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AMENDMENT 2 TO THE CONSOLIDATED ATLANTIC HIGHLY MIGRATORY SPECIES FISHERY MANAGEMENT PLAN

Including:
A Draft Environmental Impact Statement,
A Draft Regulatory Impact Review,
An Initial Regulatory Flexibility Analysis,
A Draft Social Impact Analysis

July 2007

Highly Migratory Species Management Division
Office of Sustainable Fisheries
National Marine Fisheries Service
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Amendment 2 to the Consolidated Highly Migratory Species Fishery Management Plan

Actions: Implement management measures consistent with recent stock assessments for sandbar, porbeagle, dusky, blacktip, and Large Coastal Sharks (LCS); initiate rebuilding plans for porbeagle, dusky, and sandbar sharks; implement commercial quotas and retention limits consistent with stock assessment recommendations to prevent overfishing and rebuild overfished stocks; modify recreational measures to reduce fishing mortality of overfished/overfishing stocks; modify reporting requirements; modify timing of shark stock assessments; clarify timing of release for annual Stock Assessment and Fishery Evaluation (SAFE) reports; update dehooking requirements for smalltooth sawfish; collect shark life history information through the implementation of a shark research program; and, consider additional time/area closures proposed by the South Atlantic Fishery Management Council.

Type of Statement: Draft Environmental Impact Statement; Initial Regulatory Impact Review; Initial Regulatory Flexibility Analysis; Initial Social Impact Statement

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Abstract: The National Marine Fisheries Service (NMFS) is amending the Consolidated Highly Migratory Species Fishery Management Plan based on several stock assessments that were completed in 2005/2006. Assessments for dusky and sandbar shark indicate that these species are overfished with overfishing occurring and porbeagle sharks are overfished. National Standard 1 of the Magnuson Stevens Fishery Conservation and Management Reauthorization Act (Magnuson-Stevens Act) requires Agencies to implement management measures that prevent overfishing and rebuild overfished stocks, as necessary. Based on the new stock assessments, and after considering comments received during scoping and on a Pre-draft document, NMFS is proposing measures that will reduce fishing mortality and effort to rebuild overfished Atlantic shark species while ensuring that a limited shark fishery can be maintained.

EXECUTIVE SUMMARY

The National Marine Fisheries Service (NMFS) is proposing management measures implemented via rulemaking that would reduce fishing mortality and effort to rebuild overfished Atlantic shark species while ensuring that a limited shark fishery can be maintained.

Atlantic Highly Migratory Species (HMS) are managed under the dual authority of the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (Magnuson-Stevens Act) and the Atlantic Tunas Convention Act (ATCA). Under the Magnuson-Stevens Act, NMFS must manage fisheries to maintain optimum yield (OY) by rebuilding overfished fisheries and preventing overfishing. Under ATCA, NMFS is authorized to promulgate regulations, as may be necessary and appropriate, to implement the recommendations from the International Commission for the Conservation of Atlantic Tunas (ICCAT). The measures proposed in this rulemaking are taken under the authority in Magnuson-Stevens Act. Currently, tunas, swordfish, billfish, and sharks are managed under the 2006 Consolidated HMS Fishery Management Plan (FMP).

NMFS announced its intent to prepare an Environmental Impact Statement on November 7, 2006 (71 FR 65086). In this notice, NMFS asked for comments on existing commercial and recreational shark management measures that would assist the Agency in determining options for conservation and management of Atlantic sharks consistent with relevant Federal statutes. On January 3, 2007 (72 FR 123), NMFS announced the availability of a scoping document and details of seven scoping meetings to be held during the month of January. During the scoping meetings, NMFS described the results of recent stock assessments, issues that need to be addressed concerning shark management, and options or alternatives that may be implemented to achieve objectives. NMFS released a Pre-draft of Amendment 2 to the Consolidated HMS FMP and a summary of the scoping comments to the HMS Advisory Panel (AP) in March 2007. NMFS requested that the AP and consulting parties (Atlantic, Gulf, and Caribbean Fishery Management Councils, Marine Fisheries Commissions, U.S. Coast Guard, and other State and Federal Agency representatives) submit comments by March 31, 2007, on the Pre-draft. While some of the options changed between the Pre-draft and draft stages of Amendment 2 to the Consolidated HMS FMP, the overall list of issues to be addressed has not changed. A summary of the comments received during scoping (November 7, 2006 – February 5, 2007) can be found on the HMS website: http://www.nmfs.noaa.gov/sfa/hms/sharks/2007/Comment_Summary_for_Shark_Amendment_2NOI.pdf. A summary and the transcripts of the March 2007 AP meeting can also be found on the HMS website at http://www.nmfs.noaa.gov/sfa/hms/.

NMFS considered a range of alternative suites that considered various management measures from seven different topics including quotas/species complexes, retention limits, time/area closures, seasons, regions, reporting, and recreational measures. The preferred alternatives suite in this document considered all of the comments received from the general public during the scoping and Pre-draft stages. More detail on the different alternative suites can be found in Chapters 2 and 4 of this document. NMFS believes that the preferred alternative suite in this document should, consistent with the Magnuson-Stevens Act and other domestic laws, rebuild overfished Atlantic shark stocks, end overfishing of Atlantic sharks, balance the needs of the fishermen and communities with the needs of the resource and scientists, and maximize sustainable fishing opportunities.

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List of Commonly Used Abbreviations and Acronyms

AA	Assistant Administrator for Fisheries
ACCSP	Atlantic Coastal Cooperative Statistics Program
ACS	Angler consumer surplus
ALRS	Automated Landings Reporting System
ALWTRP	Atlantic Large Whale Take Reduction Plan
ALWTRT	Atlantic Large Whale Take Reduction Team
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
BETYP	Bigeye Tuna Year Program
BFT	Bluefin tuna
BiOp	Biological Opinion
BLL	Bottom Longline
B_{MSY}	Biomass expected to yield maximum sustainable yield
B_{OY}	Biomass expected to yield optimum yield
BSD	Bluefin Tuna Statistical Document
BTF	By the fish
BUM	Blue marlin
CAR	Caribbean Statistical Area
CBP	Customs and Border Protection
CFDBS	Commercial Fisheries Database System
CFMC	Caribbean Fishery Management Council
CFL	Curved fork length
CFR	Code of Federal Regulations
CHB	Charter/Headboat
CIAT	Spanish for IATTC
CIE	Center for Independent Experts
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
COE	Certificate of Eligibility
COFI	Committee on Fisheries
CPI	Consumer Price Index

CPUE	Catch per unit effort
CSFOP	Commercial Shark Fishery Observer Program (run by University of Florida)
CSR	Center for Shark Research
CSTP	Cooperative Shark Tagging Program
CZMA	Coastal Zone Management Act
DEIS	Draft Environmental Impact Statement
DPS	Distinct population segment
DRG	Dredge
DSGFOP	Directed Shark Gillnet Fishery Observer Program
dw	Dressed weight
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFC	East Florida Coast closed area
EFH	Essential fish habitat
EFP	Exempted fishing permit
EIS	Environmental Impact Statement
EO	Executive Order
ESA	Endangered Species Act
F	Instantaneous fishing mortality
FAD	Fish aggregating device
FAO	Food and Agriculture Organization
FAS	Free Alongside Ship
FEC	Florida East Coast Statistical Area
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
GDP	Gross Domestic Product
GIS	Geographic Information System
GOM	Gulf of Mexico
GSAFDF	Gulf and South Atlantic Fishery Development Foundation
GMFMC	Gulf of Mexico Fishery Management Council
GSMFC	Gulf States Marine Fisheries Commission
HACCP	Hazard Analysis Critical Control Point
HAPC	Habitat area of particular concern

HBS	Headboat Survey
HMS	Highly migratory species: Atlantic sharks, tunas, swordfish, and billfish
HTS	Harmonized Tariff Schedule
IATTC	Inter-American Tropical Tuna Commission
ICCAT	International Commission for the Conservation of Atlantic Tunas
ILAP	Initial limited access permit
IMARPE	Instituo del Mar del Peru
INP	Instituto Nacional de Pesca
IPOA	International Plan of Action
IRFA	Initial regulatory flexibility analysis
ITP	International Trade Permit
ITQ	Individual transferable quota
ITS	Incidental take statement
IUU	Illegal, Unregulated, and Unreported
LAP	Limited access permit
LCS	Large coastal sharks
LJFL	Lower jaw fork length
LOA	Letter of Acknowledgment
LOF	List of Fisheries
LPS	Large Pelagic Survey
LWTRP	Large Whale Take Reduction Plan
LWTRT	Large Whale Take Reduction Team
M	Mortality
MAB	Mid-Atlantic Bight Statistical Area
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
MMS	Minerals Management Service
MPA	Marine protected area
MRFSS	Marine Recreational Fishing Statistics Survey
MSST	Minimum stock size threshold
MSY	Maximum sustainable yield
mt	Metric tons
NCA	North Central Atlantic
NEC	Northeast Coastal Statistical Area
NED	Northeast Distant Statistical Area
NEFMC	New England Fishery Management Council
NEFSC	Northeast Fisheries Science Center, NMFS

NEPA	National Environmental Policy Act
NERO	Northeast Regional Office, NMFS
NFRDI	National Fisheries Research and Development Institute
NGO	Non-governmental organization
NMFS	National Marine Fisheries Service
nmi	Nautical mile
NOA	Notice of Availability
NOAA	National Oceanographic and Atmospheric Administration
NOI	Notice of Intent
NPOA	National Plan of Action
NRC	Natural Resources Consultants, Inc.
NS	National Standards
NYB	New York Bight
OSF	Office of Sustainable Fisheries
OY	Optimum yield
PAT	Pop-up archival tag
PFD	Personal flotation device
PIFSC	Pacific Islands Fisheries Science Center
PLL	Pelagic longline
PLTRP	Pelagic Longline Take Reduction Plan
PLTRT	Pelagic Longline Take Reduction Team
POP	Pelagic observer program
PPI	Producer price index
OPR	Office of Protected Resources
PRA	Paperwork Reduction Act
PRM	Post-release mortality
PSAT	Pop-up satellite archival tag
RBS	Recreational Billfish Survey
Reg Flex Act	Regulatory Flexibility Act
RIR	Regulatory Impact Review
RFMC	Regional Fishery Management Council
RPAs	Reasonable and Prudent Alternatives
RPMs	Reasonable and Prudent Measures
RUM	Random utility model
SAFE Report	Stock Assessment and Fishery Evaluation Report
SAFMC	South Atlantic Fishery Management Council
SAB	South Atlantic Bight
SAI	Sailfish
SAR	Sargasso Sea

SBR	Spawning Stock Biomass Ratio
SCRS	Standing Committee for Research and Statistics
SCS	Small coastal sharks
SCUBA	Self contained underwater breathing apparatus
SD	Statistical document
Secretary	Secretary of Commerce
SEDAR	Southeast Data, Assessment, and Review
SEFSC	Southeast Fisheries Science Center, NMFS
SEIS	Supplemental Environmental Impact Statement
SEN	Seines
SERO	Southeast Regional Office, NMFS
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
SWFSC	Southwest Fisheries Science Center
TAC	Total allowable catch
TAG	Tag-A-Giant
TAL	Total allowable landings
TCs	Terms and Conditions
TL	Total length
TRP	Traps and pots
TUNS	Tuna North and Tuna South
TWL	Trawls
TXPWD	Texas Parks and Wildlife Department
UNK	Unknown
USFWS	United States Fish and Wildlife Service
VIMS	Virginia Institute of Marine Science
VMS	Vessel monitoring system
WHM	White marlin
WPFMC	Western Pacific Fishery Management Council
WTP	Willingness to pay
ww	Whole weight
WWF	World Wildlife Fund
YFT	Yellowfin tuna
YOY	Young of the year

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1.0 INTRODUCTION

Atlantic Highly Migratory Species (HMS) [1] are managed under the dual authority of the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (Magnuson-Stevens Act) and the Atlantic Tunas Convention Act (ATCA). Under the Magnuson-Stevens Act, the National Marine Fisheries Service (NMFS) must, consistent with the National Standards, manage fisheries to maintain optimum yield (OY) by rebuilding overfished fisheries and preventing overfishing. Under ATCA, NMFS is authorized to promulgate regulations, as may be necessary and appropriate, to implement the recommendations from the International Commission for the Conservation of Atlantic Tunas (ICCAT). The management measures proposed for this rulemaking, which primarily address Atlantic shark issues, are taken under the authority of the Magnuson-Stevens Act. In addition to these two laws, any management measures must also be consistent with other applicable laws including, but not limited to, the National Environmental Policy Act (NEPA), the Endangered Species Act (ESA), the Marine Mammal Protection Act (MMPA), and the Coastal Zone Management Act (CZMA).

Chapters 2 and 4 of this document provide a description of the alternatives and the analyses of the potential impacts. Chapter 3 provides a description of the fishery and Chapter 5 discusses any mitigating measures regarding the alternatives. Chapters 6, 7, and 8 fully analyze the economic impacts of the alternatives and address the requirements of a Regulatory Impact Review (RIR) and Initial Regulatory Flexibility Analysis (IRFA). Chapter 9 provides the community profiles and social impact analysis. Chapter 10 describes consistency with the National Standards, other requirements of the MSA, and other applicable law.

The National Marine Fisheries Service (NMFS) is proposing management measures implemented via rulemaking that would reduce fishing mortality and effort to rebuild overfished Atlantic shark species while ensuring that a limited shark fishery can be maintained.

1.1 Brief Management History

This section provides a brief overview of HMS management. More detail regarding the management history of Atlantic shark management can be found in Section 3.1.

In the 1980s, the Regional Fishery Management Councils were responsible for the management of Atlantic HMS. Thus, in 1985 and 1988, the five Councils finalized joint FMPs for swordfish and billfish, respectively. In 1989, the Councils requested that the Secretary of Commerce (Secretary) manage Atlantic sharks. NMFS finalized a shark FMP in 1993. Atlantic Tunas did not have an FMP until 1999.

On November 28, 1990, the President of the United States signed into law the Fishery Conservation Amendments of 1990 (Pub. L. 101-627). This law amended the Magnuson Fishery

[1] The Magnuson-Stevens Act, at 16 U.S.C. 1802(14), defines the term "highly migratory species" as tuna species, marlin (*Tetrapturus* spp. and *Makaira* spp.), oceanic sharks, sailfishes (*Istiophorus* spp.), and swordfish (*Xiphias gladius*). Further, the Magnuson-Stevens Act, at 16 U.S.C. 1802(27), defines the term "tuna species" as albacore tuna (*Thunnus alalunga*), bigeye tuna (*Thunnus obesus*), bluefin tuna (*Thunnus thynnus*), skipjack tuna (*Katsuwonus pelamis*), and yellowfin tuna (*Thunnus albacares*).

Conservation and Management Act (later renamed the Magnuson-Stevens Fishery Conservation and Management Act or Magnuson-Stevens Act) and gave the Secretary of Commerce (Secretary) the authority (effective January 1, 1992) to manage HMS in the exclusive economic zone (EEZ) of the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea under authority of the Magnuson-Stevens Act (16 U.S.C. §1811). This law also transferred from the Fishery Management Councils to the Secretary, effective November 28, 1990, the management authority for HMS in the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea (16 U.S.C. §1854(f)(3)).[1] At this time, the Secretary delegated authority to manage Atlantic HMS to NMFS.

Under the Magnuson-Stevens Act, NMFS must maintain OY of each fishery by preventing overfishing and rebuilding overfished stocks. To do this, NMFS must, among other things, consider the National Standards, including using the best scientific information and considering impacts on residents of different States, efficiency, costs, fishing communities, bycatch, and safety at sea (16 U.S.C. §1851 (a)(1-10)). The Magnuson-Stevens Act also has a specific section that addresses preparing and implementing FMPs for Atlantic HMS (16 U.S.C. §1854 (g)(1)(A-G)). In summary, the section includes, but is not limited to, requirements to:

- Consult with and consider the views of affected Councils, Commissions, and advisory groups;
- Evaluate the likely effects of conservation and management measures on participants and minimize, to the extent practicable, any disadvantage to U.S. fishermen in relation to foreign competitors;
- Provide fishing vessels with a reasonable opportunity to harvest any allocation or quota authorized under an international fishery agreement;
- Diligently pursue comparable international fishery management measures; and,
- Ensure that conservation and management measures promote international conservation of the affected fishery, take into consideration traditional fishing patterns of fishing vessels, are fair and equitable in allocating fishing privileges among U.S. fishermen and do not have economic allocation as the sole purpose, and promote, to the extent practicable, implementation of scientific research programs that include the tagging and release of Atlantic HMS.

1.2 Rebuilding and Preventing Overfishing of Atlantic Sharks

Under National Standard (NS) 1 of the Magnuson-Stevens Act (50 CFR 600.310), NMFS is required to "prevent overfishing while achieving, on a continuing basis, the [Optimum yield (OY)] from each fishery for the U.S. fishing industry." In order to accomplish this, NMFS must determine the maximum sustainable yield (MSY) and specify status determination criteria to allow a determination of the status of the stock. In cases where the fishery is overfished or where overfishing is occurring, NMFS must take action to rebuild the stock (by specifying rebuilding targets) or take action to prevent overfishing. In the Consolidated HMS FMP, NMFS

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outlined these status determination criteria and a set of rebuilding targets. This amendment does not change these criteria or targets.

On February 14, 2007 (72 FR 7016) NMFS published a Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS) to develop alternatives for guidance regarding annual catch limits (ACLs) and accountability measures (AMs) and other overfishing provisions of the Magnuson-Stevens Act. Both ACLs and AMs are new requirements of Magnuson-Stevens Act. The intent is to revise the NS1 guidelines consistent with these new requirements through a proposed and final rule before the end of 2007. Per section 104(b) of the Magnuson-Stevens Act, these ACL and AM requirements would take effect in fishing year 2010, for stocks determined by the Secretary of Commerce to be undergoing overfishing. Stocks not determined to be undergoing overfishing will need ACLs and AMs by 2011, including stocks with unknown or undefined status regarding overfishing (*i.e.*, data poor stocks). Fish stocks determined to be overfished by the Secretary after July 12, 2009, would need a FMP, FMP amendment, or proposed regulations to initiate a rebuilding plan for overfished stocks within one year. Despite the fact that this FMP amendment would likely be finalized before the final revised guidelines for NS 1 are completed, NMFS intends for the management measures included for rebuilding overfished sharks and preventing overfishing of sharks to be consistent, as much as possible, with the definition, or forthcoming criteria, of ACLs and AMs. As such, the specific quotas noted in this draft amendment could change by the final Amendment as a result of the rulemaking to update the NS1 guidelines.

Rebuilding Targets and Status Determination Criteria in the Consolidated HMS FMP

According to the definition at § 600.310 (d) of the Magnuson-Stevens Act overfishing occurs whenever a stock or stock complex is subjected to a rate or level of fishing mortality that jeopardizes its capacity to produce MSY on a continuing basis. The Consolidated HMS FMP established the maximum fishing mortality threshold (MFMT) as F_{MSY}. F_{MSY} is defined as the fishing mortality level necessary to produce MSY on a continuing basis. If the MFMT exceeds F_{MSY} for more than one year then the stock is considered to be subject to overfishing, and remedial action must be taken. This is the current situation with sandbar and dusky sharks.

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

Stocks are considered rebuilt when current biomass (B) levels are equal to B_{MSY}. B_{MSY} is the level of stock abundance at which harvesting the resource can be sustained on a continual basis at the level necessary to support MSY. Stocks are considered healthy when F is less than or equal to 0.75 F_{MSY} and B is greater than or equal to B_{OY} (the biomass level necessary to produce OY on a continuing basis). Blacktip sharks in the Gulf of Mexico region are considered healthy; however, the 2005/2006 assessment recommended that catches of blacktip sharks in this region should not increase.

Unlike past assessments, the 2005/2006 LCS stock assessment determined that it is inappropriate to assess the LCS complex as a whole and determined that status of the complex is unknown. This is due to the variation in life history parameters across species in the complex, different intrinsic rates of increase, and different catch and abundance data for all the species included in the LCS complex. Therefore, NMFS is examining alternative options to managing the LCS complex as a whole, which are described in more detail in Chapters 2 and 4. Similarly, the assessment concluded that blacktip sharks in the South Atlantic region are unknown because the assessment was unable to provide estimates of stock status or reliable population projections. As a result, the assessment recommended that current catch levels should not change.

The 1999 FMP for Atlantic HMS established that management measures for all HMS should have at least a 50-percent chance of reaching the target reference points used in developing rebuilding projections. This target is consistent with the technical guidelines for National Standard 1. The 1997 shark quota rule used a 50-percent probability in order to ensure that the stock levels were maintained and did not decline further while a rebuilding plan was developed (April 7, 1997, 62 FR 16647). However, as described in the 1999 FMP for Atlantic Tunas, Swordfish and Sharks and the 2006 Consolidated HMS FMPs, 50-percent is minimally acceptable for sharks.   In both the 1999 FMP for Atlantic Tunas, Swordfish, and Sharks and the 2003 Amendment 1 to that FMP, NMFS used a 70-percent probability to determine the rebuilding plan for the LCS to ensure that the intended results are actually realized.

