
Farming, fishing, forestry, & mining	10.2%	0.4%
Industry		
Forestry, fishing, hunting, mining, and agriculture	1.6%	0.5%
Construction	7.0%	6.7%
Manufacturing	7.7%	7.0%
Wholesale Trade	3.3%	0.1%
Retail Trade	21.4%	13.8%
Education, health & social services	19.4%	22.2%
Arts, recreation, lodging & food services	1.5%	14.2%

In the early 1980s, yellowfin tuna was the main commercial fishery for Panama City from April through December while bluefin tuna were targeted in the winter. Some of the longline vessels shifted from yellowfin tuna fishing to bottom longline fishing for grouper and sharks in 1998, since the latter required fewer crew members (Wilson *et al*., 1998). Some of these vessels targeted dolphin fish in the summer, and swordfish more rarely. In 1998, two of these vessels were owner operated, two were owned by a dealer, three were each owned by a single person who hired a captain, and two others were jointly owned and had hired captains (Wilson *et al*., 1998). In 2005, ten longline vessels held an HMS permit; 20 shark permits and 12 swordfish permits were issued to residents of Panama City.

Some pelagic longline fishermen also participated in the reef fish and bottom longline fishery. There were 16 to 19 grouper vessels operating out of Panama City in 1998. One fish trader interviewed by the researchers in 1998 reported that his current business was 87 percent yellowfin tuna and eight percent snapper, with the remainder being a mix of swordfish, bluefin tuna, dolphin, wahoo, sandbar shark, and escolar. He bought from about ten vessels in 1998, but had bought from 30 vessels a few years ago (Wilson *et al.,* 1998). The prohibition on the use of live bait in 2000 reduced the tuna and swordfish catches of the commercial fleet and increased use of bottom longline for grouper and shark. Also in 2000, the DeSoto Canyon Closed Area was established in the Gulf of Mexico, which prohibited pelagic longline fishing in these areas.

While Panama City was developing tourist and recreational fishing industries, the commercial fishermen were becoming fewer and more isolated from the rest of the community. The competition among dealers was perceived as becoming more aggressive in 1997-1998. Traditional patterns of dealers building relationships by extending services and credit to vessels

in the shrimp and longline fisheries were giving way to price-based competition to gain access to vessels. Fishermen in this community had experienced restrictions on gear, harvest, and capacity in many important fisheries. Researchers found in 1998 that alternative employment outside of the fishery was available in the developing tourism and recreational fishing industries. However, researchers concluded that this relatively ready supply of alternative employment threatened the stability of the labor pool for the fishing industry (Wilson *et al*., 1998).

6.5.14.7 Islamorada, Florida

Islamorada, located in the Florida Keys, is a popular destination for HMS recreational fishing. It is estimated that there are over 100 charter fishing vessels in the area and the self proclaimed moniker of "sportfishing capital of the world" is in reference to the recreational fishing presence in the area. The community depends on tourism, and has approximately 45 hotels/motels and over 24 marinas to support recreational fishing activities (MRAG Americas, Inc., 2008). Islamorada hosts over 10 HMS tournaments throughout the year, running from November-February, as well as a billfish tournament in August (MRAG Americas, Inc., 2008). In 2008, regulations requiring billfish tournament participants to use non-offset circle hooks when using natural baits or natural bait/artificial lure combinations became effective. Residential population in the area has increased by almost 430 percent, from 1,293 in 1990 to 6,846 in 2000, according to census data (Table 6.35). HMS commercial efforts in the area are limited, as most operations have been pushed out of the area due to marine sanctuary restrictions (MRAG Americas, Inc., 2008).

Located in the Florida Keys, Islamorada calls itself the Sportfishing Capital of the World because of its proximity to the Florida Bay, the Everglades, bonefish flats, coral reefs and the Gulf Stream. Islamorada is famous for light tackle technique and many different rods have been developed in this community. It is now increasingly a recreational fishing community, with many charterboats that troll for yellowtail snapper, grouper, blackfin tuna, dolphin, wahoo and billfish in inshore waters. Recreational activities in the Keys consist of trophy fishing, catch-and-release, spearfishing, and fishing for food. There has been a growing interest in the guided fishing industry that promotes catch-and-release (NMFS, 1999a). According to the Florida Bureau of Vessel Titling and Registration, Monroe County has a total of 23,079 registered vessels, with 18,731 pleasure and 4,260 commercial vessels as of 1996. In 1998, there were eleven marinas in Islamorada (Wilson *et al*., 1998).

Tournaments are an important marketing device for tourism in this town. The majority of vessels in Islamorada tournaments are Florida vessels, but there are some out-of-state participants. The Tourist Development Council of the Florida Keys has a large marketing budget and gives grants and sponsorship to tournaments. One tackle shop employed 57 people in 1998 and planned to open a fishing school next year that would employ six teachers and teach 24 people at a time for three to four days. Other water-related tourist businesses include powerboat rentals, boat tours, cruises, kayak, wave runner and sailboat rentals, snorkel and dive shops, boat dockage, lifts and repair shops, and fishing supply shops.

The largest resort in Islamorada began as a fishing marina and sportfishing is a big part of their marketing. The resort has two sets of vessels offshore and "back country," the local term for the Florida Bay area. There are 19 "six-pack boats" which are charterboats and one

headboat. In the winter, charter/headboats target sailfish, blackfin tuna, and bonito. Recreational fishermen in this community generally feel that retention limits, minimum sizes, voluntary catch-and-release, and other management measures are effective. Florida's ban on inshore net fishing is also considered a success. Sea trout, bonefish, pompano, and Spanish mackerel are plentiful as a result of the net ban.

According to the Monroe County Cooperative Extension Service, fishing is better as a result of regulations. However, some charter/headboat captains are pessimistic about the future. They feel that the overall fishing is not good, and they have lost customers because there are not as many fish to target (Wilson *et al*., 1998). There is a general concern in Islamorada that it would be devastating to the community if the fish stocks were depleted. There are a lot of concerns with habitat such as the loss of grass beds, destruction of mangrove shoreline, water quality, algae blooms, and coral reefs dying from ozone depletion and too much sunlight. Some people are concerned with runoff from the lower part of the peninsula including phosphates and exhaust. There is also a concern over an increasing number of fishermen in the area (Wilson *et al*., 1998).

Islamorada has been subject to considerable expansion. In 1990, the population was 1,220 individuals and in 2000, it was 6,846-429.5 percent increase over a ten-year period (Table 6.35). The population was roughly half male and half female in both census years. The pattern of age distribution, however, changed between 1990 and 2000. The population in Islamorada is older than Fort Pierce, Pompano, and Panama City. The median age increased from just over 42 years to just over 46 years old over the past decade. The dominant age group shifted from 20-44 years old to 45-64 years old. Islamorada has a very well educated population with almost 92 percent having at least graduated high school (Table 6.35).

The labor force has declined over the past decade indicating that the population is aging (Table 6.35). While the median household income and the percentage of individuals above the poverty line increased, the employment rate also increased slightly. In both 1990 and 2000, the greatest source of employment is in the technical, administrative, and sales industry sectors. Employment in farming, fishing, forestry, and mining decreased by one half. Correspondingly, the forestry, fishing, mining, and agriculture industry decreased by one half. The largest industry in Islamorada was retail trade in 2000.

Due to limited range and safety concerns about venturing farther offshore, Islamorada has a small vessel longline fleet that fishes year-round in nearby waters. While these vessels are experiencing increased difficulty with finding crew, this is significantly less of a problem for them than for larger pelagic longline vessels. Researchers found that the commercial fishing community has an increasingly smaller niche relative to recreational fisheries. They cited limited entry in the snapper, king mackerel, and crab fisheries; a ban on net use in inshore waters in Florida; and incidental catch limits for bluefin tuna as limiting factors for the commercial fisheries. On July 1, 2001 the Tortugas Ecological Reserve was established as a no-take zone within the Florida Keys National Marine Sanctuary, and prohibits commercial fishing in this area (NOAA, 2001).

Skilled captains were seeking employment in the Bahamas, as well as the growing longline fleets in South Africa and South America, while the longline supply business has shifted its emphasis to supplying foreign fleets. In Islamorada, a growing recreational fishing industry provides alternative employment opportunities for commercial fishermen familiar with charter/headboats and as fishing guides. In fact, there is a significant concentration of charter/headboat permits issued to Islamorada residents, 27 permitted vessels in 2008 (Figure 9.8). However, the Islamorada work force is fairly well educated, so finding alternative employment could be competitive.

Table 6.35 Demographic Profile for Islamorada, Florida. Source: U.S. Census, 1990 and 2000.

Demographics	1990	2000
Total Population	1,293	6,846
Sex		
Male	54.2%	53.0%
Female	45.8%	47.0%
Age		
Median Age	**42.3**	**46.2**
< 20	13.3%	17.0%
20 - 44	40.8%	30.6%
45 - 64	26.7%	35.6%
> 65	19.2%	16.9%
Race		
White	95.3%	96.8%
Black or African American	0.9%	0.5%
American Indian and Alaska Native	0.0%	0.2%
Asian and Pacific Islander	0.0%	0.7%
Other	3.9%	0.8%
Household		
Total	**672**	**3,174**
Family households	51.6%	58.4%
Nonfamily households	48.4%	41.6%
Average household size	1.92	2.10
Average family size	2.54	2.63
Housing Occupancy		
Total housing units	966	5,461
Vacant housing units	32.4%	41.9%
Housing Tenure		
Owner-occupied housing units	65.9%	71.1%
Renter-occupied housing units	34.1%	28.9%

Islamorada, Florida	1990	2000
Population:	1,293	6,846
Education:		
High school graduates (25 years or older)	77.8%	91.7%
Employment:		
Labor force (16 years and over)	73.2%	62.9%
Unemployed	0.9%	2.3%
Median Household Income	$ 26,266	$ 41,522
Individuals Below the Poverty Line	9.1%	6.9%
Employment in some industry sectors:		
Managerial/professional	25.9%	28.0%
Technical, Administrative, & Sales	30.7%	30.0%
Construction, Production, Maintenance, & Transportation	7.8%	17.9%
Farming, fishing, forestry & mining	7.9%	3.9%
Industry		
Forestry, fishing, hunting, mining, and agriculture	6.8%	3.7%
Construction	3.8%	6.6%
Manufacturing	4.6%	1.9%
Wholesale trade	2.9%	1.2%
Retail trade	39.4%	20.2%
Education, health & social services	6.1%	12.7%
Arts, recreation, lodging & food services	3.2%	21.1%

6.5.14.8 Port Salerno, Florida

Port Salerno is located on the east coast of Florida, approximately 30 miles north of West Palm Beach. It is home to 10,104 residents according to 2000 census data (Table 6.36). In the past, there have been concentrations of longline vessels that targeted shark, which claimed Port Salerno as their home port, but due to gentrification and increasing fishery regulations, commercial fishing infrastructure has shrunk, and currently there is only one commercial facility remaining in the area (MRAG Americas, Inc., 2008). Effort in the swordfish pelagic longline fishery along the east coast of Florida has shifted towards buoy gear, since it became an authorized gear type for swordfish in 2006. HMS recreational tournaments are held in Port Salerno and are sponsored by a local sailfish club in nearby Stewart, FL (MRAG Americas, Inc., 2008). The Consolidated HMS FMP limited the amount of blue and white marlin that could be landed recreationally (250 combined per year), and required billfish tournament participants to

use non-offset circle hooks when using natural baits or natural bait/artificial lure combinations. According to the 2000 census there were 10,104 residents in Port Salerno, almost a 30 percent increase from 1999 (Table 6.36). Over 80 percent of the HMS permits issued to Port Salerno addresses in 2006 were commercial in nature, and only five recreational angling permits were issues to the area (Table 6.72).

Table 6.36 Demographic Profile of Port Salerno, Florida

Demographics	**1990**	**2000**
Total population	7,786	10,104
Gender Ratio M/F (Number)	3,748 / 4,038	4,928 / 5,176
Age (Percent of total population)		
Under 18 years of age	19.2	19.9
18 to 64 years of age	56.8	55.4
65 years and over	23.9	24.7
Ethnicity or Race (Percent)		
White	88.0	88.8
Black or African American	6.9	7.0
American Indian and Alaskan Native	0.2	0.1
Asian	0.4	0.7
Native Hawaiian and other Pacific Islander		0.1
Some other race	0.1	2.3
Two or more races		1.3
Hispanic or Latino (any race)	4.4	8.2
Educational Attainment (Population 25 and over)		
Percent with less than 9th grade	6.3	3.2
Percent high school graduate or higher	81.2	85.4
Percent with a Bachelor's degree or higher	17.9	21.5
Language Spoken at Home (Population 5 years and over)		
Percent who speak a language other than English at home	10	9.5
And Percent who speak English less than very well	3.2	4.5
Household income (Median $)	31,687	39,839
Poverty Status (Percent of population with income below poverty line)	6.9	9.6
Percent female headed household	7.7	9.3
Home Ownership (Number)		
Owner occupied		3262
Renter occupied		1204
Value Owner-occupied Housing (Median $)		116,900
Monthly Contract Rent (Median $)		559
Employment Status (Population 16 yrs and over)		
Percent in the labor force	57.1	54.3
Percent of civilian labor force unemployed	5.5	2.8
Occupation (Percent in workforce)**		
Management, professional, and related occupations	-	28.5
Service occupations	-	19.3
Sales and office occupations	-	27.6
Farming, fishing, and forestry occupations	3.6	0,8
Construction, extraction, and maintenance occupations	-	13.9
Production, transportation, and material moving occupations	-	10
Industry (Percent in workforce)**		

Demographics	1990	2000
Agriculture, forestry, fishing, hunting and mining	3.1	0.9
Manufacturing	12	8.8
Percent government workers	9.8	10.4

6.5.15 Alabama

The population in Alabama has increased by about 400,000 people between 1990 and 2000 (Table 6.37). The percentage of individuals 25 years and older with a high school diploma and/or some graduate level degree has increased by about eight percent. The percentage of employed individuals, unemployment rate, and percentage of individuals below the poverty line have declined slightly in the last decade. As with many of the other states, employment in the farming, fishing, forestry, and mining industries has declined, whereas the education, health, and social services industries provided the greatest employment opportunities in 2000. Also, the arts, recreation, lodging, and food services, and manufacturing industries have been the greatest source of employment Alabama residents over the past decade.

In 2008, Alabama residents held 20 commercial tuna permits (Table 6.50), five commercial shark permits (Table 6.52), and two swordfish permits (Table 6.53). The communities involved in the shark fishery are Andalusia, Bayou la Batre, Elba, Elberta, Gulf Shores, and Lillian. There are four licensed HMS dealers working in coastal Alabama (Table 6.51). Alabama residents hold about one percent or less of the commercial tuna, shark, and swordfish permits; therefore, no community profiles have been developed to date.

The marine recreational fishery off Alabama attracted 713,000 anglers in 2007, who accounted for 2,120,000 fishing trips (NMFS, 2008). Of these recreational fishermen, approximately 41 percent were from out-of-state and about 24 percent were from non-coastal counties within Alabama. In 2008, there were 430 Alabama residents who held an angling permit to fish recreationally for HMS (Table 6.48). A large number of these anglers are in Mobile, Alabama. In 2006, recreational marine anglers generated an estimated $226 million in retail sales and supported 3,762 jobs (Southwick Associates, 2007). Thus recreational fishing off Alabama also benefits the local tourist industry as it does in Florida. Shark fishing is largely incidental to recreational fishing for other fish species.

Table 6.37 **Alabama Demographic Profile.** Source: U.S. Census, 1990 and 2000.

Alabama	1990	2000
Population:	**4,040,587**	**4,447,100**
Education:		
High school graduates (25 years or older)	66.9%	75.3%
Employment:		
Labor force (16 years and over)	61.1%	59.7%
Unemployment Rate	6.9%	6.2%
Median Household Income	$23,597	$34,135
Individuals below the poverty line*	18.3%	16.1%
Employment in some industry sectors:		
Farming, fishing, forestry & mining	3.03%	1.90%
Construction	7.1%	7.6%
Wholesale trade	4.1%	3.6%
Retail	16.2%	12.2%
Manufacturing	22.9%	18.2%
Education, health & social services	21.6%	19.3%
Arts, recreation, lodging & food services	0.9%	6.4%

*U.S. Census uses data from 1989 and 1999 to estimate these values.

There are 66 vessels with a 2008 HMS charter/headboat permit in Alabama (Table 6.49), and many of these vessels are located in Orange Beach). Some other communities with several charter/head boat permit owners are Birmingham, Mobile, Gulf Shores and Dauphin Island. There is a small, directed shark fishery advertised by some of the charter/headboats, but most take shark incidentally to other fish species throughout the year.

6.5.15.1 Orange Beach, Alabama

Orange Beach, located along Wolf Bay in Baldwin County, is primarily a tourist beach destination, but is also home to a substantial charter fishing industry (MRAG Americas, Inc., 2008). Over 50 charter vessels are docked at ten local marinas. HMS charter fishermen primarily target blue marlin, white marlin, sailfish and yellowfin tuna, and several HMS tournaments take place in the area from March-August (MRAG Americas, Inc., 2008). The Consolidated HMS FMP limited the amount of blue and white marlin that could be landed recreationally (250 combined per year), and required billfish tournament participants to use non-offset circle hooks when using natural baits or natural bait/artificial lure combinations. HMS recreational Angling and charter/headboat permits made up approximately 96 percent of all HMS permits issued to addresses in Orange Beach in 2006 (Table 6.73). According to the 2000 census there were 3,784 residents in Port Salerno, almost a 68 percent increase from 1999 (Table 6.38).

Table 6.38 **Demographic Profile of Orange Beach, Alabama**

Demographics	1990	2000
Total population	2,253	3,784
Gender Ratio M/F (Number)	1,153 / 1,100	1,967 / 1,817

Demographics	1990	2000
Age (Percent of total population)		
Under 18 years of age	15	16.6
18 to 64 years of age	63.4	65.2
65 years and over	21.6	18.2
Ethnicity or Race (Number)		
White	99.2	94.8
Black or African American	0.1	0.4
American Indian and Alaskan Native	0.5	0.7
Asian	0.1	0.2
Native Hawaiian and other Pacific Islander	0.0	0.0
Some other race	0.1	2.0
Two or more races	0.0	1.9
Hispanic or Latino (any race)	0.6	2.8
Educational Attainment (Population 25 and over)		
Percent with less than 9th grade	3.1	2.1
Percent high school graduate or higher	84.3	88.4
Percent with a Bachelor's degree or higher	21.2	24.7
Language Spoken at Home (Population 5 years and over)		
Percent who speak a language other than English at home	4.3	6.3
And Percent who speak English less than very well	1.1	4.3
Household income (Median $)	30,445	40,542
Poverty Status (Percent of population with income below poverty line)	8.6	10.6
Percent female headed household	5.9	7.8
Home Ownership (Percent)		
Owner occupied	798	1,305
Renter occupied	228	474
Value Owner-occupied Housing (Median $)	94,700	204,500
Monthly Contract Rent (Median $)	374	577
Employment Status (Population 16 yrs and over)		
Percent in the labor force	56.7	62.7
Percent of civilian labor force unemployed	3.9	3.1
Occupation (Percent in workforce)**		
Management, professional, and related occupations		25.9
Service occupations		18.4
Sales and office occupations		27.6
Farming, fishing, and forestry occupations	3.7	1.2
Construction, extraction, and maintenance occupations		20.4
Production, transportation, and material moving occupations		6.5
Industry (Percent in workforce)**		
Agriculture, forestry, fishing and hunting	2.7	0.6
Manufacturing	8.6	3.8
Percent government workers	10.3	9.4

6.5.16 Mississippi

Between 1990 and 2000, Mississippi's population increased from 2.6 million people to 2.8 million people (Table 6.39). The percentage of individuals 25 years and older with a high school diploma and/or some graduate level degree has increased significantly by almost 24

percent. The percentage of employed individuals has remained the same over the past decade, while the unemployment rate declined slightly and percentage of individuals below the poverty line declined by almost five percent. As with many of the other states, employment in the farming, fishing, forestry, and mining industries has declined, whereas the education, health, and social services industries provided the greatest employment opportunities in 2000. Also, the arts, recreation, lodging, and food services industries have been growing source of employment in Mississippi over the past decade.

Fifteen Mississippi residents held a commercial tuna permit (Table 6.50), six a commercial shark permit (Table 6.52), and one a commercial swordfish permit (Table 6.53) in 2008. Communities involved in the commercial shark fishery are Moss Point, Biloxi, and Pascagoula.

Mississippi's saltwater recreational fisheries attracted approximately 285,000 anglers in 2007 (NMFS, 2008). Out-of-state and in-state anglers from non-coastal counties made up 19 and 12 percent of that total, respectively. In 2008, there were 239 Mississippi residents with an HMS angling permit (Table 6.48). The ASA estimated that marine recreational fishing in Mississippi generated over $63 million in retail sales and 1,116 jobs in 2006(Southwick Associates, 2007). There are 27 charter/headboats with HMS permits home-ported in Mississippi (Table 6.49). Communities involved in the charter and headboat fishery include Biloxi, Gautier, Gulfport, Long Beach, Pascagoula, Pass Christian, and Picayune. Biloxi and Gulfport are each homeport to about one-third of the charter and head boat fleet with HMS permits.

Table 6.39 **Mississippi Demographic Profile.** Source: U.S. Census, 1990 and 2000.

Mississippi	1990	2000
Population:	**2,573,216**	**2,844,658**
Education:		
High school graduates (25 years or older)	64.3%	87.9%
Employment:		
Labor force (16 years and over)	59.7%	59.4%
Unemployment Rate	8.4%	7.4%
Median Household Income	$20,136	$31,330
Individuals below the poverty line*	25.2%	19.9%
Employment in some industry sectors:		
Farming, fishing, forestry & mining	4.6%	3.4%
Construction	6.4%	7.6%
Wholesale trade	3.8%	3.4%
Retail	16.1%	11.8%
Manufacturing	23.4%	18.3%
Education, health & social services	22.5%	20.1%
Arts, recreation, lodging & food services	0.7%	8.3%

*U.S. Census uses data from 1989 and 1999 to estimate these values.

Marine recreational fishing in Mississippi has three modes: shoal water fishing along salt-water marshes, behind barrier islands, and in the sounds; near-shore fishing in relatively shallow water out to some 15 miles from shore, including trips to artificial reefs and oil platforms; and

offshore fishing in deeper water with HMS species as a target. Sharks are, however, taken in all three modes and it is reported that some are retained for personal use by anglers.

6.5.17 Louisiana

The population of Louisiana has not changed by much between the last two census, 4.2 million people in 1990 and 4.5 million people in 2000 (Table 6.40). The percentage of individuals 25 years and older with a high school diploma and/or some graduate level degree has increased by almost seven percent. The percentage of employed individuals has remained the same over the past decade, while the unemployment rate and percentage of individuals below the poverty line have declined. As with many of the other states, employment in the farming, fishing, forestry, and mining industries has declined, whereas the education, health, and social services industries provided the greatest employment opportunities in 2000. Also, the arts, recreation, lodging, and food services industries have been growing source of employment over the past decade.

Louisiana was second only to Alaska in the quantity of its commercial fisheries in the United States in 2003 and fifth in value (NMFS, 2004b). Several of Louisiana's communities were in the top ten major U.S. ports for the greatest quantity of commercial fishery landings: Empire-Venice, Intracoastal, and Cameron. Two communities were ranked in the top ten for the value of the commercial fishery landings: Empire-Venice and Dulac-Chauvin, Louisiana. The menhaden fishery is based in Venice, while shrimping is the principal fishery in Dulac. Both of these fisheries have declined during the past two decades, from the peak year of Louisiana commercial landings in 1984 when 1,931,027,000 pounds of fish were landed in the state.

Table 6.40 **Louisiana Demographic Profile.** Source: U.S. Census, 1990 and 2000.

Louisiana	1990	2000
Population:	**4,219,973**	**4,468,976**
Education:		
High school graduates (25 years or older)	68.0%	74.8%
Employment:		
Labor force (16 years and over)	59.3%	59.4%
Unemployment Rate	9.6%	7.3%
Median Household Income	$21,949	$32,566
Individuals below the poverty line*	23.6%	19.6%
Employment in some industry sectors:		
Farming, fishing, forestry & mining	5.7%	4.2%*
Construction	6.8%	7.9%
Wholesale trade	4.5%	3.5%
Retail	17.5%	11.9%
Manufacturing	12.5%	10.1%
Education, health & social services	25.3%	21.7%
Arts, recreation, lodging & food services	1.1%	9.1%

*U.S. Census uses data from 1989 and 1999 to estimate these values.

Seventy Louisiana residents held a commercial tuna permit in 2008 (Table 6.50). Louisiana was home to the third largest number of shark permit holders in 2008 with 39 permitted vessels (Table 6.52). Sixteen of those permit holders live in New Orleans, Louisiana (Figure 9.4). The largest concentrations of shark vessels were home ported in New Orleans, Houma, Dulac, and Gretna. There are also 37 swordfish permit holders in Louisiana (Table 6.53). To support these HMS fisheries, there are 25 dealers licensed to purchase and sell tunas, sharks, and/or swordfish in Louisiana.

The recreational saltwater fisheries off Louisiana attracted 1,134,000 anglers in 2007, collectively making 4,516,000 fishing trips (NMFS, 2008). Of these anglers, 14 percent were from out-of-state, and 11 percent were from non-coastal counties within Louisiana. There were 663 HMS angling permit holders residing in Louisiana during 2008 (Table 6.48). The ASA estimated that saltwater angling in Louisiana generated over $472 million in retail sales and supported 7,733 jobs in 2006 (Southwick Associates, 2007). The center of fishing activity is off the Mississippi delta, and ports like Boothville-Venice, Port Fourchon and Grand Isle with good road access to the metropolitan areas of Baton Rouge and New Orleans, benefit from their access to good bottom-fishing areas and to "blue-water" areas offshore. Sharks are taken in both the bottom-fishery and in the blue-water fishery.

In 2008, 78 charter/headboats from Louisiana communities had HMS permits (Table 6.49). The majority of websites sampled show that sharks is a component of most trips offered by these vessels. Communities involved in the charter and head boat fishery for sharks include Venice, New Orleans, Chauvin/Dulac, Houma, Baton Rouge, Golden Meadow, Belle Chase, Metaire, Grande Isle, Cut-Off, Chalmette, Lake Charles, and Monroe.

As described in Section 6.3.2.1, the impacts from Hurricanes Katrina and Rita have been devastating to Louisiana and many Gulf Coast communities. NMFS is involved in several studies to determine the full economic and social impacts of these hurricanes.

6.5.17.1 Venice, Louisiana

Venice is another Louisiana community with historical ties to the commercial fishing industry. Venice has a strong focus on commercial fisheries, and cites the large volume of local shrimp landings and numerous residents involved in the fishing industry as evidence. Many residents fish commercially, at least on a part-time basis (Impact Assessment, 2004). In the past 20 years, however, oil and recreational fishing have become increasingly important for the economy of Venice. Wilson *et al*. (1998) note, however, few if any, Venice residents commercially harvest highly migratory species. Boothville-Venice is a "census designated place" and the Bureau of the Census statistics includes both small communities. Similarly, NMFS links Empire and Venice as a single port. Thus, both the port and community are referred to as Venice in this document.

The population of Venice has declined from 2,743 in 1990 to 2,220 in 2000 (Table 6.41). There is a slightly greater percentage of males compared to females in the population. The median age increased from about 26 to 32 between 1990 and 2000. The number of individuals under 20 declined by almost seven percent, while those 45 and older increased by almost seven percent in the last decade. Whites account for a majority of the resident population, but blacks or

African Americans accounted for about 29 percent of the total population in both 1990 and 2000. Despite apparent overall out-migration, numerous families of Vietnamese and Cambodian ancestry have moved to the area over the last decade (Impact Assessment, 2004). While many initially went into the fishing industry, more recently, there has been an apparent shift among many new arrivals toward citrus farming.

In 1990, there were 836 households with an average size of 3.23 people. The number of households decreased to 746 in 2000 and the average household size had dropped to 2.96 people. The number of people employed in farming, fishing, forestry, and mining decreased over the last decade from 16.9 percent to 11 percent. The forestry, fishing, hunting, mining, and agriculture industries continued to make up twenty-two percent area's businesses. Retail trade is the second largest industry in the area (Table 6.41).

In 1990, thirty-six percent of the population of Venice lived below the poverty level, but this figure dropped to 18 percent in 2000 (Table 6.41). In 1990, the median household income was $16,250. Eighteen percent of the households in Venice in 1990 received Social Security, averaging $5,433 per year, and 11 percent of the households received public assistance income, averaging $3,301 per year (NMFS, 1999a). In 2000, the per capita income of Venice residents was $13,123, while the per capita income for the state of Louisiana had increased to $16,912.

Venice is located about 30 miles south of the parish seat Point B la Hache, which is flanked by eroding wetlands and levees that border the Mississippi River. The unemployment rate is low compared to that of Dulac, perhaps because Venice has been the epicenter of oil industry activity in Louisiana. The main job opportunities in Venice are oil, seafood harvest and processing and, increasingly, recreational fishing (Wilson *et al*, 1998). Fishing infrastructure in Venice is extensive. There are several seafood dealers and docks; sale and repair facilities for commercial and recreational boats, bait shops, ice houses, boat launches, and several small marinas and marine suppliers (Impact Assessment, 2004). One of the marinas, the Cypress Cove Marina and Lodge, is a large facility offering boat storage, charter services, guided waterfowl hunting with air boat transportation, hotel, restaurant, and various support services essential for recreational fishing and hunting (Impact Assessment, 2004). The majority of business is sport-recreational. Venice extends into the Gulf of Mexico close to billfish areas that are frequented by recreational fishermen. Recreational fishing increased steadily there during the 1990s (Wilson *et al*., 1998).

Marina owners suggest that commercial fishing activity has declined over the last several years, and that Venice residents seem to be more focused on recreational fishing and oil field support. A local retail seafood dealer suggests that Louisiana's unpredictable weather and foreign shrimp imports are detrimentally affecting the local commercial fleet. Other informants suggest that the commercial fishing fleet is struggling in many ways, but that the involvement of the larger community in alternative industries, such as offshore oil field support and citrus, is keeping the local economy fairly dynamic (Impact Assessment, 2004). In 2006, 17 commercial, 10 recreational, and 26 charter/headboat HMS permits were issued to addresses in Venice (Table 6.74).