Compared to other HMS and other fish species, many shark species are slow growing, take a long time to mature (*e.g.*, sandbar sharks mature between 12 and 15 years), have few pups per brood, and generally reproduce every other or every three years (*e.g.*, the sandbar shark has an average of eight to nine pups every other year). Given these life history traits, many shark species have a low reproductive potential. Moreover, while there is data for certain shark species, many other stocks are considered data poor, resulting in a degree of uncertainty in shark management because of the paucity of biological and/or fishing data available for some species. Such data constraints make it difficult to manage most sharks on a species basis. However, as a step towards species-specific management, in this amendment, NMFS has removed sandbar sharks from the LCS complex and has defined a new complex as "non-sandbar LCS," which is comprised of silky, tiger, blacktip, spinner, bull, lemon, nurse, scalloped hammerhead, great hammerhead, and smooth hammerhead sharks. Given most sharks have low reproductive potential, long longevity, and slow growth, in this amendment to the Consolidated HMS FMP, NMFS will use a 70-percent chance of success in order to ensure that shark stocks rebuild.

National Standard 1 and Determining the Rebuilding Timeframe

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

• The status and biology of the stock or stock complex;
• Interactions between the stock or stock complex and other components of the marine ecosystem;

• The needs of the fishing communities;
• Recommendations by international organizations in which the United States participates; and
• Management measures under an international agreement in which the United States participates.

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

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

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

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

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

2005/2006 Stock Assessments and Rebuilding Timeframe for Sandbar Sharks

The 2005/2006 LCS stock assessment conducted assessments for sandbar sharks, blacktip sharks, and the LCS complex.[1] Unlike past assessments, the 2005/2006 LCS complex assessment determined that it is inappropriate to assess the LCS complex as a whole, and the Agency determined that the status of the LCS complex is unknown. Results of the sandbar shark stock assessment determined that sandbar sharks are overfished (Spawning Stock Fecundity (SSF)[1] $2004/SSF_{MSY} = 0.72$) and overfishing is occurring ($F2004/F_{MSY} = 3.72$). The assessment recommended a sandbar specific total allowable catch (TAC) level and a corresponding rebuilding timeframe. Because the LCS complex is no longer appropriate for assessment purposes, and specific recommendations were made for sandbar sharks, NMFS is setting a separate rebuilding plan for sandbar sharks in this amendment. One objective of this amendment is to ensure that fishing mortality levels for sandbar sharks are maintained at or below levels that would result in a 70-percent probability of rebuilding in the timeframe recommended by the assessment.

[1]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.

The base-case model from the 2005/2006 assessment for sandbar sharks provided probable values for future population condition and status. In all cases, OY is the yield from a fishery that will provide the greatest overall benefit to the nations, particularly with respect to food production and recreational opportunities and taking into account the protection of marine ecosystems. As such, the TAC recommended by the stock assessment is considered OY. The stock assessment discussed three rebuilding scenarios, including: rebuilding timeframe under no fishing; a TAC corresponding to a 50-percent probability of rebuilding by 2070; and a TAC corresponding to a 70-percent probability of rebuilding by 2070. Under no fishing, the stock assessment estimated that sandbar sharks would rebuild in 38 years. Adding a generation time (28 years), as described under NS 1 for species that require more than 10 years to rebuild even if fishing mortality were eliminated entirely, the target year for rebuilding the stock was estimated to be 2070 (28 years mean generation time + 38 years to rebuild if fishing mortality eliminated = 66 years, starting in 2008). Assuming fishing mortality from 2005 to 2007 would be maintained at levels similar to 2004 (the last year of data used in the stock assessment was from 2004) and that there would be a constant TAC between 2008 and 2070, the assessment estimated that sandbars would have a 70-percent probability of rebuilding by 2070 with a TAC of 220 mt whole weight (ww) (158 mt dressed weight (dw))/year and a 50-percent probability of rebuilding by 2070 with a TAC of 240 mt ww (172 mt dw)/year. As described previously, NMFS is using the 70-percent probability of rebuilding to ensure that the intended results of a management action are actually realized given the life history traits of sandbar sharks.

Measures considered in this amendment include modifying species complexes, reducing commercial quotas, accounting for recreational landings and dead discards, implementing strict retention limits, increasing reporting, and limiting the number of participants authorized to land sandbar sharks. Such measures are necessary to ensure that the rebuilding timeframe is met for sandbar sharks. The amendment also includes potential AMs (e.g., adjusting commercial quotas based on overharvests and counting all unclassified sharks as sandbar sharks) that could be used to ensure rebuilding by 2070. Sandbar sharks would be separated from the LCS complex and the quota would be reduced to 116.6 mt dw/year, which would bring the total TAC to 158.3 mt dw (220 mt ww) once other sources of sandbar sharks mortality are accounted for. At this time, NMFS considers the 220 mt ww to be the ACL required by Magnuson-Stevens Act. NMFS is also building in a buffer zone of 20 percent for the commercial fishery (under the preferred alternative, NMFS would close the fishery when reports indicate that 80 percent of the quota has been taken) as an accountability measure to decrease the likelihood that quotas are exceeded. It is important to note that, in the future, the ACL of 220 mt ww might change when the final rule is published for new Magnuson-Stevens Act requirements regarding ACLs (per the notice of intent published February 14, 2007, 72 FR 7016).

2005 Stock Assessment and Rebuilding Timeframe for Dusky Sharks

Dusky sharks have been a prohibited species since 2000. Prior to that time, they were managed in the LCS complex. The first species-specific stock assessment for dusky sharks was conducted by the Southeast Fisheries Science Center (SEFSC) in 2006 (the SEFSC started the assessment before the decision was made to conduct stock assessments using the Southeast Data Assessment and Review (SEDAR) process; the last year of data used in the assessment was 2003). This stock assessment employed three formal stock assessment methodologies to determine stock status, including: surplus production modeling, age-structured production catch-free modeling, and age-structured production modeling. Within each scenario, baseline scenarios were identified that should be regarded as the most realistic. All methodologies and scenarios explored (approximately 30 scenarios) indicated that dusky sharks are overfished ($SSF_{2003}/SSF_{MSY} = 0.15$-$0.47$). Of the scenarios explored, 27 of 30 indicated that dusky sharks are experiencing overfishing ($F_{2003}/F_{MSY} = 1.68 – 1,180$). The SEFSC was not able to determine which scenario was the most appropriate to use for management purposes. Therefore, NMFS is providing the range of SSF and F estimates from the baseline methodologies.

Projections incorporating the Consolidated HMS FMP status determination criteria were completed with three modeling approaches. Projections to the year 2100 with no fishing mortality indicate that the stock would only have a nine-percent probability of being rebuilt in that timeframe. This means it would take much longer to reach the 70-percent probability success threshold for rebuilding as described earlier. Projections with the age-structured production model (i.e., baseline scenario) predicted that dusky sharks could be rebuilt with a 70-percent probability by the year 2400. Other projections from the three modeling approaches indicate that rebuilding of dusky sharks will take between 100-400 years.

As mentioned earlier, the harvest of dusky sharks has been prohibited since 2000. Despite this fact, they are still overfished with overfishing occurring. NMFS feels this is at least partly due to the fact that they are caught as bycatch, predominantly in longline fisheries. Fishermen are likely to catch dusky sharks when targeting sandbar sharks with BLL gear. Without a definite baseline model from which to chose, NMFS cannot determine an appropriate TAC or rebuilding timeframe. Rather, NMFS' target is reducing mortality of dusky sharks as bycatch species. By reducing dusky shark bycatch, NMFS can reduce dusky shark mortality to the extent practicable. NMFS is also assuming that the rebuilding timeframe for dusky sharks will be at least 100 years. Thus, given the rebuilding timeframe for dusky sharks and their proclivity to be caught on BLL gear, the measures proposed in this amendment focus on reducing bycatch of dusky sharks in BLL fisheries. The preferred measures included would limit the number of vessels that are authorized to land sandbar sharks. There would also be a finite number of trips that would be taken targeting sandbar sharks as the quota for sandbar sharks would be reduced by approximately 80 percent. Once this quota was met, there would be no more targeting or possession of sandbar sharks or other LCS. Trips targeting sandbar sharks would also be subject to 100 percent Federal observer coverage, therefore, the Agency would be attaining near real-time information on catch composition from those vessels that are most likely to be catching dusky sharks. This would allow the Agency to respond and implement additional measures if necessary.

Implementing a more restrictive retention limit for non-sandbar LCS (22 fish/vessel/trip) would also result in reduced fishing effort targeting sharks with BLL gear. NMFS is also considering not allowing dusky sharks for public display, limiting the number of dusky sharks authorized for research, not allowing certain species of sharks that look like dusky sharks to be possessed in recreational fisheries, maintaining the mid-Atlantic shark closed area, and implementing additional time/area closures for BLL gear recommended by the SAFMC in their Amendment 14A. These measures are all expected to reduce effort and fishing mortality, which will increase the likelihood of rebuilding dusky sharks in the allotted timeframe (100-400 years). Closing both the sandbar and non-sandbar LCS season when either quota has reached 80 percent would also reduce dusky shark interactions as overall fishing effort with BLL gear would decrease.

Despite not having a definitive TAC, NMFS does have some AMs if catch of dusky sharks in the commercial fishery is higher than expected (*e.g.*, if catches are higher than those estimated in the analyses described in Chapter 4). Under the proposed measures, NMFS could take several measures depending on the situation. In the research fishery, if dusky catch is high by a particular vessel or in a particular region, NMFS could stop that trip or stop all research trips in that region and/or time. Additionally, if after reviewing the data from a particular year, NMFS decides the catch was too high, NMFS could adjust the research protocol and reduce effort or modify gear requirements, as needed. For the non-research trips, NMFS could either reduce the retention limit in an attempt to reduce effort or work with the appropriate regional fishery management council to limit effort in that fishery.

2005 Stock Assessment and Rebuilding Timeframe for Porbeagle Sharks

A stock assessment was conducted for North Atlantic porbeagle sharks in 2005 by the Canadian Department of Fisheries and Oceans. This assessment was reviewed by NMFS and determined to be the best available science and appropriate for use in U.S. domestic management. Results indicate that porbeagle sharks are overfished (Spawning Stock Number $(SSN)_{2004}/SSN_{MSY}$ = 0.15-0.32), however, overfishing is not occurring (F_{2004}/F_{MSY} = 0.83). The assessment recommended that there is a 70-percent probability of rebuilding in 100 years if F levels are maintained at or below 0.04 (current F level). As such, NMFS is establishing the rebuilding timeframe to be 100 years.

The proposed measures in the amendment would prohibit landings of porbeagle sharks in commercial and recreational fisheries. Commercial landings of porbeagle sharks are well below the 90.2 mt dw/year quota allocated for this sector and recreational landings generally only occur in a small number of tournaments in the Northeastern United States (NMFS, 2006). While the United States is not responsible for a large proportion of the porbeagle sharks landed in the Northwest Atlantic, prohibiting landings of porbeagle sharks in all sectors would increase the likelihood that fishing mortality remains below 0.04 and rebuilding occurs in the 100 years. NMFS realizes that the Canada is responsible for the rebuilding of this stock, since a directed fishery does not exist for porbeagle sharks in the United States. However, prohibiting the retention of porbeagles would also prevent fishing effort from increasing in the future. NMFS still expects a small number of porbeagle sharks to be caught and killed as bycatch each year. As such, while the prohibiting landings of porbeagle sharks should reduce landings to zero, NMFS is establishing a TAC of 10.4 mt dw/year to account for landings that may occur illegally, dead discards, and/or landings outside of NMFS jurisdiction. This TAC is based on average commercial landings and dead discards between 2003-2005. If the TAC is exceeded, the Agency may explore additional accountability measures, including reducing the TAC or other management measures as necessary.

2005/2006 Assessments for Blacktip Sharks

The 2005/2006 stock assessment assessed blacktip sharks for the first time as two separate populations: Gulf of Mexico and Atlantic. Blacktips were assessed separately in the two regions based on tagging studies that suggested that the stocks are geographically distinct and isolated. NMFS has declared the status of the Gulf of Mexico blacktip shark population is not overfished with no overfishing occurring (November 7, 2007, 71 FR 65086). This assessment also indicated that the current status of the blacktip shark population in the South Atlantic region is unknown. NMFS has declared the status of the South Atlantic blacktip shark population to be unknown (November 7, 2007, 71 FR 65086). The results of these stock assessments indicate that the Gulf of Mexico population is healthy and that the South Atlantic population is unknown. As a result, NMFS is implementing management measures to ensure that current catches do not increase in order to keep these populations at sustainable levels consistent with advice from the stock assessment. NMFS is not implementing a rebuilding plan for blacktip sharks.

1.3 Need for Action

As described above, based on the results of the 2005 Canadian porbeagle shark stock assessment, the 2006 dusky shark stock assessment, and the 2005/2006 LCS stock assessment, NMFS has determined that a number of shark fisheries are overfished and an amendment to the 2006 Consolidated HMS FMP is needed to implement management measures to rebuild overfished stocks and prevent overfishing.

Due to timing, it is likely that the final rulemaking for this amendment will not be effective before the 2008 first trimester season begins on January 1, 2008. Thus, NMFS will likely be taking additional action concerning the 2008 first trimester season. However, NMFS anticipates that the final action for this amendment will replace all previous shark regulations. As such, it is possible that the 2008 first trimester season action and the final rule for this amendment will complement each other.

As described in the proposed rule, in addition to the management measures described in this document, NMFS is also making clarifications and other changes to the regulatory text. These changes include updating the handling and dehooking equipment requirements for smalltooth sawfish to maintain compliance with the 2003 Biological Opinion as amended on March 23, 2007. Furthermore, this rule would also modify the frequency of shark stock assessments conducted by the Agency and clarify the timing of issuing the annual Stock Assessment and Fishery Evaluation (SAFE) Report.

1.4 Objectives

Consistent with the Consolidated HMS FMP objectives, the Magnuson-Stevens Act, and other relevant Federal laws, the specific objectives of this action are to:

- Implement rebuilding plans for sandbar, dusky, and porbeagle sharks;
- Provide an opportunity for the sustainable harvest of blacktip sharks and other sharks, as appropriate;
- Prevent overfishing of Atlantic sharks;

- Analyze bottom longline time/area closures and take necessary action to maintain or modify the closures, as appropriate;

- Improve, to the extent practicable, data collections or data collection programs.

1.5 Other Considerations

Fisheries Disasters

NMFS received several comments concerning declaration of a fisheries disaster. Under certain circumstances under the Magnuson-Stevens Act, a commercial fishery disaster can be declared by the Secretary. This includes commercial fishery failures due to a fishery resource disaster as a result of "man-made causes" beyond the control of fishery managers to mitigate through conservation and management measures, including regulatory restrictions to protect the marine environment. A commercial fishery failure occurs when commerce in or revenues from commerce in the fishery materially decreases or is markedly weakened in a way that can be logically traced to the disaster. Some of the regulatory alternatives being considered in this proposed rulemaking include substantial reductions in future sharks quotas to address overfishing that could result in a commercial fishery failure.

Overfishing by itself, however, is not an acceptable cause of a fishery resource disaster under the Magnuson-Stevens Act 312(a), because overfishing is not considered to be beyond the control of fishery managers to mitigate. However, overfishing may exacerbate a fisheries resource disaster of natural or undetermined causes or causes beyond the control of fishery managers to mitigate. In addition, fishery disasters are not declared before a fishery closure or restriction under the Magnuson-Stevens Act. Declaring a fishery disaster does not automatically close a fishery. Regulations closing or restricting a fishery must first be in place before a determination for declaring a disaster can be assessed. These statements regarding disaster assistance under the Magnuson-Stevens Act are guided by NOAA Policy Directive 31-108-01 (May 8, 2007).

Upon making a fisheries disaster determination, the Secretary is authorized to make funds available "for assessing the economic and social effects of the commercial fishery failure, or any activity that the Secretary determines is appropriate to restore the fishery or prevent a similar failure in the future and to assist a fishing community affected by such failures." Declaring a fishery disaster allows NMFS to request money from Congress to assist fishermen. Subject to the availability of appropriations, a regional economic transition program would provide funds or other economic assistance for disbursement to affected entities in meeting immediate regional shoreside infrastructure needs, financial assistance and job training, and fishing capacity reduction.

At this time, the Agency is unable to declare a fisheries disaster to mitigate the negative economic consequences that may be realized by participants in the shark fishery as a result of the management measures proposed in this rulemaking. As stated above, regulations or restrictions must be in place first. After the final Amendment and final regulations are implemented, NMFS may consider if a determination for fishery disaster is warranted.

Capacity Reduction Programs

The Magnuson-Stevens Act provides for voluntary reduction of excess fishing capacity through fishing capacity reduction programs. Some participants of the Atlantic shark fishery expressed interest in reducing fishing capacity for sharks via some form of buyout program. Buyouts can occur via one of three mechanisms, including: through an industry fee, via appropriations from the United States Congress, and/or provided from any State or other public sources or private or non-profit organizations. A buyout plan is not proposed in this rulemaking, despite requests for consideration from the HMS Advisory Panel and other affected constituents, because the Agency is unable to implement a buyout as a management option. Buyouts must be initiated via one of the aforementioned mechanisms.

Some participants in the shark fishery requested that an industry "business plan" be developed. This business plan was drafted under a cooperative agreement with the Gulf & South Atlantic Fisheries Foundation. The final report was received by NMFS on September 12, 2006 (Gulf & South Altantic Fisheries Foundation, 2006).

The objective of the buyout business plan submitted by the Gulf & South Atlantic Fisheries Foundation was to assess the feasibility of a buyout program within the Atlantic commercial shark fishery. The buyout plan consisted of four components, which included the analysis of socioeconomic impacts to shark-dependent communities; management, policy and resource analysis; calculation of fair-market value for a shark permit and/or vessel, and the development of the buyout business plan. Mailings to shark fishery permit holders were conducted to solicit feedback on options that were considered for the buyout business plan. The options considered included a "reverse buyback" and several permit buyback scenarios. No vessel or non-shark permit buybacks were included in the mailing. The majority of the industry respondents to the study did not support the options being considered in the business plan. Therefore, the report concluded, "An evaluation of the Buyout Business Plan options, and comments received by commercial fishermen, indicates that the Total Allowable Catch of the shark fishery cannot adequately support a buyback which industry would support." The report also concluded that a buyout program within the shark fishery could still be feasible if issues surrounding latent effort and additional financial resources outside of the shark fishery fleet could be attained to implement a buyout program.

The recent stock assessments have indicated that further reductions in shark quotas will be necessary. These reductions will likely further the problem of latent and underutilized capacity in the shark fishery and also further decrease the feasibility of an industry financed buyout. Given the negative responses to the industry-initiated buyout business plan by permit holders, NMFS is not analyzing a buyout option in this amendment. However, should appropriations be made available or another business plan be presented to the Agency, NMFS would consider these, as appropriate.

2005/2006 Sandbar Stock Assessment

A report entitled "Report to Directed Shark Fisheries, Inc. on the 2006 SEDAR 11 Assessment for Sandbar Shark" prepared by Dr. Frank J. Hester and Dr. Mark Maunder was received by the National Marine Fisheries Service (NMFS) during the scoping period for

Amendment 2 to the Consolidated HMS FMP. This report provided a critique of the sandbar shark stock assessment methods, data, and results. The authors have concerns regarding which data sets were used in the assessment, selectivity curves employed, appropriateness of catch series included, the age-at-maturity *ogive* for sandbar sharks, and the selection of biological parameters for sandbar sharks. During the review workshop held June 5-9, 2006, the panel selected by the Center for Independent Experts (CIE) found that the data and the models employed during the data and assessment workshops, respectively, were the best currently available for evaluating the stock status of sandbar sharks. The Agency has sent a formal response to the authors addressing their concerns and is moving forward with management measures consistent with the recommendations of the stock assessments as they remain the best available for evaluating the stock status of sharks. The report submitted by Dr.'s Hester and Maunder and the Agency response are included in Appendix B.

Circle Hooks

The Agency is not aware of any research documenting the conservation benefits of employing circle hooks in bottom longline (BLL) fisheries targeting shark. The efficacy of circle hooks for reducing bycatch and post hooking mortality of sea turtles are well-documented in other fisheries, including the HMS pelagic longline (PLL) fishery. A study was recently published by Read (2007) which summarizes the results of field trials testing circle hooks in fisheries in the western North Atlantic, the Azores, the Gulf of Mexico, and Ecuador. The author recommends that while circle hooks may potentially reduce the mortality of sea turtles captured in (pelagic) longline fisheries, they should be field tested in a rigorous experiment before they are required or employed in any fishery. Furthermore, circle hooks will not reduce sea turtle mortality in every pelagic (longline) fishery, rather, each case needs to be tested prior to circle hooks being required (Read, 2007). The Agency is not proposing that circle hooks be required for BLL fisheries targeting shark at this time because of the lack of data demonstrating conservation benefits in BLL fisheries, potential inconsistencies between Council-managed and HMS BLL fisheries that may occur as a result of requiring circle hooks, and observer data indicating that circle hooks are already the most frequently used type of hook on trips targeting shark in the South Atlantic and Gulf of Mexico regions. The preferred alternative described in this document may provide a mechanism to conduct the field trials necessary to appropriately assess the efficacy of circle hooks for reducing bycatch and post-hooking mortality of sea turtles in the shark BLL fishery.