Animosity regarding competition for fish extends to the political arena, as commercial and recreational fishermen oppose each other on regulatory issues. Commercial fishery participants claim that law enforcement agents harass them, while recreational fishery participants claim that regulations are not enforced in Venice because there are simply not enough agents to cover the area. Among local commercial fishermen, there is a sense that recreational fishermen have helped create a regulatory environment that is pushing commercial fishermen out of business (Wilson *et al*., 1998).

Most of the commercial vessels landing in Venice are home-ported in New Orleans or other Mississippi River towns further upriver from the Gulf of Mexico. Even Louisiana natives who fish for shark with nets in state waters live in neighboring towns, not in Venice. Shrimp is the largest commercial catch bought and sold in Venice, although this fishery has become less profitable since the late 1980s (Wilson *et al*., 1998). The longline fleet is not well integrated into the Louisiana community of Venice. The longline fishermen are mostly "commuters" from towns and cities further inland, such as New Orleans, and most of them are from a different ethnic background, including many Vietnamese-Americans. Due to the language barrier, many of these fishermen do not participate in public fisheries meetings (NMFS, 1999a).

In 1998, several dealers in Venice drew 40 percent of their business from the longline fleets. Another dealer drew only about 20 percent from longline vessels. A large wholesaler dealt only in longline catches and purchased fish from local dealers. In 1997, 60 percent of this business was tuna, 30 percent shark and ten percent swordfish. The competition between dealers in 1998 was perceived as becoming more aggressive (Wilson *et al*., 1998). Traditional patterns of dealers building relationships by extending services and credit to vessels are giving way to price-based competition to gain access to vessels.

Table 6.41 Demographic Profile of Venice, Louisiana. Source: U.S. Census, 1990 and 2000.

Demographics	1990	2000
Total Population	2,699	2,220
Sex		
Male	51.4%	51.0%
Female	48.6%	49.0%
Age		
Median Age	**26.3**	**31.7**
< 20	42.0%	35.2%
20 - 44	35.1%	35.2%
45 - 64	18.3%	22.0%
> 65	4.6%	7.6%
Race		
White	63.9%	61.9%
Black or African American	31.3%	28.7%
American Indian and Alaska Native	3.3%	3.4%
Asian and Pacific Islander	1.4%	4.0%
Other	0.0%	0.3%
Household		
Total	**836**	**746**
Family households	84.7%	78.3%
Nonfamily households	15.3%	21.7%
Average household size	3.23	2.96
Average family size	3.58	3.38
Housing Occupancy		
Total housing units	960	933
Vacant housing units	14.0%	20.0%
Housing Tenure		
Owner-occupied housing units	87.5%	87.1%
Renter-occupied housing units	12.5%	12.9%

Boothville & Venice, Louisiana	1990	2000
Population:	2,699	2,220
Education:		
High school graduates (25 years or older)	43.5%	48.4%
Employment:		
Labor force (16 years and over)	48.1%	53.0%
Unemployed	3.3%	2.0%
Median Household Income	$ 16,250	$ 33,813
Individuals Below the Poverty Line	36.2%	17.3%
Employment in some industry sectors:		
Managerial/professional	13.8%	18.1%
Technical, Administrative, & Sales	20.7%	19.5%
Construction, Production, Maintenance, & Transportation	12.1%	40.8%
Farming, fishing, forestry, & mining	16.9%	11.0%
Industry		
Forestry, fishing, hunting, mining, and agriculture	22.5%	22.7%
Construction	10.8%	8.1%
Manufacturing	7.1%	4.8%
Wholesale Trade	9.4%	0.0%
Retail Trade	16.0%	13.1%
Education, health & social services	5.6%	14.4%
Arts, recreation, lodging & food services	0.0%	10.4%

While pelagic longline fishermen with large vessels work year-round, pelagic longlining in the area tends to intensify in May and ease up during the wintertime. There are four docks in Venice where longline vessels unload. Docks in Venice employ between five and 15 workers on a seasonal basis for unloading vessels and packing seafood, as well as five to eight people year-round. The docks purchase tuna year round, shrimp from May through December, demersal fish such as drum, catfish, and sheepshead, from January through May, mullet (for the roe) from October through December (NMFS, 1999a).

The bottom longline shark fishery has been impacted by a variety of regulations since 2004. Amendment 1 to the FMP for Atlantic Tunas, Swordfish, and Sharks required release equipment on board shark fishing vessels, as well as the use of non-stainless steel corrodible hooks, and divided the fishing year into three shark seasons instead of two. The Consolidated HMS FMP required vessel owners and operators of longline (bottom and pelagic) fishing vessels to attend a safe handling and release workshop, and that second dorsal and anal fins remain attached through landing. Amendment 2 to the HMS FMP changed the commercial trip limit to 33 non-sandbar large coastal sharks, established a Shark Research Fishery, and requires that all sharks must be landed with their fins naturally attached.

Researchers in 1998 found that alternative employment outside of the fishery was available. For instance, the oil industry hired unskilled labor from this area in recent years, and employed three percent of the civilian labor force in 2000. The agricultural sector also provides employment opportunities during the off-season for fishing, as reported by one Vietnamese-American captain. However, researchers found that this relatively ready supply of alternative

employment threatened the stability of the labor pool for the fishing industry. The Vietnamese-American community has avoided such personnel problems to some extent by relying on tight kinship networks in both fishing and fish buying, although they did report some difficulty in finding captains. The Vietnamese-American community was the only one studied which reported recent investment in new longline vessels. Concerns cited by the fishermen in Venice included the safety of small vessels during winter openings, and the prospect of small vessels having to pay for observers and VMS (Wilson *et al*., 1998).

Other commercial fisheries in the area that could provide alternative employment include pompano in October, mullet from October to January, shrimp from May to December, and oysters from January to May (Wilson *et al*., 1998). Wilson *et al.* concluded that the overall effect of increased restrictions on this fleet would be increased pressure on grouper and yellowfin tuna, increased difficulty in finding and retaining employees, and an acceleration in the rate at which the fleet's vessels and experienced fishermen are moving overseas, especially to Mexico.

Recreational fishermen fish from Venice year-round, but are affected by inclement weather during the winter. The larger vessels can fish for yellowfin tuna year round, in addition to inshore species like redfish, snapper and speckled trout. Bluefin tuna are found too far away (100 miles offshore) and recreational fishermen are prohibited from directing effort on bluefin tuna anyway. They fish for billfish, particularly blue marlin, from May through November. Blacktip shark was once a popular catch, but recreational fishermen say they are now too small to be an enjoyable catch. There is some animosity between recreational and commercial fishermen, which seems to arise from competition for particular species. Charterboats regularly specify sharks as a species available to their clients.

There are only two marinas in Venice that cater to recreational fishermen, although a third parish-run marina offers vessel slips to both recreational and commercial fishermen. One opened in the mid-1980s and offers boat slips, launches, a hoist, a couple of condominiums, baitshop, fuel, and ice. The marina employs 13 people during peak summer months. Most of the marina's business comes from private vessels from New Orleans and border states. Less than one percent of this business consists of charterboats. The other marina opened only a few years ago, offering 120 pre-paid boat slips, a 64-room two-story hotel, condominiums, a dry dock storage facility, fuel, and ice. This second marina employs 12 to 15 people in its newly opened hotel and another 15 to 25 in the marina. Eight charterboats operate from the marina, and there is room for ten more.

Researchers in 1998 reported that the catch-and-release ethic for billfish was strong among recreational fishermen in Venice, but local billfishing tournaments require that trophy fish be brought to the dock and weighed. Sportfishermen prefer to catch and retain tunas, dolphin fish, and wahoo for consumption, although they voiced support for tag and release programs (NMFS, 1999a).

6.5.17.2 Dulac, Louisiana

Dulac is located in the center of Terrebonne Parish, about 15 miles South of Houma, Louisiana. Houma lies at the intersection of the Houma Navigational Canal and the Intercoastal Waterway and serves as the parish seat and a locale of employment opportunities in offshore

equipment building for Dulac residents (Wilson *et al*., 1998). With easy access to Timbalier Bay and the Gulf of Mexico via the Houma Navigational Canal, many Dulac residents are deeply involved in commercial fishing, and many recreational fishers from Houma and distant Lafayette maintain camps in this area (Impact Assessment, 2004). Terrebonne Parish government is a consolidated government so most data are gathered on a parish-wide basis. According to the Terrebonne Parish Planning Department in 1998, the parish did not spend much time tracking the importance of the commercial fishing industry, but anecdotal evidence suggests that it is a long-standing and significant part of the community economy (Wilson et al., 1998). Landings of tunas, swordfish, and sharks indicate that Dulac is among the most important fishing ports in the state. However, many of the fishermen who target HMS are a commuter population; they land fish in Dulac or purchase fish in Dulac, but they live elsewhere. Three dealers purchase fish from longline vessels; two are owned and operated by first-generation Vietnamese immigrants, and the other is run by a New Orleans native whose father operates a large tuna wholesale company in Venice.

In 1990, the population was 3,273 individuals; it declined to 2,458 in 2000 (Table 6.42). Dulac reported the same number of males as females both 1990 and 2000. Individuals under 20 years old make up the greatest proportion of the population in both 1990 and 2000 with individuals between 20 and 44 comprising the second largest age group. Whites comprise the largest proportion of race-49 and 54 percent in 1990 and 2000, respectively. American Indian and Native Alaskans accounted for 48 and 39 percent of the total population in 1990 and 2000, respectively. As noted in Wilson *et al*. (1998), however, this latter category is made up mostly of the Houma Indians, which is a tribe not recognized by the U.S. government. Less than two percent of the population was Asian/Pacific Islander, despite the fact that most of the longline captains who sustain the Dulac commercial industry for tunas, swordfish, and sharks were Vietnamese.

In 1990, Dulac had 922 households with an average size of 3.55 persons per household (Table 6.42). By 2000, the number of households had decreased to 768 and the average size of each household had dropped to 3.20 persons. At the time of the 1990 Census, nearly half of the individuals in Dulac were living below the poverty level, with a median household income of $12,653. In 2000, median household income in Dulac had increased to $22,900, but more than 30 percent of individuals continued to live below poverty level. Per capita income in Dulac in 1990 was $4,946; for the State of Louisiana, average per capita income was $10,635. By 2000, per capita income in Dulac had risen to $8,785, while for the state as a whole, per capita income had risen to $16,912. In 1990, the largest proportion of the Dulac population was employed in the technical, administrative, and sales industries. Whereas in 2000, the largest proportion of the population was employed in construction, production, maintenance, and transportation. Sixteen percent of the population was employed in the farming, fishing, forestry, and mining industries in 2000. Forestry, fishing, hunting, mining, and agriculture were the largest industries in Dulac in both 1990 and 2000.

The combination of a high concentration of minorities in the Dulac population and the high percentage of individuals living below the poverty line highlights the need to consider Executive Order 12898 or Environmental Justice. Under this Executive Order, agencies determine if there will be disproportionately high and adverse environmental effects of its

regulations on the activities of minority and low-income populations. As mentioned in Chapter 4, some of the preferred alternatives may have some negative social and/or economic impacts in general, but most of these could be mitigated and none of the preferred alternatives are likely to have disproportionate impacts on minority and low-income sectors of the Dulac population.

Table 6.42 Demographic Profile of Dulac, Louisiana. Source: U.S. Census, 1990 and 2000.

Demographics	1990	2000
Total Population	3,273	2,458
Sex		
Male	49.3%	50.0%
Female	50.7%	50.0%
Age		
Median Age	**25.5**	**31.8**
≤ 20	41.8%	35.2%
20 – 44	35.2%	32.2%
45 – 64	17.0%	22.8%
≥ 65	6.0%	9.8%
Race		
White	49.4%	54.0%
Black or African American	2.3%	2.5%
American Indian and Alaska Native	48.1%	39.4%
Asian and Pacific Islander	0.0%	0.5%
Other	0.3%	0.5%
Household		
Total Households	**922**	**768**
Family households	85.8%	79.3%
Nonfamily households	14.2%	20.7%
Average household size	3.55	3.20
Average family size	3.93	3.55
Housing Occupancy		
Total housing units	1,182	1,063
Vacant housing units	33.0%	27.8%
Housing Tenure		
Owner-occupied housing units	80.1%	79.3%
Renter-occupied housing units	19.9%	20.7%

Dulac, Louisana	1990	2000
Population:	3,273	2,458
Education:		
High school graduates (25 years or older)	27.1%	39.1%
Employment:		
Labor force (16 years and over)	37.8%	44.9%
Unemployed	8.0%	3.0%
Median Household Income	$ 12,653	$ 22,900
Individuals Below the Poverty Line	49.3%	30.9%
Employment in some industry sectors:		
Managerial/professional	5.7%	12.4%
Technical, Administrative, & Sales	18.1%	17.7%
Construction, Production, Maintenance, & Transportation	17.2%	41.4%
Farming, fishing, forestry, & mining	12.3%	15.9%
Industry		
Forestry, fishing, hunting, mining, and agriculture	23.6%	25.9%
Construction	3.7%	3.1%
Manufacturing	14.0%	10.0%
Wholesale Trade	8.5%	5.7%
Retail Trade	17.7%	10.3%
Education, health & social services	9.7%	8.5%
Arts, recreation, lodging & food services	0.0%	10.7%

Pelagic longline fishermen in Dulac target yellowfin tuna all year. Dulac longline vessels do not target swordfish, and incidentally-caught sharks are often discarded (Wilson *et al*., 1998). The competition between dealers was perceived as becoming more aggressive in 1998. Traditional patterns of dealers building relationships by extending services and credit to vessels were giving way to price-based competition to gain access to vessels. Researchers reported, in 1998, that one dock in Dulac employed three to four people, but laid them all off in 1998. That dealer purchased tuna (50 percent), shark (30 percent), swordfish (20 percent), and dolphin, wahoo, and amber jack (20 percent combined). Another dealer employed six or seven people in 1998, all of whom lived in Dulac. Of this dealer's purchases, 60 percent were tuna, 20 percent were swordfish and 20 percent were divided among other pelagic species like shark, wahoo, amber jack. A third dealer employed six Mexican workers, supplemented by local residents on a seasonal basis (Wilson *et al.*, 1998). The pelagic longline fleet has seen reductions in its catches with the prohibition of the use of live-bait in 2000 causing a reduction in the community's employment rate. In 2005, HMS permit data show only one dealer in Dulac with several HMS dealer permits.

Researchers in 1998 found that alternative employment outside of the fishery was available. For instance, while unemployment in Louisiana fishing communities has been high in

the past, the oil industry hired unskilled labor from this area in recent years. In 1990, 33 residents of Dulac worked in the oil fields and a similar number were employed by the oil industry in 2000. The agricultural sector also provides employment opportunities, as reported by one Vietnamese-American captain, particularly during the off-season for fishing. However, this supply of alternative employment threatened the stability of the labor pool for the fishing industry (Wilson *et al*., 1998). This was true for both captain and crew positions, particularly among the non-Vietnamese-American population. The Vietnamese-American community avoided such personnel problems to some extent by relying on tight kinship networks in both fishing and fish buying. The Vietnamese-Americans, however, did report some difficulty in finding captains. The Vietnamese-American community was the only one studied which reported recent investment in new longline vessels. In Louisiana, the Vietnamese-American may be impacted more intensely by changes in the regulations given the extent of their investment in this fishery (NMFS, 1999a).

Dulac was also a homeport for a limited inshore shark bottom longline fishery in Federal waters in 1998. Blacktip shark was the main catch in this fishery. These fishermen did not fish much during the winter because of the safety concerns associated with small vessels (Wilson *et al*., 1998). Typically, sharks are caught between five and 20 miles from shore. The shark bottom longline fishery has been impacted by a variety of regulations since 2004. Amendment 1 to the FMP for Atlantic Tunas, Swordfish, and Sharks required release equipment on board shark fishing vessels, as well as the use of non-stainless steel corrodible hooks, and divided the fishing year into three shark seasons instead of two. The Consolidated HMS FMP required vessel owners and operators of longline (bottom and pelagic) fishing vessels to attend a safe handling and release workshop, and that second dorsal and anal fins remain attached through landing. Amendment 2 to the HMS FMP changed the commercial trip limit to 33 non-sandbar large coastal sharks, established a Shark Research Fishery, and requires that all sharks must be landed with their fins naturally attached. Almost all vessels that sell in Dulac are owner-operated. Owners are usually their own captains or they hire a close relative to captain their vessel. Good first mates try to acquire their own vessels. At least five bottom longline vessels were built in 1997 and have been added to the fleet in Dulac. Some participants in the bottom longline fishery for sharks also participated in the reef fish fishery. The local fishermen, fishing for shark in state waters, use a gillnet and fish under a special state license because longlining for sharks in state waters is banned. In 2006, approximately 98 percent of HMS permits issued to addresses in Dulac were strictly for commercial use (

Table 6.75).

6.5.17.3 Grand Isle, Louisiana

The community of Grand Isle is located in Jefferson Parish on the only inhabited barrier island in Louisiana (MRAG Americas, Inc., 2008). It was included because of its high number of recreational permits in 2006 (Table 6.76) compared to its low population (Table 6.43), although fishing effort on HMS species in this area is minimal (MRAG Americas, Inc., 2008). Only one recreational marina remained in 2006, as the effects of Hurricane Katrina wiped out several recreational marinas in the area (MRAG Americas, Inc., 2008).

Table 6.43 Demographic Profile of Grand Isle, Louisiana

Factor	1990	2000
Total population	1,455	1,541
Gender Ratio M/F (Number)	738/717	788 / 753
Age (Percent of total population)		
Under 18 years of age	28.4	23.7
18 to 64 years of age	49.4	63.1
65 years and over	7.8	13.2
Ethnicity or Race (Percent)		
White	99.5	96
Black or African American	0.1	0.2
American Indian and Alaskan Native	0.4	2.3
Asian	0.0	0.2
Native Hawaiian and other Pacific Islander	N/A	<0.1
Some other race	0.0	0.4
Two or more races	N/A	0.9
Hispanic or Latino (any race)	0.8	1.5
Educational Attainment (Population 25 and over)		
Percent with less than 9th grade	23.9	17
Percent high school graduate or higher	57	68.3
Percent with a Bachelor's degree or higher	5.6	13.3
Language Spoken at Home (Population 5 years and over)		
Percent who speak a language other than English at home	28.2	18.4
And Percent who speak English less than very well	10.9	3.2
Household income (Median $)	19,454	33,548
Poverty Status (Percent of population with income below poverty line)	25.8	13.2
Percent female headed household	9.7	8.4
Home Ownership (Percent)		
Owner occupied	74	80.1
Renter occupied	26	19.9
Value Owner-occupied Housing (Median $)	42,100	69,500
Monthly Contract Rent (Median $)	249	409
Employment Status (Population 16 yrs and over)		
Percent in the labor force	55.1	57.8
Percent of civilian labor force unemployed	3.9	4.7
Occupation (Percent in workforce)**		
Management, professional, and related occupations	N/A	22
Service occupations	N/A	16.9
Sales and office occupations	N/A	22.5
Farming, fishing, and forestry occupations	5.4	8.8
Construction, extraction, and maintenance occupations	N/A	13.9
Production, transportation, and material moving occupations	N/A	15.9
Industry (Percent in workforce)**		
Agriculture, forestry, fishing, hunting and mining	13.9	15.3
Manufacturing	17.6	8.9
Percent government workers	13.8	14.2

6.5.18 Texas

The population of Texas has increased by nearly 4 million people over the past decade, reaching 20.1 million in 2000 (Table 6.44). The percentage of individuals 25 years and older with a high school diploma and/or a graduate level degree has increased slightly. The percentage of employed individuals, the unemployment rate, and percentage of individuals below the poverty line, have all declined over the past decade. As with many of the other states, employment in the farming, fishing, forestry, and mining industries has declined, whereas the education, health, and social services industries provided the greatest employment opportunities in 2000.

In the state of Texas during 2008, 28 residents possessed a commercial tuna permit (Table 6.50), six a commercial shark permit (Table 6.52), and four a commercial swordfish permit (Table 6.53). The commercial shark fishery generally tends to be a small portion of the commercial fisheries of Texas. There are 20 licensed HMS dealers for tuna, shark, and swordfish in Texas (Table 6.51).

In 2008, there were 724 Texas residents that held an HMS angling permit (Table 6.48). NMFS (2008) did not estimate the number of saltwater anglers or trips taken in 2007, but the ASA estimated that saltwater angling in Texas generated over $981 million in retail sales and supported 18,542 jobs (Southwick Associates, 2007). The number of charter/headboat permit holders from Texas has increased from 129 in 2003 to 172 in 2008 (Table 6.49) with a large concentration of the 2008 permit holders in Port Aransas (Figure 9.8). Most of these take shark as an incidental catch to other near-shore and offshore fish. In addition to Port Aransas, Freeport, Galveston, Houston, Port Isabel, and Port O'Connor, as well as several other communities, are home to HMS angling permit holders.

Table 6.44 **Texas Demographic Profile.** Source: U.S. Census, 1990 and 2000.

Texas	1990	2000
Population:	**16,986,510**	**20,851,820**
Education:		
High school graduates (25 years or older)	72.1%	75.7%
Employment:		
Labor force (16 years and over)	66.0%	63.6%
Unemployment Rate	7.1%	6.1%
Median Household Income	$27,016	$39,927
Individuals below the poverty line*	18.1%	15.4%
Employment in some industry sectors:		
Farming, fishing, forestry & mining	4.9%	2.7%
Construction	6.7%	8.1%
Wholesale trade	4.9%	3.9%
Retail	17.4%	12.0%
Manufacturing	14.4%	11.8%
Education, health & social services	22.5%	19.3%
Arts, recreation, lodging & food services	1.2%	7.3%

*U.S. Census uses data from 1989 and 1999 to estimate these values.

6.5.18.1 Freeport, Texas

Freeport, located approximately 45 miles south of Houston, TX and home to 12,708 residents according to 2000 census data (Table 6.45), has a highly diversified economy that supports both recreational and commercial HMS activities (Impact Assessment, 2005). There were 18 General category HMS commercial fishing permits, 66 HMS recreational angling fishing permits, and 48 HMS charter/headboat permits issued to addresses in Grand Isle in 2006 (Table 6.77). There is a small offshore pelagic commercial fleet in the area, and a much larger recreational charter fleet that targets tuna in the winter and billfish in the summer (MRAG Americas, Inc., 2008).

Table 6.45 Freeport, Texas Demographic Profile. Source MRAG Americas, Inc. (2008).

Factor	1990	2000
Total population	11,389	12,708
Gender Ratio M/F (Number)	5,692/5,697	6,353 / 6,355
Age (Percent of total population)		
Under 18 years of age	34.2	35.7
18 to 64 years of age	56.7	56.2
65 years and over	9.1	8.1
Ethnicity or Race (Percent)		
White	62.2	61.6
Black or African American	15.3	13.4
American Indian and Alaskan Native	0.4	0.6
Asian	0.3	0.4
Native Hawaiian and other Pacific Islander	0.0	<0.1
Some other race	21.9	20.9
Two or more races	0.0	3.2
Hispanic or Latino (any race)	38.6	52
Educational Attainment (Population 25 and over)		
Percent with less than 9th grade	21.3	22.6
Percent high school graduate or higher	58.1	55.1
Percent with a Bachelor's degree or higher	6.4	5.4
Language Spoken at Home (Population 5 years and over)		
Percent who speak a language other than English at home	31.9	45.3
And Percent who speak English less than very well	13.7	23.5
Household income (Median $)	21,483	30,245
Poverty Status (Percent of population with income below poverty line)	24.1	22.3
Percent female headed household	13.4	16.8
Home Ownership (Percent)		
Owner occupied	57	57
Renter occupied	43	43
Value Owner-occupied Housing (Median $)	35,800	35,700
Monthly Contract Rent (Median $)	259	439
Employment Status (Population 16 yrs and over)		
Percent in the labor force	63.6	54.3
Percent of civilian labor force unemployed	9.5	13.7

Factor	1990	2000
Occupation (Percent in workforce)**		
Management, professional, and related occupations	N/A	16.4
Service occupations	N/A	16.8
Sales and office occupations	N/A	24
Farming, fishing, and forestry occupations	2.3	0.1
Construction, extraction, and maintenance occupations	N/A	20.5
Production, transportation, and material moving occupations	N/A	22.2
Industry (Percent in workforce)**		
Agriculture, forestry, fishing, hunting and mining	3.8	0.4
Manufacturing	24.9	17.7
Percent government workers	10.1	10.5

6.5.18.2 Port Aransas, Texas

Port Aransas is a small community of 3,370 residents (Table 6.46) located in Nueces County on the northern tip of Mustang Island, approximately 32 miles southwest of Corpus Christi (MRAG Americas, Inc., 2008; Impact Assessment, 2005). It is a popular destination for sport fishermen and population in the area can expand in the summer months to over 20,000 during the peak tourist season (Impact Assessment, 2005). Recreational fishermen in the area mainly target inshore species, but there are many offshore charters available that target HMS, such as tuna, shark, and billfish (MRAG Americas, Inc., 2008). White and blue marlin, tuna, sailfish and swordfish are also targeted in four tournaments during August (MRAG Americas, Inc., 2008). The Consolidated HMS FMP limited the amount of blue and white marlin that could be landed recreationally (250 combined per year), and required billfish tournament participants to use non-offset circle hooks when using natural baits or natural bait/artificial lure combinations. There were 43 HMS charter/headboat fishing permits and 93 HMS recreational angling fishing permits issued to addresses in Grand Isle in 2006 (Table 6.78). Commercial fishing efforts for HMS generally do not take place in Port Aransas.

Table 6.46 Port Aransas, Texas Demographic Profile. Source: MRAG Americas, Inc. (2008).

Factor	1990	2000
Total population	2,233	3,370
Gender Ratio M/F (Number)	1,146 / 1,087	1,753 / 1,617
Age (Percent of total population)		
Under 18 years of age	21.6	18.9
18 to 64 years of age	64.5	65.4
65 years and over	13.9	15.7
Ethnicity or Race (Percent)		
White	96.1	93.9
Black or African American	0.2	0.4
American Indian and Alaskan Native	0.4	1.2
Asian	1.3	0.9
Native Hawaiian and other Pacific Islander	N/A	<0.1
Some other race	1.9	2.2
Two or more races	N/A	1.4
Hispanic or Latino (any race)	6.2	6.1
Educational Attainment (Population 25 and over)		
Percent with less than 9th grade	3.7	2.5
Percent high school graduate or higher	81.2	87.4
Percent with a Bachelor's degree or higher	23.9	27.9
Language Spoken at Home (Population 5 years and over)		
Percent who speak a language other than English at home	8.3	9
And Percent who speak English less than very well	3.1	2.2
Household income (Median $)	23,396	39,432
Poverty Status (Percent of population with income below poverty line)	15.8	11.3
Percent female headed household	8.1	7.3
Home Ownership (Percent)		
Owner occupied	59	69.3
Renter occupied	41	30.7
Value Owner-occupied Housing (Median $)	67,100	110,500
Monthly Contract Rent (Median $)	317	571
Employment Status (Population 16 yrs and over)		
Percent in the labor force	65.6	61.5
Percent of civilian labor force unemployed	4.6	4.1
Occupation (Percent in workforce)**		
Management, professional, and related occupations	N/A	36.4
Service occupations	N/A	21
Sales and office occupations	N/A	20.3
Farming, fishing, and forestry occupations	6.3	2.8
Construction, extraction, and maintenance occupations	N/A	11.8
Production, transportation, and material moving occupations	N/A	7.7
Industry (Percent in workforce)**		
Agriculture, forestry, fishing, hunting and mining	7.3	3.6
Manufacturing	5	1
Percent government workers	20.6	21.4

6.5.19 Puerto Rico

The population in Puerto Rico increased by nearly 300,000 people in the last decade (Table 6.47). The percentage of individuals 25 years and older with a high school diploma and/or a graduate level degree has increased by over ten percent in the last decade. The percentage of employed individuals, unemployment rate, and percentage of individuals below the poverty line all declined through the nineties. Education, health, and social services provide the greatest sources of employment. The farming, fishing, forestry, and mining employed less than two percent of the population in 2000.

While Puerto Rico was home to 103 commercial tuna permit holders in 2008, there were no permit holders for sharks or swordfish (Table 6.50; Table 6.52, and Table 6.53). A large number of the commercial tuna permit holders are in Aguadilla and another large group is located in Rincon. There are six HMS dealer permit holders in Puerto Rico; four for tunas in Aguadilla; one for tunas in Aquada; and one for sharks and swordfish in San Juan (Table 6.51).

Table 6.47 **Puerto Rico Demographic Profile.** Source: U.S. Bureau of the Census, 1990 and 2000.

Puerto Rico	**1990**	**2000**
Population:	**3,522,037**	**3,808,610**
Education:		
High school graduates (25 years or older)	49.7%	60.0%
Employment:		
Labor force (16 years and over)	47.3%	40.7%
Unemployment Rate	20.4%	19.2%
Median Household Income		$ 14,412
Individuals below the poverty line*	58.9%	48.2%
Employment in some industry sectors:		
Farming, fishing, forestry & mining		1.7%
Construction		
Wholesale trade		4.4%
Retail		11.7%
Manufacturing		13.5%
Education, health & social services		19.3%
Arts, recreation, lodging & food services		6.5%

*U.S. Census uses data from 1989 and 1999 to estimate these values.

The recreational saltwater fisheries in Puerto Rico attracted 185,000 anglers in 2007, collectively making 1,080,000 fishing trips (NMFS, 2008). Of these anglers, 16 percent of the anglers were not from Puerto Rico. In 2008, 909 HMS angling permit holders were residing in Puerto Rico (Table 6.48). The following communities have the largest concentrations of HMS anglers: San Juan, Guaynabo, Arecibo, Mayaguez, Vega Baja, Ponce, Carolina, as well as several other communities with smaller concentrations of permit holders. Twenty-two vessels from Puerto Rico held an HMS charter/headboat permit in 2008 (Table 6.49), specifically several were located in San Juan and Rincon. Due to the number of HMS permits issued to individuals located in San Juan, a community profile should be developed in the future.