References

Gulf & South Altantic Fisheries Foundation, Inc. 2006. Development of a Buyout Business Plan for the Southeast U.S. Commercial Shark Fishery. Cooperative Agreement No. NA17FD2367 (GSAFFI #84).

Read, A. J. 2007. Do circle hooks reduce the mortality of sea turtles in pelagic longlines? A review of recent experiments. Biological Conservation 135:155-169.

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2.0 SUMMARY OF THE ALTERNATIVES

As described in Chapter 1, based on the stock assessments for large coastal sharks (LCS), sandbar, blacktip, dusky, and porbeagle sharks that were finalized in 2006, NMFS is considering various shark management measures to meet the objectives of the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (Magnuson-Stevens Act) and the Consolidated Highly Migratory Species (HMS) Fishery Management Plan (FMP). NMFS conducted scoping, including seven public hearings (January 5, 2007, 72 FR 123), from November 2006 through January 2007. NMFS received a number of comments in regard to the assessments themselves and potential management measures. Based in part on these comments, NMFS produced a Pre-Draft of Amendment 2 to the Consolidated HMS FMP (pre-draft), which was presented to the HMS Advisory Panel (AP) in early March 2007, and asked for written comments on the Pre-Draft of Amendment 2 to the Consolidated HMS FMP by the end of March. Summaries of the March 2007 AP meeting and copies of the written comments received are available from the HMS Management Division.

Based in part on comments received during scoping and on the Pre-Draft of Amendment 2 to the Consolidated HMS FMP, NMFS has grouped the potential management measures into seven key topics. These seven key topics are:

1) Quotas/Species Complexes;
2) Commercial retention limits;
3) Time/Area closures;
4) Reporting requirements;
5) Seasons;
6) Regions; and
7) Recreational measures.

Traditionally, for the Atlantic shark fishery, NMFS has analyzed alternatives under each of these topics separately. For example, under quotas/species complexes, NMFS could analyze a range of quota alternatives from no fishing (or a quota of zero, with all species prohibited) to status quo (a quota of 1,017 mt dw with 19 prohibited species).

Under the approach of analyzing each topic separately, analysis can quickly become difficult and complex given the interrelatedness of the alternatives. Under this approach, choosing one alternative in one topic can have very different impacts on the alternatives under other topics. For example, under no fishing, there would be no need to establish retention limits and no need to analyze the different alternatives. However, if the quota remains at status quo, the range of retention limits alternatives that could be analyzed would change dramatically. Thus, under this approach, NMFS could be analyzing a variety of alternatives, many of which would not be viable under the objectives of the rulemaking or would not make sense when considering the alternatives under different topics.

Furthermore, analyzing these different alternatives separately may confuse the public as it may not be obvious what the ramifications of selecting different alternatives under different topics may be on the shark stocks and participants in the shark fishery. The public may prefer alternatives under different topics that cannot be implemented together (*e.g.*, together they would not meet the rebuilding plan for sandbar sharks). Additionally, listing and analyzing the topics separately may not reinforce why NMFS chose particular preferred alternatives across the different topics. Given the specific objectives of this rulemaking (including rebuilding several shark stocks and ending overfishing), only certain combinations of alternatives under the different topics will meet the management goals.

To address these concerns, NMFS explored different methods of addressing these issues in EISs completed by other Federal agencies and has decided to analyze a number of alternative "suites" that pull from a range of alternatives under all the topics. For example, the status quo alternative includes the status quo measures currently in place under all the seven key topics (*i.e.*, quotas, species complexes, retention limits, reporting, seasons, regions, and recreational measures). The analysis of this alternative suite would assess the impact of the status quo measures as a whole. Similarly, all the other alternative suites assess the impacts of the changes to each key topic being proposed within each alternative suite.

NMFS intends for this method:

- To capture the entire range of potential environmental and socioeconomic impacts and better describe the relationship between the different alternatives;
- To provide a clearer representation of the impacts of the alternatives and why an alternative suite is preferred;
- To reduce the number of permutations or combinations of alternatives that may be combined, and which could be at odds with one another;
- To provide fishermen with a better understanding of how a particular alternative suite would affect them based on the permit(s) they possess;
- To elucidate the viable combination of management measures that will rebuild several shark stocks and end overfishing; and,
- To clarify the approach being used to reach the management goals outlined in this rulemaking (*i.e.*, outline how the total allowable catch for sandbar sharks is being attained while allowing retention of other shark species).

The alternative suites are described below and in Table 2.1. The ecological and socio-economic impacts of each alternative suite, as a whole, are analyzed in Chapter 4 and other chapters.

2.1 Description of Alternative Suites

The proposed action would include a combination of several preferred alternatives (suites). One alternative suite would need to be selected from alternative suites 1-5. In addition, one alternative would also need to be selected regarding the timing of stock assessments (either alternative 6 or 7) and SAFE reports (alternative 8 or 9). Currently, the preferred alternatives include: alternative suite 4, alternative 7, and alternative 9.

2.1.1 Alternative Suite 1: Maintaining the Existing Atlantic Commercial and Recreational Shark Fisheries (Status Quo)

The status quo alternative suite would maintain the existing commercial and recreational management measures for the Atlantic LCS, Small Coastal Sharks (SCS), and pelagic shark fisheries. The seventy-two species of Atlantic sharks managed by NMFS are divided into four species groups for management: LCS, SCS, pelagic sharks, and prohibited sharks. The LCS complex is comprised of 11 species including sandbar, silky, tiger, blacktip, spinner, bull, lemon, nurse, scalloped hammerhead, great hammerhead, and smooth hammerhead sharks. SCS consist of finetooth, Atlantic sharpnose, blacknose, and bonnethead sharks. Pelagic sharks consist of blue, oceanic whitetip, porbeagle, shortfin mako, and thresher sharks. Prohibited sharks consist of sand tiger, bigeye sand tiger, whale, basking, white, dusky, bignose, Galapagos, night, Caribbean reef, smalltail, Caribbean sharpnose, narrowtooth, Atlantic angel, longfin mako, bigeye thresher, sevengill, sixgill, and bigeye sixgill sharks. The remaining 33 species are included for data collection purposes only.

Specific management measures currently in place include:

Commercial Management Measures

Quotas/Species Complexes:

- LCS Complex (11 species, includes sandbar sharks) = 1,017 mt dw; SCS complex = 454 mt dw; Blue Sharks = 273 mt dw; Pelagic Sharks (Other than Blue and Porbeagle Sharks) = 488 mt dw; Porbeagle Sharks = 92 mt dw; and Display and Scientific Research = 60 mt ww;
- Overharvests and underharvests are deducted from/added to the next years corresponding regional trimester quota;

Retention Limits:

- LCS: 4,000 lb dw for directed permit holders and 5 LCS for incidental permit holders;
- SCS: No retention limit for directed permit holders and 16 SCS and pelagic sharks combined for incidental permit holders;
- Pelagic Sharks: No retention limit for directed permit holders and 16 SCS and pelagic sharks combined for incidental permit holders;
- Fishermen may land sharks with fins removed except for the anal and 2nd dorsal fins. The total quantity of fins may not exceed 5 percent of the total dressed carcass weight of sharks on board;

Time/Area Closures:

- Mid-Atlantic Shark Closed Area and Caribbean Sustainable Fisheries Act (SFA) closures are seasonal bottom longline (BLL) closures; the Atlantic Large Whale Take Reduction Team has implemented a suite of gear restrictions, observer requirements, etc. to reduce the likelihood of interactions between shark gillnet gear and endangered north Atlantic right whales during the winter calving period. Several pelagic longline (PLL) time/area closures apply if shark permit holders are using this gear;

Reporting:

- Dealer reports must be *postmarked* by the dealer within 10 days of the 1st and 15th of every month;
- Logbooks (Coastal Fisheries or HMS Logbook) must be submitted by fishermen within 7 days of offloading any sharks;
- Mandatory vessel observer coverage if selected;

Seasons:

- Three trimesters (January – April; May – August; and, September – December) for LCS, SCS, and Pelagic sharks;
- Seasons are established based on quota availability, catch rates, and public comment. LCS opening and closing dates are announced before season opening. Pelagic and SCS sharks closed, as needed, with 14-day notice;

Regions:

- Three regions (Gulf of Mexico, South Atlantic, and North Atlantic) for SCS and LCS; no regions for pelagic sharks;

Recreational Management Measures:

- Authorized species include bonnethead, bull, nurse, tiger, lemon, hammerheads, sandbar, Atlantic sharpnose, porbeagle, finetooth, smooth hammerhead, great hammerhead, smooth hammerhead, blacknose, shortfin mako, common thresher, oceanic whitetip, blue, spinner, and silky sharks;
- Possession limit: 1 shark > 54" per vessel per trip, also 1 sharpnose and 1 bonnethead per person per trip with no minimum size requirements;

2.1.2 Alternative Suite 2: Shark Fishery for Directed, HMS Angling, and HMS Charter/Headboat Permit Holders Only

Alternative suite 2 would allow only directed shark permit holders to commercially harvest sharks, but would prohibit retention of sandbar sharks on pelagic longline (PLL) gear. Incidental permit holders would not be allowed to retain any shark species. Based on their overfished status, porbeagle sharks would be placed on the prohibited list in alternative suites 2 through 5, resulting in no retention of porbeagle sharks by commercial or recreational fishermen. Species complexes, commercial quotas, and commercial retention limits for alternative suites 2-4 are described in Appendix A. Recreational bag limits would stay the same as the status quo for alternative suites 2 through 5; however, only the species listed in Table 2.1 would be allowed to be retained by recreational fishermen (*i.e.*, those that possess a HMS Angling, HMS Charter/Headboat, or Atlantic tunas General Category permit if participating in a registered HMS tournament). This list of authorized species is based on species of shark that recreational fishermen could easily identify to reduce fishing pressure as a result of mis-identification on dusky, sandbar, and porbeagle sharks.

Dusky sharks would not be authorized for collection for public display under alternative suites 2 through 5. However, based on research needs and objectives, NMFS would review the allocation of dusky sharks for research on a case by case basis. NMFS would allocate 1 mt dw (1.39 mt ww) of the current 60 mt ww (43.2 mt dw) display and research set-aside to sandbar sharks for public display. An additional 1 mt dw (1.39 mt ww) of the sandbar sharks would be allocated specifically for research conducted by industry vessels (however, this would be separate from any sandbar quota used in the research fishery in alternative suite 4). The remaining research and display set-aside (41.2 mt dw or 57.2 mt ww) would be authorized for all other shark species, excluding dusky and sandbar sharks, under the exempted fishing program. These new allocations would apply to alternative suites 2 through 5.

Specific management measures analyzed in this alternative suite include:

Commercial Management Measures

Quotas/Species Complexes:

- Sandbar = 116.6 mt dw; non-sandbar LCS = 541.2 mt dw; SCS = 454 mt dw; Blue Sharks = 273 mt dw; Pelagic Sharks (Other than Blue Sharks) = 488 mt dw; Porbeagle Sharks = Prohibited (0 mt dw quota); and Display and Scientific Research = 60 mt ww (Sandbar = 2.8 mt ww (2 mt dw); all other shark species (except dusky sharks) = 57.2 mt ww (41.2 mt dw);
- Overharvests would be removed from the next season's quota. Underharvests for species that are not unknown, overfished, or experiencing overfishing would be transferred to the next season's quota, up to 50 percent of the base quota. For species/complexes that are overfished, experiencing overfishing, or unknown; underharvests would not be transferred to the next season's quota;

Time/Area Closures:

- Maintain existing mid-Atlantic shark closed area closure; close the eight marine protected areas (MPAs) in the South Atlantic Fishery Management Council's (SAFMC) Amendment 14;

Retention Limits:

- 8 sandbar/vessel/trip and 21 non-sandbar LCS/vessel/trip for directed permit holders only; no trip limit for SCS and pelagic sharks for directed permit holders;
- No retention of any sharks by incidental permit holders;
- No sandbar sharks retained with PLL onboard;
- Retention of porbeagle sharks would be prohibited in all fisheries;
- All sharks landed with fins attached;

Reporting:

- Dealer reports must be received by NMFS within 24 hours of sale of shark;
- All unclassified sharks reported would be categorized as sandbar sharks;
- Vessels subject to mandatory observer coverage if selected;
- Requirements for vessel logbook submission would remain the same;

Seasons:

- One commercial season opening on January 1 of each year;
- Close seasons for sandbar and non-sandbar LCS when landings of either reach 80% of the available quota with a five day notice;
- SCS and pelagic sharks would continue to be retained until SCS and pelagic shark landings reach 80% of their respective quotas;

Regions:

- One region for all managed shark species;

Recreational Management Measures:

- Authorized species include bonnethead, nurse, tiger, lemon, hammerheads, sharpnose, shortfin mako, common thresher, oceanic whitetip, blue, and spinner sharks. Possession limit: 1 shark > 54" FL per vessel per trip, also 1 sharpnose and 1 bonnethead per person per trip with no minimum size requirements.

2.1.3 Alternative Suite 3: Shark Fishery for Directed, Incidental, HMS Angling, and HMS Charter/Headboat Permit Holders

Alternative suite 3 would implement a host of management measures resulting in a reduced shark fishery for sandbar sharks and non-sandbar LCS by incidental and directed shark permit holders. Incidental and directed shark permit holders would also be allowed to land SCS and pelagic sharks (except porbeagle sharks). Recreational fishermen (*i.e.*, those that possess a HMS Angling, HMS Charter/Headboat, or Atlantic tunas General Category permit if participating in a registered HMS tournament) would be allowed to retain species of sharks that are easy to identify (see Table 2.1). Unlike alternative suite 2, this alternative would allow incidental shark permit holders to retain some sharks. Species complexes, commercial quotas, and commercial retention limits for this alternative suite are described in Appendix A.

Specific management measures implemented via this alternative would include:

Commercial Management Measures

Quotas/Species Complexes:

- Sandbar = 116.6 mt dw; non-sandbar LCS = 541.2 mt dw; SCS = 454 mt dw; Blue Sharks = 273 mt dw; Pelagic Sharks (Other than Blue Sharks) = 488 mt dw; Porbeagle Sharks = Prohibited (0 mt dw quota); and Display and Scientific Research = 60 mt ww

(Sandbar = 2.8 mt ww (2 mt dw); all other shark species (except dusky sharks) = 57.2 mt ww (41.2 mt dw);

- Overharvests would be removed from the next season's quota. Underharvests for species that are not unknown, overfished, or experiencing overfishing would be transferred to the next season's quota, up to 50 percent of the base quota. For species/complexes that are overfished, unknown, or experiencing overfishing, underharvests would not be transferred to the next season's quota;

Time Area Closures:

- Maintain existing time area closures and close the eight time/area closures recommended by the SAFMC in their Amendment 14;

Retention Limits:

- 4 sandbar/vessel/trip and 10 non-sandbar LCS/vessel/trip for directed and incidental permit holders;
- No retention limit for SCS and pelagic sharks for directed permit holders;
- 16 SCS and pelagic sharks combined for incidental permit holders;
- Retention of porbeagle sharks would be prohibited in all fisheries;
- All sharks must be landed with fins attached;
- All gears allowed (no restrictions for PLL);

Reporting:

- Dealer reports must be *received* by NMFS not later than 10 days after each reporting period (*i.e.*, 25th and 10th of each month); logbook and observer requirements would be maintained;
- All unclassified sharks reported would be categorized as sandbar sharks;

Seasons:

- One commercial season opening on January 1 of each year;
- Close seasons for sandbar and non-sandbar LCS when landings of either reach 80% of the available quota with a five day notice;
- SCS and pelagic sharks could continue to be retained until SCS and pelagic shark landings reach 80% of their respective quotas;

Regions:

- One region for all managed shark species;

Recreational Management Measures:

- Authorized species include: bonnethead, nurse, tiger, lemon, hammerheads, sharpnose, shortfin mako, common thresher, oceanic whitetip, blue, spinner, and silky sharks.

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

2.1.4 Alternative Suite 4: Establish a Research Fishery for Sandbar Sharks; Shark Fishery for Directed, Incidental, HMS Angling, and HMS Charter/Headboat Permit Holders – Preferred Alternative

Alternative suite 4 would establish a small research fishery that would harvest the entire 116.6 mt dw sandbar quota. Vessels inside the research fishery could also retain non-sandbar LCS, SCS, and pelagic sharks (except porbeagle sharks). Vessels with commercial shark permits outside of the research fishery could only retain non-sandbar LCS as well as SCS and pelagic sharks (except porbeagle sharks) (see Table 2.1). Participation in this research fishery would be subject to vessels meeting specific criteria designed to meet research objectives while allowing fishermen to earn revenue from selling sandbar sharks. These criteria may include, but are not limited to: possession of a commercial shark permit, seasonal flexibility with regard to trips targeting sandbar sharks, willingness and ability to take an observer on 100 percent of fishing trips and collect biological samples from landed and released sharks, and ability to participate in the program for at least one year. Vessels not participating in the research program would still be authorized to land non-sandbar LCS, SCS, and pelagic sharks subject to the retention limits described below. Species complexes, commercial quotas, and commercial retention limits for this alternative suite are described in Appendix A. Only vessels participating in the research fishery could land sandbar sharks.

The Agency is proposing incorporation of the shark research fishery into the existing program for issuance of Exempted Fishing Permits, Display Permits, Scientific Research Permits, and Letters of Acknowledgement. Commercial shark permit holders (directed and incidental) would be invited to submit an application to participate in the shark research fishery on an annual basis. Applications would be evaluated to ensure that selected vessels are willing to take an observer and participate in data collection efforts on all trips under the purview of this permit, vessels are flexible with regard to timing of fishing excursions to ensure that samples are collected throughout the year, vessels are selected from all regions to ensure that samples are collected throughout the U.S. Atlantic, and that selected vessels have not had any significant fisheries violations in the past. The Agency is interested in collecting biological samples from sandbar and non-sandbar LCS throughout the year, therefore, the Agency would determine when the research vessels would fish to ensure adequate spatial and temporal sampling throughout the year. At this time, the Agency is not certain regarding the number of vessels that may participate in the shark research fishery. Data collected from the shark research fishery would assist fisheries scientists and managers maintain catch series data from the commercial shark fishery that are critical for future stock assessments. Shark life history data, including age at first maturity for sandbar sharks could also be improved as a result of this research fishery. Furthermore, research assessing methods to reduce interactions with dusky sharks, protected resources, or other bycatch may be investigated on vessels participating in this program.

Specific management measures implemented via this alternative would include:

Commercial Management Measures

Quotas/Species Complexes:

- Sandbar = 116.6 mt dw; non-sandbar LCS = 514.2 mt dw; SCS = 454 mt dw; Blue Sharks = 273 mt dw; Pelagic Sharks (Other than Blue Sharks) = 488 mt dw; Porbeagle Sharks = Prohibited (0 mt dw quota); and Display and Scientific Research = 60 mt ww (Sandbar = 2.8 mt ww (2 mt dw); all other shark species (except dusky sharks) = 57.2 mt ww (41.2 mt dw);
- Overharvests would be removed from the next season's quota. Underharvests for species that are not unknown, overfished, or experiencing overfishing would be transferred to the next season's quota, up to 50 percent of the base quota. For species/complexes that are overfished, unknown, or experiencing overfishing; underharvests would not be transferred to the next season's quota;

Time Area Closures:

- Maintain existing time area closures and close the eight time/area closures recommended by the SAFMC;

Retention Limits:

- No sandbar sharks may be landed outside of research program;
- Trip limit for sandbar and non-sandbar LCS (combined) for vessels participating in research program would vary depending on research criteria and data needs;
- 22 non-sandbar LCS/vessel/trip for directed and incidental permit holders not participating in research program;
- No trip limit for SCS or pelagic sharks (except porbeagle sharks) for directed permit holders; 16 SCS and pelagic sharks (except porbeagle sharks) combined for incidental permit holders;
- Retention of porbeagle sharks would be prohibited in all fisheries;
- All sharks must be landed with fins attached for all vessels;

Reporting:

- 100 percent observer coverage for vessels participating in sandbar shark research program;
- Dealer reports must be *received* by NMFS not later than 10 days after each reporting period (*i.e.*, 25th and 10th of each month);
- Other logbook and observer requirements would be maintained for vessels not participating in research program;
- All unclassified sharks reported would be categorized as sandbar sharks.

Seasons:

- One commercial season opening on January 1 of each year;

- Close seasons for sandbar and non-sandbar LCS when landings of either reach 80% of the available quota with a five day notice;
- SCS and pelagic sharks could continue to be retained until SCS and pelagic shark landings reach 80% of their respective quotas;

Regions:

- One region for all managed shark species;

Recreational Management Measures:

- Authorized species include: bonnethead, nurse, tiger, lemon, hammerheads, sharpnose, shortfin mako, common thresher, oceanic whitetip, blue, spinner, and silky sharks. Possession limit: 1 >54" FL shark per vessel per trip, also 1 sharpnose and 1 bonnethead per person with no minimum size

2.1.5 Alternative Suite 5: Close Atlantic Shark Fisheries

This alternative would close all Atlantic, Gulf of Mexico, and Caribbean shark fisheries for all fishermen until reopening is warranted based on new stock assessments. Since interactions with sharks would likely occur in other commercial fisheries (e.g., snapper grouper, tilefish, mackerel), this alternative suite would modify the process of selection for discard reporting in the Coastal Fisheries Logbook to ensure that data on shark interactions in other non-HMS fisheries would be available. Shark landings would be limited to research and the collection for public display via the HMS Exempted Fishing Program. Recreational fisheries would be catch and release only.