Generally, the fishing industry of Puerto Rico is made up of private clubs for the upper and middle class and small, and poor artisanal fishing communities. There are approximately 2,500 licensed artisanal fishermen who are required to report their landings to the Office of Natural Resources' Fisheries Laboratory. However, interviews and informal conversation with artisanal fishermen suggest that the reported and actual landings differ widely (Wilson *et al.*, 1998). At the local level, there are artisanal fishermen's associations (villages) and recreational fishermen's membership clubs.

The fishing industry is not a prominent economic activity in Puerto Rico and variations in fishing incomes have little impact on the island's economy. Most of the recreational fishing activity centers around the capital city of San Juan. Artisanal fishing communities are found throughout the island. These communities are extremely poor and will likely be the communities most affected by changes in regulations. The extremely deep inshore waters off these areas make billfish and other highly migratory species accessible to the artisanal fishery.

6.5.19.1 Arecibo, Puerto Rico

The Arecibo population in 1990 was 93,385 people; approximately 99 percent of those people were born in Puerto Rico or in the United States (NMFS, 1999b). The majority of the population is classified as Hispanic or Latino. Naturalized citizens and non-citizens each make up less than one percent of the population of Arecibo, but their ethnicity is unknown. According to interviews with local government officials, the vast majority of immigrants in Arecibo are from the Dominican Republic; however, there is no way to confirm that information due to waves of illegal immigration. In 2000, the U.S. Census reported the Arecibo population grew by less than seven percent (101,131 people).

The number of households in Arecibo grew by almost ten thousand throughout the last decade, from 24,333 to 34,245 households. In 1990, the median household income is $7,520. By 2000, the median household income increased by $5,000 to $12,520. In the early nineties, thirty-two percent of the households are receiving some kind of public assistance; the average public assistance income is $1,939. The number of individuals below the poverty line did decrease over the past decade, from 73 percent to almost 51 percent. The unemployment rate also declined from 23 percent to eight percent in 2000. Of the population age 16 and older, 43.9 percent are in the civilian labor force in 1990, whereas this number declined to 38 percent in 2000. In 1990, the highest employing industries for men and women were manufacturing and services. In 2000, the construction, production, maintenance, and transportation industries supplied the greatest number of employment opportunities.

Recreational fishing is the predominant mode of participation in the HMS fisheries in Arecibo, Puerto Rico. Fifty-one Arecibo residents hold an HMS angling permit, but none of 28 charter/headboat permit holders in Puerto Rico are from Arecibo. Two Arecibo residents hold a commercial tuna permit. Despite the lack of commercial shark and swordfish permit holders in Puerto Rico, there is one HMS permitted dealer for sharks and swordfish in San Juan, one for tunas in Aquada, and four for tunas in Aquadilla.

The Arecibo Yacht Club is a private club created by and for the local recreational fishermen. The members of the club formed the Association of Sport Fishing of Arecibo and its facilities. Members of the Arecibo Yacht Club organize marlin and inshore fishing tournaments. According to local government officials, the municipality does not get any economic benefit from those tournaments because all the profits go directly to the Club, which is a private business. The tournament does not affect the economy of the region even indirectly by promoting related business because the participants are mainly the same local fishermen. The marlin tournament is held in May. However, according to the commodore of the club, the tournaments are not always lucrative, even for the club (Wilson *et al*., 1998). The club has approximately 253 members, and among them, 82 are boat owners. The size of the vessels fluctuates between 18 and 50 feet. The larger boats, measuring 33 feet or more, have a crew consisting of a captain and a mate. The crew is in charge of the maintenance of the boats while in the marina and directing the fishing journeys. The facilities of the club and marina were constructed with private funds and are a very exclusive place for the middle-upper class of Arecibo. Although, the commodore reports that in the club's facilities there is an area available for the boats of the artisanal fishermen.

Among the members are part-time artisanal fishermen, but most of them are recreational fishermen. However, usually they come out on the weekends and use the money they obtain from the catch to pay for the trip expenses. The artisanal fishermen catch mostly red snapper and grouper by bottom fishing. This kind of fishing is done with a line that goes to the bottom of the sea, mostly in rocky areas. The rest of the fishermen mainly target dolphin and tuna. To catch these species, they use a hand line, or a single cord with one hook. From May through October, marlin, white needle, and blue needle are typically found seven to ten miles from the shore.

6.6 Future Assessments

In the 2008 assessment, MRAG Americas, Inc. developed a list of HMS communities using permit and census data similar to a study by Sepez *et al.* (2005). This assessment yielded 14 new community profiles, and is a method that is reproducible and can be applied in the future to identify new communities that have emerging involvement in HMS fisheries, as well as monitor changes in HMS communities that have been profiled in the past. Along with evaulating the number of HMS permits in relation to population to determine areas of concern NMFS should continue to consult with the HMS permit databases, landings information, and HMS AP members to determine the most appropriate community profiles for HMS-related fisheries.

Table 6.48 Number and Percentage of HMS Angling Permits by State and Country as of May 2008.

Angling Permits		
State	Total	Percentage
Florida	4276	15.9%
Massachusetts	3552	13.2%
New Jersey	3200	11.9%
North Carolina	2148	8.0%
New York	2025	7.5%
Pennsylvania	1510	5.6%
Maryland	1455	5.4%
Virginia	1285	4.8%
South Carolina	955	3.5%
Puerto Rico	909	3.4%
Connecticut	857	3.2%
Delaware	737	2.7%
Texas	724	2.7%
Louisiana	663	2.5%
Rhode Island	507	1.9%
Alabama	430	1.6%
New Hampshire	426	1.6%
Maine	419	1.6%
Georgia	244	0.9%
Mississippi	239	0.9%
Tennessee	44	0.2%
Virgin Islands	44	0.2%
Vermont	38	0.1%
Ohio	33	0.1%
Illinois	24	0.1%
Michigan	23	0.1%
West Virginia	16	0.1%

State	Total	Percentage
Missouri	14	0.1%
Washington DC	12	0.0%
Indiana	11	0.0%
Wisconsin	11	0.0%
Arkansas	9	0.0%
California	9	0.0%
Minnesota	9	0.0%
Oklahoma	8	0.0%
British Virgin Islands	7	0.0%
Colorado	7	0.0%
Arizona	6	0.0%
Kansas	5	0.0%
Kentucky	5	0.0%
Canada	4	0.0%
Iowa	4	0.0%
Nebraska	3	0.0%
Nevada	4	0.0%
South Dakota	4	0.0%
North Dakota	3	0.0%
New Mexico	3	0.0%
Washington	3	0.0%
Wyoming	3	0.0%
Oregon	2	0.0%
Cayman Islands	1	0.0%
Guam	1	0.0%
Hawaii	1	0.0%
Montana	1	0.0%
Total	26933	100%

Table 6.49 Number and Percentage of HMS Charter/Headboat Permits by State and Country as of May 2008.

Charter/Headboat Permits		
State	Permits	Percentage
Florida	699	16.3%
Massachusetts	649	15.1%
New Jersey	553	12.9%
North Carolina	431	10.0%
New York	369	8.6%
Texas	172	4.0%
Maryland	162	3.8%
South Carolina	159	3.7%
Virginia	148	3.4%
Rhode Island	142	3.3%
Pennsylvania	134	3.1%
Deleware	121	2.8%
Connecticut	114	2.7%
Maine	88	2.0%
Louisiana	78	1.8%
New Hampshire	67	1.6%
Alabama	66	1.5%
Georgia	35	0.8%
Mississippi	27	0.6%
Puerto Rico	22	0.5%
Virgin Islands	21	0.5%
Michigan	7	0.2%
Minnesota	6	0.1%
Tennessee	5	0.1%
Illinois	3	0.1%
Vermont	3	0.1%
Hawaii	2	0.0%
Kentucky	2	0.0%
Missouri	2	0.0%
Ohio	2	0.0%
West Virginia	2	0.0%
California	1	0.0%
Colorado	1	0.0%
Washington DC	1	0.0%
Indiana	1	0.0%
Nevada	1	0.0%
Oklahoma	1	0.0%
Total	4297	100.0%

Table 6.50 Number and Percentage of Commercial Tuna Permits by State and Country in 2008.

Commercial Tuna Permits		
State	Permits	Percentage
Massachusetts	1248	28.9
North Carolina	645	15.0
Maine	439	10.2
New Jersey	292	6.8
Florida	264	6.1
New York	261	6.1
New Hampshire	231	5.4
Rhode Island	183	4.2
Connecticut	140	3.2
Puerto Rico	103	2.4
Virginia	85	2.0
South Carolina	71	1.6
Louisiana	70	1.6
Pennsylvania	60	1.4
Maryland	46	1.1
Deleware	42	1.0
Texas	28	0.6
Virgin Islands	22	0.5
Alabama	20	0.5
Georgia	19	0.4
Mississippi	15	0.3
Vermont	8	0.2
West Virginia	4	0.1
Colorado	3	0.1
Missouri	2	0.0
Oklahoma	2	0.0
Alaska	1	0.0
Arkansas	1	0.0
California	1	0.0
Minnesota	1	0.0
Nevada	1	0.0
Oregon	1	0.0
Tennnesse	1	0.0
Washington	1	0.0
Total	4311	100

Table 6.51 Number and Percentage of HMS Shark, Swordfish, and Tuna Dealers by State and Country as of August 2008.

HMS Shark, Swordfish and Tuna Permits		
State	Permits	Percentage
FL	134	19.3%
MA	114	16.4%
NY	82	11.8%
NJ	75	10.8%
NC	58	8.4%
RI	47	6.8%
SC	32	4.6%
VA	27	3.9%
LA	23	3.3%
ME	19	2.7%
CA	17	2.4%

HMS Shark, Swordfish and Tuna Permits		
State	Permits	Percentage
MD	13	1.9%
TX	12	1.7%
HI	8	1.2%
PR	8	1.2%
NH	5	0.7%
AL	4	0.6%
VI	4	0.6%
CT	3	0.4%
GA	3	0.4%
DE	2	0.3%
PA	2	0.3%
WA	2	0.3%
Total	694	100.0%

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Table 6.52 Number and Percentage of Directed and Incidental Shark Permit Holders by State as of February 2008.

Shark Permits		
State	# of Permits	Percentage
Florida	277	55.5%
New Jersey	54	10.8%
Louisiana	39	7.8%
North Carolina	30	6.0%
South Carolina	20	4.0%
Massachusetts	17	3.4%
New York	15	3.0%
Rhode Island	7	1.4%
Maryland	6	1.2%

State	# of Permits	Percentage
Mississippi	6	1.2%
Texas	6	1.2%
Virginia	5	1.0%
Alabama	5	1.0%
Maine	3	0.6%
Connecticut	3	0.6%
Georgia	3	0.6%
New Hampshire	2	0.4%
Delaware	1	0.2%
Total	499	100.0%

Table 6.53 Number and Percentage of Swordfish Permit Holders by State as of February 2008.

Swordfish Permits		
State	# of Permits	Percentage
Florida	144	42.6%
New Jersey	50	14.8%
Louisiana	37	10.9%
Massachusetts	25	7.4%
Rhode Island	18	5.3%
New York	17	5.0%
North Carolina	16	4.7%
Maryland	6	1.8%
South Carolina	6	1.8%
Virginia	4	1.2%
Texas	4	1.2%
Maine	3	0.9%
Connecticut	3	0.9%
Alabama	2	0.6%
New Hampshire	1	0.3%
Delaware	1	0.3%
Mississippi	1	0.3%
Total	338	100.0%

Table 6.54 2006 Commercial HMS landings (lb) by community according to MRAG Americas, Inc. (2008).

Community	Swordfish	Bigeye Tuna	Bluefin Tuna	Yellowfin Tuna	Albacore Tuna	Skipjack Tuna	Blue Shark	Hammerhead	Thresher	Silky	Spinner	Tiger	Sandbar	Shortfin mako
Wakefield	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
New Bedford	100,449	17,436	2,225	54,544	7,620	0	0	587	0	44	0	580	42	6,594
Gloucester	25,501	6,547	1,483	1,844	1,889	0	0	0	0	0	0	0	0	4,710
Montauk	848	1,172	0	1,526	96	0	0	0	0	0	0	0	0	157
Barnegat Light	146,859	68,297	9,640	203,427	31,666	0	0	0	0	153	0	0	166	13,660
Brielle	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cape May	28,044	11,302	1,483	116,843	6,500	0	465	587	0	0	0	773	6,644	3,454
Ocean City	47,540	25,499	3,337	100,569	4,643	17	58	0	0	3,797	0	0	21,885	14,838
Atlantic Beach	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wanchese	231,768	266,710	14,460	1,004,736	4,899	370	2,035	17,202	3,335	175	5,856	725	74,209	44,513
Hatteras Village	0	0	0	0	0	0	0	168	0	0	0	145	11,503	0
Morehead City	4,026	345	0	127	224	0	0	0	0	0	0	0	0	79
Beaufort	176,952	3,928	1,854	30,578	640	0	0	2,517	0	502	48	0	8,139	4,161
Islamorada	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Port Salerno	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Madeira Beach	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Apalachicola	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Destin	2,755	551	0	4,132	0	0	0	1,762	0	0	1,104	1,208	12,043	79
Orange Beach	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dulac	274,010	45,416	23,359	1,090,811	7,204	470	116	0	0	0	0	0	0	1,021
Venice	2,543	689	0	58,930	0	0	0	0	0	0	0	0	0	236
Grand Isle	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Port Aransas	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Freeport	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 6.55 **HMS Permits for Gloucester, Massachusetts, 2006** (MRAG Americas, Inc., 2008)

Type of Permit	Frequency	Percent of total
HMS Angling	145	3.3%
Shark Directed	2	0.9%
Shark Incidental	2	0.7%
Swordfish Directed	3	1.6%
Swordfish Incidental	2	0.7%
HMS General	145	3.2%
HMS Charter/Headboat	32	0.8%
HMS Longline	4	1.7%
Tuna Dealer	12	2.9%

Table 6.56 **HMS Permits for New Bedford, Massachusetts, 2006** (MRAG Americas, Inc., 2008)

Type of Permit	Frequency	Percent of total
HMS Angling	36	0.8%
Shark Directed	0	-
Shark Incidental	3	1.0%
Swordfish Directed	3	1.6%
Swordfish Incidental	3	1.0%
HMS General	36	0.8%
HMS Charter/Headboat	1	0.02%
HMS Longline	3	1.3%
Tuna Dealer	18	4.4%

Table 6.57 **HMS Permits for Wakefield, Rhode Island, 2006** (MRAG Americas, Inc., 2008)

Type of Permit	Frequency	Percent of total
HMS Angling	44	0.2%
Shark Directed	0	-
Shark Incidental	0	-
Swordfish Directed	0	-
Swordfish Incidental	0	-
HMS General	15	0.3%
HMS Charter/Headboat	14	0.3%
HMS Longline	0	-
Tuna Dealer	9	2.2%

Table 6.58 **HMS Permits for Montauk, New York, 2006** (MRAG Americas, Inc., 2008)

Type of Permit	Frequency	Percent of total
HMS Angling	187	0.7%
Shark Directed	0	-
Shark Incidental	5	1.7%
Swordfish Directed	3	1.6%
Swordfish Incidental	5	1.7%
HMS General	65	1.5%
HMS Charter/Headboat	78	1.8%
HMS Longline	3	1.3%
Tuna Dealer	5	1.2%

Table 6.59 **HMS Permits for Barnegat Light, New Jersey, 2006** (MRAG Americas, Inc., 2008)

Type of Permit	Frequency	Percent of total
HMS Angling	11	0.2%
Shark Directed	17	7.4%
Shark Incidental	5	1.7%
Swordfish Directed	14	7.7%
Swordfish Incidental	5	1.7%
HMS General	11	0.2%
HMS Charter/Headboat	9	0.2%
HMS Longline	15	6.3%
Tuna Dealer	4	0.9%

Table 6.60 **HMS Permits for Brielle, New Jersey, 2006** (MRAG Americas, Inc., 2008)

Type of Permit	Frequency	Percent of total
HMS Angling	11	0.2%
Shark Directed	0	-
Shark Incidental	1	0.3%
Swordfish Directed	0	-
Swordfish Incidental	1	0.3%
HMS General	11	0.2%
HMS Charter/Headboat	37	0.8%
HMS Longline	0	-
Tuna Dealer	1	0.1%

Table 6.61 **HMS Permits for Cape May, New Jersey, 2006** (MRAG Americas, Inc., 2008)

Type of Permit	Frequency	Percent of total
HMS Angling	538	2.1%
Shark Directed	2	0.9%
Shark Incidental	8	2.7%
Swordfish Directed	2	1.1%
Swordfish Incidental	8	2.7%
HMS General	30	0.7%
HMS Charter/Headboat	88	2.1%
HMS Longline	4	1.7%
Tuna Dealer	4	0.9%

Table 6.62 **HMS Permits for Ocean City, Maryland, 2006** (MRAG Americas, Inc., 2008)

Type of Permit	Frequency	Percent of total
HMS Angling	667	2.5%
Shark Directed	4	1.7%
Shark Incidental	2	0.7%
Swordfish Directed	6	3.5%
Swordfish Incidental	2	0.7%
HMS General	31	0.7%
HMS Charter/Headboat	110	2.6%
HMS Longline	4	1.7%
Tuna Dealer	2	0.4%

Table 6.63 **HMS Permits for Atlantic Beach, North Carolina, 2006** (MRAG Americas, Inc., 2008)

Type of Permit	Frequency	Percent of total
HMS Angling	145	0.5%
Shark Directed	0	-
Shark Incidental	0	-
Swordfish Directed	0	-
Swordfish Incidental	0	-
HMS General	48	1.1%
HMS Charter/Headboat	37	0.8%
HMS Longline	0	-
Tuna Dealer	1	0.2%

Table 6.64 **HMS Permits for Beaufort, North Carolina, 2006** (MRAG Americas, Inc., 2008)

Type of Permit	Frequency	Percent of total
HMS Angling	154	0.6%
Shark Directed	0	1.5%
Shark Incidental	3	-
Swordfish Directed	0	-
Swordfish Incidental	0	-
HMS General	31	0.7%
HMS Charter/Headboat	22	0.5%
HMS Longline	0	-
Tuna Dealer	6	1.5%

Table 6.65 **HMS Permits for Hatteras Village, North Carolina, 2006** (MRAG Americas, Inc., 2008)

Type of Permit	Frequency	Percent of total
HMS Angling	16	0.3%
Shark Directed	3	1.3%
Shark Incidental	2	0.7%
Swordfish Directed	0	-
Swordfish Incidental	2	0.7%
HMS General	16	0.4%
HMS Charter/Headboat	57	1.3%
HMS Longline	1	0.4%
Tuna Dealer	1	0.2%

Table 6.66 **HMS Permits for Morehead City, North Carolina, 2006** (MRAG Americas, Inc., 2008)

Type of Permit	Frequency	Percent of total
HMS Angling	294	1.1%
Shark Directed	0	-
Shark Incidental	1	0.3%
Swordfish Directed	0	-
Swordfish Incidental	1	0.3%
HMS General	83	1.8%
HMS Charter/Headboat	49	1.1%
HMS Longline	0	-
Tuna Dealer	3	0.7%

Table 6.67 **HMS Permits for Wanchese, North Carolina, 2006** (MRAG Americas, Inc., 2008)

Type of Permit	Frequency	Percent of total
HMS Angling	32	0.7%
Shark Directed	12	5.2%
Shark Incidental	2	0.7%
Swordfish Directed	8	4.4%
Swordfish Incidental	2	0.7%
HMS General	32	0.7%
HMS Charter/Headboat	17	0.4%
HMS Longline	11	4.7%
Tuna Dealer	5	1.2%

Table 6.68 **HMS Permits for Apalachicola, FL, 2006** (MRAG Americas, Inc., 2008)

Type of Permit	Frequency	Percent of total
HMS Angling	5	0.02%
Shark Directed	0	-
Shark Incidental	1	0.3%
Swordfish Directed	0	-
Swordfish Incidental	1	0.3%
HMS General	1	-
HMS Charter/Headboat	1	0.02%
HMS Longline	0	-
Tuna Dealer	1	0.2%

Table 6.69 **HMS Permits for Destin, Florida, 2006** (MRAG Americas, Inc., 2008)

Type of Permit	Frequency	Percent of total
HMS Angling	116	0.4%
Shark Directed	7	3.0%
Shark Incidental	6	2.0%
Swordfish Directed	5	2.7%
Swordfish Incidental	6	2.0%
HMS General	7	0.2%
HMS Charter/Headboat	48	1.1%
HMS Longline	7	3.0%
Tuna Dealer	1	0.2%

Table 6.70 **HMS Permits for Islamorada, Florida, 2006** (MRAG Americas, Inc., 2008)

Type of Permit	Frequency	Percent of total
HMS Angling	3	0.06%
Shark Directed	1	0.4%
Shark Incidental	0	-
Swordfish Directed	0	-
Swordfish Incidental	1	0.3%
HMS General	3	0.1%
HMS Charter/Headboat	45	1.0%
HMS Longline	0	-
Tuna Dealer	0	-

Table 6.71 **HMS Permits for Madeira Beach, Florida, 2006** (MRAG Americas, Inc., 2008)

Type of Permit	Frequency	Percent of total
HMS Angling	0	-
Shark Directed	17	7.0%
Shark Incidental	4	1.3%
Swordfish Directed	5	2.7%
Swordfish Incidental	4	1.3%
HMS General	0	-
HMS Charter/Headboat	1	0.02%
HMS Longline	8	3.4%
Tuna Dealer	0	-

Table 6.72 **HMS Permits for Port Salerno, Florida, 2006** (MRAG Americas, Inc., 2008)

Type of Permit	Frequency	Percent of total
HMS Angling	5	.02%
Shark Directed	13	5.6%
Shark Incidental	4	1.3%
Swordfish Directed	0	-
Swordfish Incidental	4	1.3%
HMS General	3	0.1%
HMS Charter/Headboat	0	-
HMS Longline	0	-
Tuna Dealer	0	-

Table 6.73 **HMS Permits for Orange Beach, Alabama, 2006** (MRAG Americas, Inc., 2008)

Type of Permit	Frequency	Percent of total
HMS Angling	205	0.8%
Shark Directed	0	-
Shark Incidental	1	0.3%
Swordfish Directed	0	-
Swordfish Incidental	1	0.3%
HMS General	8	0.2%
HMS Charter/Headboat	49	1.2%
HMS Longline	1	0.4%
Tuna Dealer	0	-

Table 6.74 **HMS Permits for Venice, Louisiana, 2006** (MRAG Americas, Inc., 2008)

Type of Permit	Frequency	Percent of total
HMS Angling	10	0.2%
Shark Directed	0	-
Shark Incidental	2	0.7%
Swordfish Directed	1	0.5%
Swordfish Incidental	2	0.7%
HMS General	10	0.2%
HMS Charter/Headboat	26	0.6%
HMS Longline	3	1.3%
Tuna Dealer	1	0.2%

Table 6.75 **HMS Permits for Dulac, Louisiana, 2006** (MRAG Americas, Inc., 2008)

Type of Permit	Frequency	Percent of total
HMS Angling	0	-
Shark Directed	1	0.4%
Shark Incidental	10	3.4%
Swordfish Directed	10	5.5%
Swordfish Incidental	10	3.4%
HMS General	0	-
HMS Charter/Headboat	1	0.02%
HMS Longline	22	9.3
Tuna Dealer	2	0.5%

Table 6.76 **HMS Permits for Grand Isle, Louisiana, 2006** (MRAG Americas, Inc., 2008)

Type of Permit	Frequency	Percent of total
HMS Angling	55	0.2%
Shark Directed	0	-
Shark Incidental	0	-
Swordfish Directed	0	-
Swordfish Incidental	0	-
HMS General	4	0.1%
HMS Charter/Headboat	6	0.1%
HMS Longline	0	-
Tuna Dealer	0	-

Table 6.77 **HMS Permits for Freeport, Texas, 2006** (MRAG Americas, Inc., 2008)

Type of Permit	Frequency	Percent of total
HMS Angling	66	1.5%
Shark Directed	0	-
Shark Incidental	0	-
Swordfish Directed	0	-
Swordfish Incidental	0	-
HMS General	18	0.4%
HMS Charter/Headboat	48	1.1%
HMS Longline	0	-
Tuna Dealer	5	1.2%

Table 6.78 **HMS Permits for Port Aransas, Texas, 2006** (MRAG Americas, Inc., 2008)

Type of Permit	Frequency	Percent of total
HMS Angling	93	0.3%
Shark Directed	0	-
Shark Incidental	0	-
Swordfish Directed	0	-
Swordfish Incidental	0	-
HMS General	3	0.1%
HMS Charter/Headboat	43	1.0%
HMS Longline	0	-
Tuna Dealer	0	-

Chapter 6 References

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7.0 INTERNATIONAL TRADE AND FISH PROCESSING

Several regional fishery management organizations (RFMOs), including ICCAT, have taken steps to improve the collection of international trade data to further international conservation policy for the management of HMS. 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 RFMO management measures. United States participation in 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 Atlantic HMS species.

7.1 Overview of International Trade for Atlantic HMS

7.1.1 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 marine fish products online for the public at http://www.st.nmfs.gov/st1/trade/index.html. Some species are combined into groups (*e.g.*, sharks), 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. For example, the HTS code for Atlantic, Pacific, and even Indian Ocean bigeye tuna is the same.

Trade data for Atlantic HMS are more useful as a conservation tool when they include more detailed information, such as 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 more detailed information while monitoring international trade of bluefin tuna, swordfish, southern bluefin tuna, and frozen bigeye tuna. Under NMFS regulations at 50 CFR 300 supbart M, NMFS requires traders of these species and shark fins to obtain the HMS International Trade Permit. 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 are described in further detail below.

7.1.2 Bluefin Tuna Catch Document

For over a decade, the trade of bluefin tuna was tracked internationally under ICCAT's Bluefin Tuna Statistical Document (BSD) program (Recommendation 92-01). In 2007, ICCAT adopted a more rigorous bluefin tuna catch document (BCD) program (Recommendation 07-10) which tracks bluefin from capture, through farming operations, landing, and trade. NMFS implemented the program in July 2008 (73 CFR 31380, June 2, 2008). The intent of the program is to support the ICCAT Rebuilding Program by accounting for all bluefin tuna harvested and available in the marketplace, or held in cages.

A BCD is required to be generated at the harvest of all bluefin tuna. In the United States, bluefin tuna are tagged when landed, and landing data associated with the tag number is transmitted to NMFS. The tag stays on the fish until it is cut up into portions to be consumed, and the associated landings data can be retrieved at any time by referencing the tag number. If a bluefin is exported, then a BCD document is generated to accompany the export, and remains with the fish until it is consumed abroad. Exporters must also be permitted under the HMS International Trade Program.

BCDs are required to accompany the import of any bluefin tuna into the United States. Importers are first required to obtain an HMS International Trade Permit from NMFS, and must report any trade of bluefin tuna or other covered species. NMFS routinely consults import data generated by Customs and Border Protection (CBP) to check against BCD data and ensure that importers are abiding by BCD and other NMFS regulations implementing ICCAT requirements.

7.1.3 Swordfish Statistical Document

In 2005, the ICCAT swordfish statistical document (SD) program was implemented by the United States to track trade of Atlantic swordfish and assist in implementing the ICCAT minimum size of 14.9 kg dw. The swordfish SD program is based on a 2001 ICCAT recommendation (01-22), and ensures that all imported swordfish are greater than the minimum size of 14.9 kg (33 lb) dw, and identifies the flag of the harvesting vessel and ocean area of origin. Similar to the BCD program, CBP data on swordfish imports is also used to obtain missing data and identify dealers that are not following the required reporting procedures. Previously during the time period from 1999-2005, a certificate of eligibility was required for swordfish imports into the United States, which ensured that all imports were greater than the required minimum size.

7.1.4 Bigeye Tuna Statistical Document

Like the two previous trade monitoring programs discussed above, the bigeye tuna SD program is used to track movement of internationally traded bigeye tuna to its final destination. ICCAT recommended the implementation of a bigeye tuna SD program in 2001 (recommendation 01-21). The initial program was implemented in 2005 along with the swordfish SD, and applies only to frozen bigeye tuna. It may be expanded to cover fresh product in the future. Other RFMOs, including the Inter-American Tropical Tuna Commission and the Indian Ocean Tuna Commission, have also adopted frozen bigeye SD programs.

7.1.5 Dolphin-safe Tuna Imports

For every shipment of frozen or processed tuna imported into the United States, a completed Fisheries Certificate of Origin (NOAA Form 370) is required to be submitted to the U.S. Customs and Border Protection at the time of importation. In some cases, an additional certification signed by a representative of a nation participating in the International Dolphin Conservation Program or a Captain's Statement is required to accompany the NOAA Form 370. Since the late 1970s, NOAA Form 370 has been used to document imports of fresh tuna and other species of tuna for the purpose of protecting dolphins in the Eastern Tropical Pacific Ocean. Form 370 is filed with other documents necessary for entry of yellowfin tuna into the United States. The form is *not* required for fresh tuna, animal food, or canned petfood made from tuna. Further information is available on the website http://dolphinsafe.gov/.

7.1.6 Billfish Certificate of Eligibility

The Billfish Certificate of Eligibility is used to ensure that any billfish being imported or sold in the United States (outside of the Pacific states) is not of Atlantic origin. In the Pacific states, billfish involved in trade are presumed to be of Pacific origin. Any statement that contains the specified information is sufficient to meet the certificate of eligibility documentation requirements; it is not necessary to use the form available from NMFS or to submit the form to NMFS upon final disposition of the billfish.

7.2 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.

7.2.1 Atlantic and Pacific Bluefin Tuna Exports

As discussed in the previous section, NMFS collects detailed export data on bluefin tuna (Atlantic and Pacific) through the BCD program. Table 7.1 gives bluefin tuna export data for exports from the United States. Recent decreases in Atlantic BFT exports since 1999 could in part be a result of the growing U.S. market for high-quality fresh bluefin tuna meat. Since 2004, exports could also have been reduced because of a reduction in U.S. Atlantic bluefin tuna landings.