Specific management measures implemented via this alternative would include:

Quotas/Species Complexes:

- Sandbar = 0 mt dw; non-sandbar LCS = 0 mt dw; SCS = 0 mt dw; Blue Sharks = 0 mt dw; Pelagic Sharks (Other than Blue Sharks) = 0 mt dw; Porbeagle Sharks = Prohibited (0 mt dw quota); and Display and Scientific Research = 60 mt ww (Sandbar = 2.8 mt ww (2 mt dw); all other shark species (except dusky sharks) = 57.2 mt ww (41.2 mt dw);

Time/Area Closures:

- Time/Area closures for BLL gear for the commercial shark fishery would no longer be applicable since all retention of sharks would be prohibited;
- HMS time/area closures for other gear types and fisheries would still be in effect;

Retention Limits:

- No sharks of any species could be possessed in the Atlantic, Caribbean, and Gulf of Mexico;

Reporting:

- Modify logbook dead discard reporting for the Coastal Fisheries Logbook to ensure that information on shark interactions would be available;
- Request Atlantic, Gulf of Mexico, and Caribbean Fishery Management Councils that manage fisheries using longline and/or gillnet gear to place observers on vessels to monitor shark bycatch;

Seasons:

- No open seasons;

Regions:

- No regions for sharks;

Recreational Measures:

- Recreational fisheries for sharks would be catch and release only with no possession allowed.

2.2 Other Alternatives Analyzed

NMFS is also considering alternatives that would modify the existing schedule for conducting shark stock assessments and clarifying when the annual Stock Assessment and Fishery Evaluation (SAFE) report should be released. These alternatives are not analyzed within alternative suites.

2.2.1 Stock Assessment Frequency

Alternative 6: Stock Assessments for Sharks Every 2-3 Years (Status Quo)

Alternative 6 would maintain current requirements to conduct stock assessments every 2-3 years. The 1999 FMP established that stock assessments be conducted for each species or species group every two to three years. HMS stock assessments are crucial in order to define stock boundaries, monitor rebuilding plans, improve knowledge of stock dynamics, and incorporate additional data in a timely manner. Since 2000, there have been two stock assessments completed by NMFS for LCS (2002, 2005/2006), one assessment completed for SCS (May 2002), and one is in progress for SCS (2007). Other assessments have been completed by other entities, including: SCS (August 2002 by Mote Marine Laboratory), two assessments for pelagic sharks (2004 by ICCAT), and the porbeagle assessment completed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The Agency is aware of another stock assessment being conducted by the Standing Committee on Research and Statistics (SCRS) of ICCAT for shortfin mako and blue sharks in 2008.

Alternative 7: Stock Assessments for Sharks At Least Every 5 years - Preferred Alternative

Alternative 7 would change the current process outlined in the 1999 FMP by requiring stock assessments for sharks at least every five years versus every 2-3 years. Stock assessments could occur more frequently, however, they must be conducted at least every five years. Because of the time necessary to modify management measures consistent with stock assessments, it seems prudent to lengthen the amount of time between stock assessments to allow existing or forthcoming measures to attempt to achieve their stated objectives. In 2003, the Agency adopted the Southeast Data Assessment and Review (SEDAR) process for completing shark stock assessments at the request of industry, environmentalists, and academics. This process increases the time necessary to complete a stock assessment because it entails three week long workshops where data are reviewed, stock assessment models run, and results reviewed by an outside panel. Since this process can take up to a year to complete necessary assessments on a species complex, completing these assessments every 2-3 years is not practical. This alternative would not modify any stock assessments that are already scheduled; assessments conducted by other management entities, and would also not affect frequency of stock assessments conducted for other HMS species.

2.2.2 SAFE Report Timing

Alternative 8: SAFE Report Published in January or February of Every Year (Status Quo)

Alternative 8 would maintain the current process of publishing a SAFE report in January or February of each year. According to the 1999 FMP, each year in January or February, NMFS publishes one SAFE report for the Atlantic tunas, swordfish, billfish, and sharks. The SAFE report follows the guidelines specified in National Standard (NS) 2 and are used by NMFS to develop and evaluate regulatory adjustments under the framework procedure or the FMP amendment process. This information provides the basis for determining annual harvest levels from each stock, documenting significant trends or changes in the resource, the bycatch, and the fishery over time, and assessing the relative success of existing state and Federal fishery management programs.

Alternative 9: SAFE Report Published in the Fall of Every Year – Preferred Alternative

Alternative 9 would modify the existing regulations by requiring the publication of a SAFE report in the fall of each year. The annual SAFE report would still be used to develop and evaluate regulatory adjustments under the framework procedure or the FMP amendment process as it is currently under the status quo, but it would be released to the public by the fall of each year.

2.3 Alternatives Considered But Not Further Analyzed

2.3.1 Shark Fishery for Directed, Incidental, HMS Angling, and HMS Charter/Headboat Permit Holders Only (No BLL Gear)

This alternative would remove BLL gear from the HMS authorized gear list but would still allow a fishery for directed, incidental, HMS Angling, Atlantic tunas general category (if participating in a registered tournament), and HMS Charter/Headboat permit holders using other authorized gears, including: gillnet, handline, rod and reel, bandit gear, and PLL. Commercial shark permit holders would not be able to possess sharks with BLL gear on board. The alternative is being considered but not further analyzed at this time because BLL gear is the primary gear used to harvest sharks. As such, it makes sense that to reduce shark mortality of at least some species for the Agency to consider not allowing BLL gear in the shark fishery. However, this gear type is also deployed in other fisheries to target other non-HMS (snapper/grouper, reef fish, and tilefish). Selecting this alternative could result in excessive regulatory discards of sharks because vessels with commercial shark permits would have to discard all sharks landed incidentally in the pursuit of other non-HMS species when BLL gear is onboard. Further, the increased retention limits described in this alternative suite may encourage shark fishermen to increase effort significantly in the shark gillnet fishery which, depending on where this effort were concentrated, may increase bycatch and the likelihood of interactions with marine mammals.

Not allowing BLL gear in the shark fishery would have significant economic and social impacts on commercial shark permit holders primarily using BLL gear. While it is assumed that very few directed shark permit holders subsist entirely on revenues attained from the shark fishery, however, impacts would still be severe for those participants that did depend on any income from participating in the directed shark fishery at certain times of the year. Because of the extensive economic impacts to shark directed permit holders as a result of not allowing BLL gear in the shark fishery, it is assumed that directed permit holders would likely pursue one of the following options as a result of closing the Atlantic shark fishery: (1) transfer fishing effort to other fisheries for which they are already permitted (snapper grouper, king and Spanish mackerel, tilefish, lobster, dolphin/wahoo, etc), (2) acquire the necessary permits to participate in other fisheries (both open access and/or limited access fisheries), or (3) relinquish all permits and leave the fishing industry.

Specific management measures implemented via this alternative would include:

Commercial Management Measures

<u>Quotas/Species Complexes</u>:

- Sandbar = 116.6 mt dw; non-sandbar LCS = 514.2 mt dw; SCS = 454 mt dw; Blue Sharks = 273 mt dw; Pelagic Sharks (Other than Blue Sharks) = 488 mt dw; Porbeagle Sharks = Prohibited (0 mt dw quota); and Display and Scientific Research = 60 mt ww (Sandbar = 2.8 mt ww (2 mt dw); all other shark species (except dusky sharks) = 57.2 mt ww (41.2 mt dw);

- Overharvests would be removed from the next season's quota. Underharvests for species that are not unknown, overfished, or experiencing overfishing would be transferred to the next season's quota, up to 50 percent of the base quota. For other species/complexes, underharvests would not be transferred to the next season's quota;

Time Area Closures:

- Revise existing BLL closures to reflect the fact that BLL is no longer an authorized gear in HMS fisheries;

Retention Limits:

- 10 sandbar/vessel/trip and 48 non-sandbar LCS/vessel/trip for directed and incidental permit holders;
- No trip limit for SCS or pelagic sharks (except porbeagle sharks) for directed permit holders;
- 16 SCS and pelagic sharks (except porbeagle sharks) combined for incidental permit holders;
- Retention of porbeagle sharks would be prohibited in all fisheries; and,
- All sharks must be landed with all fins attached;

Reporting:

- Dealer reports must be received by NMFS within 14 days;
- Other logbook and observer requirements would be maintained; and,
- All unclassified sharks reported would be categorized as sandbar sharks;

Seasons:

- One commercial season opens for all sharks opening on January 1 of each year;
- Retention of sandbar, non-sandbar LCS, SCS, and pelagic sharks (except porbeagle sharks) would be prohibited within 5-days of achieving 80 percent of their respective quotas;

Regions:

- One region for all managed shark species;

Recreational Management Measures:

- Authorized species include: bonnethead, nurse, tiger, lemon, hammerheads, sharpnose, shortfin mako, common thresher, oceanic whitetip, blue, and spinner sharks. Possession limit: 1 >54" FL shark per vessel per trip, also 1 sharpnose and 1 bonnethead per person with no minimum size.

Table 2.1 Overview of alternatives suites

Alternative Suite	Quotas/Species Complexes	Time Area Closures	Retention Limits	Reporting	Seasons	Regions	Recreational Measures
1 – Status Quo	- 1,017 dw LCS - 454 dw SCS - 488 dw Pelagic Sharks - 273 dw Blue Sharks - 92 mt dw Porbeagle Sharks - 19 Prohibited spp - 60 mt ww for EFPs	Mid-Atlantic (BLL), Caribbean (BLL), Right Whale (GN), PLL closures;	- 4,000 lb dw directed LCS; no trip limit for pel/SCS - 5 LCS and 16 pel/SCS for incidental	- Observers, logbooks, dealer weigh-outs	Trimesters	3 regions	1 shark > 54” vessel/trip, plus 1 sharpnose and 1 bonnethead per person/trip (no minimum size)
2 – Limited Shark Fishery for Directed Permit Holders Only	- 116.6 mt dw Sandbar Sharks - 541 mt dw non-sandbar LCS - SQ SCS - SQ Pelagic Sharks - SQ Blue Sharks - Add porbeagle sharks to Prohibited spp. - Sub-quota for Sandbar EFPs - No dusky sharks authorized for display -Remove overharvests from next year - Carryover 50 percent of base quota for spp. not overfished (*i.e.*, SCS) - No carryover for overfished, overfishing, or unknown spp (*e.g.*, LCS)	- Status Quo + - SAFMC’s closures	- 8 Sandbar sharks/vessel/trip - 22 non-sandbar LCS/vessel/trip (~1,032 lb/trip for sandbar and non-sandbar LCS) - SCS/Pelagics no trip limit - All sharks landed fins on - Directed permit holders only - No sandbar with PLL onboard	- Increase dealer reporting frequency to *received* within 24 hrs from time of sale (requires PRA revision) - Observers/Logbooks SQ - Unclass = sandbar not LCS	- Open Jan. 1 - Close both non-sandbar LCS and Sandbar sharks when either @ 80% -Pelagic sharks and SCS close @ 80% - 5 days notice	No Regions	- SQ retention and size limit - Possession of: bonnethead, nurse, tiger, hammerheads, lemon, sharpnose, mako, spinner, thresher, oceanic whitetip, & blue ONLY

Alternative Suite	Quotas/Species Complexes	Time Area Closures	Retention Limits	Reporting	Seasons	Regions	Recreational Measures
3 – Limited Shark Fishery for Directed and Incidental Permit Holders (all gears)	Same as Alt 2	Same as Alt 2	- 4 Sandbar/vessel/trip - 10 non-sandbar LCS/vessel/trip (~499 lb dw/trip for sandbar and non-sandbar LCS) - Directed and Incidental permit holders same trip limit for sandbar/non-sandbar LCS - SCS/Pelagic sharks no trip limit for directed permit - SCS/Pelagic sharks 16/trip (combined) for incidental permit - All sharks landed fins on - All gears allowed	- Dealer reports *received* within 14 days - Observers/Logbooks SQ - Unclassified = sandbar sharks; not LCS complex	Same as Alt 2	Same as Alt 2	Same as Alt 2

Alternative Suite	Quotas/Species Complexes	Time Area Closures	Retention Limits	Reporting	Seasons	Regions	Recreational Measures
4 - Research set aside; allows for very small directed fishery for LCS	Same as Alt 2	Same as Alt 2	- Sandbar retention only by vessels with shark research permit ONLY - Depends upon research objectives - 22 non-sandbar LCS/vessel/trip (491 mt dw left of non-sandbar LCS quota) for directed/incidental permit holders - SCS/Pelagic sharks no trip limit for directed permit - SCS/Pelagic sharks 16/trip for incidental permit - All sharks landed fins on	- 100% observer coverage on research vessels; - Observers/Logbooks SQ - Dealer reports *received* within 14 days - Unclassified = sandbar sharks; not LCS complex	Same as Alt 2	Same as Alt 2	Same as Alt 2
5 – Close Atlantic Shark Fishery	All species prohibited	NA	None, all species prohibited	-Need to improve logbook discard reporting for Coastal Fisheries Logbook	NA	NA	No possession of any sharks, catch and release only

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3.0 DESCRIPTION OF AFFECTED ENVIRONMENT

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

3.1 Introduction to HMS Management and HMS Fisheries

Atlantic (Highly Migratory Species) HMS fisheries are managed directly by the Secretary of Commerce, who designated that responsibility to the National Marine Fisheries Service (NMFS). The HMS Management Division within NMFS is the lead in developing regulations for HMS fisheries, although some actions (*e.g.*, Large Whale Take Reduction Plan) are taken by other NMFS offices if the main legislation (*e.g.*, Marine Mammal Protection Act) driving the action are not the Magnuson-Stevens Act or ATCA. Because of their migratory nature, HMS fishery management requires management at the international, national, and state levels. NMFS manages HMS fisheries in Federal waters (domestic) and the high seas (international) while individual States establish regulations for some HMS in their own waters. There are exceptions to this generalization. For example, Federally-permitted commercial shark fishermen, as a condition of their permit, are required to follow Federal regulations in all waters unless that state has more restrictive regulations. Additionally, in 2005, the Atlantic States Marine Fisheries Commission agreed to develop an interstate coastal shark FMP. Once complete, this interstate FMP would coordinate management measures among all states along the Atlantic coast (Florida to Maine). NMFS is participating in the development of this interstate FMP.

Generally, on the domestic level, NMFS implements international agreements, as appropriate, and management measures that are required under domestic laws such as the Magnuson-Stevens Act. While NMFS does not generally manage HMS fisheries in state waters, states are invited to send representatives to AP meetings and to participate in stock assessments, public hearings, or other fora. NMFS is working to improve its communication and coordination with state agencies. In 2006, NMFS reviewed the shark regulations of several states and has asked for some states to consider changing their regulations to become more consistent with Federal regulations. This request resulted in changes and dialogues with certain states regarding the regulations such as the Commonwealth of Virginia and the State of Florida. Additionally, as a result of ASMFC's decision to develop an interstate FMP, the State of Maine opened a dialogue with the NMFS regarding shark regulations. NMFS will share this draft FMP amendment with the states and will work with states, to the extent practicable, to ensure complementary regulations. See Section 3.1.3 for more information regarding state regulations by state.

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

3.1.1 History of Domestic Shark Management

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

3.1.1.1 Pre-1999 Atlantic Shark Fisheries and Management

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

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

The commercial shark fishery has been sporadic in nature. In the early 1900s, a Pacific shark fishery supplied limited demands for fresh shark fillets and fish meal as well as a more substantial market for dried fins of soupfin sharks. In 1937, the price of soupfin shark liver skyrocketed when it was discovered to be the richest source of vitamin A available in commercial quantities. A shark fishery in the Caribbean Sea, off the coast of Florida, and in the Gulf of Mexico developed in response to this demand (Wagner, 1966). At this time, shark fishing gear included gillnets, hook and line, anchored bottom longlines (BLL), floating longlines, and benthic lines for deepwater fishing. These gear types are slightly different than the gears used today and are fully described in Wagner (1966). By 1950, the availability of synthetic vitamin A caused most shark fisheries to be abandoned (Wagner, 1966).

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

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

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

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

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

As catches accelerated through the 1980s, shark stocks suffered a precipitous decline. Peak commercial landings of large coastal and pelagic sharks were reported in 1989. In 1989, the five Atlantic Fishery Management Councils asked the Secretary of Commerce to develop a

Shark FMP. The Councils were concerned about the late maturity and low fecundity of sharks, the increase in fishing mortality, and the possibility of the resource being overfished. The Councils requested that the FMP cap commercial fishing effort, establish a recreational bag limit, prohibit "finning," and begin a data collection system.

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

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

At that time, NMFS identified LCS as overfished and pelagic and SCS as fully fished. The quotas were 2,436 mt dressed weight (dw) for LCS and 580 mt dw for pelagic sharks. No quota was established for SCS. Under the rebuilding plan established in the 1993 FMP, the LCS quota was expected to increase every year up to the maximum sustainable yield estimated in the 1992 stock assessment, which was 3,787 mt dw.

A number of difficulties arose in the initial year of implementation of the Shark FMP that resulted in a short season and low ex-vessel prices. To address these problems, a commercial trip limit of 4,000 lb for permitted vessels for LCS was implemented on December 28, 1993 (58 FR 68556), and a control date for the Atlantic shark fishery was established on February 22, 1994 (59 FR 8457). A final rule to implement additional measures authorized by the FMP published on October 18, 1994 (59 FR 52453), which:

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

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

In June 1996, NMFS convened another stock assessment to examine the status of LCS stocks. The 1996 stock assessment found no clear evidence that LCS stocks were rebuilding and concluded that "[a]nalyses indicate that recovery is more likely to occur with reductions in effective fishing mortality rate of 50 [percent] or more." In response to these results, in 1997, NMFS reduced the LCS commercial quota by 50 percent to 1,285 mt dw and the recreational retention limit to two LCS, SCS, and pelagic sharks combined per trip with an additional allowance of two Atlantic sharpnose sharks per person per trip (62 FR 16648, April 2, 1997). In this same rule, NMFS established an annual commercial quota for SCS of 1,760 mt dw and prohibited possession of five species. As a result of litigation, NMFS prepared additional economic analyses on the 1997 LCS quotas and was allowed to maintain those quotas during resolution of the case.

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

In June 1998, NMFS held another LCS stock assessment. The 1998 stock assessment found that LCS were overfished and would not rebuild under 1997 harvest levels. Based in part on the results of the 1998 stock assessment, in April 1999, NMFS published the 1999 FMP which included numerous measures to rebuild or prevent overfishing of Atlantic sharks in commercial and recreational fisheries. The 1999 FMP replaced the 1993 Atlantic Shark FMP. Management measures related to sharks that changed in the 1999 FMP included:

- Reducing commercial LCS and SCS quotas;
- Establishing ridgeback and non-ridgeback categories of LCS;
- Implementing a commercial minimum size for ridgeback LCS;
- Establishing blue shark, porbeagle shark, and other pelagic shark subgroups of the pelagic sharks and establishing a commercial quota for each subgroup;
- Reducing recreational retention limits for all sharks;
- Establishing a recreational minimum size for all sharks except Atlantic sharpnose;
- Expanding the list of prohibited shark species to 19 species;
- Implementing limited access in commercial fisheries;
- Establishing a shark public display quota;
- Establishing new procedures for counting dead discards and state landings of sharks after Federal fishing season closures against Federal quotas; and
- Establishing season-specific over- and underharvest adjustment procedures.

The implementing regulations were published on May 28, 1999 (64 FR 29090). However, in 1999, a court enjoined implementation of the 1999 regulations, as they related to the ongoing litigation on the 1997 quotas. Further history of this litigation and shark management is provided under Section 3.1.1.4 below. A year later, on June 12, 2000, the court issued an order clarifying that NMFS could proceed with implementation and enforcement of the 1999 prohibited species provisions (64 FR 29090, May 28, 1999).

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

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

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

In October 1998, NMFS announced in the Federal Register the availability of the draft FMP. The comment period on the draft FMP lasted from October 25, 1998, to March 12, 1999. The proposed rule that accompanied the draft FMP was published in the Federal Register on January 20, 1999. The supplemental part that related to the bluefin tuna rebuilding program published in the Federal Register on February 25, 1999. The comment period on the proposed rule and its supplement also went until March 12, 1999. Subsequent to the release of the proposed rule, NMFS held 27 public hearings in communities from Texas to Maine and the Caribbean. During the comment period, NMFS received several thousand comments from commercial and recreational fishermen, scientists, conservationists, and concerned individuals. An HMS AP meeting was held toward the end of the comment period to allow HMS AP members to view most of the comments NMFS had received on the draft FMP and accompanying proposed rule.

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

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

3.1.1.3 Post 1999 FMP

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

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

As noted under Section 3.1.1.1, in 1999, a court enjoined the Agency from implementing many of the shark-specific regulations in the 1999 FMP. In 2000, the injunction was lifted when a settlement agreement was entered to resolve the 1997 and 1999 lawsuits. The settlement agreement required, among other things, an independent (*i.e.*, non-NMFS) review of the 1998 LCS stock assessment. The settlement agreement did not address any regulations affecting the pelagic shark, prohibited species, or recreational shark fisheries. Once the injunction was lifted, on January 1, 2001, the pelagic shark quotas adopted in the 1999 HMS FMP were implemented (66 FR 55). Additionally, on March 6, 2001, NMFS published an emergency rule implementing the settlement agreement (66 FR 13441). This emergency rule expired on September 4, 2001, and established the LCS and SCS commercial quotas at 1997 levels.

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

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

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

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

3.1.1.5 Other Post-1999 FMP Regulations for Sharks

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

- National Plan of Action for the Conservation and Management of Sharks: On February 15, 2001, NMFS released the final National Plan of Action (NPOA) for the Conservation and Management of Sharks (66 FR 10484). The NPOA was developed pursuant to the endorsement of the International Plan of Action (IPOA) by the United Nations' FAO Committee on Fisheries Ministerial Meeting in February 1999. The overall objective of the IPOA is to ensure conservation and management of sharks and their long-term sustainable use. The final NPOA, consistent with the Magnuson-Stevens Act, requires NMFS and the Regional Fishery Management Councils to undertake extensive data collection, analysis, and management measures in order to ensure the long-term sustainability of U.S. shark fisheries. The NPOA also encourages Interstate Marine Fisheries Commissions and State agencies to initiate or expand current data collection, analysis, and management measures and to implement regulations consistent with federal regulations, as needed. For additional information on the U.S. NPOA and its implementation, see http://www.nmfs.noaa.gov.

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

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

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

3.1.1.6 Consolidated HMS FMP and Beyond

As stated in the previous sections, NMFS issued two separate FMPs in April 1999 for the Atlantic HMS fisheries. The 1999 Fishery Management Plan for Atlantic Tunas, Swordfish, and Sharks, combined, amended, and replaced previous management plans for swordfish and sharks, and was the first FMP for tunas. Amendment 1 to the Billfish Management Plan updated and amended the 1988 Billfish FMP. The 2006 Consolidated HMS FMP consolidated the management of all Atlantic HMS into once comprehensive FMP, and combined and simplified the objectives of the previous FMPs.

During the five-and-a-half years that these two FMPs co-existed, there was a growing recognition by the Agency of the interrelated nature of these fisheries and the need to consider management actions together. In addition, the Agency had identified some adverse ramifications stemming from separation of the plans, including unnecessary administrative redundancy and complexity, loss of efficiency, and public confusion over the management process. Therefore, NMFS proposed to improve coordination of the conservation and management of the domestic fisheries for Atlantic swordfish, tunas, sharks and billfish by consolidating the management of all HMS into one FMP. In 2005, NMFS released the draft Consolidated HMS FMP. The final Consolidated HMS FMP was completed in July 2006 and the implementing regulations were published on October 2, 2006 (71 FR 58058).

The final Consolidated HMS FMP changed certain management measures, adjusted regulatory framework measures, and continued the process of updating HMS EFH. Measures that were specific to the shark fisheries included mandatory workshops and certifications for all vessel owners and operators that have PLL or BLL gear on their vessels and that had been issued or were required to be issued any of the HMS limited access permits (LAPs) to participate in HMS longline and gillnet fisheries. These workshops provide information and ensure proficiency with using required equipment to handle release and disentangle sea turtles, smalltooth sawfish, and other non-target species. The Consolidated HMS FMP also requires Federally permitted shark dealers to attend Atlantic shark identification workshops to train shark dealers to properly identify shark carcasses. Additional measures specific to sharks include the differentiation between PLL and BLL gear based upon the species composition of the catch onboard or landed, the requirement that the 2nd dorsal fin and the anal fin remain on all sharks through landing, and a new prohibition making it illegal for any person to sell or purchase any HMS that was offloaded from an individual vessel in excess of the retention limits specified in § § 635.23 and 635.24. The Consolidated HMS FMP also implemented complementary HMS management measures in Madison-Swanson and Steamboat Lumps Marine Reserves and established criteria to consider when implementing new time/area closures or making modifications to existing time/area closures.

Recent actions taken by NMFS affecting the Atlantic shark fishery include a combined emergency and final rule (December 14, 2006, 71 FR 75122) that adjusted the 2007 first season commercial quotas for LCS, SCS and pelagic sharks based on over- or underharvests from the 2006 fishing season and that announced the season opening and closing dates for the first season 2007. During the first season of 2006, the South Atlantic region landed 278.2 percent (393.1 mt dw) of their LCS quota (141.3 mt dw) and 15.6 percent (44.5 mt dw) of their SCS quota (284.6). The Gulf of Mexico also landed 151.1 percent (336.6 mt dw) of their LCS quota (222.8 mt dw) and 527 percent (78 mt dw) of the SCS quota (14.8 mt dw). The North Atlantic region experienced underharvests for both their LCS and SCS quotas (landing approximately 3.8 percent and 0 percent, respectively). As a result of these extensive overharvests in 2006, NMFS closed the South Atlantic region to directed LCS fishing during the 2007 first season. NMFS transferred 63.2 mt dw of the South Atlantic's regional SCS underharvest in the 2006 first season to the Gulf of Mexico, allowing a first season SCS fishery in both regions. This afforded the Gulf of Mexico region its baseline SCS quota of 15.1 mt dw in the 2007 first season. This rule also gave NMFS the flexibility to open the mid-Atlantic shark closed area during the month of July in 2007, pending available quota. Although the South Atlantic region was closed to LCS fishing in the first season of 2007, there is still overharvest from the first season in 2006 that needs to be addressed.

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

3.1.2 International Shark Management

ICCAT is responsible for the conservation of tunas and tuna-like species in the Atlantic Ocean and adjacent seas. Tuna-like species include the following pelagic sharks only: the Atlantic blue shark and the shortfin mako. The organization was established at a Conference of Plenipotentiaries, which prepared and adopted the International Convention for the Conservation of Atlantic Tunas, signed in Rio de Janeiro, Brazil, in 1966. The 2006 Regular Meeting of ICCAT was held November 17 – 26, 2006, in Dubrovnik, Croatia. As such, much of the work at the 2006 Commission meeting dealt with improvement of ICCAT statistics and conservation measures, compliance with existing ICCAT recommendations, and the functioning of the Commission. For purposes of clarity, it should be understood that ICCAT recommendations are binding instruments for Contracting Parties while ICCAT resolutions are non-binding and express the will of the Commission. All ICCAT recommendations and resolutions are available on the ICCAT website at http://www.ICCAT.es.

3.1.2.1 Atlantic Sharks

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

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

3.1.3 Existing State Regulations

Table 3-1 outlines the existing State regulations as of April 19, 2007, with regard to shark species. The HMS Management Division updates this table periodically throughout the year. While the HMS Management Division updates this table periodically throughout the year, persons interested in the current regulations for any state should contact that state directly.

Table 3-1 **State Rules and Regulations Pertaining to Sharks, as of April 19, 2007.** Please note that state regulations are subject to change. Please contact the appropriate state personnel to ensure that the regulations listed below remain current. X = Regulations in Effect; n = Regulation Repealed; FL = Fork Length; CL = Carcass Length; TL = Total Length; LJFL = Lower Jaw Fork Length; CFL = Curved Fork Length; DW = Dressed Weight; and SCS = Small Coastal Sharks; LCS = Large Coastal Sharks.

State	Cite Reference	Regulatory Details	Contact Information
ME	Code ME R. 13-188 ' 50	Regulations apply to coastal sharks and Spiny dogfish. Regulations prohibit dogfish & shark finning; dogfish trip limit and matches federal closures.	ME Department of Marine Resources George Lapointe Phone: 207/624-6553 Fax: 207/624-6024
NH	FIS 603.19	Regulations apply to Spiny dogfish only	NH Fish and Game Clare McBane Phone: 603/868-1095 Fax: 603/868-3305
MA	322 CMR § 6.35 & 6.37 CMRs available online at http://www.mass.gov/dfwele/dmf/commercialfishing/cmr_index.htm	Regulations apply to Spiny dogfish; Prohibition on harvest, catch, take, possession, transportation, selling or offer to sell any basking, dusky, sand tiger, or white sharks.	MA Division of Marine Fisheries Melanie Griffin Phone: 617/626-1528 Fax: 617/626-1509
RI	RIMFC Regulations § 7.15	Regulations apply to spiny dogfish only	RI Department of Environment Management April Valliere Phone: 401-423-1939 FAX: 401-423-1925
CT	Regulations of Connecticut State Agencies § 26-159a-19	Regulations apply to spiny dogfish only	CT Department of Environmental Protection David Simpson Phone: 860/434-6043 Fax: 860/434-6150
NY	NY Environmental Conservation ' 13-0338; State of New York Codes, Rules and Regulations (Section 40.1)	Shark finning prohibited; Reference to the Federal regulations 50 CFR part 635; Prohibited sharks listed	NY Department of Environmental Conservation Gordon Colvin Phone: 631/444-0435 Fax: 631/444-0449

State	Cite Reference	Regulatory Details	Contact Information
NJ	NJ Administrative Code, Title 7. Department of Environmental Protection, NJAC 7:25-18.1 and 7:25-18.12(d)	Commercial/Recreational: min size 48” TL or 23” from the origin of the first dorsal fin to pre-caudal pit; possession limit - 2 fish/vessel or 2 fish per person if fishing from shore or a land based structure, must hold Federal permit to possess or sell more than 2 sharks; no sale during Federal closures; Finning prohibited; Prohibited Species: basking, bigeye sand tiger, sand tiger, whale and white sharks.	NJ Fish and Wildlife Hugh Carberry, Phone: 609/748-2020 Fax: 609/748-2032 Additional contact: Peter Clarke 609 748-4334
DE	DE Code Regulations 3541	Reference to Federal regulations for sharks; Recreational/Commercial: min size – 54” FL; bag limit – 1 shark/vessel/trip; shorebound anglers – 1 shark/person/day; 2 Atlantic sharpnose/vessel/trip with no min size; Prohibited Species: same as Federal species. Prohibition against fins without being naturally attached to the body.	DE Division of Fish and Wildlife Roy Miller Phone: 302/739-9914
MD	Code of Maryland Reg. title 8, § 02.05.17	Recreational: min size - 54" FL or 31" carcass; 1 shark/vessel/trip; 1 Atlantic sharpnose/person/trip with no min size; Commercial: 4000 lbs/day; Finning and longline prohibition; Prohibited Species are same as Federal regulations.	MD Department of Natural Resources Harley Speir Howard King Phone: 410/260-8264

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

State	Cite Reference	Regulatory Details	Contact Information
NC	NC Administrative Code tit. 15A, r.3M.0505; Proclamation FF-38-2006 * Modify closed area off NC to allow fishing outside 15 fathoms during 1st trimester (Jan 1 - Feb 15)	Director may impose restrictions for size, seasons, areas, quantity, etc. via proclamation; Commercial: open seasons and species groups same as Federal; 4000 lb trip limit for LCS; retain fins with carcass through point of landing; LL shall only be used to harvest LCS during open season, shall not exceed 500 yds or have more than 50 hooks; Recreational: LCS (54" FL min size) - no more than 1 shark/vessel/day or 1 shark/person/day, SCS (no min size) – no more than 1 finetooth or blacknose shark/vessel/day and no more than 1 Atlantic sharpnose and 1 bonnethead/person/day, pelagics (no min size) -1 shark/vessel/day; Same prohibited shark species as Federal regulations.	NC Division of Marine Fisheries Louis B. Daniel III Phone: 252/726-7021 Fax: 252/726-0254
SC	SC Code Ann. § 50-5-2725, 50-5-2730	Recreational: 2 Atlantic sharpnose/person/day and 1 Bonnethead/person/day, no min size; All others – 1 shark/boat/trip, min size – 54" FL; Reference to Federal commercial regulations and prohibited species; Illegal in state waters to harvest/retain sharks taken in gillnet; Annual state permit required in addition to federal permit to take sharks for commercial purposes in state waters	SC Department of Natural Resources Mel Bell Phone: 843/953-9007 Fax: 843/953-9386
GA	GA Code Ann. § 27-4-130.1; OCGA § 27-4-7(b); GA Comp. R. & Regs. § 391-2-4-.04	Gear Restrictions/Prohibitions - Use of gillnets is prohibited in state waters. Sharks – Commercial/Recreational: 2 sharks from the Small Shark Composite (bonnethead, sharpnose, and spiny dogfish, daily limit may consist of 2 of the same species (*e.g.*, 2 bonnetheads, 2 Atlantic sharpnose) or 2 different species, SCS min size 30" TL; all other sharks - 2 sharks/person or boat, whichever is less, min size 48" TL, may include only 1 greater than 84"; Prohibited Species: sand tiger sharks. All species must be landed head and fins intact. Sharks may not be landed in Georgia if harvested using gillnets.	GA Department of Natural Resources Phone: 912/264-7218 Fax: 912/262-3143

State	Cite Reference	Regulatory Details	Contact Information
FL	FL Administrative Code Ann. r.68B-44, F.A.C	Commercial/Recreational: min size - none; possession limit – 1 shark/person/day or 2 sharks/vessel on any vessel with 2 or more persons on board; State waters close to commercial harvest when adjacent Federal waters close; Federal permit required for commercial harvest, so Federal regulations apply unless state regulations are more restrictive; Finning & Filleting prohibited; and same prohibited species as Federal regulations, except Caribbean sharpnose is not included. Spiny dogfish is prohibited.	FL Fish and Wildlife Conservation Commission Lisa Gregg Phone: 850/488-6058 Fax: 850/488-7152
AL	AL Administrative Code r. 220-2-.46, r.220-3-.30, r.220-3-.37	Recreational & Commercial: bag limit – 2 sharpnose/person/day; no min size; all other sharks – 1/person/day; min size – 54" FL or 30" dressed; state waters close when Federal season closes; Prohibition: Atlantic angel, bigeye thresher, dusky, longfin mako, sand tiger, basking, whale, white, and nurse sharks.	AL Department of Conservation and Natural Resources Major Jenkins Phone: 251/861-2882
LA	LA Administrative Code Title 76, Pt. VII, Ch. 3, § 357	Recreational: min size – 54" FL, except Atlantic sharpnose and bonnethead; bag limit - 1 sharpnose/person/day; all other sharks – 1 fish/person/day; Commercial: 4,000 lb LCS trip limit, no min size; Com & Rec Harvest Prohibited: 4/1-6/30; Prohibition: same as Federal regulations, as well as smalltooth and largetooth sawfish	LA Department of Wildlife and Fisheries Harry Blanchet 225/765-2889 fax 225/765-2489
MS	MS Code Title-22 part 7	Recreational: min size - LCS/Pelagics 37" TL; SCS 25" TL; bag limit - LCS/Pelagics 1/person up to 3/vessel; SCS 4/person; Commercial & Prohibited Species - Reference to Federal regulations.	MS Department of Marine Resources Mike Buchanan Phone: 228/374-5000
TX	TX Administrative Code Title 31, Part 2, Parks and Wildlife Code Title 5, Parks and Wildlife Proclamations 65.3 and 65.72	Commercial/Recreational: bag limit - 1 shark/person/day; Commercial/Recreational possession limit is twice the daily bag limit (i.e., 2 sharks/person/day); min size 24" TL.	TX Parks & Wildlife Aaron Reed (Austin) Phone: 512/389-8046 Fax: 512/389-4450 Mark Lingo (Brownsville) Phone: 956/350-4490

State	Cite Reference	Regulatory Details	Contact Information
Puerto Rico	Regulation #6768 Article 8 – General Fishing Limits Article 13 – Limitations Article 17 – Permits for Recreational Fishing	Sharks are covered under the federal regulation known as Highly Migratory Species of the United States Department of Commerce (50 CFR, Part 635). Fishers who capture these species shall comply with said regulation.	Puerto Rico Department of Natural and Environmental Resources Craig Lilyestrom Phone: 787-724-8774 x4042 craig@caribe.net
U.S. Virgin Islands	US VI Commercial and Recreational Fisher's Information Booklet Revised June 2004	Federal regulations and federal permit requirements apply in territorial waters.	www.caribbeanfmc.com http://www.caribbeanfmc.com/usvi%20booklet/fisher%20booklet%20final.pdf

3.2 Status of the Stocks

The thresholds used to determine the status of Atlantic HMS, including sharks, are fully described in Chapter 3 of the 1999 Tunas, Swordfish, and Shark FMP and Amendment 1 to the Billfish FMP, Chapter 3 of the 2006 Consolidated HMS FMP, and are presented in Figure 3-1. These thresholds are based on the thresholds described in a paper describing the technical guidance for implementing National Standard 1 of the Magnuson-Stevens Act (Restrepo *et al*., 1998). These thresholds will not change as a result this Amendment 2 to the 2006 Consolidated HMS FMP.

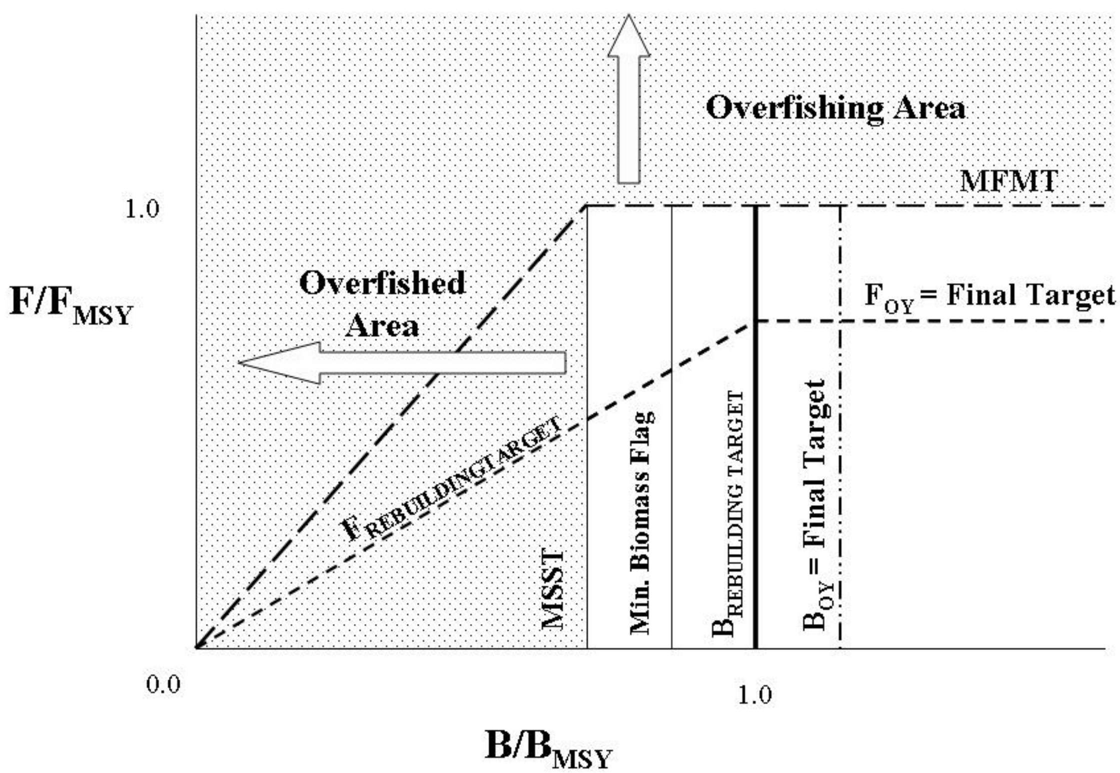

Figure 3-1 Illustration of the status determination and rebuilding terms.

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

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

If a species is declared overfished or has overfishing occurring, action to rebuild the stock and/or prevent further overfishing is required by law. A species is considered rebuilt when B is greater than B_{MSY} and F is less than F_{MSY}. A species is considered healthy when B is greater than or equal to the biomass at optimum yield (B_{OY}) and F is less than or equal to the fishing mortality at optimum yield (F_{OY}).

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

- Maximum Fishing Mortality Threshold (MFMT) = $F_{limit} = F_{MSY}$;
- Overfishing is occurring when $F_{year} > F_{MSY}$;
- Minimum Stock Size Threshold (MSST) = $B_{limit} = (1\text{-}M)B_{MSY}$ when $M < 0.5 = 0.5B_{MSY}$ when $M >= 0.5$;
- Overfished when $B_{year}/B_{MSY} <$ MSST;
- Biomass target during rebuilding = B_{MSY};
- Fishing mortality during rebuilding < F_{MSY};
- Fishing mortality for healthy stocks = $0.75F_{MSY}$;
- Biomass for healthy stocks = B_{OY} = ~1.25 to $1.30B_{MSY}$;
- Minimum biomass flag = $(1\text{-}M)B_{OY}$; and
- Level of certainty of *at least* 50 percent but depends on species and circumstances; for sharks, a level of certainty of 70 percent is used as a guide.