Table 7.1 includes data from the NMFS BCD program, and Census Bureau data. Census Bureau data are consistently greater in value than data reported by the BCD program. This has

been determined to be a result of NMFS' additional quality control measures that ensure data for other species (*e.g.*, Southern bluefin tuna) or other transaction types (*e.g.*, re-exports) are not erroneously included with bluefin export data. BFT re-export data are listed separately in Table 7.7.

Table 7.1 United States Exports of Atlantic and Pacific Bluefin Tuna, 1999-2007. (Sources: NMFS BCD Program, NERO, and Census Bureau.)

Year	Atlantic Commercial Landings (NERO, MT, DW)	Atlantic BFT Exports (BSD, MT, DW)	Pacific BFT Exports (BSD, MT, DW)	Total U.S. Exports (BSD, MT, DW)	Total U.S. Exports (Census Bureau, MT)	Value of U.S. Exports (Census Bureau, $ million)
1999	876.0	735.6	95.7	831.3	1,183	9.37
2000	903.9	758.0	76.0	834.0	1,044	11.20
2001	987.0	812.3	67.0	879.0	1,020	10.70
2002	964.0	730.4	0.1	730.5	922	10.74
2003	756.9	578.7	2.1	580.8	998	11.36
2004	428.6	247.3	0.0	247.3	370	4.50
2005	419.4	245.7	125.1	370.8	454	5.30
2006	204.6	93.1	0.0	93.1	281	3.60
2007	196.4	85.4	8.2	93.6	238	2.90

Note: most exports of Pacific BFT were in round (whole) form, although some exports were of dressed and gilled/gutted fish; Atlantic exports included whole, dressed, and product forms (dw); data are preliminary and subject to change.

7.2.2 Other Tuna Exports

Export data for other tunas is gathered by the Census Bureau, and includes trade data for albacore, yellowfin, bigeye, and skipjack tuna from all ocean areas of origin combined. In 2001, albacore tuna first replaced bluefin tuna as the most valuable tuna export from the United States (Table 7.2), according to Census Bureau information. Albacore has remained a higher value export than bluefin tuna since 2003. Comparing the last five years, the amount and value of exported albacore was greatest for the year 2004, and second greatest in 2007. During the time period covered by this table, the annual amount and value of frozen exports exceeded fresh exports for every year.

Table 7.2 **Amount and Value of U.S. Exports of Albacore Tuna From All Ocean Areas, 1999-2007 (Census Bureau data) and U.S. Landings of North Atlantic Albacore Tuna** (2008 U.S. National Report to ICCAT).

Year	Atlantic Landings (mt ww)	U.S. Exports (from all ocean areas)					
		Fresh		Frozen		Total for all Exports	
		MT	US$ (million)	MT	US$ (million)	MT	US$ (million)
1999	317	517	1.01	2,743	5.52	3,260	6.54
2000	407	263	0.78	2,747	6.04	3,010	6.83
2001	324	1,542	3.62	4,609	9.83	6,151	13.45
2002	488	680	1.50	4,483	8.28	5,163	9.78
2003	448	894	1.86	9,731	18.85	10,624	20.71
2004	640	1,360	3.28	10,737	24.11	12,097	27.38
2005	486	549	1.61	7,402	16.99	7,951	18.60
2006	400	378	1.04	8,810	19.56	9,187	20.60
2007	532	275	0.84	11,731	25.52	12,006	26.35

Note: Landings may be calculated on a calendar or fishing year basis; exports may be in whole (ww) or product weight (dw); data are preliminary and subject to change.

Table 7.3 and Table 7.4 show U.S. Atlantic landings and U.S. exports from all ocean areas combined for yellowfin and skipjack tuna, respectively. Yellowfin exports were greater and more valuable than exports for skipjack or bigeye tuna (Table 7.5), although yellowfin tuna exports decreased markedly in 2004 and have continued to decline through 2007. The amount of fresh yellowfin product exported usually exceeds the amount of frozen yellowfin product annually. Fresh product and overall exports were highest in 2002 and 2003. The amount and value of exported fresh and frozen skipjack tuna has varied over the nine year period covered in Table 7.4, without any discernable trends. Exports and landings of skipjack in 1999 far exceeded values for the following years.

Table 7.3 **Amount and Value of U.S. Exports of Yellowfin Tuna From All Ocean Areas, 1999-2007 (Census Bureau data) and U.S. Landings of Atlantic Yellowfin Tuna** (***2008 U.S. National Report to ICCAT).***

Year	Atlantic Landings (mt ww)	U.S. Exports (from all ocean areas)					
		Fresh		Frozen		Total for all Exports	
		MT	US$ (million)	MT	US$ (million)	MT	US$ (million)
1999	7,569	947	2.09	390	.84	1337	2.93
2000	7,051	412	1.12	406	.76	819	1.89
2001	6,703	290	.71	834	1.45	1124	2.17
2002	5,646	1612	2.37	420	.81	2033	3.19
2003	7,685	1792	2.93	176	.68	1968	3.62
2004	6,437	306	1.54	242	.31	549	1.86
2005	5,562	158	1.70	291	.97	449	2.67
2006	7,090	183	1.96	108	.37	291	2.32
2007	5,559	148	1.75	138	.44	286	2.19

Note: Landings may be calculated on a calendar or fishing year basis; exports may be in whole (ww) or product weight (dw); data are preliminary and subject to change.

Table 7.4 **Amount and Value of U.S. Exports of Skipjack Tuna From All Ocean Areas, 1999-2007 (Census Bureau data) and U.S. Landings of West Atlantic Skipjack Tuna (*2008 U.S. National Report to ICCAT*).**

Year	Atlantic Landings (mt ww)	U.S. Exports (from all ocean areas)					
		Fresh		Frozen		Total for all Exports	
		MT	US$ (million)	MT	US$ (million)	MT	US$ (million)
1999	152	88	.20	1092	.89	1,181	1.10
2000	44	7	.01	83	.05	91	.06
2001	69	82	.15	34	.04	117	.20
2002	66	66	.17	11	.01	77	.18
2003	77	81	.22	0	0	81	.22
2004	102	55	.30	140	.18	196	.48
2005	30	35	.14	-	-	35	.14
2006	61	6	.02	23	.04	30	.06
2007	66	17	.06	77	.12	94	.18

Note: Landings data may have been ported on either a fishing year or calendar year basis; exports may be in whole (ww) or product weight (dw); data are preliminary and subject to change.

Bigeye tuna exports and Atlantic landings are given in Table 7.5. No data were available for bigeye tuna exports in 2001, and prior to 2001 bigeye exports were included in the category of unspecified tuna. Annually, bigeye tuna exports include more fresh than frozen product.

Table 7.5 **Amount and Value of U.S. Exports of Bigeye Tuna From All Ocean Areas, 2002-2007 (Census Bureau data) and U.S. Landings of Atlantic Bigeye Tuna (*2008 U.S. National Report to ICCAT*).**

Year	Atlantic Landings (mt ww)	U.S. Exports (from all ocean areas)					
		Fresh		Frozen		Total for all Exports	
		MT	US$ (million)	MT	US$ (million)	MT	US$ (million)
2002	600	95	.22	8	.01	104	.24
2003	480	255	.47	40	.08	295	.56
2004	419	361	1.40	48	.10	410	1.51
2005	484	431	1.95	50	.12	481	2.07
2006	991	223	1.69	76	.20	299	1.89
2007	523	128	1.38	65	.14	193	1.52

NOTE: Landings data may have been reported on either a fishing year or calendar year basis; exports may be in whole (ww) or product weight (dw); data are preliminary and subject to change.

7.2.3 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 7.6 indicates the magnitude and value of shark exports by the United States from 1999 – 2007. The reduction in shark fin exports from 2002 to 2007 is of particular note, as is the increase in the unit value of shark fins during this time period. Decreases in shark fin trade were expected as the result of the Shark Finning Prohibition Act, which was enacted in December of 2000 and implemented by final rule (67 FR 6194, February 11, 2002).

Table 7.6 Amount and Value of U.S. Shark Product Exports From 1999-2007. (Source: Census Bureau.)

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

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

7.2.4 Re-exports of Atlantic HMS

For purposes of international trade tracking of HMS, the term "re-export" refers to a product that has been entered for consumption into the United States and then exported to another country, with or without further processing in the United States (from 50 CFR Part 300, Subpart M, International Trade Documentation and Tracking Programs for HMS). For most HMS species for most years, re-export activity is a small fraction of export activity and well below relative reference points of 1000 mt and/or one million dollars annually. Exceptions to this include fresh yellowfin tuna re-exports which were valued at $1.5 million in 2003 and fresh and frozen yellowfin tuna valued at $1.1 million in 2002 (Census Bureau data). In 2004, dried shark fin re-exports reached a six year maximum value of $1.8 million (29 mt, down from 34 mt in 2003).

Bluefin tuna re-exports reached a five year maximum in 2003 (Table 7.7), at 691 mt, which exceeded the amount of bluefin exports for the year, for the first time in the history of the BSD program (K. Goldsmith, pers. com.). Further investigation into BSD program data found that the increases in bluefin re-exports from 2003-2005 reflected the growth of the Mexican farming/mariculture industry which exports product to the United States for re-export to Japan. Implementation of the HMS International Trade Permit regulations in 2005 (69 FR 67268,

November 17, 2004) changed the way re-exports and transshipments were distinguished, and probably resulted in the decrease in re-exports since 2005.

7.2.5 Summary of Atlantic HMS Exports

Nationally, the value of HMS exports (from all ocean areas combined) is dominated by tuna products. In 2007, fresh and frozen tuna products accounted for 17,332 mt dw or 1.5 percent of the 1,128,746 mt dw of fresh and frozen seafood products exported from the United States, as indicated in *Fisheries of the United States, 2007*. The value of these HMS products accounted for $56.97 million, out of a national total of $3.4 billion.

Data reflecting international trade of HMS species harvested from all ocean areas are of limited value for describing trade of HMS harvested from the Atlantic Ocean. For example, Atlantic landings of albacore tuna (commercial and recreational) for 2003 were reported in the 2004 U.S. National Report to ICCAT as 448 mt (Table 7.2). National trade data show that over 10,000 mt of albacore were exported, which indicates that the majority of albacore exports were Pacific Ocean product. Trade tracking programs such as the bluefin tuna, swordfish, and bigeye tuna statistical document programs are much more useful for describing the international disposition of Atlantic HMS.

7.3 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.

7.3.1 Bluefin Tuna Imports

United States imports and re-exports of bluefin tuna for 1999 through 2007, as reported through both CBP and BCD program data, are shown in Table 7.7. The difference in import numbers between the CBP and BCD data may be explained by a lack of knowledge and compliance with the BCD program by importers, especially those on the Pacific coast.

The rise in popularity of sashimi in the United States has generated increased imports of bluefin tuna, and dealers are reporting an expanded domestic market for both locally-caught and imported raw tuna. As discussed previously, the large amount of re-exports in the mid-2000’s resulted from the increase in importation of farmed bluefin from Mexico and re-exportation to Japan. The subsequent decrease is presumed to be a reflection of the change in the way transshipments and re-exports are distinguished.

Table 7.7 **Imports of Atlantic and Pacific Bluefin Tuna into the United States: 1999-2007.** (Sources: NMFS BSD program and CBP data.)

YEAR	NMFS BSD Program		U.S. CBP Data	
	Imports (MT)	Re-exports (MT)	Imports (MT)	VALUE (US$ million)
1999	411.9	16.6	558.6	3.02
2000	361.9	99.3	453.4	7.67
2001	512.9	7.0	532.3	8.21
2002	529.3	94.1	605.0	9.75
2003	649.9	691.0	780.3	11.67
2004	823.4	684.8	886.1	15.25
2005	966.1	496.0	1064.0	19.96
2006	791.5	18.5	865.2	17.05
2007	584.6	17.7	697.1	13.97

Note: Most imports of BFT were in dressed form, and some were round and gilled/gutted fish, fillets or belly meat (dw); data are preliminary and subject to change. Southern bluefin tuna trade was included in figures for Atlantic and Pacific bluefin tuna trade prior to 2002.

7.3.2 Other Tuna Imports

Since January 2001, CBP has been collecting species-specific import information for bigeye tuna (grouped to include all ocean areas). Previously, bigeye tuna had been grouped with other tuna under general tuna imports. The total amount of bigeye tuna imports has ranged between 4800 and 7900 mt over the last seven years, as shown in Table 7.8. No trends are identifiable.

Table 7.8 **Imports of Bigeye Tuna Into the United States From All Ocean Areas Combined: 2001-2007.** (Source: Census Bureau data.)

Year	Fresh		Frozen		Total for all Imports	
	MT	US$ (million)	MT	US$ (million)	MT	US$ (million)
2001	4684	25.70	135	.32	4,820	26.02
2002	6312	39.84	319	.70	6,632	40.55
2003	7312	51.01	560	1.48	7,872	52.49
2004	6752	49.10	1175	2.62	7,928	51.73
2005	5040	38.18	1539	3.33	6,579	41.51
2006	4920	36.55	1522.6	3.15	6,442	39.70
2007	5617	42.30	1512	3.19	7,129	45.49

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

Annual yellowfin tuna imports into the United States for all ocean areas combined are given in Table 7.9. As indicated by the data in this section, yellowfin tuna are imported in the greatest quantity of all fresh and frozen tuna products. The annual value and total amount of yellowfin imports has increased gradually from 1999 – 2007. Most imported yellowfin products are fresh.

Table 7.9 **Imports of Yellowfin Tuna Into the United States From All Ocean Areas Combined: 1999-2007. (Source: Census Bureau data.)**

Year	Fresh		Frozen		Total for all Imports	
	MT	US$ (million)	MT	US$ (million)	MT	US$ (million)
1999	11,756	63.04	9411	24.90	21,168	87.94
2000	13,153	70.27	3290	18.73	16,443	89.00
2001	15,563	85.50	3967	23.45	19,530	108.95
2002	15,966	95.22	4619	29.31	20,585	124.53
2003	15,299	94.03	5579	39.67	20,878	133.71
2004	15,624	99.41	5833	35.35	21,457	134.96
2005	17,064	116.58	6002	46.89	23,066	163.47
2006	17,792	126.47	5442	42.78	23,234	169.25
2007	17,985	137.42	5506	44.26	23,492	181.69

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

The amount of albacore imports from all ocean areas has generally been declining since 1999 (Table 7.10). In 1999, albacore imports were valued at $144 million while in 2005 the value dropped to approximately $5 million. Import amounts and value have been fairly stable

over the last several years. (Products in airtight containers (e.g., cans or foil pouches) are not included in these data.)

Table 7.10 Imports of Albacore Tuna into the United States From All Ocean Areas Combined: 1999-2007. (Source: Census Bureau data.)

Year	Fresh		Frozen		Total for all Imports	
	MT	US$ (million)	MT	US$ (million)	MT	US$ (million)
1999	1776	5.39	63,284	139.50	65,060	144.89
2000	1843	6.42	51,001	127.33	52,845	133.76
2001	1107	3.85	40,428	105.58	41,536	109.43
2002	1296	4.81	11,903	24.49	13,200	29.31
2003	1062	4.11	12,569	25.90	13,632	30.02
2004	1004	3.12	4943	11.67	5947	14.80
2005	706	2.38	1016	2.96	1722	5.34
2006	876	3.54	667	1.71	1543	5.25
2007	945	3.86	718	1.98	1664	5.86

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

Skipjack tuna imports into the United States are comprised mainly of frozen product (Table 7.11). Like albacore tuna, the amount and value of skipjack imports have also decreased dramatically since 1999, but have rebounded slightly in the last two years. The amount of product imported fell from over 8,000 mt dw in 1999 to 112 mt dw in 2004, but climbed back up to 1,023 mt dw in 2006. Likewise, the value of these products during this time period fell from $6.3 million to $0.98 million. (Products in airtight containers (e.g., cans or foil pouches) are not included in these data.)

Table 7.11 Imports of Skipjack Tuna From All Ocean Areas Combined Into the United States: 1999-2007. (Source: U.S. Census Bureau data.)

Year	Fresh		Frozen		Total for all Imports	
	MT	US$ (million)	MT	US$ (million)	MT	US$ (million)
1999	0	0	8,238	6.30	8,238	6.30
2000	0	0	904	2.75	904	2.75
2001	<1	<0.01	377	0.61	378	0.62
2002	<1	0.01	824	0.83	825	0.84
2003	0	0	224	0.43	224	0.43
2004	<1	<0.01	110	0.26	112	0.27
2005	0	0	652	0.67	652	0.67

Year	Fresh		Frozen		Total for all Imports	
	MT	US$ (million)	MT	US$ (million)	MT	US$ (million)
2006	140	0.14	883	0.84	1,023	0.98
2007	31	0.06	835	0.73	866	0.79

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

7.3.3 Swordfish Imports

Table 7.12 summarizes swordfish import data collected by NMFS' Swordfish Statistical Document Program for the 2007 calendar year. According to these data, most swordfish imports were Pacific Ocean product. For Atlantic product, most imports came from Canada, followed by Brazil. CBP data located at the bottom of the table reflect a larger amount of imports than reported by the import monitoring program, and may be used by NMFS staff to follow up with importers, collect statistical documents that have not been submitted, and enforce dealer reporting requirements.

Table 7.12 Swordfish Import Data for the 2007 Calendar Year Collected Under the NMFS Swordfish Statistical Document Program.

Flag of Harvesting Vessel	Ocean Area of Origin								Total (mt dw)
	Atlantic (mt dw)	North Atlantic (mt dw)	South Atlantic (mt dw)	Med. (mt dw)	Pacific (mt dw)	Western Pacific (mt dw)	Indian (mt dw)	Not Provided (mt dw)	
Australia	-	-	-	-	0.5	66.6	28.4	-	95.4
Belize	-	-	-	-	29.6	-	-	-	29.6
Brazil	11.3	-	312.2	-	11.6	-	-	0.5	335.6
Canada	-	478.5	-	-	-	-	-	-	478.5
Chile	-	-	-	-	580.1	-	3.4	-	583.5
Columbia	-	-	-	-	2.9	-	-	-	2.9
Costa Rica	-	-	-	0.5	225.0	-	-	1.0	226.5
Ecuador	-	-	0.1	22.8	293.3	-	0.1	2.3	318.6
Fiji Islands	-	-	-	-	18.2	14.3	1.0	2.3	35.8
Indonesia	-	-	-	-	224.3	-	-	-	224.3
Japan	-	-	-	-	4.9	-	4.7	-	9.6
Malaysia	-	-	-	-	0.9	-	62.4	-	63.3
Mexico	-	0.1	-	-	314.5	-	-	-	314.6
New Zealand	-	-	-	-	0.7	55.2	-	0.5	56.5
Nicaragua	-	-	-	-	33.5	-	-	-	33.5
Panama	-	-	-	-	708.0	-	-	-	708.0
Philippines	-	-	-	-	2.6	-	-	-	2.6
South Africa	16.4	0.3	18.0	-	-	-	56.6	0.7	92.1
St. Vincent	-	27.9	5.5	-	-	-	-	-	33.4
Taiwan	-	7.2	-	-	14.1	-	-	-	21.3
Trinidad & Tobago	-	5.3	-	-	-	-	-	1.0	6.2
Uruguay	2.8	-	44.8	-	-	-	-	-	47.6
Venezuela	-	16.1	1.3	-	-	-	-	-	17.4
Vietnam	-	-	-	-	164.7	-	-	-	164.7
np	-	-	1.8	16.0	241.8	0.3	12.9	12.6	285.3
Total Imports Reported by SDs	- 30.6	- 535.4	- 383.7	- 39.2	- 2,871.0	- 136.4	- 169.5	- 20.9	- 4,186.7
Total Imports Reported by U.S. Customs & Border Protection									9,841.6
Total Imports Not Reported by SDs									5,654.9

SD Data as of 10/22/08

Table 7.13 indicates the amount and value of swordfish products imported by the United States from 1999 – 2007, as recorded by the U.S. Census Bureau, for all ocean areas combined. New import product categories were added in 2007. The amount of each product imported per year and annual totals for product and value were fairly consistent over the past several years. Total imports fell by approximately 900 mt in 2007.

Table 7.13 Imported Swordfish Products by Year: 1999-2007. (Source: Census Bureau data.)

Year	Fresh (MT)			Frozen (MT)					Total for all Imports	
	Steaks		Other	Fillets	Steaks	Other			MT	US$ (million)
1999	81		8595	4377	401	386			13,842	71.70
2000	161		8626	4833	524	167			14,314	85.57
2001	71		8982	3814	710	119			13,697	81.89
2002	195		9726	4156	956	677			15,711	88.26
2003	147		8079	3929	433	560			13,150	75.62
2004	157		6568	3261	387	351			10,726	70.95
2005	172		6388	2957	367	304			10,187	77.17
2006	77		6830	2875	351	201			10,334	75.63
*New Categories in 2007	*Fillets	Steaks	Other	Fillets	Steaks	*Meat >6.8 kg	*Meat <=6.8 kg	Other		
2007	174	84	5412	2520	171	118	737	205	9,422	70.85

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

7.3.4 Shark Imports

Similar to tuna imports other than bluefin tuna and frozen bigeye tuna, NMFS does not require shark 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 and steaks. 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 trans-shipment 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 7.14 summarizes Census Bureau data on shark imports for 1999 through 2007. Imports of fresh shark products and shark fins have decreased significantly since 1999. As of July 2, 2008, shark importers, exporters, and re-exporters are required to be permitted under NMFS' HMS International Trade Permit regulations (73 FR 31380). Permitting of shark fin traders was implemented to assist in enforcement and monitoring trade of this valuable commodity.

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

Table 7.14 **U.S. Imports of Shark Products From All Ocean Areas Combined: 1999-2007.** (Source: Census Bureau data.)

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

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

7.3.5 Summary of U.S. Imports of Atlantic HMS

The import data in this section show that many HMS species are part of a valuable import market. As discussed previously regarding exports, most data documenting imports include products harvested from many ocean areas, not just the Atlantic Ocean. However, the statistical document programs for bluefin tuna, swordfish, and frozen bigeye tuna provide information specifically about product harvested from the Atlantic Ocean and imported into the United States.

7.4 The Use of Trade Data for Conservation Purposes

Trade data has been used in a number of ways to support the international management of HMS. When appropriate, the SCRS uses trade data on bluefin tuna, swordfish, bigeye tuna, and yellowfin tuna that are submitted to ICCAT as an indication of landings trends. These data can then be used to augment estimates of fishing mortality of these species, which improves scientific stock assessments. In addition, these data can be used to assist in assessing compliance with ICCAT recommendations and identify those countries whose fishing practices diminish the effectiveness of ICCAT conservation and management measures. On several occasions, ICCAT has adopted recommendations to address the lack of compliance with management programs for the bluefin tuna, bigeye tuna, and North and South Atlantic swordfish fisheries by ICCAT members. Penalties for non-compliance or fishing in a manner that diminishes the effectiveness of ICCAT conservation measures may include catch limit reductions and, if necessary, trade restrictive measures.

For example, an analysis of vessel sighting and Japanese bluefin statistical document data led to the 1996 determination that fishing vessels from the countries of Panama, Honduras, and Belize were fishing in a manner that diminished the effectiveness of the bluefin tuna rebuilding program, and resulted in a 1996 ICCAT recommendation for sanctions against the import of bluefin tuna from these countries (Table 7.15). In 1999, ICCAT recommended this trade restriction on Panama be lifted as a result of the Government of Panama's efforts to substantially reduce fishing vessel activities deemed inconsistent with ICCAT measures. In 2001, Honduras became a member of ICCAT, and based on this change in status and Honduras' significant efforts to control its fleet and address ICCAT concerns, ICCAT recommended lifting trade sanctions for bluefin tuna. The bluefin sanction for Belize was lifted by ICCAT in 2002.

In another example, import data from 1997–1999 revealed significant Atlantic bluefin tuna exports from Equatorial Guinea despite the fact that a zero catch limit was in effect for that country. The government of Equatorial Guinea had not responded to ICCAT inquiries and had reported no bluefin tuna catch data to ICCAT, and as a result ICCAT recommended trade restrictions as a penalty for non-compliance. Based on information regarding improved compliance presented by Equatorial Guinea at the 2004 ICCAT meeting, specifically, that Equatorial Guinea had canceled licenses and flags of large-scale longline vessels previously participating in IUU tuna fishing in the Convention area and guaranteed compliance with ICCAT conservation and management measures, the trade sanction was lifted by ICCAT. As indicated in Table 7.15, most of the trade sanctions recommended by ICCAT since 1996 have been lifted. In fact, only trade sanctions for Bolivia and Georgia remain in effect.

Table 7.15 Summary and Current Status of ICCAT Recommended Trade Sanctions for Bluefin Tuna, Swordfish, and Bigeye Tuna Implemented by the United States.

Country	Species	ICCAT Recommended Sanction	U.S. Sanction Implemented	ICCAT Sanction Lifted	U.S. Sanction Lifted
Panama	Bluefin	1996	1997	1999	2000
Honduras	Bluefin	1996	1997	2001	2004
	Bigeye	2000	2002	2002	2004
	Swordfish	1999	2000	2001	2004
Belize	Bluefin	1996	1997	2002	2004
	Swordfish	1999	2000	2002	2004
	Bigeye	2000	2002	2002	2004
Equatorial Guinea	Bluefin	1999	2000	2004	2005
	Bigeye	2000	2002	2004	2005
Cambodia	Bigeye	2000	2002	2004	2005
St. Vincent & the Grenadines	Bigeye	2000	2002	2002	2004
Bolivia	Bigeye	2002	2004	In effect	In effect
Sierra Leone	Bluefin	2002	2004	2004	2005
	Bigeye	2002	2004	2004	2005
	Swordfish	2002	2004	2004	2005
Georgia	Bigeye	2003	2004	In effect	In effect

7.5 Overview of the Processing Industry for Atlantic HMS

Understanding the harvesting and processing sectors is essential when analyzing world trade in highly migratory fish species. The processing related entities that depend on Atlantic HMS are as diverse as the species and products themselves. Processing techniques range from the simple dressing and icing of swordfish at sea, to elaborate grading and processing schemes for bluefin tuna, to processing shark fins. Like all other seafood, HMS are perishable and may pose health hazards if not handled properly. Products range from those having a long shelf-life, such as swordfish, to highly perishable species like yellowfin tuna. Improperly handled yellowfin tuna can produce histamine, and shark meat requires careful handling due to the high concentrations of urea in the body of the shark. In addition, swordfish and sharks may contain high levels of mercury. Processing companies are aware of these characteristics and their costs of doing business vary accordingly to protect consumers. The Food and Drug Administration (FDA) works closely with NOAA Office of Law Enforcement to monitor incoming shipments of seafood, including highly migratory species.

FDA's Seafood Hazard Analysis Critical Control Point (HACCP) program implemented regulations that require processors of fish and fishery products to operate preventive control systems to ensure human food safety. Among other things, processors must effectively maintain the safety of their products, systematically monitor the operation of critical control points to ensure that they are working as they should, and keep records of the results of that monitoring. Processors must also develop written HACCP plans that describe the details and operation of their HACCP systems. Each processor may tailor its HACCP system to meet its own circumstances. The best way for FDA to determine whether a processor is effectively operating a HACCP system is by inspecting the processor. Federal review of monitoring and other records generated by the HACCP system is a critical component of an inspection because it allows the inspector to match records against the practices and conditions being observed in the plant and it discourages fraud. NMFS works closely with the FDA, in support of the HACCP program.

Just as HACCP plans vary between processors, transportation of the seafood to market also varies widely from the direct domestic sale of some shark or swordfish meat by a fisherman to a restaurant (carried by truck) to the quick, and sometimes complicated, export of bluefin tuna from fisherman to dealer to broker to the Japanese auction (carried by a commercial airline carrier). Frozen swordfish and tunas are often brought to the United States by overseas shipping companies and sharks and other products may be exported from the United States, processed overseas, and imported in a final product form.

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

7.5.1 Processing and Wholesale Sectors

NMFS has limited quantitative information on the processing sector, including the amount of HMS products sold in processed forms. In addition, knowledge regarding the utilization of Atlantic HMS is largely limited to the major or most valuable product forms, such as export-quality bluefin tuna.

Much of the processing of export-quality Atlantic bluefin tuna occurs onboard the vessel harvesting the fish, which serves to maximize fish quality. Bluefin are gutted and bled, and protected from the heat and sunlight by immersion in ice or an icy brine. Upon landing, bluefin are immediately graded and prepared for export to Japan's fresh fish market. The fish are either refrigerated or exported immediately in insulated crates or "coffins" filled with ice or icepacks.

Other Atlantic tunas, especially bigeye tuna, are frequently shipped fresh to Japan in dressed form. Swordfish are sold fresh and frozen in dressed form and as processed products (*e.g.*, steaks and fillets). The utilization of sharks is not well known since trade statistics frequently do not indicate product forms such as skins and leather, jaws, fishmeal and fertilizer, liver oil, and cartilage (Rose, 1996). Domestically-landed shark meat may be sold to supermarkets and processors of frozen fish products (this meat is generally labeled as either blacktip or mako shark, regardless of the actual species). Shark fins are generally dried and then exported. NMFS continues to work with industry to collect information specific to U.S. and foreign processing of Atlantic HMS to better track markets, conserve stocks, and manage sustainable fisheries.

The U.S. processing and wholesale sectors are dependent upon both U.S. and international HMS fisheries. Individuals involved in these businesses buy the seafood, cut it into pieces that transform it into a consumer product, and then sell it to restaurants or retail outlets. Employment varies widely among processing firms. Often employment is seasonal unless the firms also process imported seafood or a wide range of domestic seafood. The majority of firms handle other types of seafood and are not solely dependent on HMS. Other participants in the commercial trade sector include brokers, freight forwarders, and carriers (primarily commercial airlines, trucking, and shipping companies). Swordfish, tunas, and sharks are important commodities on world markets, generating significant amounts in export earnings in recent years.

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

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8.0 BYCATCH, INCIDENTAL CATCH, AND PROTECTED SPECIES

Bycatch in commercial and recreational fisheries is 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.

8.1 Bycatch Reduction and the Magnuson-Stevens Act

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

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 HMS fisheries in which there is zero bycatch because none of the currently legal fishing gears are perfectly selective for the target species of each fishing operation (with the possible exception of the swordfish/tuna harpoon fishery and speargun fishery). Therefore, to totally eliminate bycatch of all non-target species in Atlantic HMS fisheries would be impractical. The goal then is to minimize the amount of bycatch to the extent practicable and minimize the mortality of species caught as bycatch.

8.1.1 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 these 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, but not always, observer programs also will be the most cost-effective of these alternatives (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.*, 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. These data are collected with respect to fishing gear type (see Section 8.1.1). 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 Pelagic Observer Program (POP) data in the U.S. Atlantic pelagic longline 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 prohibited 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 HMS fisheries currently in place. 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.

8.1.1.1 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 pelagic longline 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 observer 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° 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 (Table 4.1) 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 2005-07 ranged from 7.5 – 10.8 percent. Since 1992, data collection priorities have been to collect catch and effort data of the U.S. Atlantic pelagic longline 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).

Purse Seine Fishery

Vessels operating in the bluefin tuna purse seine fishery submit either Vessel Trip Reports (NERO) or HMS logbooks (Southeast) based on the type of Federal permits they hold in addition to their HMS permit. Observers were placed on purse seine vessels operating in this fishery in 1996 and 2001 in order to monitor groundfish bycatch in closed areas in the Northwest Atlantic (B. McHale, pers. comm., 2005). The purse seine fishery was observed to have very little bycatch of groundfish or other species of fish and no protected species interactions. As a result, observer coverage has not been used recently to document bycatch or validate logbook reports. In addition, the lack of effort in recent years has not warranted consideration for additional observer coverage.

Shark Bottom Longline Fishery

Vessels participating in the bottom longline 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. Observers have monitored the shark bottom longline 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). Beginning in 2006, target coverage level will be 3.9 percent of the total fishing effort. This level is 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). Shark fishermen can use the pelagic longline 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.

The Final Rule for Amendment 2 to the Consolidated Highly Migratory Species (HMS) Fishery Management Plan (FMP) (73 FR 35778, June 24, 2008, corrected at 73 FR 40658, July 15, 2008) established, among other things, a shark research fishery to maintain time series data for stock assessments and to meet NMFS' 2009 research objectives. The shark research fishery permits authorize participation in the shark research fishery and the collection of sandbar and non-sandbar large coastal sharks (LCS) from federal waters in the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea for the purposes of scientific data collection subject to 100 percent observer coverage. The commercial vessels selected to participate in the shark research fishery are the only vessels authorized to land/harvest sandbars subject to the sandbar quota available for each year. The base quota is 87.9 mt dw/year through December 31, 2012, although this number may be reduced in the event of overharvests, if any,and 116.6 mt dw/year starting on January 1, 2013. The selected vessels would also have access to the non-sandbar LCS, small coastal shark (SCS), and pelagic shark quotas. Commercial vessels not participating in the shark research fishery may only land non-sandbar LCS, SCS, and pelagic sharks subject to the retention limits and quotas per 50 CFR 635.24 and 635.27, respectively.

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 May 2008 Biological Opinion. During right whale calving season (15 November to 15 April), 100 percent observer coverage is required for shark gillnet vessels operating from West Palm Beach, FL, to Sebastian Inlet, FL. Outside right whale calving season, observer coverage is equal to that which would obtain a sample size needed to provide estimates of sea turtle or marine mammal interactions with an expected CV of 0.3 (in 2003, this was 33.8 percent of the total trips) (Carlson and Baremore, 2002).

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 previously 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.

Commercial Handgear Fishery

The commercial handgear fishery includes vessels using handline, harpoon, rod and reel, or bandit gear to fish for HMS. NMFS has the authority to use observers to collect bycatch information from commercial vessels fishing for tunas. Many of these vessels are already

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 fishery data collection of vessels fishing for HMS with handgear, such as selecting additional HMS permitted vessels to report in logbooks or to be selected for observer coverage, and is investigating alternatives for electronic reporting. Therefore, no estimates of bycatch are available at this time. Bycatch and bycatch mortality are considered to be low due to the nature of the gear but this should be validated in the future.

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 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.

8.2 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 (Table 8.1), 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 Fishery Management Plan for Atlantic Tunas, Swordfish and Sharks (NMFS, 1999), Regulatory Amendment 1 to the 1999 FMP (NMFS, 2000), Regulatory Adjustment 2 to

the 1999 FMP (NMFS, 2002), Amendment 1 to the 1999 FMP (NMFS, 2003a), and in the Consolidated HMS FMP (NMFS, 2006). 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.

8.2.1 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. Bycatch reporting is addressed in Section 8.1.1. Additional species and fishery specific data are presented in Section 4.0.

Pelagic longline dead discards of swordfish, billfish, large coastal sharks, and pelagic sharks are estimated using data from NMFS observer reports and pelagic logbook reports. Shark bottom longline 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.

NMFS has not estimated bycatch in the swordfish harpoon fishery. NMFS has limited historical observer data on harpooned swordfish from driftnet trips in which harpoons were sometimes used. Swordfish harpoon fishermen are required to submit pelagic logbooks and NMFS can examine those for their utility in estimating bycatch. NMFS has not estimated bycatch in the bluefin tuna harpoon fishery because these fishermen have not been selected to submit logbooks. NMFS has not estimated bycatch in the General category commercial rod and reel tuna fishery although anecdotal evidence indicates that some undersized bluefin tuna may be captured. Studies of post-release mortality are ongoing.

There is concern about the accuracy of discard estimates in the recreational rod and reel fishery for HMS due to the low number of observations by the LPS and the MRFSS. Recreational bycatch estimates (numbers of fish released alive and dead) are not currently available, except for bluefin tuna. For some species, encounters are considered rare events, which might result in bycatch estimates with considerable uncertainty. Due to improvements in survey methodology, increased numbers of intercepts (interviews with fishermen) have been collected since 2002. NMFS intends to develop bycatch estimates (live and dead discards) and estimates of uncertainty from the recreational fishery from the LPS. These data will be included in future SAFE reports. Bycatch estimates may also be examined by using tournament data for the recreational fishery.

Table 8.1 **Summary of bycatch species in HMS fisheries, Marine Mammal Protection Act (MMPA) category, endangered Species Act (ESA) requirements, data collection, and management measures by fishery/gear type.** (Excerpted from HMS Bycatch Priorities and Implementation Plan and updated through September 2008)

Fishery/Gear Type	Bycatch Species	MMPA Category	ESA Requirements	Bycatch Data Collection	Management Measures
Pelagic Longline	Bluefin tuna Billfish Undersize target species Marine mammals Sea turtles Seabirds Non-target finfish Prohibited shark species Large Coastal Shark species after closure	Category I	Jeopardy findings in 2000 & 2004; Reasonable and Prudent Alternative implemented 2001-04; ITS, Terms & Conditions, RPMs	Permit requirement (1985); logbook requirement (SWO-1985; SHK - 1993); observer requirement (1992), EFPs (2001-present)	BFT target catch requirements (1981); quotas (SWO - 1985; SHK - 1993); prohibit possession of billfish (1988); minimum size (1995); gear marking (1999); line clippers, dipnets (2000); MAB closure (1999); limited access (1999); limit the length of mainline (1996-1997 only); move 1 nm after an interaction (1999); voluntary vessel operator workshops (1999); GOM closure (2000); FL, Charleston Bump, NED closures (2001); gangion length, corrodible hooks, de-hooking devices, handling & release guidelines (2001); NED experiment (2001-03); VMS (2003); circle hooks and bait requirements (2004); mandatory safe handling and release workshops (2006); sea turtle control device (2008); closed area research (2008)
Shark Bottom Longline	Prohibited shark species Target species after closure Sea turtles Smalltooth sawfish Non-target finfish	Category III	ITS, Terms & Conditions, RPMs	Permit requirement (1993); logbook requirement (1993); observer coverage (1994)	Quotas (1993); trip limit (1994); gear marking (1999); handling & release guidelines (2001); line clippers, dipnets, corrodible hooks, de-hooking devices, move 1 nm after an interaction (2004); South Atlantic closure, VMS (2005); shark identification workshops for dealers (2007); sea turtle control device (2008)
Shark Gillnet	Prohibited shark species Sea turtles Marine mammals Non-target finfish Smalltooth sawfish	Category II	ITS, Terms & Conditions, RPMs	Permit requirement (1993); logbook requirement (1993); observer coverage (1994)	Quotas (1993); trip limit (1994); gear marking (1999); deployment restrictions (1999); 30-day closure for leatherbacks (2001); handling & release guidelines (2001); net checks (2002); whale sighting (2002); VMS (2004); closure for right whale mortality (2006); shark identification workshops for dealers (2007)
BFT Purse Seine	Undersize target species Non-target finfish	Category III	ITS, Terms & Conditions	Permit requirement (1982); observer requirement (1996,	Quotas (1975); limited access, individual vessel quotas (1982); minimum size (1982)

Fishery/Gear Type	Bycatch Species	MMPA Category	ESA Requirements	Bycatch Data Collection	Management Measures
				2001 only); EFPs (2002-03)	
BFT & SWO Harpoon	Undersize target species	Category III	ITS, Terms & Conditions	Permit requirement (BFT - 1982; SWO - 1987); SWO logbook requirement (1987)	Quotas (BFT - 1982; SW0 - 1985); minimum size (BFT - 1982; SWO - 1985)
Handgear - Commercial	Undersize target species Non-target finfish	Category III	ITS, Terms & Conditions	Permit requirement (BFT - 1982; SWO 1987; SHK - 1993); logbook requirement (SWO - 1985; SHK - 1993)	Regulations vary by species, including quotas, minimum sizes, retention limits, landing form
Handgear - Recreational	Undersize target species Non-target finfish	Category III	ITS, Terms & Conditions	Large Pelagic Survey (1992); MRFSS (1981)	Regulations vary by species, including minimum sizes, retention limits, landing form; BFT quotas

8.2.2 Bycatch Mortality

8.2.2.1 Introduction

The reduction of bycatch mortality is an important component of NS 9. Physical injuries may not be apparent to the fisherman who is quickly releasing a fish because there may be injuries associated with the stress of being hooked or caught in a net. Little is known about the mortality rates of many of the species managed under this FMP but there are some data for certain species. Information on bycatch mortality of these fish should continue to be collected, and in the future, could be used to estimate bycatch mortality in stock assessments.

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

8.2.2.2 Mortality by Fishery

Pelagic Longline Fishery

NMFS collects data on the disposition (released alive or dead) of bycatch species from logbooks submitted by fishermen in the pelagic longline fishery. Observer reports also include disposition of the catch as well as information on hook location, trailing gear and injury status of protected species interactions. These data are used to estimate post-release mortality of sea turtles and marine mammals based on guidelines for each (Angliss and DeMaster 1998, Ryder *et al*. 2006). See Section 0 for estimates of sea turtle and marine mammal bycatch estimates.

Purse Seine Fishery

NMFS has limited observer data on the bluefin tuna purse seine fishery. There are no recorded instances of non-tuna finfish, other than minimal numbers of blue sharks, caught in tuna purse seines. Anecdotal evidence indicates that if fish are discarded, they are easily released out of the net with minimal bycatch mortality.

Bottom Longline Fishery

The shark bottom longline fishery has relatively low observed bycatch rates. Historically, finfish bycatch has averaged approximately five percent in the bottom longline fishery. Observed protected species bycatch (sea turtles) has typically been much lower, less than 0.01 percent of the total observed catch. See Section 0 for more information. Disposition of discards is recorded by observers and can be used to estimate discard mortality.

Shark Gillnet Fishery

The shark gillnet fishery has relatively low observed bycatch rates. Finfish bycatch during the 2007 fishery ranged from 1.4 to 13.3 percent of the total catch from directed shark sets. Observed protected species bycatch (sea turtles and marine mammals) was less than 0.1

percent of the total catch by number. See Section 0 for more information. Disposition of discards is recorded by observers and can be used to estimate discard mortality.

Commercial Handgear Fishery

Vessels targeting bluefin tuna with harpoon gear have not been selected for observer coverage since the deliberate fishing nature of the gear is such that bycatch is expected to be low. Therefore, there are no recorded instances of non-target finfish caught with harpoons and NMFS cannot quantify the bycatch of undersized bluefin tuna in this fishery. Bycatch in the swordfish harpoon fishery is virtually if not totally, non-existent. Since bycatch approaches zero in this fishery, it follows that bycatch mortality is near zero. Disposition of bycatch reported in logbooks is used to estimate mortality of bycatch in the hook and line handgear fisheries.

Recreational Handgear Fishery

The LPS collects data on disposition of bycatch (released alive or dead) in recreational HMS fisheries. Rod and reel discard estimates from Virginia to Maine during June through October can 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 low. See Section 0 for more information.

Post-release mortality studies have been conducted on few HMS at this time. Immediate mortality in recreational hook and line-caught juvenile bluefin tuna can be high (29.2 percent) due to injuries or predation (Belle, 1997). This is thought to be a conservative estimate because scientific personnel in the study were professionally trained and had extensive experience in fish handling techniques designed to reduce mortality. Mortality often occurs ten minutes or longer after the fish is released under normal circumstances. Injuries may not be readily apparent to the angler and seemingly minor capture injuries may be related to substantial internal injuries. Forty percent of sampled tuna that died during that study did not have injuries that would be apparent to the angler in the boat. Skomal and Chase (1996) provided evidence that the stress of rod and reel angling did not cause immediate post-release mortality in larger bluefin tuna (50 to 150 kg). However, they documented metabolic and pH disturbances in bluefin tuna sampled off Cape Hatteras, NC. The physiological consequences of angling stress are poorly understood for several species of large pelagic fishes (Skomal and Chase, 1996).

A study by Graves *et al.* (2002), investigated short-term (five days) post-release mortality of Atlantic blue marlin using pop-up satellite tag technology. A total of nine recreationally-caught blue marlin were tagged and released during July and August of 1999. All hooks employed in the study were "J" hooks. The attached tags were programmed to detach from the fish after five days and to record direct temperature and inclination of the buoyant tag to determine if the fish were actively swimming after being released. After detachment, the tags floated to the surface and began transmitting recorded position, temperature and inclination data to satellites of the Argos™ system. Three different lines of evidence provided by the tags (movement, water temperature, and tag inclination) suggested that at least eight of the nine blue marlin survived for five days after being tagged and released. One of the tags did not transmit any data which precluded the derivation of a conclusion regarding the tagged marlin's survival.

The study was continued in 2003 to evaluate post release survival and habitat use of white marlin using pop-up satellite archival tags (PSATs) caught and released from four locations in the western North Atlantic recreational fishery (Horodysky and Graves, 2005). Forty-one tags were attached to white marlin caught using dead baits rigged on straight shank ("J") hooks (n = 21) or circle hooks (n = 20) offshore of the U.S. Mid-Atlantic, the Dominican Republic, Mexico, and Venezuela. Survival was significantly higher ($p<0.01$) for white marlin caught on circle hooks (100 percent) relative to those caught on straight-shank ("J") hooks (65 percent). These results, along with previous studies on circle hook performance, suggest that a change in hook type can significantly increase the survival of white marlin released from recreational fishing gear. Data from these short term deployments also suggest that white marlin strongly associate with warm, near surface waters. However, based on the frequency, persistence, and patterns of vertical movements, white marlin appear to direct a considerable proportion of foraging effort well below surface waters, a behavior that may account for relatively high catch rates of white marlin on some pelagic longline sets. NMFS continues to support studies on recreational post-release mortality and intends to account for this source of mortality when additional information becomes available.

8.3 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, and is reproduced below. These guidelines are discretionary, not mandatory, and are intended to inform the angling public of NMFS' views regarding what constitutes appropriate angling behavior. Part of the code covers catch-and-release fishing and is directed towards minimizing bycatch mortality.

Code of Angling Ethics

- Promotes, through education and practice, ethical behavior in the use of aquatic resources.
- Values and respects the aquatic environment and all living things in it.
- Avoids spilling, and never dumps any pollutants, such as gasoline and oil, into the aquatic environment.
- Disposes of all trash, including worn-out lines, leaders, and hooks, in appropriate containers, and helps to keep fishing sites litter-free.
- Takes all precautionary measures necessary to prevent the spread of exotic plants and animals, including live baitfish, into non-native habitats.
- Learns and obeys angling and boating regulations, and treats other anglers, boaters, and property owners with courtesy and respect.
- Respects property rights, and never trespasses on private lands or waters.

- Keeps no more fish than needed for consumption, and never wastefully discards fish that are retained.
- Practices conservation by carefully handling and releasing alive all fish that are unwanted or prohibited by regulation, as well as other animals that may become hooked or entangled accidentally.
- Uses tackle and techniques, which minimize harm to fish when engaging in "catch-and-release" angling.

8.4 Interactions of HMS Fishing Gears with Protected Species

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

8.4.1 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 2007 and draft 2008 stock assessment reports are available and can be obtained on the web at:
http://www.nmfs.noaa.gov/prot_res/PR2/Stock_Assessment_Program/sars.html

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 2008 MMPA LOF was published on November 27, 2007 (72 FR 66048) and the final 2009 MMPA LOF was published on December 1, 2008 (73 FR 73032). The Atlantic Ocean, Caribbean, and Gulf of Mexico large pelagic longline fishery is classified as Category I (frequent serious injuries and mortalities incidental to commercial fishing) and the southeastern Atlantic shark gillnet fishery is classified as Category II (occasional serious injuries and mortalities). The following Atlantic HMS fisheries are classified as Category III (remote likelihood or no known serious injuries or mortalities): Atlantic tuna purse seine; Gulf of Maine and Mid-Atlantic tuna, shark and swordfish, hook-and-line/harpoon; southeastern Mid-Atlantic and Gulf of Mexico shark bottom longline; and Mid-Atlantic, southeastern Atlantic, and Gulf of Mexico pelagic hook-and-line/harpoon fisheries. Commercial passenger fishing vessel

(charter/headboat) fisheries are subject to Section 118 and are listed as a Category III fishery. Recreational vessels are not categorized since they are not considered commercial fishing vessels. Beginning with the 2009 LOF, high seas fisheries are included in the LOF. Many fisheries operate in both U.S. waters and on the high seas thereby making the high seas component an extension of a fishery already on the LOF. NMFS categorizes the majority of high seas fisheries on the LOF as Category II based on the lack of marine mammal stock abundance information from the high seas. Exceptions to this are high seas fisheries that also operate in U.S. waters that have already been categorized as I, II, or III. For additional information on the fisheries categories and how fisheries are classified, see http://www.nmfs.noaa.gov/pr/interactions/lof/.

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

NMFS continues to investigate serious injuries to marine mammals as they are released from fishing gear. In April 1999, NMFS held a joint meeting of the three regional scientific review groups to further discuss the issue. NMFS is continuing to develop marine mammal serious injury guidelines and until these are published, NMFS will apply the criteria listed by the review groups to make determinations for specific fisheries. The current Biological Opinions for Atlantic HMS fisheries have resulted in a conclusion of no jeopardy for marine mammals. The 1999 HMS FMP implemented several of the recommendations of the Atlantic Offshore Cetacean Take Reduction Team (AOCTRT) including: 1) a requirement that vessels fishing for HMS move one nautical mile (nm) after an entanglement with protected species; 2) limiting the length of the mainline to 24 nm in the MAB from August 1, 1999 through November 30, 2000; 3) voluntary vessel operator education workshops for HMS pelagic longline vessels; 4) handling and release guidelines; and 5) limited access for swordfish, shark and tuna longline permits.

More recently, a Pelagic Longline Take Reduction Team (PLTRT) was formed which replaced the disbanded AOCTRT. The PLTRT developed a draft Take Reduction Plan (TRP) and was published along with a proposed rule to implement it on June 24, 2008 (73 FR35623). The PLTRT recommended a suite of management strategies to reduce mortality and serious injury of pilot whales and Risso's dolphins in the Atlantic pelagic longline fishery. NMFS proposes the following three regulatory measures: (1) Establish a Cape Hatteras Special Research Area (CHSRA), with specific observer and research participation requirements for fishermen operating in that area; (2) set a 20–nm (37.02–km) upper limit on mainline length for all pelagic longline sets within the MAB; and (3) develop and publish an informational placard that must be displayed in the wheelhouse and the working deck of all active pelagic longline vessels in the Atlantic fishery. A summary of the observed and estimated marine mammal interactions with the pelagic longline fishery is presented in Table 4.6 and Table 4.7.

8.4.2 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 United States Fish and Wildlife Agency (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.

8.4.2.1 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 pelagic longline 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 pelagic longline fishery jeopardized the continued existence of loggerhead and leatherback sea turtles. This document reported that the pelagic longline 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 pelagic longline fishing (effective July 15, 2001), modified how pelagic longline 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 pelagic longline 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. pelagic longline 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 pelagic longline 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 pelagic longline 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 pelagic longline fishery was completed on June 1, 2004. The BiOp concluded that long-term continued operation of the Atlantic pelagic longline 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 pelagic longline 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, lineclippers, 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 (Table 8.2) (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 pelagic longline 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).

Internationally, the United States is pursuing sea turtle conservation through international, regional, and bilateral organizations such as ICCAT, the Asia Pacific Fisheries 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.

8.4.2.2 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 and commercial 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 bottom longline fisheries from 1994 through 2004 (NMFS, 2003a). Based on these observations, expanded sawfish take estimates for 1994-2002 were developed for the shark bottom longline fishery (NMFS, 2003a). A total of 466 sawfish were estimated to have been taken in this fishery during 1994 - 2002, resulting in an average of 52 per year. All were released alive except one. Estimates of sawfish bycatch for 2003-06 have been developed and range from 0 to 161 interactions per year (Richards, 2007a; 2007b). However, due to the sparseness of observations (interactions) and effort variables chosen for the various approaches to estimating total interactions, the results were not very precise. A small bottom longline time-area closure to protect smalltooth sawfish southwest of Key West, FL, was considered during the development of the Consolidated HMS FMP (NMFS, 2006) but not implemented due to the lack of information regarding critical habitat for this species. A proposed rule to designate critical habitat for smalltooth sawfish was published on November 20, 2008 (73 FR 70290).

8.4.3 Interactions with Seabirds

Observer data from 1992 through 2007 indicate that seabird bycatch is relatively low in the U.S. Atlantic pelagic longline fishery (Table 4.10) (NMFS, 2008). Since 1992, a total of 141 seabird interactions have been observed, with 101 observed killed (71.6 percent). In 2007, there were 117 active U.S. pelagic longline vessels fishing for swordfish in the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea that reportedly set approximately 6.1 million hooks. A total of six seabirds were observed taken. Extrapolated estimates of seabird bycatch varied substantially from 1992-2007, ranging from 0 in 1996 to a high of 1,109 in 1997 (Table 4.13). The average extrapolated estimate of seabird bycatch was 210 per year while the extrapolated estimate of dead seabird bycatch was 150 per year, ranging from 0 to 623 (Table 4.14).

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 bottom longline fishery has been virtually non-existent. A single pelican has been observed killed from 1994 through 2007. No expanded estimates of seabird bycatch or catch rates for the bottom longline fishery have been made due to the rarity of seabird takes.

8.5 Measures to Address Protected Species Concerns

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

Table 8.2 Estimated se turtle interactions by species in the US Atlantic pelagic longline fishery, 1999-2007, and Incidental Take Levels (ITS).

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

8.6 Bycatch of HMS in Other Fisheries

NMFS is concerned about bycatch mortality of Atlantic HMS in any Federal or state-managed fishery which captures them. NMFS plans to address bycatch of these species in the appropriate FMPs through coordination with the responsible management body. For example, capture of swordfish and tunas incidental to squid trawl operations is addressed in the Squid, Mackerel, and Butterfish FMP. Capture rates of tunas in coastal gillnet fisheries are being explored through issuance of exempted fishing permits and reporting requirements. NMFS continues to solicit bycatch data on HMS from all state, interjurisdictional, and Federal data collection programs. NMFS supports development of an interstate management plan for coastal sharks by the ASMFC to protect sharks caught incidentally in state-managed fisheries. NMFS has requested assistance from the ASMFC, GSMFC, and Atlantic and Gulf Regional Fishery Management Councils in identifying potential sources of bycatch of finetooth sharks in state waters fisheries or other fisheries outside the jurisdiction of this FMP.

8.6.1 Squid Mid-Water Trawl

U.S. squid trawl fishermen, using mid-water gear, landed 8.6 mt ww of yellowfin tuna, skipjack tuna, albacore tuna, bigeye tuna, and swordfish in 2003 incidental to the squid, mackerel, and butterfish trawl fishery (Table 8.3). Bycatch of HMS in other trawl fisheries may be included as a portion of the overall reported trawl landings in Table 8.3. Landings decreased from 2002 for bigeye and albacore tuna, and increased slightly for yellowfin and skipjack tuna. Swordfish landings increased by 50 percent but remain at a low level relative to the directed fishery landings. A retention limit of five swordfish per trip allows squid trawl fishermen with swordfish limited access permits to land some of the swordfish that are encountered, although regulatory discards still occur.

Table 8.3 **Atlantic HMS Landed (mt ww) Incidental to Trawl Fisheries, 1998-2007.** Source: NMFS, 2003; NMFS, 2005; NMFS, 2008.

Species	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Yellowfin Tuna	0.7	4.1	1.76	2.7	0.3	2.2	1.6	0.2	0.7	2.4
Skipjack Tuna	0.2	1.0	<0.05	0.2	<0.05	0.5	0.2	0.07	0.7	<0.01
Bigeye Tuna	0.5	1.2	1.7	0.4	0.5	0.03	0.9	0.6	0.0	0.4
Albacore	2.4	0.4	<0.05	0.0	0.3	0.02	2.7	1.7	1.1	0.3
Swordfish	5.9	7.5	10.9	2.5	3.9	5.6	8.3	8.2	3.5	6.5
Total	9.7	14.2	14.46	5.8	5.0	8.35	13.7	10.77	6.0	9.61

8.6.2 Menhaden Purse Seine Fishery

In the menhaden purse seine fishery, sharks were caught incidentally in approximately 30 percent of the purse seine sets observed (deSilva *et al.*, 2001). Ten species of sharks were identified with blacktip sharks being the most common species. Approximately 20 percent of the sharks were not identified to species. An estimated 30,000 sharks were taken in this fishery

annually in 1994 and 1995. At the time of release, 75 percent of sharks were dead, 12 percent were disoriented, and eight percent were healthy. The odds of observing shark bycatch was highest in April and May. Stomach analyses of sharks suggest that their occurrence in the fishery is probably the result of sharks preying on gulf menhaden (deSilva *et al*., 2001). No new data are available at this time.

Industry workers in this fishery employ a fish excluder device to reduce the retention of sharks and other large species (Rester and Condrey, 1999). In addition, a recently introduced hose cage modification may prove to be effective in reducing shark bycatch. These devices vary in effectiveness and no standards exist for such bycatch reduction measures in this fishery. In addition, there are currently no reporting requirements for takes of sharks in the menhaden purse seine fishery. Recent estimates of large coastal sharks discarded in this fishery range from 24,000 – 26,200 individuals (Cortés, 2005).

8.6.3 Shrimp Trawl Fishery

Shark bycatch in the shrimp trawl fishery consists mainly of sharks too small to be highly valued in the commercial market. As a result, few sharks are retained. Bycatch estimates of LCS in this fishery have been generated and were reviewed in the most recent LCS assessment (Table 8.4) (SEDAR 11, 2006). Bycatch estimates of the small coastal shark complex were generated for both the GOM and SA shrimp trawl fisheries for the most recent SCS stock assessment. Requirements for turtle excluder devices in these fisheries have probably resulted in less bycatch because sharks are physically excluded from entering the gear. Bycatch of the SCS complex in the Gulf of Mexico shrimp trawl fishery consists mainly of Atlantic sharpnose and bonnethead sharks (SEDAR 13, 2007). Finetooth sharks were added as a select species for the shrimp trawl observer program in 2005 to help determine if this fishery has bycatch of finetooth sharks. Prior to this, data on finetooth shark bycatch was not recorded.

Table 8.4 Estimates of bycatch (numbers of fish) of small coastal sharks in the U.S. south Atlantic and Gulf of Mexico shrimp trawl fisheries and bottom longline fishery relative to total catch. Source: SEDAR 13, 2007.

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

Year	Shrimp Bycatch (GOM)	Percent of Total Catch (GOM)	Shrimp Bycatch (SA)	Percent of Total Catch (SA)	Bottom Longline Discards	Percent of Total Catch	Total Catch
2004	797000	67.1	101330	8.5	30165	2.5	1188402
2005	530943	59.9	66893	7.5	29020	3.3	886732

8.6.4 Southeast Gillnet Fishery

Gillnet fisheries operating in the south Atlantic, particularly off Florida, have been shown to incidentally take various species of sharks (see Section 0 for full description). These fisheries are primarily targeting Spanish mackerel and whiting (kingfish). Vessels participating in these fisheries either have a mackerel permit and a commercial shark permit which allows retention and landing of sharks, or may be operating in an unmanaged fishery (whiting) that requires no permit at this time. Vessels operating in these fisheries and holding a Federal permit are required to file trip reports (Coastal Fisheries Logbook). Preliminary data from observed gillnet trips not targeting sharks indicate that Atlantic sharpnose, bonnethead, blacktip, finetooth, scalloped hammerhead, blacknose, spinner and tiger sharks were caught (Carlson and Bethea, 2006). Expanding observer coverage in South Atlantic gillnet fisheries that are landing sharks could provide additional data on the extent of the bycatch of HMS species in these fisheries and thereby improving the stock assessments for these species. NMFS will attempt to continue expanded observer coverage in these fisheries as resources allow.