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

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

Species	Current Relative Biomass Level	Current Biomass B_{YEAR}	N_{MSY}	Minimum Stock Size Threshold (MSST)	Current Relative Fishing Mortality Rate	Maximum Fishing Mortality Threshold (F_{MSY})	Outlook
Sandbar Sharks	*SSF_{2004}/SSF_{MSY}=0 .72	3.06E+07	5.94E+05	4.75 - 5.35E+05	F_{2004}/F_{MSY} = 3.72	0.015	Overfished; Overfishing is occurring
Gulf of Mexico Blacktip Sharks**	*SSF_{2004}/SSF_{MSY}= 2.54 - 2.56	1.33E+08 – 1.93E+09	1.23 – 1.78E+07	0.99 - 1.07E+07	F_{2004}/F_{MSY} = 0.03-0.04	0.20	Not overfished; No overfishing is occurring
Atlantic Blacktip Sharks	unknown	unknown	unknown	unknown	unknown	unknown	unknown
Dusky Sharks**	B_{2003}/B_{MSY}= 0.15 - 0.47	687,290	4,409,144	unknown	F_{2003}/F_{MSY}=1.68-1,810	0.00005 – 0.0115	Overfished; Overfishing is occurring
LCS Complex	unknown	unknown	unknown	unknown	unknown	unknown	unknown
Porbeagle Sharks	*SSN_{2004}/SSN_{MSY} = 0.15 – 0.32	5,520-12,945	29,382 – 40,670	unknown	F_{2004}/F_{MSY} = 0.83	0.033 – 0.065	Overfished; overfishing is not occurring

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

3.2.1 Atlantic Sharks

3.2.1.1 Life History/Species Biology

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

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

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

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

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

Shark habitat can be described in four broad categories: (1) coastal, (2) pelagic, (3) coastal-pelagic, and (4) deep-dwelling. Coastal species inhabit estuaries, the nearshore and waters of the continental shelves, *e.g*., blacktip (*Carcharhinus limbatus*), finetooth, bull, lemon, and sharpnose sharks (*Rhizoprionondon terraenovae*). Pelagic species, on the other hand, range widely in the upper zones of the oceans, often traveling over entire ocean basins. Examples include shortfin mako (*Isurus oxyrinchus*), blue (*Prionace glauca*), and oceanic whitetip (*Carcharhinus longimanus*) sharks. Coastal-pelagic species are intermediate in that they occur both inshore and beyond the continental shelves, but have not demonstrated mid-ocean or transoceanic movements. Sandbar sharks are examples of a coastal-pelagic species. Deep-dwelling species, *e.g*., most cat sharks (*Apristurus* spp.) and gulper sharks (*Centrophorus* spp.) inhabit the dark, cold waters of the continental slopes and deeper waters of the ocean basins.

Seventy-three species of sharks are known to inhabit the waters along the U.S. Atlantic coast, including the Gulf of Mexico and the waters around Puerto Rico and the U.S. Virgin Islands. Thirty-nine species are managed by HMS; spiny dogfish also occur along the U.S. coast, however management for this species is under the authority of the Atlantic States Marine Fisheries Commission as well as the New England and Mid-Atlantic Fishery Management Councils. Deep-water sharks were removed from the management unit in 2003. Based on the ecology and fishery dynamics, the sharks have previously been divided into four species groups for management: (1) large coastal sharks, (2) small coastal sharks, (3) pelagic sharks, and (4) prohibited species (Table 3-3).

Table 3-3 Common names of shark species included within the four species management units under Amendment 2 to the Consolidated HMS FMP.

Management Unit	Shark Species Included
Large Coastal Sharks (11)	Sandbar, silky, tiger, blacktip, bull, spinner, lemon, nurse, smooth hammerhead, scalloped hammerhead, and great hammerhead sharks
Small Coastal Sharks (4)	Atlantic sharpnose, blacknose, finetooth, and bonnethead sharks
Pelagic Sharks (5)	Shortfin mako, thresher, oceanic whitetip, porbeagle, and blue sharks
Prohibited Species (19)	Whale, basking, sand tiger, bigeye sandtiger, white, dusky, night, bignose, Galapagos, Caribbean reef, narrowtooth, longfin mako, bigeye thresher, sevengill, sixgill, bigeye sixgill, Caribbean sharpnose, smalltail, and Atlantic angel sharks

3.2.1.2 Stock Status and Outlook

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

3.2.1.3 Large Coastal Sharks

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

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

Sandbar Sharks

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

Blacktip Sharks

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

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

Dusky Sharks

The first dusky-specific shark assessment was released on May 25, 2006 (71 FR 30123). The 2006 dusky shark stock assessment used data through 2003 and indicates that dusky sharks

(*Carcharhinus obscurus*) are overfished (B_{2003}/B_{MSY} = 0.15 – 0.47) with overfishing occurring (F_{2004}/F_{MSY} = 1.68 – 1810). The assessment recommends that rebuilding for dusky sharks could require 100 to 400 years. Based on these results, NMFS declared the status of dusky sharks as overfished with overfishing occurring (November 7, 2006; 71 FR 65086).

3.2.1.4 Small Coastal Sharks

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

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

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

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

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

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

3.2.1.5 Pelagic Sharks

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

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

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

ICCAT Stock Assessment on Blue and Shortfin Mako Sharks

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

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

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

COSEWIC Stock Assessment on Porbeagle

COSEWIC conducted a species report and assessment for porbeagle in 2004. They suggest that significant declines in porbeagle abundance have occurred as a result of overexploitation in fisheries. In May 2004, the COSEWIC recommended to the Canadian Minister of Fisheries that porbeagles be listed as endangered under the Species at Risk Act (SARA). In 2006, the Canadian government decided not to list the porbeagle shark under SARA due to the economic impact of a listing, both on the commercial fishing industry and on the government who would have to expend over $50,000 annually in monitoring funds (Canada Gazette 2006; http://canadagazette.gc.ca/partII/2006/20060906/html/si110-e.html).

Canada has conducted stock assessments on porbeagle sharks in 1999, 2001, 2003, and 2005. Reduced Canadian porbeagle quotas in 2002 brought the 2004 exploitation rate to a sustainable level. According to the 2005 recovery assessment report conducted by Canada, the North Atlantic porbeagle stock has a 70 percent probability of recovery in approximately 100 years if F is less than or equal to 0.04. To date, the United States has not conducted a stock assessment on porbeagle sharks. NMFS has reviewed the Canadian stock assessment and deems it to be the best available science and appropriate to use for U.S. domestic management purposes. The Canadian assessment indicates that porbeagle sharks are overfished (SSN_{2004}/SSN_{MSY} = 0.15 – 0.32; SSN is spawning stock number and used as a proxy for biomass). However, the Canadian assessment indicates that overfishing is not occurring (F_{2004}/F_{MSY} = 0.83). Based on these results, NMFS declared the status of porbeagle sharks as overfished, but overfishing is not occurring (71 FR 65086).

3.2.1.6 Effects of Regulations

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

The regulations governing the recreational and commercial shark fisheries allow opportunities for participants to pursue sharks for leisure, subsistence, and/or commercial gain while maintaining compliance with statutes that include, but are not limited to, the Magnuson Stevens Act, Endangered Species Act, Marine Mammal Protection Act, and the National Environmental Policy Act. These regulations seek to minimize bycatch of non-target, prohibited shark species, and protected resources by a variety of measures, including, but not limited to: mandating the use of corrodible, non-stainless steel hooks; requiring possession of handling and release equipment for protected resources (long handled line cutters and dipnets); conducting gillnet checks every two hours; mandatory observer coverage for commercial fisheries (if selected); limits on the deployment and operation of authorized gears; and, maintaining 19 species of shark on the prohibited species list (possession not authorized). Rebuilding overfished stocks is another objective of shark fishery regulations, and is accomplished through numerous measures, including, but not limited to: regional and trimester fishing quotas based on MSY; regional and trimester fishing seasons; commercial trip limits (4,000 lbs dw for LCS); recreational bag limits (1 shark/vessel/day for all authorized species except Atlantic sharpnose and bonnethead sharks (1 shark/person/day); and, recreational minimum size limits (>54” FL for all authorized species except Atlantic sharpnose and bonnethead sharks). Controlling fishing effort is accomplished by the requirement to possess a limited access permits for commercial shark fisheries and upgrading restrictions for transferred permits. Reducing fishing mortality of prohibited dusky sharks and juvenile sandbar sharks is achieved by the Mid-Atlantic time area closure (January 1 – July 31) and the requirement to use VMS when BLL gear is onboard during this time period.

The final rule implementing Amendment 1 to the 1999 FMP was published in the Federal Register on December 23, 2003. This final rule revised the shark regulations based on the results of the 2002 stock assessments for SCS and LCS. Results of these stock assessments indicate the SCS complex is not overfished (*e.g.*, depleted in abundance) and overfishing is not occurring; the LCS complex continues to be overfished, and overfishing is occurring; sandbar sharks are not overfished, but overfishing is occurring; blacktip shark stocks are rebuilt and healthy; and finetooth sharks are not overfished, but overfishing is occurring. In Amendment 1 to the 1999 FMP, NMFS revised the rebuilding timeframe for LCS to 26 years from 2004, and implemented several new regulatory changes. Management measures enacted in the amendment included: re-aggregating the large coastal shark complex; using maximum sustainable yield (MSY) as a basis for setting commercial quotas; eliminating the commercial minimum size restrictions; implementing a commercial trip limit for LCS and SCS; implementing trimester commercial fishing seasons effective January 1, 2005; imposing gear restrictions to reduce bycatch; implementing a time/area closure off the coast of North Carolina effective January 1, 2005; and establishing three regional commercial quotas (Gulf of Mexico, South Atlantic, and North Atlantic) for LCS and SCS management units. For more detail on the management history surrounding shark regulations see Section 3.1.

As a result of using the MSY as a basis for setting quotas and implementing a new rebuilding plan, the overall quota for LCS in later years, such as 2004, of 1,017 metric tons (mt) dressed weight (dw) (2.24 million lbs dw) was lower than both the 2002 LCS quota of 1,285 mt dw (2.83 million lbs dw) and the 2003 LCS quota of 1,714 mt dw (3.78 million lbs dw). The annual SCS quota is 454 mt dw per year. The annual quotas for pelagic sharks are 273 mt dw for blue sharks, 92 mt dw for porbeagle sharks, and 488 mt dw for pelagic sharks other than porbeagle and blue sharks.

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

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

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

3.2.1.7 Recent and Ongoing Research

Northeast Fisheries Science Center (NEFSC)

Fishery Independent Survey for Coastal Sharks

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

Age and Growth of Coastal and Pelagic Sharks

A comprehensive aging and validation study for the shortfin mako continued in conjunction with scientists at Moss Landing Marine Laboratories, California, using bomb carbon techniques. Additional validation studies were begun on the sandbar shark, dusky shark, tiger shark, and white shark (*Carcharodon carcharias*). Age and growth studies on the tiger shark (with scientists at the University of New Hampshire), thresher shark (*Alopias vulpinus*, with scientists at the University of Rhode Island), night shark (*Carcharhinus signatus*, with NMFS scientists at the SEFSC Panama City Laboratory), and bull shark (with scientists with the Florida Division of Natural Resources) are under way. Collection, processing, photographing, and reading of samples are in various stages for these species, including intercalibration of techniques, criteria, and band readings. This intercalibration process involves sharing samples and comparing counts between researchers, including a researcher from the Natal Sharks Board, South Africa, for joint work on shortfin mako, blue, and basking shark band periodicity. Collections of vertebrae took place at tournaments and on the biannual research cruise, with 285 sharks injected with oxytetracycline for validation. Night and dusky sharks were prepared with gross sectioning to determine the best method for reading, and all processing was initiated using histology. Readings were completed on the thresher and tiger sharks toward intercalibration to generate bias graphs. Vertebrae, length-frequency data, and tag/recapture data collected from 1962 to present are being analyzed on each of these species to obtain growth parameters.

Biology of the Thresher Shark

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

Biology of the Porbeagle Shark

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

Collection of Recreational Shark Fishing Data and Samples

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

Essential Fish Habitat and Shark Identification Updates

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

Cooperative Shark Tagging Program (CSTP)

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

Atlantic Blue Shark Life History and Assessment Studies

A collaborative program to examine the biology and population dynamics of the blue shark, in the North Atlantic is ongoing. Research on the food and feeding ecology of the blue shark is being conducted cooperatively with University of Rhode Island staff with additional samples collected and a manuscript under revision. A detailed reexamination of the reproductive parameters of the blue shark continued with collection of additional biological samples to determine if any changes have occurred since the 1970s. A manuscript on blue shark stock structure based on tagging data was completed, detailing size composition and movements between Atlantic regions. In addition, research focused on the population dynamics in the North Atlantic with the objectives of constructing a time series of blue shark catch rates (CPUE) from research surveys, estimation of blue shark migration and survival rates, and the development of an integrated tagging and population dynamics model for the North Atlantic for use in stock assessment continued in collaboration with scientists at the School of Aquatic and Fishery Sciences, University of Washington. Progress, to date, includes the preliminary recovery of historical research survey catch data, size composition, and biological sampling data on pelagic sharks and preliminary analysis of survival and movement rates for blue sharks based on tag and release data from the NMFS CSTP. Preparation of standardized catch rate and size composition data compatible with PLL observer data continued with a resulting ICCAT submission. As part of this comprehensive program, cooperative research continued with the Irish Marine Institute and Central Fisheries Board on mark-recapture databases, including coordination of formats and programs with the NMFS CSTP for joint data analyses.

Atlantic Shortfin Mako Life History and Assessment Studies

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

Blacktip Shark Migrations

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

Cooperative Atlantic States Shark Pupping and Nursery Survey (COASTSPAN)

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

Juvenile Shark Survey for Monitoring and Assessing Delaware Bay Sandbar Sharks

NEFSC staff conducts this part of the COASTSPAN monitoring and assessment project for the juvenile sandbar shark population in the Delaware Bay nursery grounds using monthly longline surveys from June to September each year. A random stratified sampling plan based on depth and geographic location is ongoing to assess and monitor the juvenile sandbar shark population during the nursery season. In addition, the tagging and recapture data from this project are being used to examine the temporal and spatial relative abundance and distribution of sandbar sharks in Delaware Bay.

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

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

Ecosystems Modeling

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

Overview of Gulf and Atlantic Shark Nurseries

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

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

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

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

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

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

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

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

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

<u>Other Shark Research in Press</u>

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

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

Southeast Fisheries Science Center (SEFSC)

Stock Assessments of Large Coastal and Prohibited Sharks

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

Update on Catches of Atlantic Sharks

An update on catches of large and small coastal and pelagic sharks in U.S. Atlantic, Gulf of Mexico, and Caribbean waters was generated in October 2006 (Updated catches of Atlantic sharks. LCS05/06-DW-16) and formed the basis of the catch scenarios included in the SEDAR Data Workshop report described above. Time series of commercial and recreational landings and discard estimates from several sources were compiled for the large coastal shark complex and sandbar and blacktip sharks. In addition, recent species-specific commercial and recreational landings were provided for sharks in the large coastal, small coastal, and pelagic groups. Species-specific information on the geographical distribution of commercial landings by gear type and geographical distribution of the recreational catches was also provided. Trends in length-frequency distributions and average weights and lengths of selected species reported from three separate recreational surveys and in the directed shark bottom-longline observer program were also included. Another update on catches of Atlantic sharks will be generated in FY 2007.

Observer Programs: Shark Longline Program

From 1994 to 2004, the southeastern United States commercial shark BLL fishery was monitored by the University of Florida Commercial Shark Fishery Observer Program. In 2005, the responsibilities of the program were moved to the NOAA Fisheries Service Panama City Laboratory Shark Population Assessment Group in Panama City, FL. This program is designed to meet the intent of the ESA and the FMP for HMS. It was created to obtain better data on catch, bycatch, and discards in the shark BLL fishery. All observers are required to attend a 1-week safety training and species identification course prior to being dispatched to the fishery. While onboard the vessel, the observer records information on gear characteristics and all species caught, condition of the catch (*e.g.*, alive, dead, damaged, or unknown), and the final disposition of the catch (*e.g.*, kept, released, finned, etc.). The target coverage level is 3.9 percent of the total fishing effort. This level is estimated to attain a sample size needed to provide estimates of protected resource interaction with an expected coefficient of variation of 0.3.

<u>Observer Programs: Shark Gillnet Program</u>

Since 1993, an observer program has been underway to estimate catch and bycatch in the directed shark gillnet fisheries along the southeastern U.S. Atlantic coast. This program was designed to meet the intent of the Marine Mammal Protection Act (MMPA), ESA, and the 1999 revised FMP for HMS. It was also created to obtain better data on catch, bycatch, and discards in the shark fishery. The Atlantic Large Whale Take Reduction Plan and the Biological Opinion issued under Section 7 of ESA mandate 100 percent observer coverage during the right whale calving season (15 November - 1 April). Outside the right whale calving season (1 April - 14 November), observer coverage equivalent to 38 percent of all trips is maintained. Similar to the shark longline observer program, all observers are required to attend a 1-week safety training and species identification course and while onboard the vessel record information on gear characteristics and all species caught, condition of the catch and the final disposition of the catch.

<u>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</u>

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

<u>Elasmobranch Feeding Ecology and Shark Diet Database</u>

The Consolidated HMS FMP gives little consideration to ecosystem function because there is little quantitative species-specific data on diet, competition, predator-prey interactions, and habitat requirements of sharks. Therefore, several studies are currently under way describing the diet and foraging ecology, habitat use, and predator–prey interactions of elasmobranchs in various communities. Atlantic angel sharks (*Squatina dumerili*) have been collected for stomach content analysis from a trawl fishery in northeastern Florida since 2004. Evidence suggests angel sharks consumed mostly teleost fishes, with Atlantic croaker (*Micropogonias undulatus*) being the most common fish species (Baremore, I.E., Murie, D.J., Carlson, J.K.2006. Trophic dynamics of the Atlantic angel Shark in the northern Gulf of Mexico Abstract: American Society of Ichthyologists and Herpetologists/American Elasmobranch Society Annual meeting). The diet of the roundel skate *Raja texana* from the northern Gulf of Mexico is also being examined (Bethea, D.M., Hale, L. 2006. Diet of the roundel skate *Raja texana* from the northern Gulf of Mexico Abstract: American Society of Ichthyologists and Herpetologists/American Elasmobranch Society Annual meeting). A database containing information on quantitative food and feeding studies of sharks conducted around the world has been in development for several years and presently includes over 200 studies. This fully searchable database will continue to be updated and fine-tuned in FY 2007 and will be used as part of a collaborative study with researchers from the University of Washington, University of Wisconsin, and the Inter-American Tropical Tuna Commission, aimed at characterizing intra-guild predation and cannibalism in pelagic predators and evaluate the implications for the dynamics, assessment and management of Pacific tuna populations.

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

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

Essential Fish Habitat

Conventional theory assumes that shark nursery areas are habitats where female sharks give birth to young or lay eggs, or where juvenile sharks spend their first weeks, months, or years of life. The SEFSC Panama City Shark Population Assessment Group is currently testing a number of hypotheses regarding juvenile sharks and EFH that challenge this assumption. There are many bays and inlets along the Gulf of Mexico coastline which may serve as EFH for sharks. These habitats vary from near-oceanic conditions to shallow, enclosed estuarine areas. Following Beck et al. (2001), the SEFSC Panama City Shark Population Assessment Group is determining which habitats provide a greater “nursery value” for a given species. A study using diet and bioenergetics published in 2006 by the Panama City Laboratory (Bethea, D.M., J.K. Carlson, J. Buckel, and M. Satterwhite. Ontogenetic and site-related trends in the diet of the Atlantic sharpnose shark from the northeast Gulf of Mexico. Bulletin of Marine Science 78(2): 287-307) concluded that Crooked Island Sound provided a greater “nursery value” than Apalachicola Bay, FL.

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

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

Life History Studies of Elasmobranchs

Biological samples are obtained through research surveys and cruises, recreational fishers, and collection by onboard observers on commercial fishing vessels. Age and growth rates and other life history aspects of selected species are processed and data analyzed following standard methodology. This information is vital as input to population models incorporating variation and uncertainty in estimates of life-history traits to predict the productivity of the stocks and ensure they are harvested at sustainable levels. Samples are obtained from commercial fishers and fishery-independent surveys. Samples and preliminary analysis continue on determining life history parameters for skates in the Gulf of Mexico, a group of elasmobranchs often ignored despite being harvested as catch and bycatch in commercial fisheries. In 2006, the age and growth parameters of blacktip sharks (Carlson, J.K. J.R. Sulikowski, and I.E. Baremore. In press. Do differences in life history exist for blacktip sharks, *Carcharhinus limbatus*, from the United States South Atlantic Bight and Eastern Gulf of Mexico? Environmental Biology of Fishes) and scalloped hammerhead sharks (Piercy, A., J.K. Carlson, J.R. Sulikowski, and G.M. Burgess. In press. Age and growth of the scalloped hammerhead shark, *Sphyrna lewini*, in the northwest Atlantic Ocean and Gulf of Mexico. Marine and Freshwater Research) from the Gulf of Mexico and southeast United States were published. In addition, a study was published on the reproductive cycle of blacknose sharks in the Gulf of Mexico, which concluded that not all carcharhinid sharks exhibit a biennial reproductive cycle (Sulikowski, J.A. W.B. Driggers, T.S. Ford, R. Boonstra and J.K. Carlson. Reproductive cycle of the blacknose shark, *Carcharhinus acronotus*, in the Gulf of Mexico. Journal of Fish Biology). Along this line, new studies began in 2006 on the reproductive cycle of blacktip sharks in the Gulf of Mexico and sandbar sharks in the Atlantic Ocean.