8.7 Effectiveness of Existing Time/Area Closures in Reducing Bycatch

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

The combined effects of the individual area closures and gear restrictions were examined by comparing the reported catch and discards from 2005-2007 to the averages for 1997-1999 throughout the entire U.S. Atlantic fishery. Previous analyses attempted to examine the effectiveness of the time/area closures only by comparing the 2001-03 reported catch and discards to the base period (1997-99) chosen and are included here as well for reference. The percent changes in the reported numbers of fish caught and discarded were compared to the predicted changes from the analyses in Regulatory Amendment 1 to the 1999 FMP (NMFS, 2000). Overall effort, expressed as the number of hooks reported set, declined by 30 percent from 1997-99 (Table 8.5). Declines were noted for both the numbers of kept and discards of almost all species examined including swordfish, tunas, sharks, billfish, and sea turtles. The only positive changes from the base period were the numbers of bluefin tuna and dolphin kept and discarded. The reported number of bluefin tuna kept increased by 39.2 percent for 2005-07 compared to 1997-99 (Table 8.5). The number of reported discards of bluefin tuna increased by almost 12 percent between the same time periods, which matches the predicted 11 percent increase from the analyses in Regulatory Amendment 1. The number of dolphin kept was virtually unchanged between time periods and the number of dolphin discards increased by 13

percent, although the absolute number of discards were relatively low (less than one thousand fish) (

Table 8.6). Billfish (blue and white marlin, sailfish) discards reportedly decreased by 61.3 to 76 percent from 1997-99 to 2005-07 (

Table 8.6). The reported discards of spearfish declined by 30.4 percent, although the absolute number of discards was also low (less than 200 fish). The reported number of turtle interactions decreased by 67.5 percent from 1997-99 to 2005-07.

The reported distribution of effort over the same time periods was also examined for changes in fishing behavior (

Table 8.7). Declines in the number of hooks set were noted for almost all areas with the exception of the SAR area, where reported effort had increased seven-fold from the 1997-99 period. However, this effort represents on about two percent of the overall effort reported in this fishery. Overall, reported effort decreased by 30 percent from 1997-99 to 2005-07. Reported effort declined by only 15 percent in the GOM and MAB areas, while reported effort declined by 30 percent or more in all other areas with the exception of the SAR. Although reported effort declined by 65 percent in the SAT area (Tuna North and Tuna South combined), recent effort has shown an increasing trend.

Concern over the status of bluefin tuna and the effects of the pelagic longline fishery on the species led to a re-examination of a previous analysis which compared the reported catch and discards of select species or species groups from the MAB and NEC to that reported in the rest of the fishing areas (Table 8.8). The number of bluefin tuna discards reported from the MAB/NEC has increased over the last few years while the discards from the other areas has remained relatively constant. The increase in bluefin tuna discards in the MAB/NEC does not appear to be effort-related as the reported number of hooks set has also been relatively stable.

Table 8.5 **Total number of swordfish, bluefin tuna, yellowfin tuna, bigeye tuna, total BAYS (bigeye, albacore, yellowfin and skipjack tuna), reported landed or discarded in the U.S. Atlantic PLL fishery, 1997 – 2007, and percent change from 1997-99. Predicted values from Regulatory Amendment 1 where Pred [1] = without redistribution of effort, Pred [2] = with redistribution of effort.** Source: HMS Logbook data.

Year	Number of hooks set (x1000)	Swordfish kept	Swordfish discards	Bluefin Tuna kept	Bluefin Tuna discards	Yellowfin Tuna kept	Yellowfin Tuna discards	Bigeye Tuna kept	Bigeye Tuna discards	Total BAYS kept	Total BAYS discards
1997	9,674.5	69,222	20,555	207	706	76,211	1,869	21,985	1,618	105,553	4,264
1998	8,031.3	70,627	23,345	237	1,321	55,507	2,710	19,324	876	82,572	4,018
1999	7,893.6	67,544	20,656	270	604	85,307	2,889	22,615	906	116,306	4,389
2000	8,021.9	63,535	16,706	236	738	73,205	1,772	13,908	348	95,294	2,968
2001	7,742.3	49,236	14,448	183	348	53,751	1,811	18,976	559	82,997	3,806
2002	7,229.6	50,439	13,182	178	593	59,758	1,655	14,056	277	80,749	2,599
2003	7,120.4	52,838	12,089	275	881	51,988	2,015	7,539	348	64,601	2,802
2004	7,325.9	46,950	10,704	476	1,031	64,128	1,736	8,266	486	77,989	3,452
2005	5,922.6	41,239	11,158	376	766	43,833	1,316	8,383	369	57,237	2,545
2006	5,662.0	38,241	8,900	261	833	55,821	1,426	12,491	257	73,058	2,865
2007	6,290.6	45,933	11,823	357	1,345	56,062	1,452	8,913	249	70,390	3,031
Mean											
1997-99	8,533.1	69,131	21,519	238	877	72,342	2,489	21,308	1,133	101,477	4,224
A) 2001-03	7,364.1	50,838	13,240	212	607	55,166	1,827	13,524	395	76,116	3,069
B) 2005-07	5,958.4	41,804	10,627	331	981	51,905	1,398	9,929	292	66,895	2,814
% dif (A)	-13.7	-26.5	-38.5	-10.9	-30.7	-23.7	-26.6	-36.5	-65.2	-25.0	-27.3
% dif (B)	-30.2	-39.5	-50.6	39.2	11.9	-28.2	-43.8	-53.4	-74.3	-34.1	-33.4
Pred [1]		-24.6	-41.5		-1.0					-5.2	
Pred [2]		-13.0	-31.4		10.7					10.0	

Table 8.6 **Total number of pelagic sharks, large coastal sharks, dolphin (mahi mahi), and wahoo reported landed or discarded and number of billfish (blue and white marlin, sailfish, spearfish) and sea turtles reported caught and discarded in the U.S. Atlantic PLL fishery, 1997 – 2007, and percent change from 1997-99. Predicted values from Regulatory Amendment 1 where Pred [1] = without redistribution of effort, Pred [2] = with redistribution of effort.** Source: HMS logbook data.

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

Table 8.7 **Reported distribution of hooks set by area, 1995-2007, and percent change from 1997-99 (CAR=Caribbean, GOM=Gulf of Mexico, FEC=Florida East Coast, SAB=South Atlantic Bight, MAB=Mid-Atlantic Bight, NEC=Northeast Coastal, NED=Northeast Distant, SAR=Sargasso, NCA=North Central Atlantic, and SAT=Tuna North & Tuna South).** Source: HMS logbook data.

Year	CAR	GOM	FEC	SAB	MAB	NEC	NED	SAR	NCA	SAT	Total
1995	688,761	2,662,962	647,060	853,095	2,394,484	1,072,438	765,485	16,430	785,749	298,113	10,184,577
1996	651,673	3,612,577	579,064	1,591,526	1,040,205	1,139,399	589,982	87,285	500,262	601,729	10,393,702
1997	473,536	3,418,396	787,834	948,850	1,209,966	1,231,096	689,494	21,640	209,946	683,755	9,674,513
1998	333,766	3,004,727	669,533	720,675	1,320,946	886,459	506,079	3,500	247,457	338,191	8,031,333
1999	177,028	3,615,770	710,373	769,808	1,271,316	587,225	338,719	17,795	117,031	288,532	7,893,597
2000	259,369	3,682,965	718,463	813,972	1,035,296	610,103	543,699	10,959	224,364	122,684	8,021,874
2001	218,013	3,549,658	470,855	730,926	1,109,990	865,281	315,695	11,437	292,383	178,639	7,742,247
2002	172,962	3,597,953	495,245	435,231	1,022,578	559,771	464,868	104,165	241,621	135,252	7,229,628
2003	134,611	3,900,014	500,413	544,368	702,220	448,438	576,727	112,787	132,205	68,600	7,120,383
2004	298,129	4,118,468	264,524	672,973	856,521	462,171	455,862	128,582	20,990	47,730	7,325,950
2005	180,885	3,037,968	323,551	467,680	835,091	356,696	462,490	110,107	55,716	92,382	5,922,566
2006	73,774	2,577,231	281,239	544,647	1,085,640	406,199	339,586	135,575	64,500	153,620	5,662,011
2007	32,650	2,920,725	347,236	739,272	1,319,056	326,532	285,827	100,336	11,409	207,598	6,290,641
Mean											
1997-99	328,110	3,346,298	722,580	813,111	1,267,409	901,593	511,431	14,312	191,478	436,826	8,533,148
A) 2001-03	175,195	3,682,536	488,838	569,965	944,929	624,497	452,430	76,130	222,070	127,497	7,364,086
B) 2005-07	95,770	2,845,308	317,342	583,866	1,079,929	363,142	362,634	115,339	43,875	151,200	5,958,406
% dif (A)	-46.6	10.0	-32.3	-29.9	-25.4	-30.7	-11.5	431.9	16.0	-70.8	-13.7
% dif (B)	-70.8	-15.0	-56.1	-28.2	-14.8	-59.7	-29.1	705.9	-77.1	-65.4	-30.2

Table 8.8 **Number of bluefin tuna (BFT), swordfish (SWO), sharks (PEL-pelagic; LCS-Large Coastal Sharks), billfish, and turtles reported kept and/or discarded in the Mid-Atlantic Bight (MAB) and Northeast Coastal (NEC) areas combined versus all other areas as reported in the pelagic logbook data, 1995-2007.** Source: HMS logbook Data.

			SPECIES									
Area	**Year**	**Hooks set (x1000)**	**BFT kept**	**BFT discards**	**SWO kept**	**SWO discards**	**PEL shark kept**	**PEL shark discards**	**LCS kept**	**LCS discards**	**Billfish discards**	**Turtle interactions**
MAB & NEC	1995	3,466.9	96	2,791	5,845	5,399	2,683	36,415	7,747	2,125	1,461	81
	1996	2,179.6	74	1,601	3,124	874	2,520	37,743	6,435	2,004	1,184	20
	1997	2,441.1	96	583	6,330	3,663	3,062	40,515	6,670	958	803	52
	1998	2,207.4	94	1,157	9,684	4,923	2,143	28,579	1,781	890	401	57
	1999	1,858.5	70	335	8,213	4,331	1,680	12,479	1,966	736	818	174
	2000	1,645.4	26	356	8,748	2,846	2,099	13,083	4,744	1,407	240	30
	2001	1,975.3	45	200	10,661	4,000	2,537	9,013	4,383	997	310	69
	2002	1,582.3	18	389	10,986	4,219	2,378	7,308	2,331	1,207	311	41
	2003	1,150.7	67	471	10,888	3,022	2,222	6,929	2,787	1,429	172	42
	2004	1,318.7	128	709	8,486	2,463	2,323	7,594	923	1,488	219	54
	2005	1,191.8	96	575	9,184	2,420	1,912	7,026	2,512	2,433	473	44
	2006	1,491.8	124	737	10,278	2,564	1,428	7,547	1,279	2,180	266	28
	2007	1,645.6	137	1,148	14,102	3,082	2,313	8,169	431	2,861	407	55
All Other Areas (non-MAB/NEC)	1995	6,717.7	156	103	67,191	24,436	3,094	53,937	17,883	6,140	6,176	1,047
	1996	8,214.1	129	115	70,640	23,506	3,044	47,725	14,469	8,292	6,582	474
	1997	7,233.5	111	123	62,892	16,892	2,048	41,507	7,076	6,911	6,091	215
	1998	5,823.9	143	164	60,943	18,422	1,588	16,682	4,677	4,687	3,364	833
	1999	6,035.1	200	269	59,331	16,325	1,172	16,516	4,409	4,741	3,968	458
	2000	6,376.5	210	382	54,787	13,860	969	14,965	3,014	5,320	3,394	241
	2001	5,767	138	148	38,575	10,448	974	14,941	2,127	3,895	1,723	352
	2002	5,647.3	160	204	39,453	8,963	693	15,160	1,746	2,761	2,866	426
	2003	5,969.7	208	410	41,950	9,067	907	14,842	2,565	3,453	1,641	357
	2004	6,007.3	348	322	38,464	8,241	1,137	17,820	1,381	3,656	2,151	316

			SPECIES									
Area	**Year**	**Hooks set (x1000)**	**BFT kept**	**BFT discards**	**SWO kept**	**SWO discards**	**PEL shark kept**	**PEL shark discards**	**LCS kept**	**LCS discards**	**Billfish discards**	**Turtle interactions**
	2005	4,730.8	280	191	32,055	8,738	1,238	14,534	853	3,448	1,608	110
	2006	4,170.2	137	96	27,963	6,336	670	16,566	489	3,146	1,149	100
	2007	4,645.1	200	197	31,831	8,741	1,191	19,309	115	4,272	1,416	245

The reported declines in swordfish kept and discarded, large coastal sharks kept and discarded, and dolphin kept were similar to the predicted values developed for Regulatory Amendment 1. Reported discards of bluefin tuna, pelagic sharks, all billfish (with the exception of spearfish for which no predicted change was developed in Regulatory Amendment 1), and total BAYS tunas kept all declined more than the predicted values.

8.7.1 Prohibition of Live Bait in the Gulf of Mexico

Amendment 1 to the 1999 FMP also prohibited the use of live bait on pelagic longline gear in the Gulf of Mexico due to concerns over the incidental bycatch of billfish. Based on logbook data, the number of hooks reported set with live bait or a combination of live and dead bait in the Gulf of Mexico decreased from 22.7 percent in 2000, to less than 0.1 percent in 2003 (Table 8.9). However, the number of hooks reported set with no bait type specified increased from zero in 1999 – 2001 to 3.7 percent in 2003, declining to less than one percent in 2004. Also, the reported number of hooks set in the Gulf of Mexico has increased in recent years. The reported effort in 2004 represents an increase of 21.8 percent from 2000. NMFS will continue to analyze the effectiveness of the live bait prohibition in the Gulf of Mexico pelagic longline fishery.

Table 8.9 **Comparison of the number of hooks (thousands) reported set in the Gulf of Mexico with dead, artificial, or live bait, or a combination of baits, 1999-2007 (numbers in parentheses are percent of the total number of hooks set in the Gulf of Mexico).** Source: PLL Logbook data.

Bait Type	1999	2000	2001	2002	2003	2004	2005	2006	2007
Dead	2,336 (70.9)	2,598 (77.3)	3,176.5 (98.3)	3,494.6 (97.6)	3,668.7 (96.3)	4,089.0 (99.8)	2,878.9 (94.8)	2,368.2 (91.9)	2,908.5 (99.6)
Live	372 (11.3)	259 (7.7)	5,500.0 (0.2)	0.7 (<0.1)	1.5 (<0.1)	0 (0)	0 (0)	0 (0)	1.2 (<0.1)
Both (DL)	585 (17.8)	506 (15.0)	49.3 (1.5)	13.1 (0.4)	1 (<0.1)	0 (0)	0.9 (<0.1)	0 (0)	0 (0)
Artificial	-	-	-	-	-	-	0 (0)	8.7 (0.3)	0 (0)
Both (DA)	-	-	-	-	-	-	20.3 (0.7)	14.2 (0.6)	0.7 (<0.1)
Unknown	0 (0)	0 (0)	0 (0)	71.0 (2.0)	139.6 (3.6)	8.0 (0.2)	137.5 (4.5)	186.1 (7.2)	10.4 (0.4)
Total hooks	3,293	3,363	3,231.2	3,579.5	3,810.8	4,097.0	3,037.5	2,577.2	2,920.7

8.7.2 Conclusions

The time/area closures and live bait prohibition in the Gulf of Mexico have been relatively successful at reducing bycatch in the HMS pelagic longline fishery. Reported discards of all species of billfish have declined (

Table 8.6). The reported number of turtles caught, swordfish discarded, bluefin tuna discarded, and pelagic and large coastal shark discards have also declined. However, the reported number of target species kept, such as swordfish and BAYS tuna, have decreased more than was predicted. This is contrary to the other objective of the time/area closures, which was to minimize the reduction in target catch. NMFS will continue to analyze these measures as additional data become available and examine the effects of ongoing regulatory change over time.

8.8 Evaluation of Other Bycatch Reduction Measures

NMFS continues to monitor and evaluate bycatch in HMS fisheries through direct enumeration (pelagic and bottom longline 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)

Major changes to the ALWTRP were implemented in a Final Rule that published on October 5, 2007 (72 FR 57104). Regulations that affect HMS fisheries specifically gillnet fisheries, include: 1) a closed area for all gillnet fisheries from November 15 – April 15 from 29° 00' N to 32° 00' N from shore eastward to 80° 00'W and off SC, within 35 nautical miles of the coast (Southeast US Restricted Area North); 2) a restricted area from December 1 – March 31 from 27° 51'N to 29° 00'N from shore eastward to 80° 00'W (Southeast US Restricted Area South); 3) additional seasonal boundaries for EEZ waters east of 80° 00'W from 26° 46.50'N to 32° 00'N (Other Southeast Gillnet Waters); and 4) a monitoring area specific to the Atlantic shark gillnet fishery that extends from the area along the coast from 27° 51'N south to 26° 46.50'N eastward to 80° 00'W (Southeast US Monitoring Area) effective December 1 – March 31. Specific compliance requirements for fishing in these areas varies and are summarized in the Guide to the Atlantic Large Whale Take Reduction Plan. For additional information please see the ALWTRP website http://www.nero.noaa.gov/whaletrp/index.html.

- Atlantic Bottlenose Dolphin Take Reduction Team

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

- MMPA List of Fisheries Update/Stock Assessment

NMFS continues to update the MMPA List of Fisheries and the 2008 final list is available. The final 2009 List of Fisheries published on December 1, 2008 (73 FR 73032). Final

2007 and draft 2008 stock assessment reports are available and can be obtained on the web at: http://www.nmfs.noaa.gov/prot_res/PR2/Stock_Assessment_Program/sars.html.

- Pelagic Longline Take Reduction Team (PLTRT)

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

- VMS in the pelagic longline fishery

NMFS adopted fleet-wide VMS requirements in the Atlantic pelagic longline 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 pelagic longline fishery, and instructed to "undertake further consideration of the scope of the [VMS] requirements in light of any attendant relevant conservation benefits." On October 15, 2002, the court issued a final order that denied plaintiff's objections to the VMS regulations. Based on this ruling, NMFS implemented the VMS requirement in September 2003.

- VMS in other HMS fisheries

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

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9.0 HMS PERMITS AND TOURNAMENTS

This section provides updates for the number of permits that were issued in conjunction with HMS fishing activities as of May 2008. Dealer permit numbers listed in this section for shark and swordfish are as of August 2008. Section 9.7, Atlantic HMS Tournaments, 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 fisheries as of May (fishing permits) and August (dealer permits) 2008, are included in

Table 9.1 through Table 9.6. These tables have been updated since the 2007 Stock Assessment and Fishery Evaluation (SAFE) Report, which listed numbers of permits as of October 2007. The overall number of commercial limited access permits for Atlantic swordfish, tunas, and sharks decreased from 1,086 to 1,079 (

Table 9.1) between October 2007 and May 2008; however, the numbers of permits are subject to change based upon ongoing permit renewal or expiration. Figure 9.1-9.6 show the distribution of limited access permits. The overall number of tuna permits increased in some categories between October 2007 and May 2008 (Table 9.2). The HMS Angling Permit category went into effect on March 1, 2003 (67 FR 77434, December 18, 2003), and there has been a significant increase in Angling category permits over the past few years (Table 9.2). The number of tuna dealer permits increased from 286 (October 2007) to 395 (August 2008) (

Table 9.5) (Figure 9.12).

Table 9.1 **Distribution of Shark, Swordfish, and Tuna longline Limited Access Permits Between 2001 and 2008. Permit number are as of May 2008.**

State	# Directed Swordfish	# Incidental Swordfish	# Swordfish Handgear	# Directed Shark	# Incidental Shark	# Tuna Longline	# Permit Holders/# Permits
ME	2	-	1	2	1	2	4/9
NH	-	-	1	-	2	-	3/3
MA	11	2	12	4	13	11	32/53
RI	1	1	16	-	7	1	19/26
CT	1	-	2	1	2	1	5/7
NY	9	3	5	7	8	17	24/49
NJ	32	13	5	28	26	37	61/141
DE	1	-	-	-	1	1	1/3
MD	6	-	-	3	3	8	8/20
VA	1	3	-	1	4	2	5/11
NC	10	6	-	16	14	14	33/60
SC	4	2	-	7	13	5	22/31
GA	-	-	-	2	1	-	3/3
FL	71	34	39	134	143	98	341/519
AL	-	2	-	4	1	1	8/8
MS	-	1	-	1	5		6/7
LA	31	6	-	3	36	37	44/113
TX	1	3	-	1	5	5	8/15
CA	-	-	-	-	-	1	1/1
***Totals 2008**	**181**	**76**	**81**	**214**	**285**	**241**	**628/1079**
2007	**180**	**79**	**82**	**231**	**296**	**218**	**613/1086**
2006	**191**	**86**	**88**	**240**	**312**	**214**	**604/1131**
2005	**190**	**91**	**92**	**235**	**320**	**200**	**639/1128**
2004	**195**	**99**	**96**	**241**	**348**	**222**	**657/1201**
2003	**206**	**99**	**95**	**251**	**359**	**235**	**696/1245**
2002	**205**	**110**	**94**	**251**	**376**	**226**	**713/1262**
2001	**208**	**112**	**100**	**252**	**390**	**213**	**752/1275**

* Number of permit holders in each category, and state, is subject to change as permits are renewed or expire.

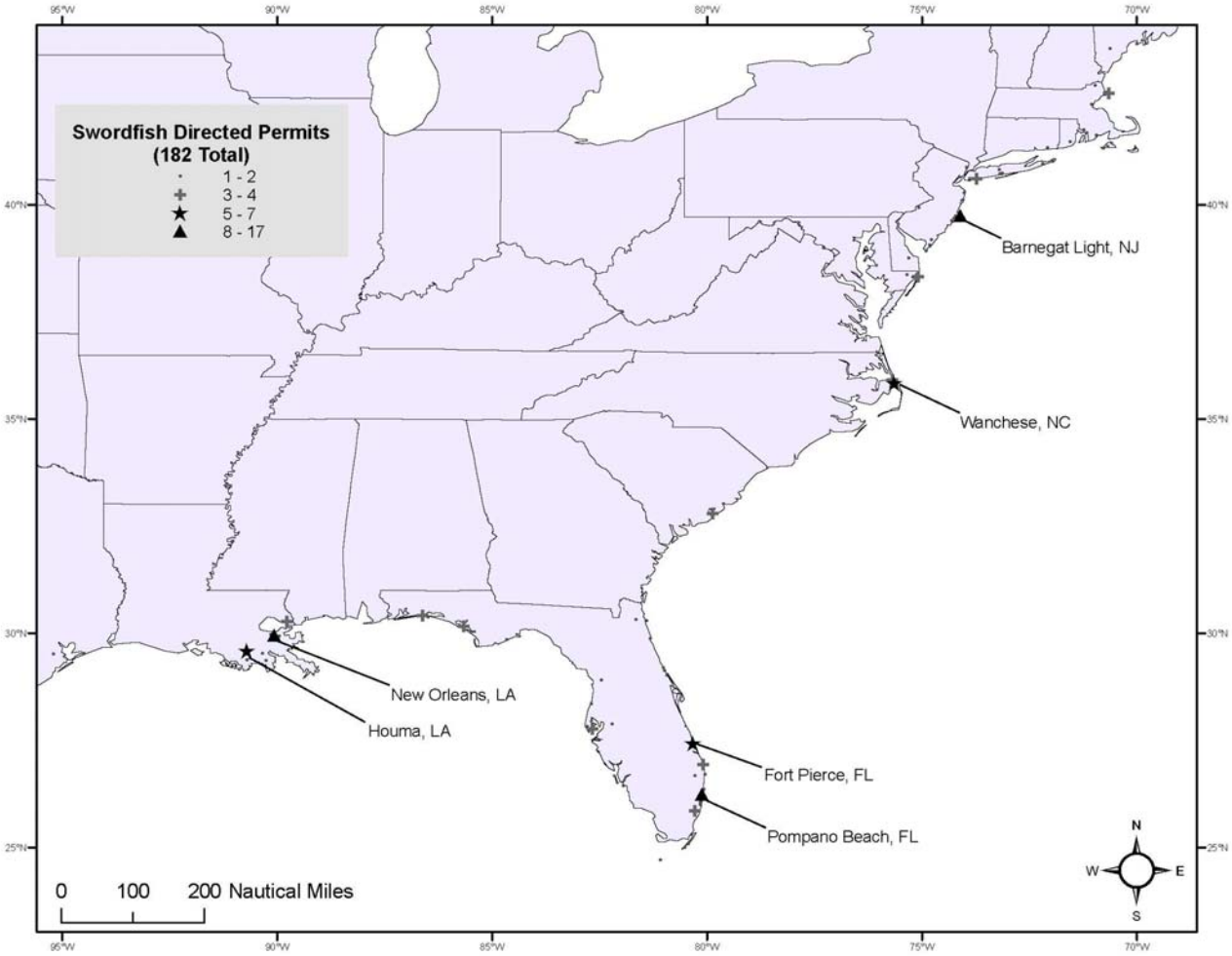

Figure 9.1 Distribution of Swordfish Directed permit holders as of May 2008

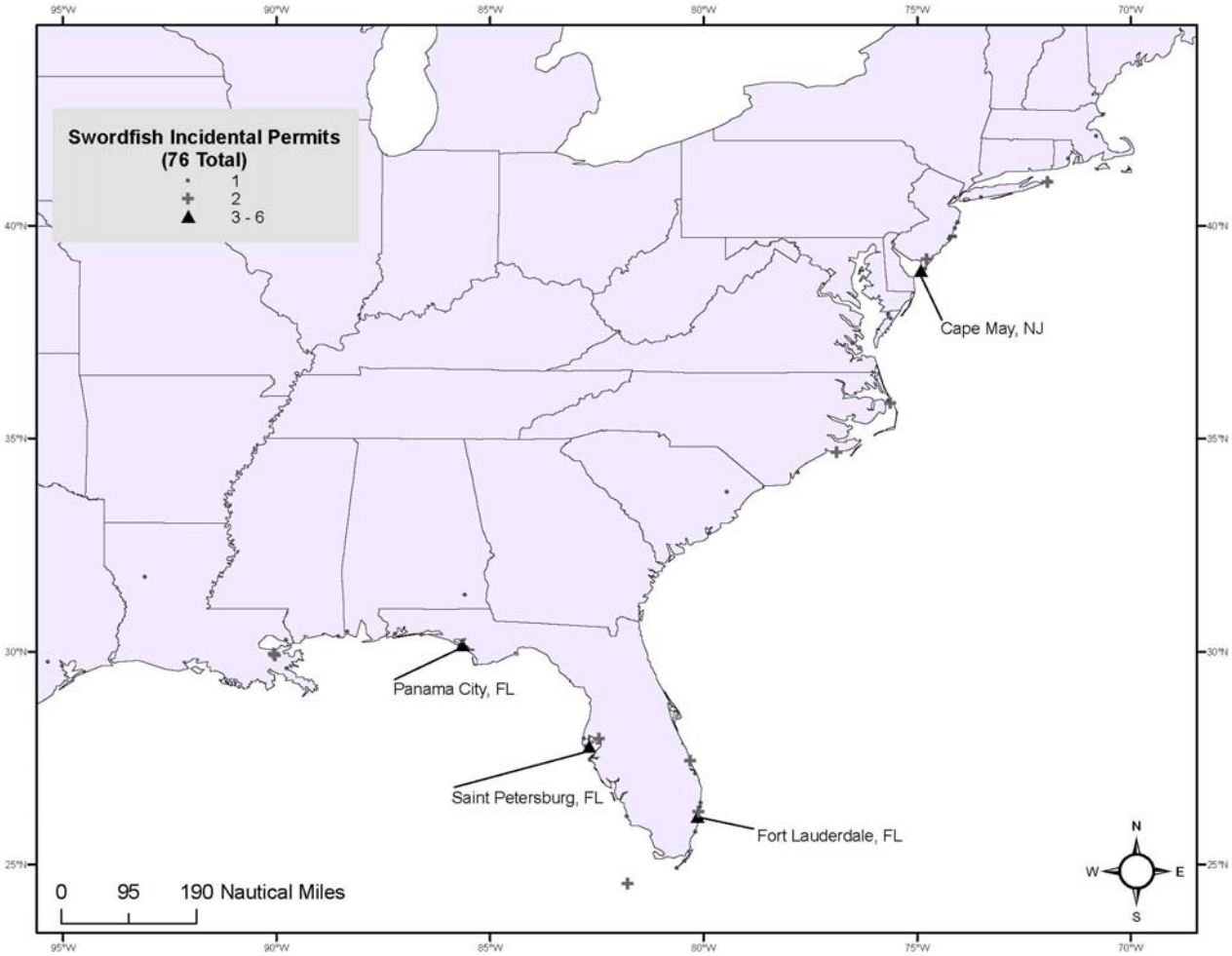

Figure 9.2 Distribution of Swordfish Incidental permit holders as of May 2008

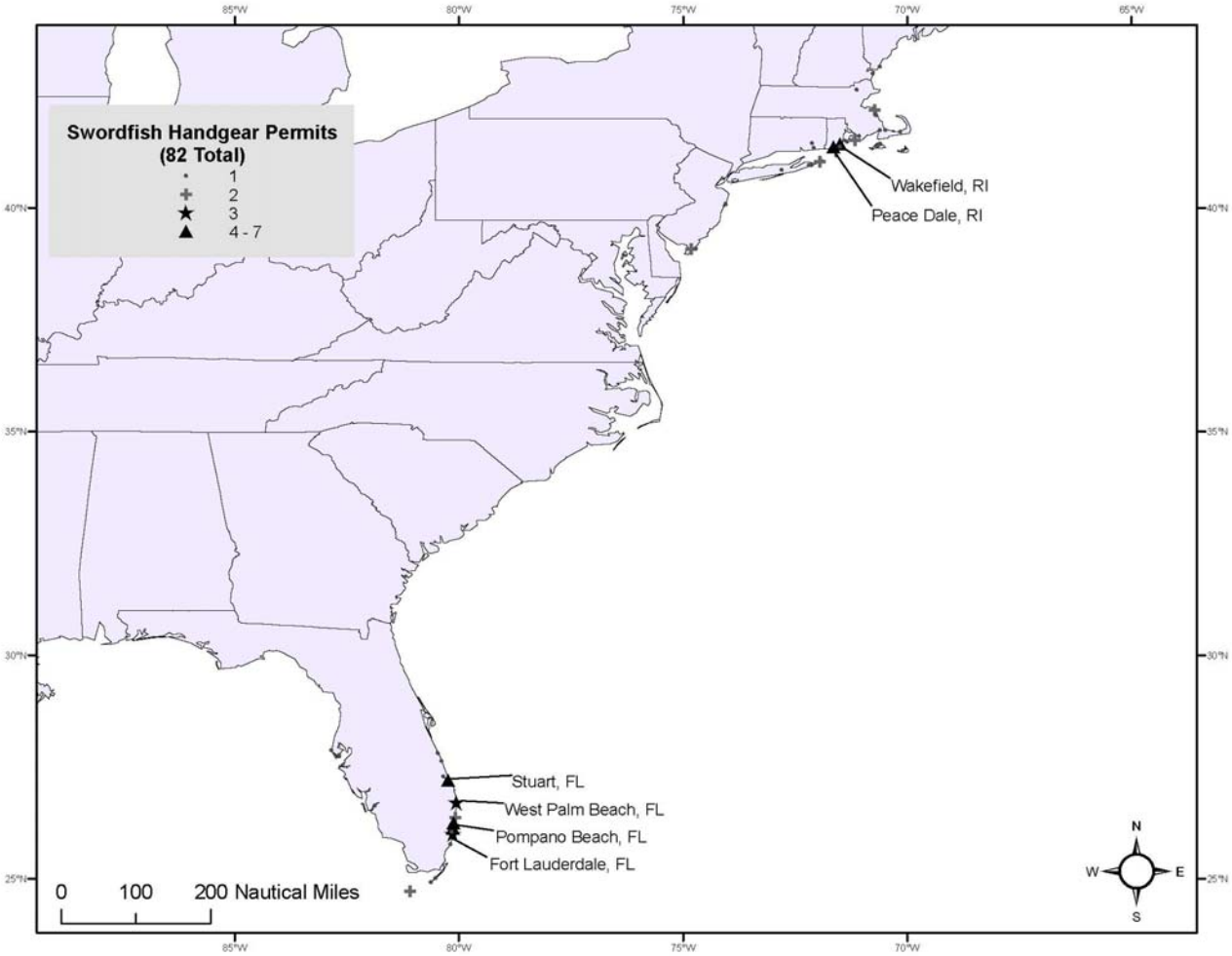

Figure 9.3 Distribution of Swordfish Handgear permit holders as of May 2008

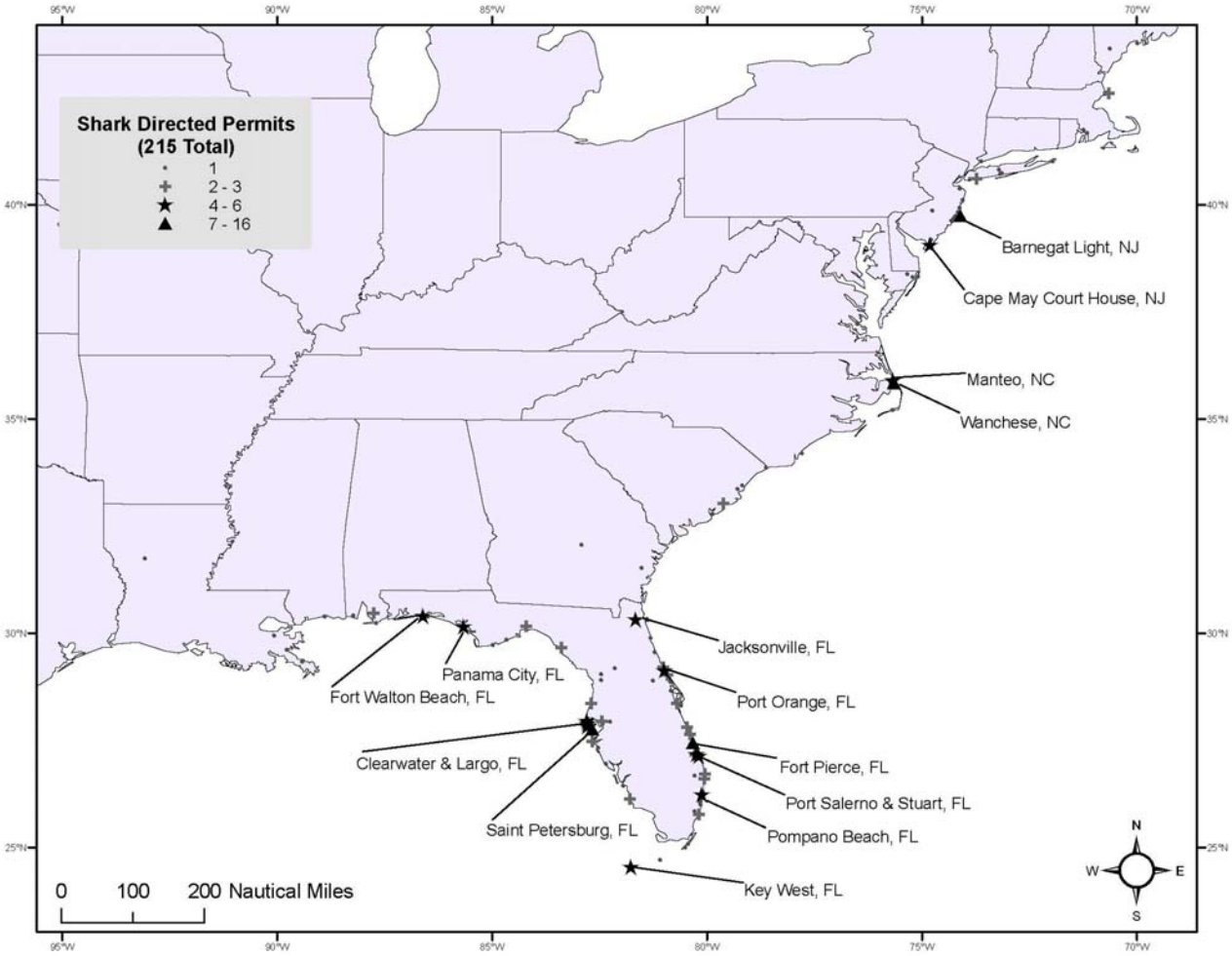

Figure 9.4 Distribution of Shark Directed permit holders as of May 2008

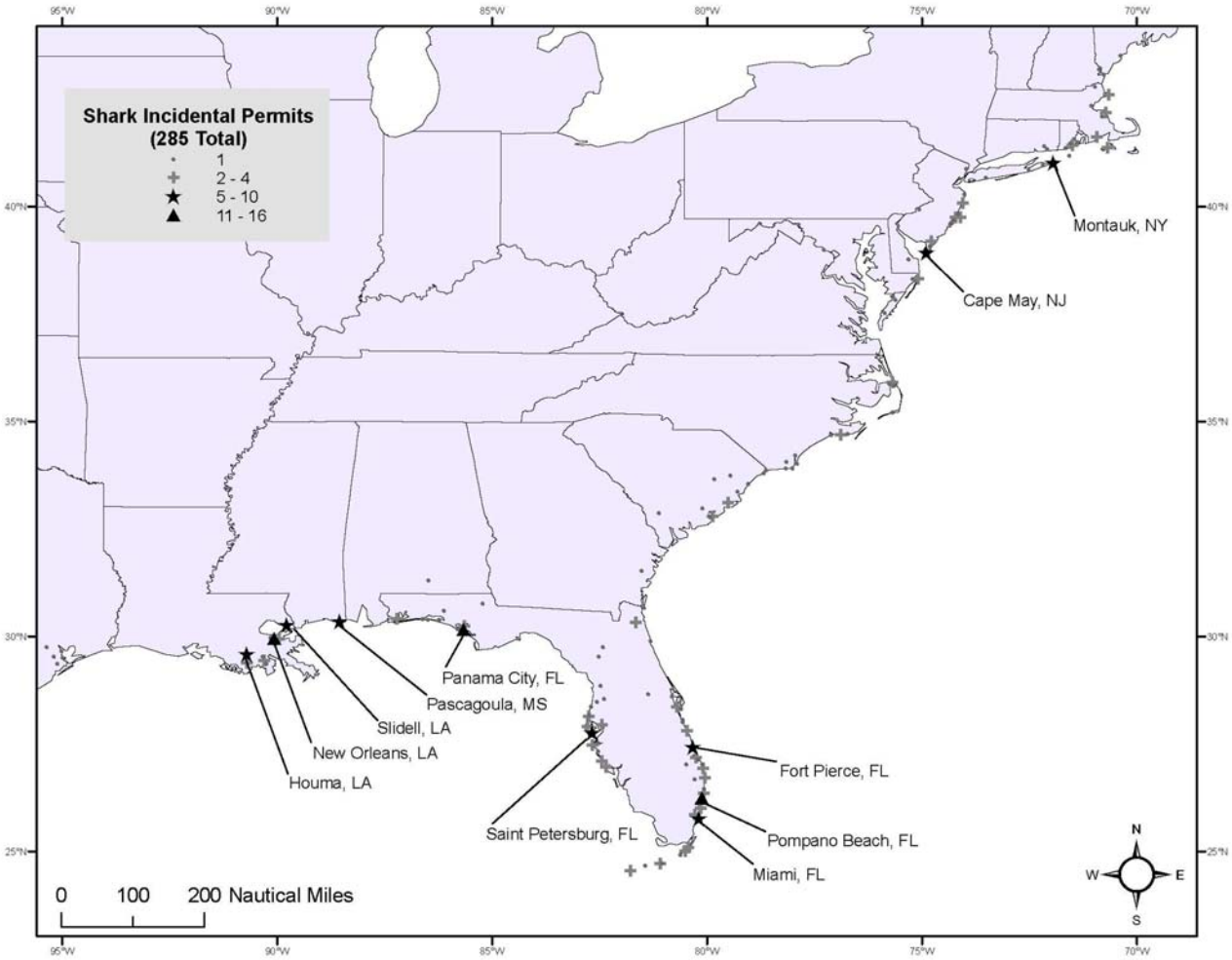

Figure 9.5 Distribution of Shark Incidental permit holders as of May 2008

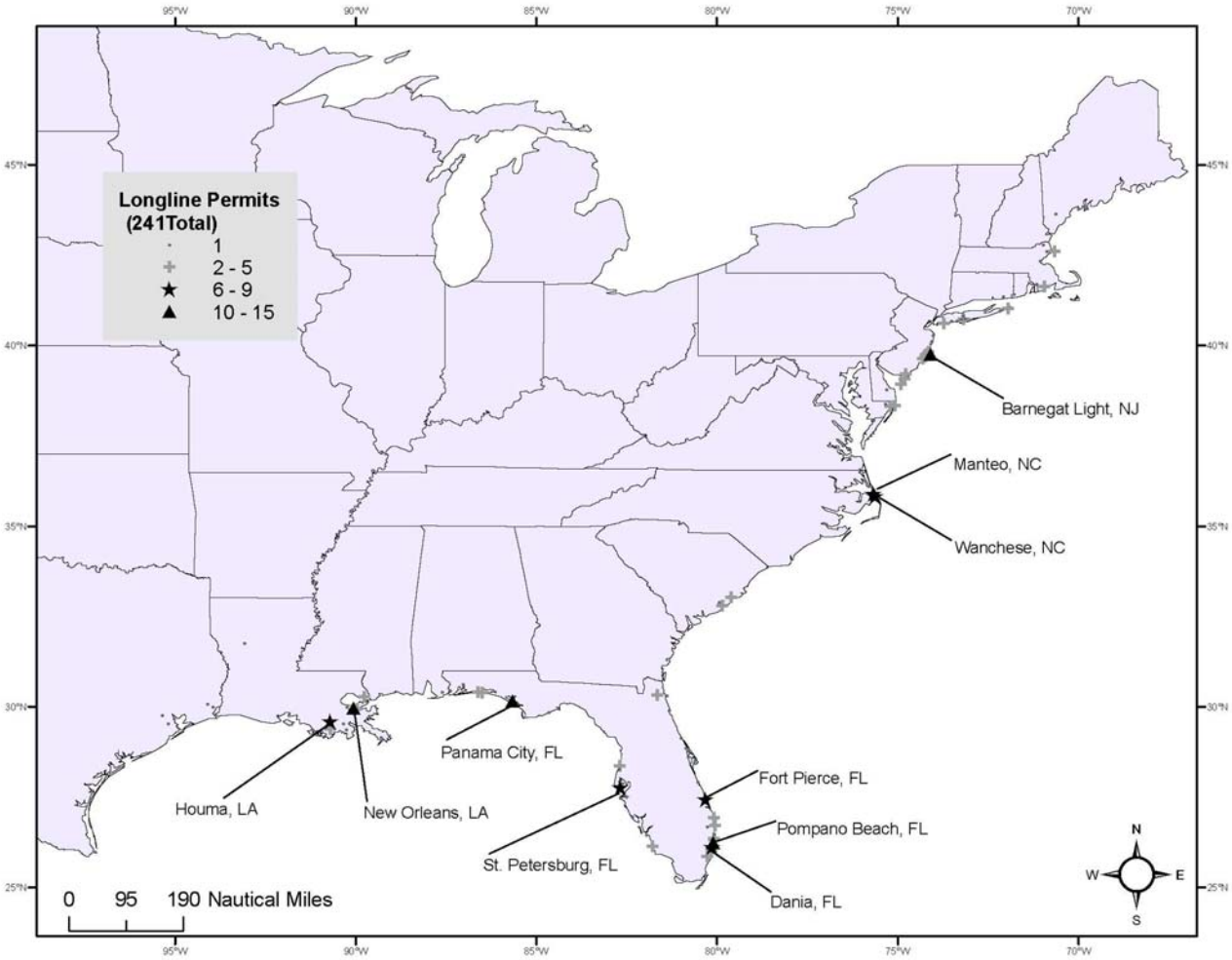

Figure 9.6 Distribution of Tuna Longline Category permit holders as of May 2008

9.1 Vessel Upgrading Requirements and Safety Issues

When the limited access program was implemented in 1999, NMFS included vessel upgrading restrictions that were the same as those implemented by the New England Fishery Management Council (NEFMC) and the Mid-Atlantic Fishery Management Council (MAFMC) in order to minimize the number of regulations with which fishermen had to comply with. The upgrading restrictions prohibited vessels from increasing overall length and gross or net tonnage by more than ten percent and prohibited an increase in horsepower by more than 20 percent. However, as of August 6, 2007 (72 FR 31688), vessels holding a particular combination of permits, to increase vessel length, gross registered tonnage, and net tonnage by up to 35 percent relative to the vessel's baseline specifications. Increase in horsepower on these vessels is unlimited.

Since the regulations were implemented NMFS has received comments that remaining vessel upgrading restrictions are not appropriate for longline vessels, 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. NMFS is considering these issues and whether additional rulemakings would be appropriate. 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 has 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 in overall length; and creating vessel categories. NMFS is considering these options, and, as with any potential changes in the permitting system, will allow for adequate public comment during the rulemaking process before making any changes to the regulations.

9.2 Atlantic Tunas Permits

The number of Atlantic Tunas permit holders by category is listed in Table 9.2. The number of permits in the Longline, General, Angling, and Charter/Headboat (CHB) Categories increased between 2007 and 2008. The increase in Longline Category permits could be attributed to the elimination of the "sunset" provision for these permits as of August 4, 2008 (73 FR 38144, July 3, 2008). This rule allows the most recent shark and swordfish limited access permit holders on record to renew previously expired Longline permits as long as other requirements for renewal were met. Distributions for General Category permits can be found in Figure 9.7. Trap Category permits (9 total) occur from North Carolina to Massachusetts. Harpoon Category permits (26 total) occur from mainly from Rhode Island north to Maine with the exception of one permit holder in North Carolina. Currently there are five entities eligible to participate in the purse seine tuna fishery but recently one vessel was sold. Therefore, there were only four Purse Seine Category permits issued in 2007 and 2008.

Table 9.2 **The number of Atlantic tuna permit holders in each category are listed for 2001 through 2008. Permit numbers for 2008 are as of May 2008. The actual number of 2008 permit holders in each category is subject to change as individuals renew or allow their permits to expire.**

Category	2001	2002	2003**	2004	2005	2006	2007	2008
Longline	213	226	235	222	200	214	218	241
Angling *	12,685	13,263	18,804	20,245	24,127	25,238	24,220	26,933
Harpoon	53	56	47	49	40	40	26	26
Trap	1	6	2	2	7	7	9	9
General	6,072	6,431	5,526	5,057	4,494	4,824	3,616	4,031
Purse Seine	5	5	5	5	5	5	4	4
CHB*	3,260	3,659	4,167	3,881	3,963	4,173	3,899	4,297
Total	**22,289**	**23,646**	**28,789**	**29,461**	**32,836**	**34,501**	**31,992**	**35,568**

* HMS Angling and CHB permit became effective March 1, 2003 (67 FR 77434, December 18, 2003) and includes all HMS, not just tunas.

In December 2002, NMFS published a final rule (67 FR 77434, December 18, 2002) that required the owner of each vessel used to fish recreationally for Atlantic HMS or on which Atlantic HMS are retained or possessed, to obtain an HMS Angling permit. This rule also established a requirement that owners of charter boats or headboats that are used to fish for, take, retain, or possess Atlantic tunas, sharks, swordfish, or billfish must obtain a HMS CHB permit. Effective March 1, 2003, this permit replaced the Atlantic Tunas Angling and CHB category permit. It is discussed in greater detail in the Section 0 HMS Angling Permit.

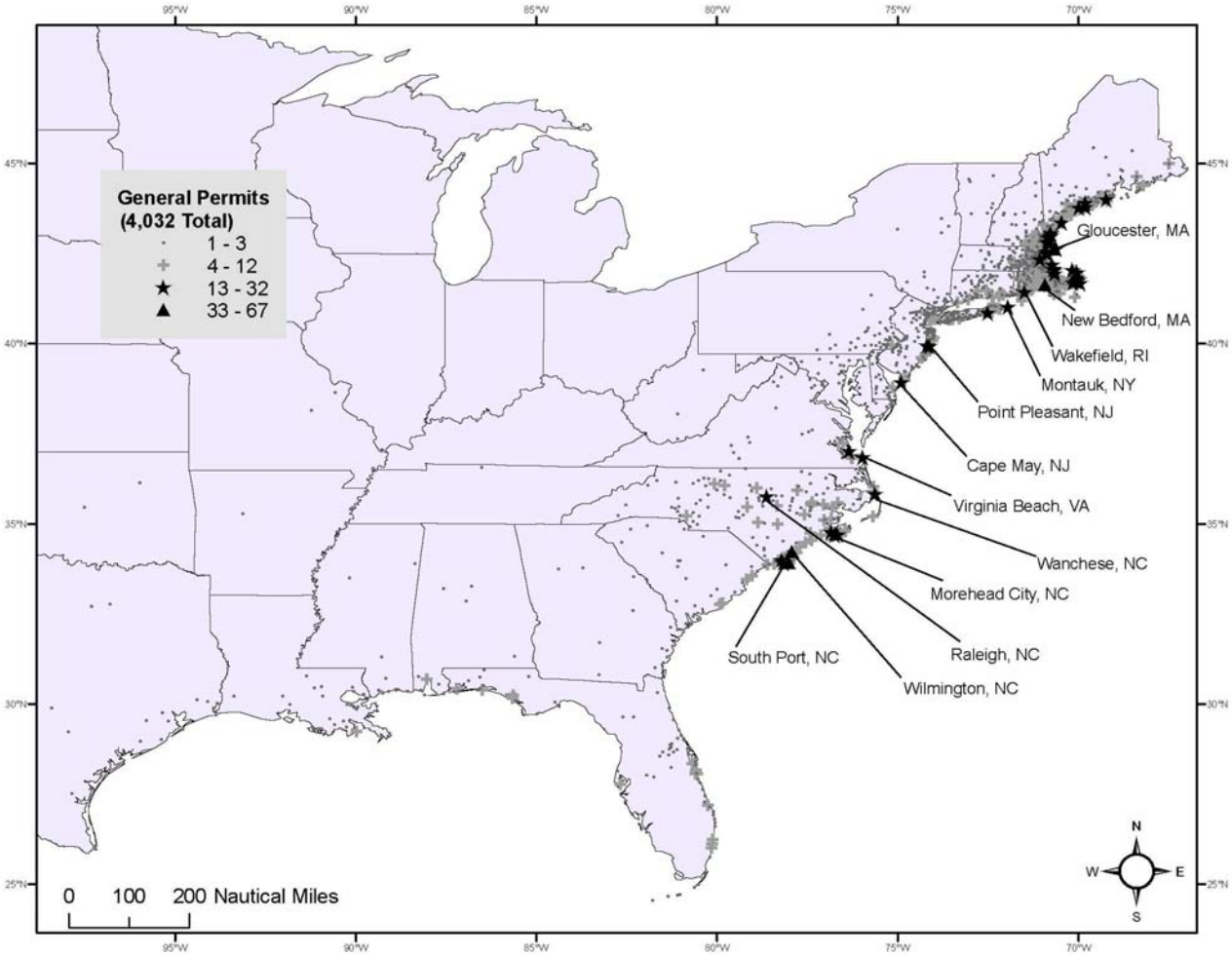

Figure 9.7 Distribution of General Category tuna permit holders as of May 2008

9.3 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 defining CHB operations. This established a requirement that owners of charter boats 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, even if there is a change in the vessel's ownership. The total number of CHB permits increased between 2007 and 2008. The distribution of HMS CHB permits can be seen in Figure 9.8.

Table 9.3 CHB Permits by State as of May 2008.

State	CHB permits	State	CHB Permits
AL	66	NJ	553
CT	114	NY	369
DE	121	NV	1
FL	699	OH	2
GA	35	PA	134
LA	78	PR	22
MA	649	RI	142
MD	162	SC	159
ME	88	TN	5
MI	7	TX	172
MS	27	VA	148
NC	431	VI	21
NH	67	Other	25
Total			**4,297**

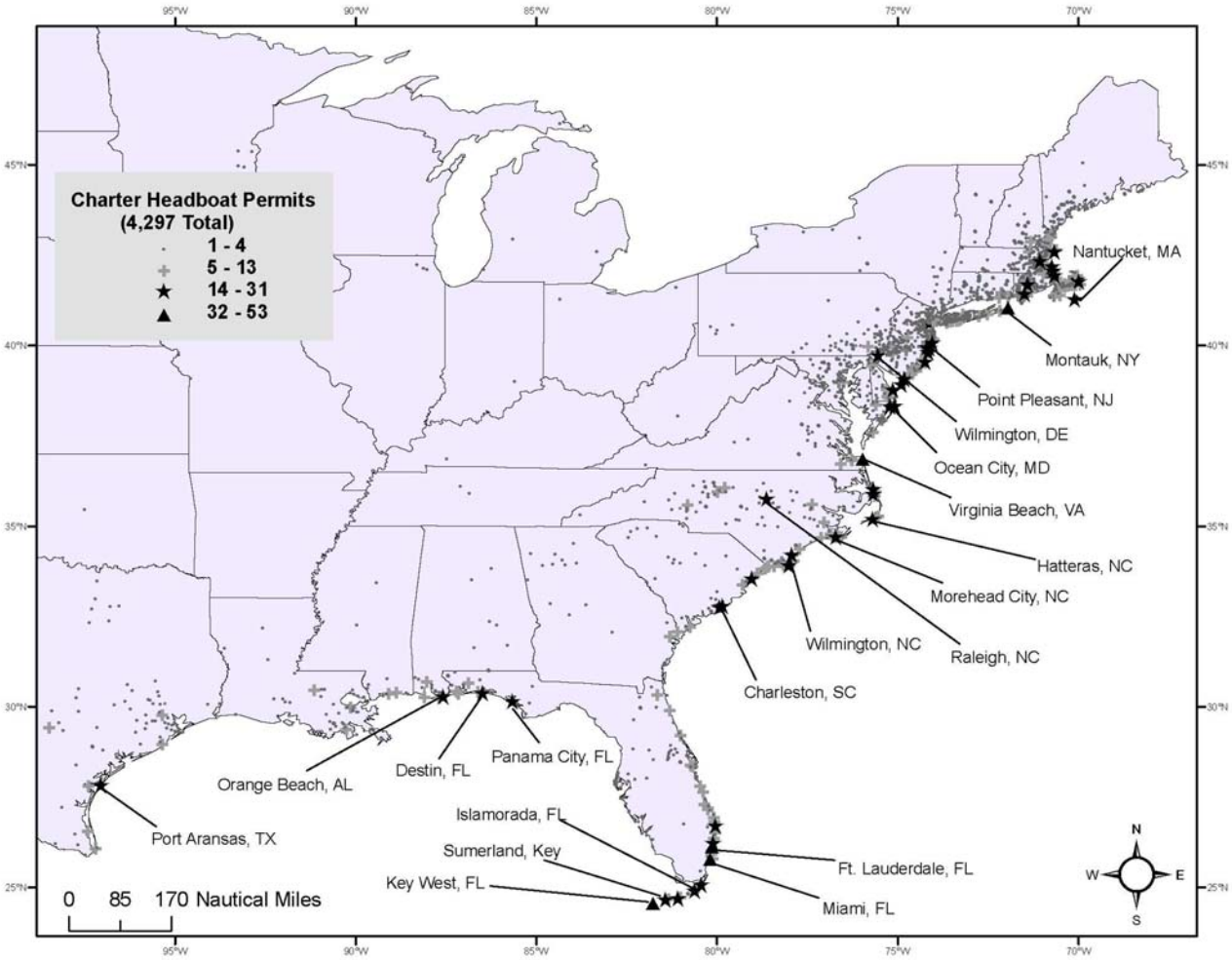

Figure 9.8 Distribution of HMS CHB Category permit holders as of May 2008

9.4 HMS Angling Permit

Effective March 2003 (67 FR 77434, Dec. 18, 2002), the HMS Angling Category permit is required to fish for, retain, or possess, including catch and release fishing, any federally regulated HMS. Current permit numbers for the HMS Angling category are listed in Table 9.2, and the distribution of HMS Angling Category permits is shown in Figure 9.9. Species authorized for harvested with an HMS Angling permit 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 Category 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 Category permit for a fishing year will not be issued an HMS Charter/ Headboat permit or an Atlantic Tunas permit in any category for that same fishing year, regardless of any change in the vessel's ownership.

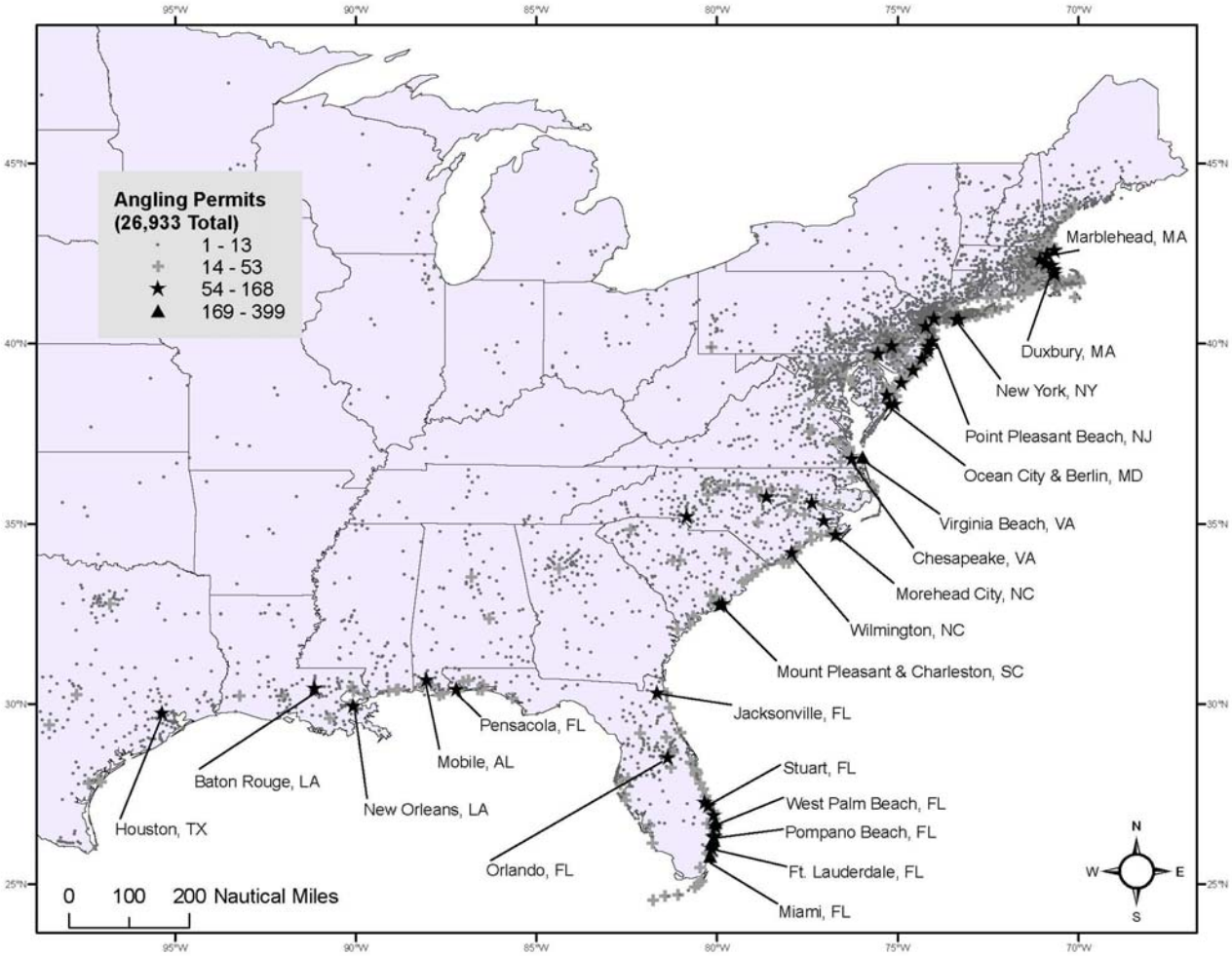

Figure 9.9 Distribution of HMS Angling Category permit holders as of May 2008

9.5 Dealer Permits

Dealer permits are required for commercial receipt of Atlantic tuna, swordfish, and sharks, and are described in further detail in the 2006 Consolidated HMS FMP. Dealer permits are open access. An Atlantic shark dealer permit is required for any entity, person, or company that is the "first receiver" of any Atlantic shark or part of an Atlantic shark. A first receiver is any entity, person, or company that takes, for commercial purposes (other than solely for transport), immediate possession of the fish, or any part of the fish, as the fish are offloaded from a fishing vessel of the United States. Shark dealers or a proxy for each location that first receives sharks must attend and successfully complete an Atlantic Shark Identification Workshop, and be issued a certificate in order to obtain or renew their shark dealer permit. Also, trucks or other conveyances which are extensions of a shark dealer's place of business must possess a copy of a valid Atlantic Shark Identification Workshop Certificate. All permitted dealers are required to submit reports detailing the nature of their business. Swordfish and shark dealer permit holders must submit bi-weekly dealer reports on all HMS they purchase. Swordfish and shark dealer permit numbers are listed in Table 9.4, and distributions of those permits are shown in Figure 9.10 and 9.11 respectively. 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). 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.