Elemental chemistry of elasmobranch vertebrae

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

Cooperative Research—Habitat Utilization among Coastal Sharks

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

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

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

Shark Assessment Research Surveys

The SEFSC Mississippi Laboratories (MSL) has conducted BLL surveys in the Gulf of Mexico, Caribbean, and Southern North Atlantic since 1995 (21 surveys completed through 2005). The primary objective was assessment of the distribution and abundance of large and small coastal sharks across their known ranges to develop a time series for trend analysis. The surveys were designed to satisfy five important assessment principles: stockwide survey, synopticity, well-defined universe, controlling biases, and useful precision. The BLL surveys are the only long-term, nearly stock-wide, fishery-independent surveys of Western North Atlantic

Ocean sharks conducted in U.S. and neighboring waters. Ancillary objectives were to collect biological and environmental data, and to tag-and-release sharks. Starting in 1997 and under the auspices of the MEXUS Gulf Program, MSL have provided logistical and technical support to Mexico's Instituto Nacional de la Pesca to conduct a cooperative research cruise aboard both the NOAA Ship OREGON II (1997 and 1998) and the Mexican research vessel Onjuku (2001 and 2002) in Mexican waters of the Gulf of Mexico. The circumference of Cuba was surveyed with the NOAA Ship OREGON II during 1998. One of the most noteworthy changes in the surveys was a shift from the standard "J" hook used in all the earlier surveys to a circle "C" hook (gear testing surveys conducted in 2000), which is much more efficient for capturing teleosts and slightly more efficient for elasmobranchs. Current surveys continue to address expanding fisheries management requirements for both elasmobranchs and teleosts and annual surveys include the U.S. Atlantic coast from Cape Hatteras to southern Florida and the U.S. Gulf of Mexico.

3.3 Habitat

Section 303(a)(7) of the Magnuson-Stevens Act, 16 U.S.C. §§ 1801 *et seq*., as amended by the Sustainable Fisheries Act in 1996, requires FMPs to describe and identify EFH, minimize to the extent practicable adverse effects on such habitat caused by fishing, and identify other actions to encourage the conservation and enhancement of such habitat. The Magnuson-Stevens Act defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." (16 U.S.C. § 1802 (10)). The EFH regulations (at 50 C.F.R. 600 Subpart J) provide additional interpretation of the definition of essential fish habitat:

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

The EFH regulations require that EFH be described and identified within the U.S. EEZ for all life stages of each species in a fishery management unit. FMPs must describe EFH in text, tables, and figures that provide information on the biological requirements for each life history stage of the species. According to the EFH regulations, an initial inventory of available environmental and fisheries data sources should be undertaken to compile information necessary to describe and identify EFH and to identify major species-specific habitat data gaps. Habitats that satisfy the criteria in the Magnuson-Stevens Act have been identified and described as EFH in the 1999 FMPs and in Amendment 1 to the 1999 Tunas, Swordfish, and Shark FMP and are currently being identified and described as EFH in Amendment 1 to the 2006 Consolidated HMS FMP.

NMFS originally described and identified EFH and related EFH regulatory elements for all HMS in the management unit in the 1999 FMPs, and more recently updated EFH for five shark species (blacktip, sandbar, dusky, nurse, and finetooth sharks) in Amendment 1 to the 1999

Tunas, Swordfish, and Shark FMP, which was implemented in 2003. The EFH regulations further require NMFS to conduct a comprehensive review of all EFH related information at least once every five years and revise or amend the EFH boundaries if warranted. To that effect, NMFS undertook the comprehensive five-year review of information pertaining to EFH for all HMS in the management unit in the 2006 Consolidated HMS FMP. Based on the findings of this review, NMFS issued a Notice of Intent to amend EFH for HMS on November 7, 2006 (71 FR 65087). NMFS may recommend that certain EFH boundaries need to be modified in a subsequent rulemaking. At that time, alternatives for boundary modifications would be proposed. For a complete description of the comprehensive five-year review of all new EFH information see Chapter 10 and Appendix B of the 2006 Consolidated HMS FMP.

3.3.1.1 Habitat Areas of Particular Concern

To further the conservation and enhancement of EFH, the EFH guidelines encourage FMPs to identify Habitat Areas of Particular Concern (HAPCs). HAPCs are areas within EFH that meet one or more of the following criteria: they are ecologically important, particularly vulnerable to degradation, undergoing stress from development, or are a rare habitat type. HAPCs can be used to focus conservation efforts on specific habitat types that are particularly important to managed species. Currently, only one area for sandbar sharks off of North Carolina, Chesapeake Bay, MD, and Great Bay, NJ, has been identified as a HAPC for HMS (1999 FMP). Although no new HAPCs have been identified since the 1999 FMP, and no new HAPCs were proposed in the Consolidated HMS FMP, the information compiled during the review may be used to identify HAPC areas in the EFH Amendment.

3.3.2 Habitat Types and Distributions

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

3.4 Fishery Data Update

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

The revised list of authorized fisheries (LOF) and fishing gear used in those fisheries became effective December 1, 1999 (64 FR 67511). The rule applies to all U.S. marine fisheries, including Atlantic HMS. As stated in the rule, "no person or vessel may employ fishing gear or participate in a fishery in the exclusive economic zone (EEZ) not included in this LOF without giving 90 days' advance notice to the appropriate Fishery Management Council (Council) or, with respect to Atlantic HMS, the Secretary of Commerce (Secretary)." Acceptable HMS fisheries and authorized gear types for Atlantic tunas, swordfish, and sharks include: swordfish handgear fishery - rod and reel, harpoon, handline, bandit gear; PLL fishery - longline; shark drift gillnet fishery - gillnet; shark BLL fishery - longline; shark recreational fishery - rod and reel, handline; tuna purse seine fishery - purse seine; tuna recreational fishery- rod and reel, handline; and tuna handgear fishery - rod and reel, harpoon, handline, bandit gear. For Atlantic billfish, the only acceptable fishery and authorized gear type is recreational fishery - rod and reel. Species whose life history characteristics may lead to their eventual categorization as highly migratory, but which are not currently under the Secretary or Regional Council management authority, are covered in two broad categories: Recreational Fisheries (Non-FMP) and Commercial Fisheries (Non-FMP). Species that fit this description may be harvested with the gears listed for these catchall categories.

3.4.1 Bottom Longline

3.4.1.1 Domestic History and Current Management

Commercial shark fishing effort is generally concentrated in the southeastern United States and Gulf of Mexico (Cortes and Neer, 2002). During 1997 – 2003, 92 – 98 percent of LCS, 38 – 49 percent of pelagic sharks, and nearly all SCS (80 – 100 percent) came from the southeast region (Cortes, pers. comm.). McHugh and Murray (1997) found in a survey of shark fishery participants that the largest concentration of BLL fishing vessels is found along the central Gulf coast of Florida, with the John's Pass - Madeira Beach area considered the center of directed shark fishing activities. Consistent with other HMS fisheries, some shark fishery participants move from their homeports to other fishing areas as the seasons change and fish stocks move.

The Atlantic BLL fishery targets both LCS and SCS. Bottom longline is the primary commercial gear employed in the LCS and SCS fisheries in all regions. Gear characteristics vary by region, but in general, an approximately ten-mile long BLL, containing about 600 hooks is fished overnight. Skates, sharks, or various finfishes are used as bait. The gear typically consists of a heavy monofilament mainline with lighter weight monofilament gangions. Some fishermen may occasionally use a flexible 1/16 inch wire rope as gangion material or as a short leader above the hook.

3.4.1.2 Recent Catch and Landings Data

The following section provides information on shark landings as reported in the shark BLL observer program. In January 2002, the observer coverage requirements in the shark BLL fishery changed from voluntary to mandatory participation if selected. NMFS selects approximately 40 - 50 vessels for observer coverage during each season. Vessels are randomly selected if they have a directed shark limited access permit, have reported landings from sharks during the previous year, and have not been selected for observer coverage during each of the three previous seasons.

The U.S. Atlantic commercial shark BLL fishery was monitored by the University of Florida and Florida Museum of Natural History, Commercial Shark Fishery Observer Program

(CSFOP) from 1994 through the first season of 2005. In June 2005, responsibility for the observer program was transferred to the SEFSC's Panama City Laboratory. The observer program trains and places the observers aboard vessels in the directed shark BLL fishery in the Atlantic and Gulf of Mexico to collect data on the commercial shark fishery and thus improve overall management strategies for the fishery. Observers provide baseline characterization information, by region, on catch rates, species composition, catch disposition, relative abundance, and size composition within species for the large coastal and small coastal shark BLL fisheries.

During 2003, six observers logged 263 sea days on shark fishing trips aboard 20 vessels in the Atlantic from North Carolina to Florida and in the eastern Gulf of Mexico off Florida. The number of trips taken on each vessel ranged from one to five and the number of sea days each observer logged ranged from nine to 35. Observers documented the catches and fishing effort on approximately 150 longline sets that fished 103,351 hooks. During 2004, five observers logged 196 sea days on 56 shark fishing trips aboard 11 vessels. Observers documented the catches and fishing effort during 120 longline sets that fished 90,980 hooks.

Data from the shark observer program between 2000 and 2002 show that LCS comprised 66.2 percent of the total catch (Burgess and Morgan, 2002). During 2003, LCS comprised 68.4 percent of the total catch, and in 2004 LCS comprised 66.7 percent of the total catch. Sandbar sharks dominated the observed catches with 30.6 percent of total LCS catch in 2003 and 26.6 percent in 2004. Regional differences in sandbar shark abundance were evident. For example, in the Carolina region, sandbar sharks comprised 67.4 percent of the total catch and 77.2 percent of the large coastal shark catch. In the Florida Gulf region, sandbar sharks comprised 62.0 percent of the total catch and 66.5 percent of the large coastal catch, whereas in the Florida East Coast region, sandbar sharks comprised only 17.2 percent of the total observed catch, and 37.1 percent of the large coastal shark catch (Burgess and Morgan, 2003). Blacktip sharks comprised 13.9 percent of total observed catch and 20.3 percent of the large coastal catch (Burgess and Morgan, 2002). Tiger sharks comprised 7.5 percent of the total observed catch and 11.0 percent of the large coastal shark catch. A majority of tiger sharks (71.7 percent) and nurse sharks (98.8 percent) were tagged and released.

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

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

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

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

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

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

3.4.1.3 Bottom Longline Bycatch

Under MMPA (16 U.S.C. 1361 et seq.) the Atlantic shark gillnet fishery is classified as Category II (occasional serious injuries and mortalities), and the shark BLL as Category III (remote likelihood or no known serious injuries or mortalities) (March 28, 2007; 72 FR 14466). On October 29, 2003, NMFS issued a biological opinion (BiOp) pursuant to ESA regarding Atlantic shark fisheries. This BiOp concluded that the level of anticipated take in the Atlantic shark fishery resulting from measures implemented in Amendment 1 to the 1999 FMP (68 FR 74746), were not likely to jeopardize the continued existence of endangered green, leatherback, and Kemp's ridley sea turtles, the endangered smalltooth sawfish, or the threatened loggerhead sea turtle. Furthermore, it concluded that the actions in the rule were not likely to adversely affect marine mammals. As a result of this conclusion, NMFS (NMFS, 2003) anticipates that the continued operation of the shark BLL fishery will result in a five year total incidental take of the following numbers of sea turtles: Leatherback – 172; loggerhead – 1,370; a total of 30 in any combination of hawksbill, green, and Kemp's ridley sea turtles. NMFS also anticipates a five year take of 261 smalltooth sawfish, of which no lethal takes are expected. If the actual calculated incidental captures or mortalities exceed the incidental take statement, a formal consultation for that gear type must be re-initiated immediately. More information is available in Amendment 1 to the 1999 FMP and the October 2003 BiOp and is not repeated here.

Loggerhead Sea Turtles

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

Leatherback Sea Turtles

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

Smalltooth Sawfish

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

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

Marine Mammals

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

Seabirds

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

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

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

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

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

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

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

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

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

Table 3-8 Total number of Observed Sea Turtle Interactions by Year for Years 1994-2006 in the Shark BLL Fishery. Source: Shark BLL Observer Program. Letters in parentheses indicate whether the sea turtle was released alive (A), dead (D), or in an unknown (U) condition.

Year	Leatherback Sea Turtle	Loggerhead Sea Turtle	Other Sea Turtle	Total
1994	1 (1U)	5 (5U)	6 (6U)	12
1995		4 (3A, 1D)		4
1996	1 (1U)	6 (3A, 2D, 1U)		7
1997	1 (1U)	5 (3A, 2U)		6
1998		2 (1A, 1D)	1 (1A)	3
1999		2 (2A)		2
2001	1 (1D)	2 (2A)		3
2002		5 (3A, 1D, 1U)		5
2003		7 (6A, 1D)	1 (1U)	8
2004		5 (3A, 2D)		5
2005	2 (1A, 1D)	4 (1A, 3D)	1 (1U)	7
2006		12 (3A, 4D, 5U),		12
Total	6	59	9	74

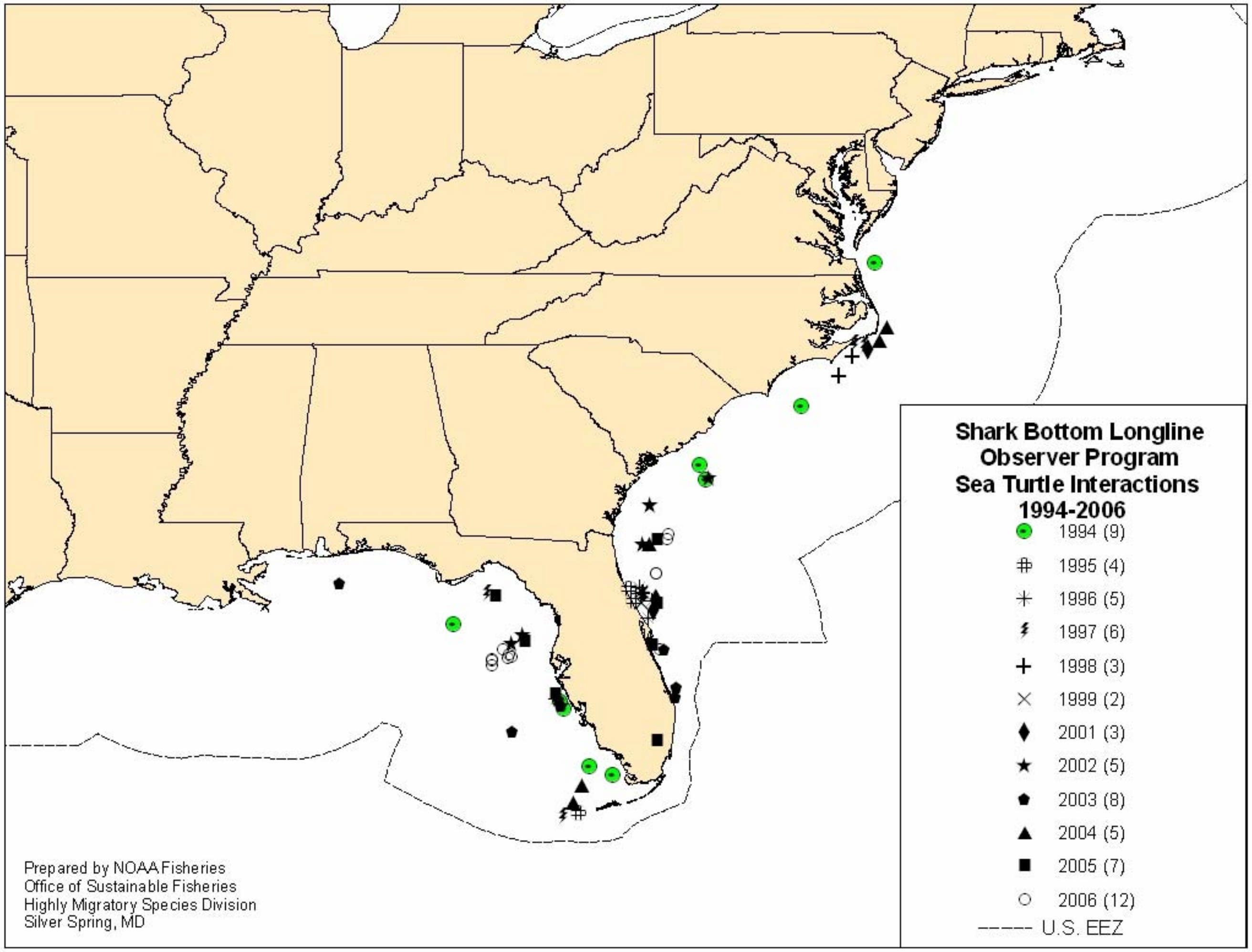

Figure 3-2 **Observed sea turtle interactions in the shark BLL fishery from 1994-2006.** Source: Commercial Shark Fishery Observer Program data (1994-1st season of 2005) and NMFS' Shark Observer Program data (2nd season 2005-2006).

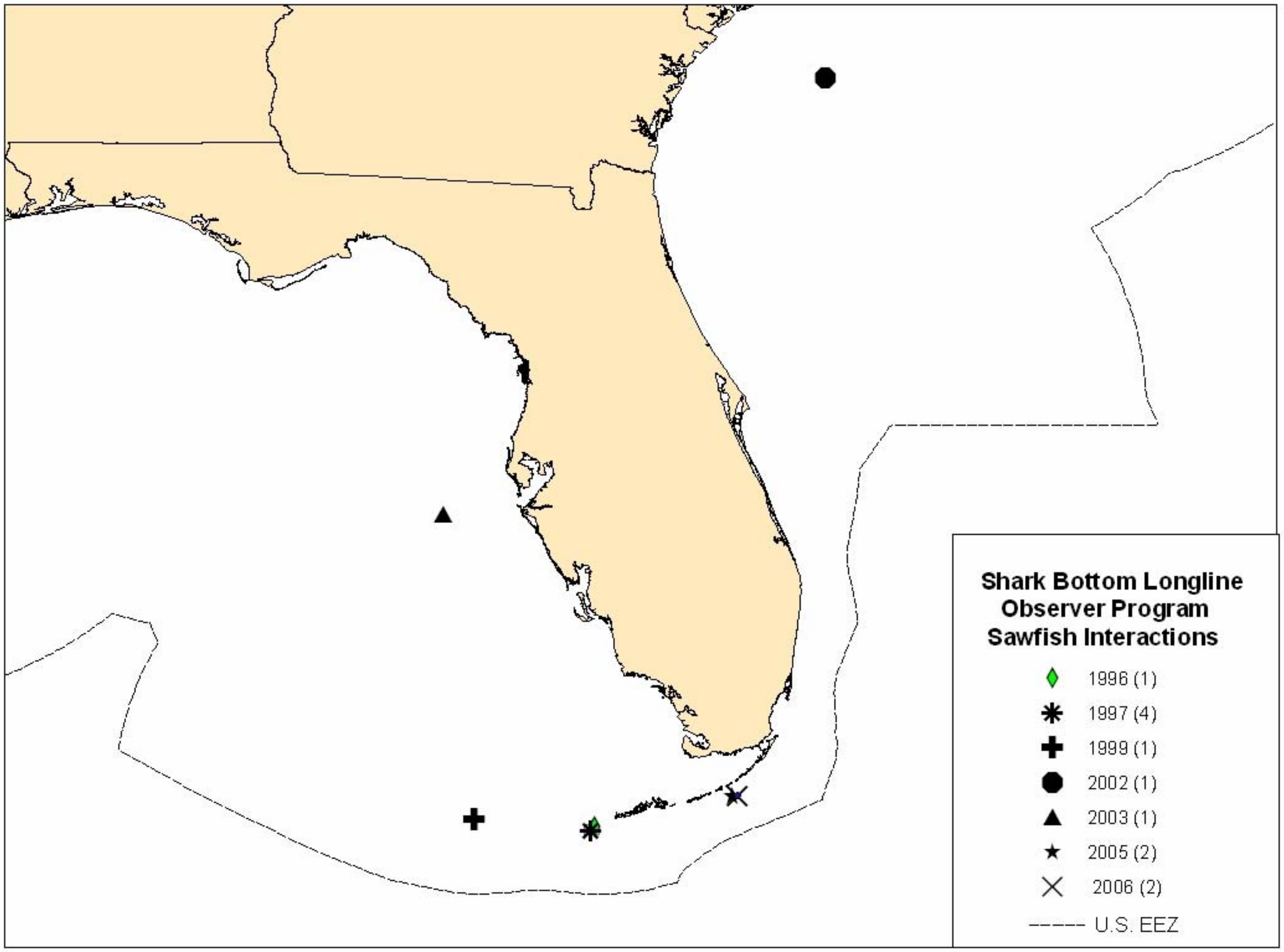

Figure 3-3 **Observed sawfish interactions and observed sets (smaller grey circles) in the shark BLL fishery from 1994-2006.** Source: Commercial Shark Fishery Observer Program data (1994-1st season of 2005) and NMFS' Shark Observer Program data (2nd season 2005-2006).