Starting July 1, 2005, dealers who import and/or export certain HMS species are required to obtain the NMFS HMS International Trade Permit (ITP) (69 FR 67268, November 17, 2004) (Table 9.6). The permit was established to coordinate U.S. implementation of International Commission for the Conservation of Atlantic Tunas (ICCAT) and Inter-America Tropical Tuna Commission trade tracking recommendations. The HMS ITP is required for trade of bluefin tuna, southern bluefin tuna, swordfish, frozen bigeye tuna, and shark fins. Reporting associated with the HMS ITP includes biweekly reports and submission of swordfish, southern bluefin tuna, and bigeye tuna statistical documents. For Atlantic and Pacific bluefin tuna, NMFS implemented a final rule that requires the use of the ICCAT bluefin catch document to fulfill reporting requirement of ITP holders (73 FR 31380 June 2, 2008). Importers and exporters of shark fins are exempt from reporting requirements at this time, but are required to hold a valid ITP.

Table 9.4 **Number of domestic shark and swordfish dealer permits issued in each between 2001 and 2008. Permits for 2008 are as of August 2008. The actual number of permits per state may change as permit holders move or sell their businesses.**

State/Country	Atlantic swordfish	Atlantic sharks	# of permits
AL	1	3	4
CA	9	3	12
FL	68	48	116
GA	1	1	2
HI	3	1	4
LA	8	7	15
MA	13	5	18
MD	2	2	4
ME	2	2	4
MS	--	--	--
NC	17	11	28
NJ	10	9	19
NY	9	6	15
PA	1	--	1
PR	1		1
RI	8	5	13
SC	10	15	25
TX	4	6	10
VA	3	4	7
VI	--	--	--
WA	1	--	1
Totals 2008	**171**	**128**	**299**
2007	**269**	**206**	**475**
2006	**285**	**336**	**621**
2005	**294**	**228**	**522**
2004	**321**	**230**	**559**
2003	**319**	**254**	**573**
2002	**321**	**267**	**588**
2001	**302**	**249**	**551**

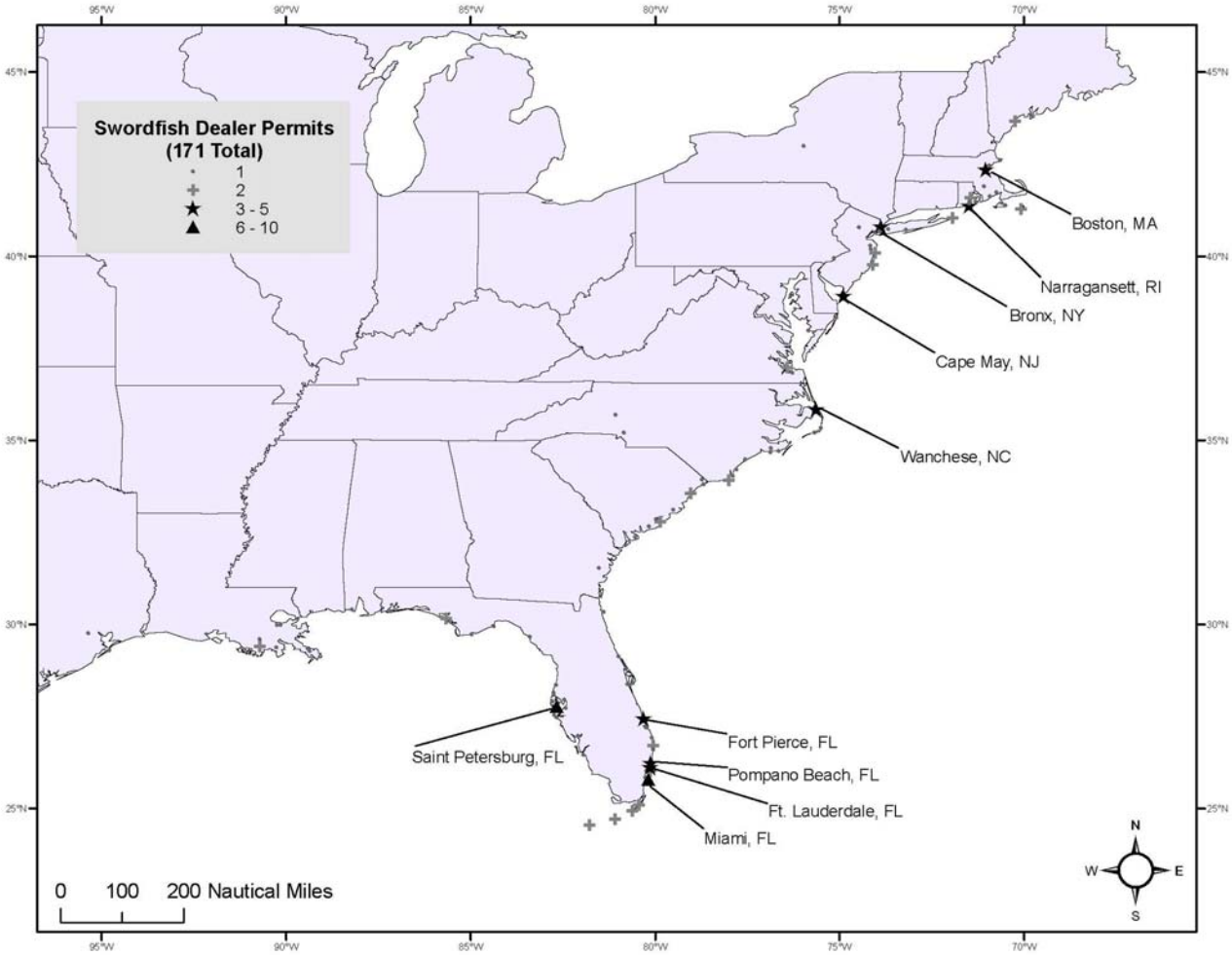

Figure 9.10 Distribution of swordfish dealer permit holders as of August 2008

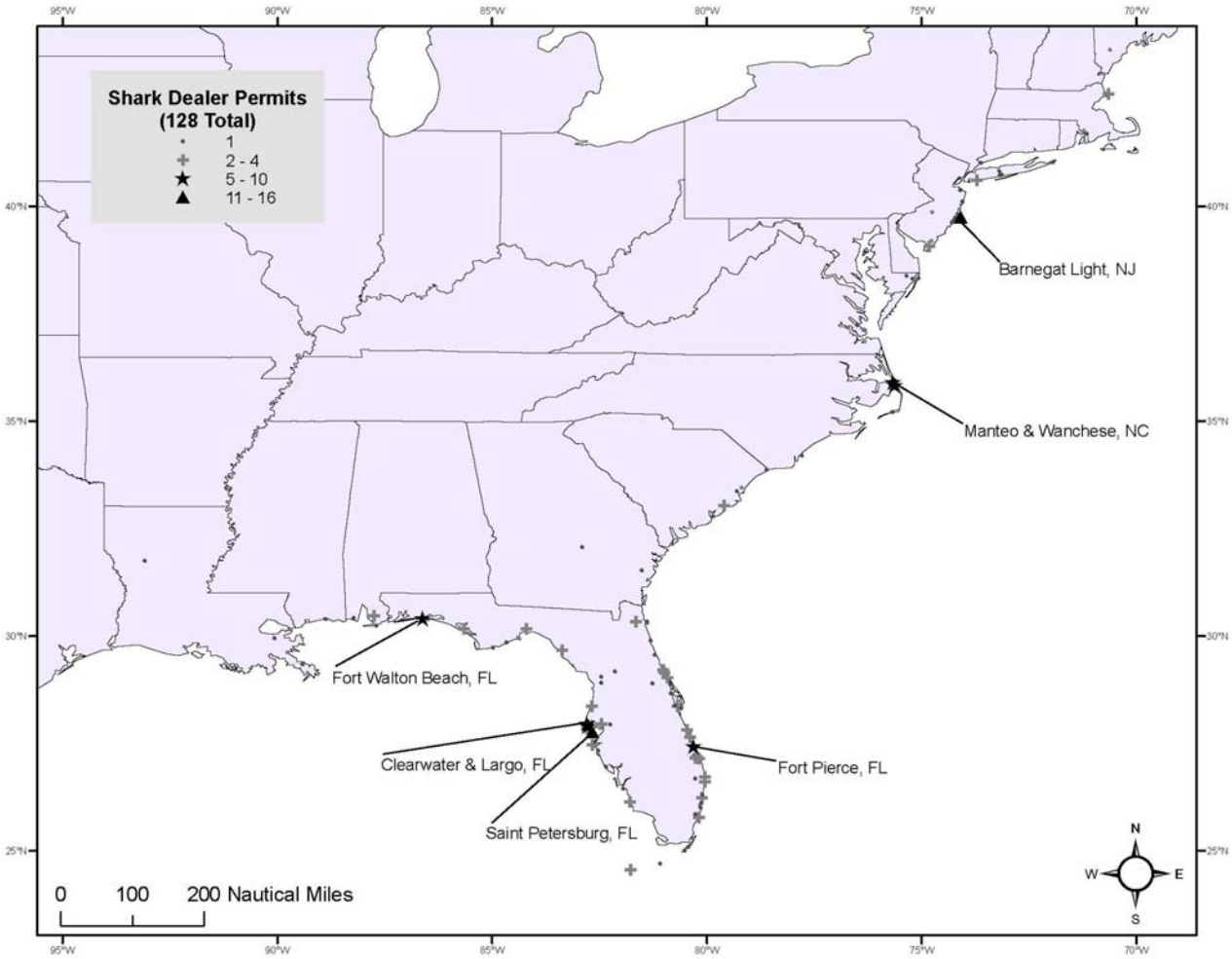

Figure 9.11 Distribution of shark dealer permit holders as of August 2008

Table 9.5 **Number of Atlantic tuna dealer permits by state as of August 2008. Dealers may obtain a permit to sell and purchase only bluefin tuna, only BAYS tunas, or both bluefin and BAYS tunas.**

State	Bluefin Only *	BAYS Only	Bluefin and BAYS	Total Atlantic Tunas Dealer Permits
AL	--	--	--	--
CA	3	--	2	5
CT	--	1	2	3
DE	--	--	2	2
FL	1	3	14	18
GA	--	--	1	1
IL	--	--	--	--
HI	--	--	4	4
LA	--	--	8	8
MA	10	6	80	96
MD	--	1	8	9
ME	6	--	9	15
NC	5	2	23	30
NH	--	--	5	5
NJ	--	9	47	56
NY	2	18	47	67
PA	1	--	--	1
PR	--	5	2	7
RI	1	6	27	34
SC	--	1	6	7
TX	--	2	--	2
VA	1	5	14	20
VI	--	3	1	4
WA	--	--	1	1
Total	**30**	**62**	**303**	**395**

*Does not include Pacific bluefin tuna dealer permits which were eliminated July 1, 2005.

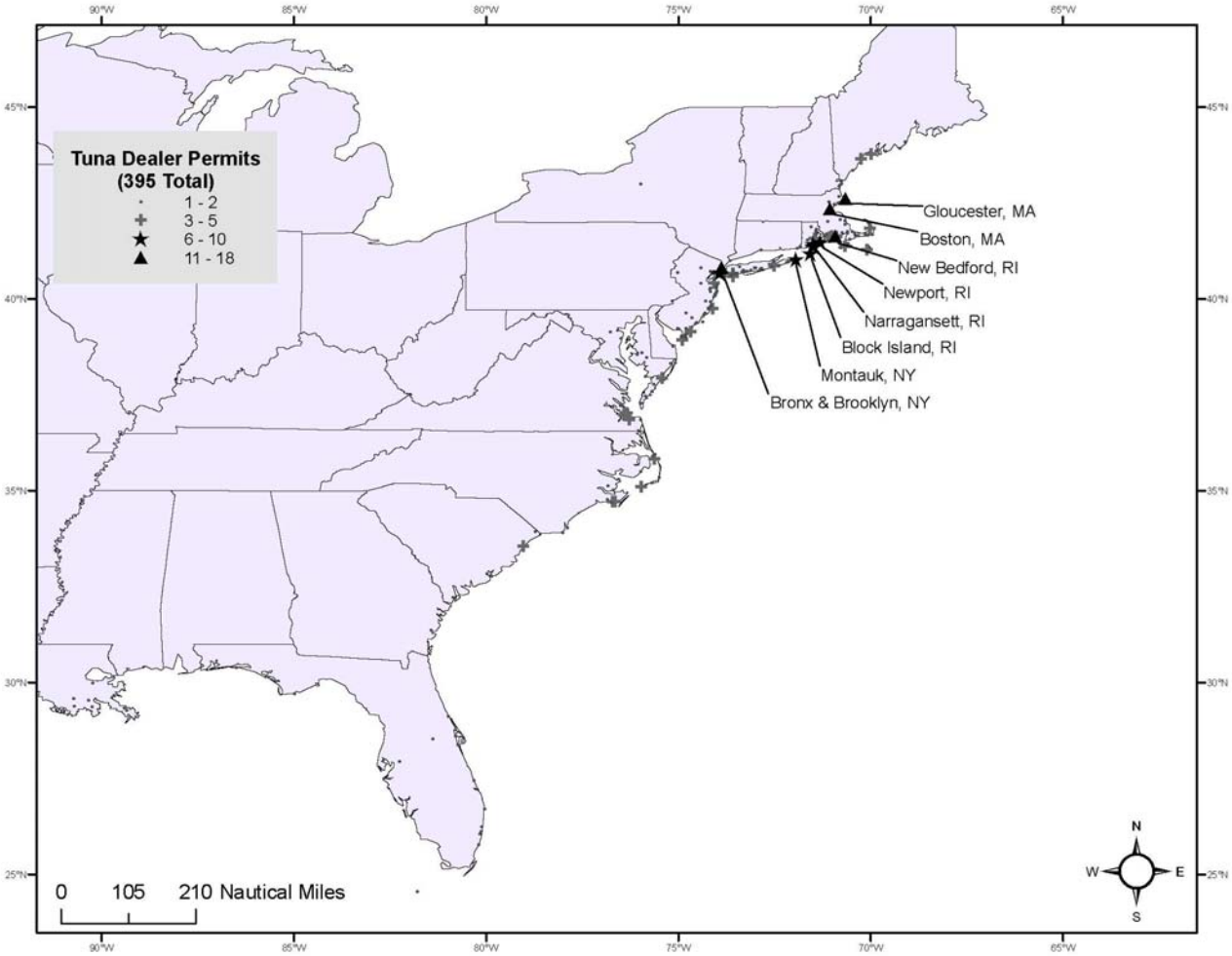

Figure 9.12 Distribution of tuna dealer permit holders as of August 2008

Table 9.6 Number of International Trade Permits (ITP) by state (province) as of August 2008.

State/Province	Number of ITPs
CA	63
CT	1
FL	42
HI	10
IL	1
KS	1
LA	2
MA	24
MD	2
ME	5
NC	3
NH	1
NJ	10
NY	19
OR	1
PA	2
RI	5
TX	3
VA	3
WA	7
Total	**205**

9.6 Exempted Fishing Permits (EFPs), Display Permits, Letters of Acknowledgement (LOAs) Chartering Permits, and Scientific Research Permits (SRPs)

EFPs, display permits, LOAs and SRPs are issued under the authority of the Magnuson-Stevens Act (MSA) (16 U.S.C. 1801 et seq.) and/or ATCA (16 U.S.C. 971 et seq.). EFPs are issued to individuals 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. Similar to SRPs, LOAs are issued to individuals conducting research from "bona fide" research vessels on species that are only regulated by MSA and not ATCA. NMFS does request research plans for these activities and indicates concurrence by issuing an LOA. 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. The 2003 Amendment 1 to the Atlantic Tunas, Swordfish, and Sharks FMP implemented and created a separate display permitting system, which operates apart from the exempted fishing activities that are focusing on scientific research. The application process for display permits is similar to that required for EFPs and SRPs. When NMFS implemented Amendment 2 to the 2006 Consolidated HMS FMP (73 FR 35788 June, 24 2008), the shark quota for EFPs, display permits, and SRPs remained the same. However, the quota for sandbar shark was reduced to 1.39 mt. authorized for display and 1.39 mt authorized for research under EFPs and SRPs.

Amendment 2 to the Consolidated HMS FMP also implemented a shark research fishery. This research fishery is conducted under the auspices of the exempted fishing program. Research fishery permit holders assist NMFS in collecting valuable shark life history data and data for future shark stock assessments. Fishermen must fill out an application for a shark research permit under the exempted fishing program to participate in the shark research fishery. In 2008, NMFS received 25 applications from 17 applicants. Of the 15 qualified applicants, 11 were chosen to participate in the shark research fishery. Shark research fishery participants are subject to 100 percent observer coverage in addition to other terms and conditions.

Issuance of EFPs, display permits, and SRPs may be necessary because possession of certain shark and billfish species are otherwise prohibited, possession of billfishes on board commercial fishing vessels is prohibited, the commercial fisheries for bluefin tuna, swordfish and large coastal sharks may be closed for extended periods during which collection of live animals and/or biological samples would otherwise be prohibited, or for other reasons. These EFPs, SRPs, and display permits would authorize collections of tunas, swordfish, billfishes, and sharks 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 pop-up satellite 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 (69 FR 70396 December 6, 2004), 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 that U.S. vessels have attained 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. 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. Due to interest from the commercial industry, NMFS is currently considering changes to the vessel chartering regulations to potentially allow catches taken under a chartering arrangement to count against the Atlantic HMS quota.

The number of EFPs, display permits, and SRPs issued from 2004 – 2008 by category and species are listed in Table 9.7. Year-end reports for permits issued for 2008 are required, and are expected to be submitted to NMFS in early 2009.

Table 9.7 Number of Exempted Fishing Permits (EFPs), Display Permits, and Scientific Research Permits (SRPs) issued between 2002 and 2008.

Permit type		2004	2005	2006	2007	2008*
Exempted Fishing Permit	Sharks for display	8	6	7	6	5
	HMS for display	1	1	1	3	1
	Tunas for display	1	0	0	0	0
	Shark research on a non-scientific vessel	6	5	7	4	4
	Tuna research on a non-scientific vessel	11	7	5	4	4
	HMS research on a non-scientific vessel	5	3	4	9	7
	Billfish research on a non-scientific vessel	1	2	3	3	3
	Shark Fishing	0	0	0	0	0
	HMS Chartering	1	0	0	0	0
	Tuna Fishing	2	0	5	0	0
	TOTAL	**36**	**24**	**32**	**29**	**24**
Scientific Research Permit	Shark research	3	4	2	2	0
	Tuna research	0	0	0	1	0
	Billfish research	0	0	1	0	0
	HMS (multi-species) research	1	4	4	1	1
	TOTAL	**4**	**8**	**7**	**4**	**1**
Letters of Acknowledgement	Shark research	2	4	5	8	6
	TOTAL	**2**	**4**	**5**	**8**	**6**

Permit numbers for 2008 are as of September 1, 2008.

9.7 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 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 United States 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 the fishing tournament and is used for awarding prizes. Generally, 100 percent of all billfish tournaments are selected for reporting to the Recreational Billfish Survey (RBS), because the information is critical to determine U.S. billfish landings for ICCAT compliance purposes. In 2007, the Marine Recreational Information Program selected approximately 35 to 40 shark and tuna tournaments from Maine through Virginia to report catch data from the tournaments. This data will be compared with LPS data that was collected in 2007. Tournament registration forms are available at: http://www.nmfs.noaa.gov/sfa/hms/linkpages/reporting_forms.htm.

In 2007, approximately 300 tournaments registered with the HMS Management Division, and occurred along the U.S. Atlantic coast, including the Gulf of Mexico and Caribbean. 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 manufacturers, marinas, boat dealers, marine suppliers, beverage distributors, resorts, radio stations, publications, chambers of commerce, restaurants, and other local businesses is often involved.

Many HMS fishing tournaments, particularly those that target billfish, promote strict conservation principles in their rules. For example, significant numbers of blue marlin, white marlin, and sailfish tournaments are "release-only," utilizing observers, angler affidavits, polygraph tests, photographs, or digital video camcorders to document the live release of billfish. Minimum sizes for fish that are allowed to be landed in many tournaments are often larger than

state and Federal requirements. Also, since January, 2008, NMFS has required that anglers fishing in any tournament awarding points or prizes for Atlantic billfish must use circle hooks when deploying natural bait or natural bait/artificial lure combinations. Because fishing tournament participants are often well-respected anglers (*i.e*. highliners), these conservation trends likely influence the general angling population in a positive manner.

Table 9.8 presents the number of registered HMS tournaments, by state, between 2002 and 2007. This table indicates that, in 2007, HMS fishing tournaments were conducted most frequently in Florida, Texas, Louisiana, Puerto Rico, New Jersey, North Carolina, South Carolina, New York, Georgia, Maryland, Massachusetts, and Alabama. By far, the largest number of registered HMS tournaments has consistently occurred in the state of Florida.

Table 9.8 Number of Registered HMS Tournaments by State between 2002 and 2007. Source: NMFS Atlantic HMS Tournament Registration Database

STATE	2002	2003	2004	2005	2006	2007	2008[2]
ME	3	3	5	3	5	5	4
NH	0	0	0	0	0	0	0
MA	1	7	10	4	7	10	10
RI	2	3	3	2	2	2	2
CT	0	0	0	1	1	0	1
NY	4	14	14	10	12	13	13
NJ	5	18	17	16	19	17	20
DE	0	0	1	0	0	1	1
MD	2	14	14	14	13	11	13
VA	1	5	4	5	4	6	5
NC	5	15	16	18	17	17	16
SC	3	13	9	9	12	13	16
GA	1	12	3	13	11	11	10
FL	26	66	57	74	83	97	71
AL	7	9	8	7	8	10	8
MS	2	7	2	2	1	1	1
LA	0	20	22	26	20	24	24
TX	1	17	10	17	17	33	21
PR	4	13	17	22	19	20	18
USVI	0	6	1	10	7	7	2
Bahamas[1]	2	1	2	2	1	1	1
Bermuda[1]	0	0	0	1	0	0	0
Turks/Caicos[1]	0	1	0	0	0	0	0
TOTAL	**68**	**244**	**215**	**256**	**259**	**299**	**257**

[1]Some foreign tournaments voluntarily registered because the participants were mostly U.S. citizens.
[2]2008 are through October 30, 2008

Table 9.9 shows the number and percentage of HMS tournaments awarding points or awards for a particular HMS, based upon 2007 tournament registrations. Blue marlin, white marlin, sailfish, and yellowfin tuna are the predominant target species in HMS fishing tournaments.

Table 9.9 **Number and Percent of All 2007 HMS Tournaments Awarding Points or Prizes for an HMS.** Source: NMFS Atlantic HMS Tournament Registration Database

Species	Number of Tournaments	Percent of tournaments
Blue Marlin	201	67.2%
White Marlin	186	62.2%
Sailfish	184	61.5%
Yellowfin Tuna	168	56.2%
Bluefin Tuna	93	31.1%
Swordfish	83	27.7%
Pelagic Sharks	59	19.7%
Bigeye Tuna	53	17.7%
Albacore Tuna	29	9.7%
Skipjack Tuna	21	7.0%
Small Coastal Sharks	21	7.0%
Ridgeback Sharks	11	3.7%
Non-Ridgeback Sharks	10	3.3%

Table 9.10-9.12 indicate the percentage and number of 2007 HMS registered tournaments, by state (or country), for blue marlin, white marlin and sailfish, respectively. These tables indicate that Florida is the leading state in terms of numbers of registered billfish tournaments, especially for sailfish.

Table 9.10 **Registered Blue Marlin Tournaments, 2007.** Source: NMFS Atlantic HMS Tournament Registration Database.

State	Number of 2007 Tournaments Awarding Points or Prizes for Blue Marlin	Percent of Total 2007 Tournaments Awarding Points or Prizes for Blue Marlin
Florida	48	23.8%
Texas	33	16.4%
Louisiana	22	10.9%
Puerto Rico	16	8.0%
North Carolina	16	8.0%
Georgia	11	5.5%

State	Number of 2007 Tournaments Awarding Points or Prizes for Blue Marlin	Percent of Total 2007 Tournaments Awarding Points or Prizes for Blue Marlin
New Jersey	10	5.0%
Maryland	9	4.5%
South Carolina	8	4.0%
U.S. Virgin Islands	7	3.5%
Alabama	7	3.5%
Virginia	5	2.5%
Massachusetts	3	1.5%
New York	2	1.0%
Bahamas[1]	1	0.5%
Rhode Island	1	0.5%
Delaware	1	0.5%
Mississippi	1	0.5%
TOTAL	**201**	**100%**

Table 9.11 **Registered White Marlin Tournaments, 2007.** Source: NMFS Atlantic HMS Tournament Registration Database.

State	Number of 2007 Tournaments Awarding Points or Prizes for White Marlin	% of Total 2007 Tournaments Awarding Points or Prizes for White Marlin
Florida	47	25.3%
Texas	31	16.7%
Louisiana	22	11.8%
North Carolina	16	8.6%
Georgia	11	5.9%
New Jersey	10	5.4%
Maryland	9	4.8%
South Carolina	8	4.3%
Alabama	7	3.8%
U.S. Virgin Islands	6	3.2%
Puerto Rico	5	2.7%
Virginia	5	2.7%
Massachusetts	3	1.6%
New York	2	1.1%
Bahamas[1]	1	0.5%
Rhode Island	1	0.5%
Mississippi	1	0.5%
Delaware	1	0.5%
TOTAL	**186**	**100%**

Table 9.12 **Registered Sailfish Tournaments, 2007.** Source: NMFS Atlantic HMS Tournament Registration Database.

State	Number of 2007 Tournaments Awarding Points or Prizes for Sailfish	% of Total 2007 Tournaments Awarding Points or Prizes for Sailfish
Florida	72	39.1%
Texas	32	17.4%
Louisiana	22	11.9%
North Carolina	12	6.5%
Georgia	11	6.0%
Puerto Rico	8	4.3%
South Carolina	8	4.3%
Alabama	7	3.8%
Virginia	5	2.7%
Maryland	2	1.1%
U.S. Virgin Islands	2	1.1%
Bahamas[1]	1	0.5%
Massachusetts	1	0.5%
Mississippi	1	0.5%
TOTAL	**184**	**100%**

10.0 ISSUES FOR CONSIDERATION AND OUTLOOK

NMFS strives to create economically and biologically healthy fisheries. Identifying and addressing emerging issues in a timely manner, NMFS can work towards achieving and maintaining the balance of biological and economic imperatives necessary to realize goals of stable, prosperous, and sustainable HMS fisheries.

Based on matters identified by the HMS Advisory Panel, the general public, and NMFS staff, this section serves as an important means to identify potential areas for future management practices to ensure sustainable HMS fisheries. The order of issues does not reflect any order of importance, and this list is not meant to be an exhaustive list of management issues facing Atlantic HMS fisheries. Rather, the intent is to inspire discussion on these topics, trigger identification of other important issues, and, in some cases, take regulatory action if necessary. NMFS may consider some of these issues for future rulemakings, but it is worth noting that some of these more complicated matters may require further input from the public (e.g., scoping meetings, workshops, etc.) which could take several years to complete. This section may also serve as a starting point for discussions by the HMS Advisory Panel.

Possible Issues for Future Rules and/or FMP Amendments

Tunas

I.	Implementation of international requirements (bluefin, yellowfin, albacore, bigeye)
II.	Bluefin quota allocations
III.	Bluefin discard estimates from harpoon, purse seine, longline, and rod and reel fisheries
IV.	Possession at-sea and landing requirements (*e.g.*, tails on, filleting at sea)

Billfish

V.	Tournament registration and reporting - electronic v. call-in system
VI.	Improving recreational catch and effort data
VII.	Caribbean FMP Amendment 4
VIII.	Scope of Certificate of Eligibility Form

Swordfish

IX.	Quota allocations (directed, incidental and recreational)
X.	Implementation of international recommendations
XI.	Swordfish fleet revitalization - next steps

Sharks

XII.	Vessel allocations (directed, incidental, research, ITQs)
XIII.	Small Coastal Shark FMP Amendment 3
XIV.	Continued coordination with state management

General

XV.	Aquaculture and fish farming
XVI.	Improving outreach to fishermen/constituents

HMS Permit Modernization

XVII.	Permit reform (Individual Transferable Quotas (ITQs)/Limited Access Privilege Programs (LAPPs)); gear based v. species based permit
XVIII.	Rationalization of permits with harvesting capacity
XIX.	Revisiting handgear permit issuance

Bycatch Reduction

XX.	Examining the efficacy of existing pelagic longline time/area closures
XXI.	On-going identification and careful handling workshops and three year certificate renewal period
XXII.	Use of VMS
XXIII.	Highgrading
XXIV.	Bluefin tuna bycatch in the Gulf of Mexico
XXV.	Implementation of Pelagic Longline Take Reduction Plan requirements

Recordkeeping and Reporting

XXVI.	Streamlining the reporting process and/or revising/creating logbooks for all fishermen and dealers (e.g., one logbook for each fishery, electronic logbooks)
XXVII.	Implementation of the International Trade Data System
XXVIII.	Tournament reporting (e.g., electronic, call-in, logbooks)
XXIX.	Recreational surveys v. direct reporting for all HMS
XXX.	Observer coverage on all fishing vessels, including recreational

Exempted Fishing/Scientific Research/Public Display Permits

XXXI.	Consistency with state regulations
XXXII.	Monitoring and enforcement issues

Review of State Regulations Under the Atlantic Tunas Conservation Act and Magnuson-Stevens Fishery Conservation and Management Act

XXXIII.	Formal review of swordfish and billfish regulations under ATCA
XXXIV.	Update tuna review under ATCA