3.4.2 Gillnet Fishery

3.4.2.1 Domestic History and Current Management

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

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

3.4.2.2 Recent Catch and Landings

The following section provides information on shark landings as reported in the shark gillnet observer program. The 2006 Directed Shark Gillnet Fishery Observer Program report described the gear and soak time deployed by drift gillnet, strike gillnet, and sink gillnet fishermen. Set duration was generally 0.3 hours in depths averaging 20.9 m, and haulback averaged 3.3 hours. The average time from setting the net through completion of haulback was 10.2 hours. Stretched mesh sizes measured from 12.7-25.4 cm. Strikenetters use the largest mesh size (22.9-30.4 cm) and the set times were 3.2 hours. Sink gillnets used to target sharks generally use 7.3-20.3 cm mesh size and the process lasted for approximately 6.1 hours. This gear was also observed being deployed to target non-HMS (teleosts); using a stretched mesh size of 6.4-12.7 cm, and the entire process took approximately 2.3 hours (Carlson and Bethea, 2007).

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

Gillnet Landings and Bycatch

On September 23, 2002, NMFS implemented a restricted area to reduce bycatch of right whales from November 15 through March 31 (67 FR 59471). In this area, only gillnets used in a strikenet fashion can operate during times when right whales are present. Operation in this area at that time requires 100 percent observer coverage. Vessels fishing in a strikenet fashion used nets 364.8 meters long, 30.4 meters deep, and with mesh size 22.9 cm.

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

In the strikenet fishery, 99.7 percent of the observed catch were sharks with only 0.15 percent teleosts, and 0.07 percent non-shark elasmobranchs. Blacktip, finetooth, and spinner shark comprised over 94 percent of the observed shark strike net catch by number and weight. Tarpon and little tunny were the teleosts encountered most frequently (Carlson and Bethea, 2007). Sinknet landings and bycatch vary by target species. Four main groups were targeted on observed sink gillnet trips in 2005 and 2006, including: shark, Spanish mackerel, kingfish, and various teleosts. Vessels targeting sharks with this gear caught 79.3 percent sharks, 17.6 percent teleosts, and 3.1 percent non-shark elasmobranchs. Vessels targeting Spanish mackerel caught 89.5 percent teleosts, 10.4 percent sharks, and 0.02 non-shark elasmobranchs. Vessels targeting kingfish caught 90.5 percent teleosts, 3.9 percent sharks, and 6.1 percent non-shark elasmobranchs. When targeting various teleosts with sink gillnet gear, vessels caught 98 percent teleosts and 2 percent shark (Carlson and Bethea, 2007).

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

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

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

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

On November 15, 2006, NMFS published a final rule (72 FR 34632, June 25, 2007) to close Atlantic waters to gillnetting in an area South of New Smyrna Beach, Florida to the South Carolina/Georgia border (71 FR 66469). The action was taken to prevent the significant risk to the wellbeing of endangered right whales from entanglement in gillnet gear in the core right whale calving area during calving season.

Loggerhead Sea Turtles

Loggerhead sea turtles are rarely caught in the shark gillnet fishery. During the 1999 right whale calving season, no loggerhead sea turtles were observed caught in this fishery (Carlson and Lee, 1999), and no loggerheads were observed caught with strikenets during the 2000 – 2002 right whale calving seasons (Carlson 2000; Carlson and Baremore, 2001; Carlson and Baremore, 2002a). However, three loggerhead sea turtles were observed caught with drift gillnets during right whale calving season, one each year from 2000 to 2002 (Carlson, 2000; Carlson and Baremore, 2001; Carlson and Baremore, 2002a; Garrison, 2003). In 2004 there were no observed sea turtle interactions in either the strikenet or drift gillnet fisheries.

No loggerhead sea turtles were caught outside of the right whale calving season in 2002 (Carlson and Baremore, 2002b), and no loggerhead turtles were observed caught during or after the right whale calving season in 2003 or 2004 in the directed shark gillnet fishery (Carlson and Baremore 2003; Carlson, pers. comm). In 2005, five loggerheads were observed caught, and in 2006 three loggerheads were observed caught (Table 3-13).

Leatherback Sea Turtles

In the shark gillnet fishery, leatherback sea turtles are sporadically caught. During the 1999 right whale calving season, two leatherback sea turtles were caught in this fishery, and both were released alive (Carlson and Lee, 1999). No leatherback sea turtles were observed caught with strikenets during the 2000 – 2002 right whale calving seasons (Carlson, 2000; Carlson and Baremore, 2001; Carlson and Baremore, 2002a). Leatherback sea turtles have been observed caught in shark drift gillnets including 14 in 2001 and 2 in 2002 (Carlson, 2000; Carlson and Baremore, 2001; Carlson and Baremore, 2002a; Garrison, 2003). NMFS temporarily closed the shark gillnet fishery (strikenetting was allowed) from March 9 to April 9, 2001, due to the increased number of leatherback interactions that year (66 FR 15045, March 15, 2001).

From 2003 – 2004, no leatherback sea turtles were observed caught in gillnets fished in strikenet or driftnet methods (Carlson and Baremore 2003; Carlson, pers. comm.). In 2005, one leatherback turtle was caught and released alive (Table 3-13). In 2006, no leatherbacks were observed caught in gillnets (Table 3-13).

Smalltooth Sawfish

To date there has been only one observed catch of a smalltooth sawfish in shark gillnet fisheries. The sawfish was taken on June 25, 2003, in a gillnet off southeast Florida and was released alive (Carlson and Baremore, 2003). The set was characteristic of a typical drift gillnet set, with gear extending 30 to 40 feet deep in 50 to 60 feet of water. Prior to this event it was speculated that the depth at which drift gillnets are set above the sea floor may preclude smalltooth sawfish from being caught. From 2004-2006, there were no observed catches of smalltooth sawfish in shark gillnet fisheries (Table 3-14).

Although sometimes described as a lethargic demersal species, smalltooth sawfish feed mostly on schooling fish, thus they would occur higher in the water column during feeding activity. In fact, smalltooth sawfish and Atlantic sharks may be attracted to the same schools of fish, potentially making smalltooth sawfish quite vulnerable if present in the area fished. The previous absence of smalltooth sawfish incidental capture records is more likely attributed to the relatively low effort in this fishery and the rarity of smalltooth sawfish, especially in Federal waters. These factors may result in little overlap of the species with the gear. The sawfish was cut from the net and released alive with no visible injuries. This indicates that smalltooth sawfish can be removed safely if entangled gear is sacrificed.

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

Marine Mammals

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

Table 3-9 Total Strike gillnet Shark Catch and Bycatch by Species in order of Decreasing Abundance for all Observed Trips, 2005-2006. Source: Carlson and Bethea, 2007.

Species	Total Number Caught	Kept (%)	Discarded Alive (%)	Discarded Dead (%)
Blacktip shark	9,831	89.5	0.2	10.3
Finetooth	1,687	100	0	0
Spinner Shark	1,108	100	0	0
Blacknose shark	541	100	0	0
Dusky shark	20	0	25	75

Species	Total Number Caught	Kept (%)	Discarded Alive (%)	Discarded Dead (%)
Atlantic sharpnose	7	100	0	0
Scalloped Hammerhead	7	71.4	0	28.6
Tarpon	5	0	0	100
Blackfin tuna	5	100	0	0
Manta ray	4	0	100	0
Bonnethead shark	3	100	0	0
Cobia	3	100	0	0
Cownose ray	3	0	33.3	66.7
Red drum	2	0	50	50
Bull shark	2	100	0	0
Spotted eagle ray	2	0	100	0
Nurse shark	1	100	0	0
Crevalle jack	1	100	0	0
Southern flounder	1	100	0	0
Barracudas	1	0	0	100
Remoras	1	100	0	0
Ocellated flounder	1	0	0	100
Total	**13,236**			

Table 3-10 Total Shark Catch by Species and Species Disposition in Order of Decreasing Abundance for all Observed Driftnet Sets 2005-2006. Source: Carlson and Bethea, 2007.

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

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

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

Table 3-12 Total Sink gillnet Shark Catch and Bycatch by Species in order of Decreasing Abundance for all Observed Trips, 2005-2006. Source: Carlson and Bethea, 2007.

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

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

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

Table 3-13 Total number of Observed Sea Turtle Interactions by Year from 2000-2006 in the Shark Gillnet Fishery. Source: Directed Shark Gillnet Observer Program. Letters in parentheses indicate whether the sea turtle was released alive (A), dead (D), or unknown (U).

Year	Leatherback Sea Turtle	Loggerhead Sea Turtle	Total
2000		1 (U)	1
2001		1 (U)	1

2002		1 (U)	1
2003			0
2004			0
2005	1(A)	5 (4A, 1D)	6
2006		3 (2A, 1D)	3
Total	1	11	12

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

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

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

3.4.3 Pelagic Longline Fishery

3.4.3.1 Domestic History and Current Management

The U.S. PLL fishery for Atlantic HMS primarily targets swordfish, yellowfin tuna, and bigeye tuna in various areas and seasons. Secondary target species include dolphin, albacore tuna, pelagic sharks (including mako, thresher, and porbeagle sharks), as well as several species of large coastal sharks. Although this gear can be modified (*e.g.*, depth of set, hook type, etc.) to target swordfish, tunas, or sharks, it is generally a multi-species fishery. These vessel operators are opportunistic, switching gear style and making subtle changes to target the best available economic opportunity of each individual trip. Pelagic longline gear sometimes attracts and hooks non-target finfish with little or no commercial value as well as species that cannot be retained by commercial fishermen due to regulations, such as billfish. Pelagic longlines may also interact with protected species such as marine mammals, sea turtles, and seabirds. Thus, this gear has been classified as a Category I fishery with respect to MMPA. Any species (or undersized catch of permitted species) that cannot be landed due to fishery regulations is required to be released, whether dead or alive. Pelagic longline gear is composed of several parts (see 3.4[1]) (NMFS, 1999).

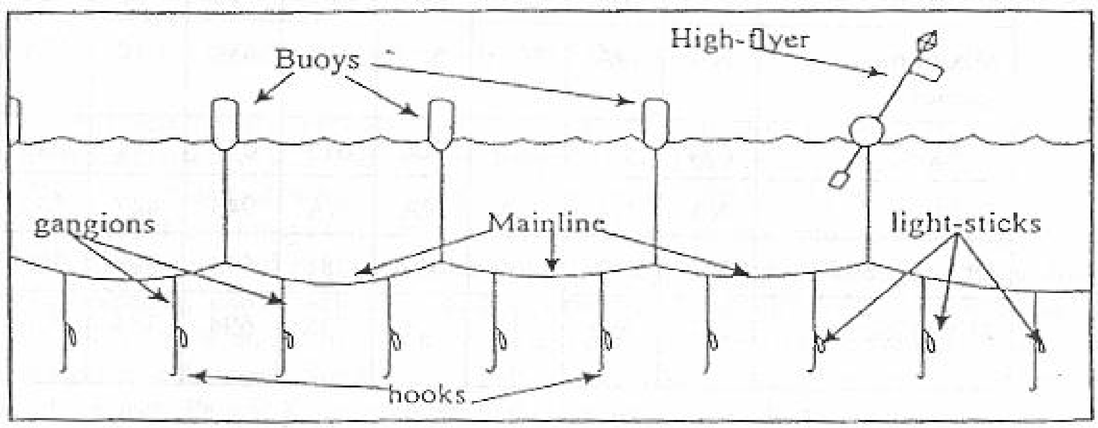

Figure 3-4 **Typical U.S. PLL Gear.** Source: Arocha, 1996

The primary fishing line, or mainline of the longline system, can vary from five to 40 miles in length, with approximately 20 to 30 hooks per mile. The depth of the mainline is determined by ocean currents and the length of the floatline, which connects the mainline to several buoys, and periodic markers which can have radar reflectors or radio beacons attached. Each individual hook is connected by a leader, or gangion, to the mainline. Lightsticks, which contain chemicals that emit a glowing light, are often used, particularly when targeting swordfish. When attached to the hook and suspended at a certain depth, lightsticks attract baitfish, which may, in turn, attract pelagic predators (NMFS, 1999).

When targeting swordfish, PLL gear is generally deployed at sunset and hauled at sunrise to take advantage of swordfish nocturnal near-surface feeding habits (NMFS, 1999). In general, longlines targeting tunas are set in the morning, deeper in the water column, and hauled in the evening. Except for vessels of the distant water fleet, which undertake extended trips, fishing vessels preferentially target swordfish during periods when the moon is full to take advantage of increased densities of pelagic species near the surface. The number of hooks per set varies with line configuration and target species (3.16) (NMFS, 1999). The PLL gear components may also be deployed as a trolling gear to target surface feeding tunas. Under this configuration, the mainline and gangions are elevated and actively trolled so that the baits fish on or above the water's surface. This style of fishing is often referred to as "green-stick fishing," and reports indicate that it can be extremely efficient compared to conventional fishing techniques. For more information on green-stick fishing gear and the configurations allowed under current regulations, please refer to the discussions of alternative H4 in Chapters 2 and 4 of the 2006 Consolidated HMS FMP. At present, NMFS is considering alternatives in regard to changes with greenstick use in HMS fisheries.

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

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

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

Regional U.S. Pelagic Longline Fisheries Description

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

Management of the U.S. Pelagic Longline Fishery

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

In June 2004, NMFS conditionally re-opened the NED to PLL fishing. NMFS limited vessels with PLL gear onboard in that area, at all times, to possessing onboard and/or using only 18/0 or larger circle hooks with an offset not to exceed ten degrees. Only whole mackerel and squid baits may be possessed and or utilized with allowable hooks. In August of 2004, NMFS limited vessels with PLL gear onboard, at all times, in all areas open to PLL fishing, excluding the NED, to possessing onboard and/or using only 16/0 or larger non-offset circle hooks and/or 18/0 or larger circle hooks with an offset not to exceed ten degrees. Only whole finfish and squid baits may be possessed and/or utilized with allowable hooks. All PLL vessels must possess and use sea turtle handling and release gear in compliance with NMFS careful release protocols.

Permits

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

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

Monitoring and Reporting

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

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

Pelagic Longline Observer Program

During 2005, NMFS observers recorded 796 PLL sets for an overall fishery coverage of 10.1 percent. In non-experimental fishing, the overall observer coverage was 7.2 percent. A total of 247 experimental PLL sets were observed in the NEC, GOM, FEC, MAB, and SAB areas, primarily during the second and third quarters. These experimental sets (EXP) had 100 percent observer coverage and are separated from the normal commercial fishery in Table 3-16 (Walsh and Garrison, 2006). In 2004, NMFS observers recorded 702 PLL sets for an overall coverage of 7.3 percent. During the first and second quarters of 2004, 60 experimental sets employing circle hooks were made in the Gulf of Mexico. These sets had 100 percent observer coverage (Garrison, 2005). One thousand eighty-eight PLL sets were observed and recorded by NMFS observers in 2003 (11.5 percent overall coverage – 100 percent coverage in the NED; and 6.2 percent coverage in remaining areas) (Garrison and Richards, 2004). Table 3-16 details the amount of observer coverage in past years for this fleet. Generally, due to logistical problems, it has not always been possible to place observers on all selected trips. NMFS is working towards improving compliance with observer requirements and facilitating communication between vessel operators and observer program coordinators. In addition, fishermen are reminded of the safety requirements for the placement of observers specified at 50 CFR 600.746, and the need to have all safety equipment on board required by the U.S. Coast Guard.

Table 3-16 **Observer Coverage of the PLL Fishery.** Source: Yeung, 2001; Garrison, 2003; Garrison and Richards, 2004; Garrison, 2005; Walsh and Garrison, 2006.

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

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

3.4.3.2 Recent Catch and Landings

U.S. PLL catch (including bycatch, incidental catch, and target catch) is largely related to these vessel and gear characteristics, but is summarized for the whole fishery in Table 3-17.

From May 1992 through December 2000, the Pelagic Observer Program (POP) recorded a total of 4,612 elasmobranchs (15 percent of the total catch) caught off the southeastern U.S.

coast in fisheries targeting tunas and swordfish (Beerkircher *et al.*, 2004). Of the 22 elasmobranch species observed, silky sharks were numerically dominant (31.4 percent of the elasmobranch catch), with silky, dusky, night, blue, tiger, scalloped hammerhead, and unidentified sharks making up the majority (84.6 percent) (Beerkircher *et al.*, 2004).

Table 3-17 Reported Catch of Species Caught by U.S. Atlantic PLLs, in Number of Fish, for 1999-2005. Source: PLL Logbook Data.

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

Incidental bycatch

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

3.4.3.3 Safety Issues

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

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

3.4.3.4 International Issues and Catch

Pelagic longline fisheries for Atlantic HMS primarily target swordfish and tunas. Directed PLL fisheries in the Atlantic have been operated by Spain, the United States, and Canada since the late 1950s or early 1960s. The Japanese PLL tuna fishery started in 1956 and has operated throughout the Atlantic since then (NMFS, 1999). Most of the 35 other ICCAT nations now also operate PLL vessels.

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

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

Nevertheless, ICCAT does report landings by gear type. Available data indicate that longline effort produces the second highest volume of catch and effort, and is the most broadly distributed (longitudinally and latitudinally) of the gears used to target ICCAT managed species (Figure 3-5) (SCRS, 2004). Purse seines produce the highest volume of catch of ICCAT managed species from the Atlantic (SCRS, 2004). From 1999 through 2002 (inclusive) there was a declining trend in estimated international landings of HMS for fisheries in which the United States participated. In 2004, international landings of HMS for fisheries in which the U.S. participated totaled 106,774 mt, which represented a modest decrease from 2003 (SCRS, 2005).

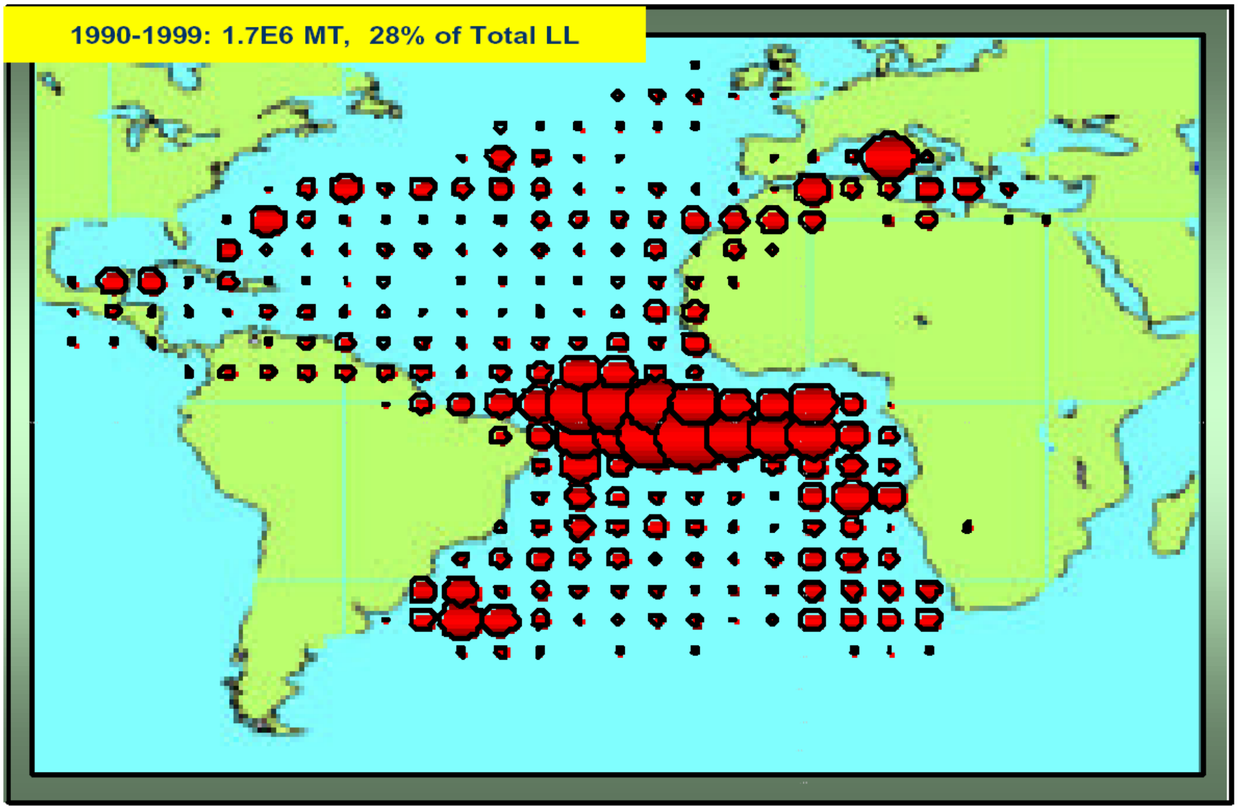

Figure 3-5 Distribution of Atlantic Longline Catches for all Countries 1990-1999. Source: SCRS, 2004

Scientific observer data are being collected on a range of PLL fleets in the Atlantic and will be increasingly useful in better quantifying total catch, catch composition, and disposition of catch as these observer programs mature. Previous ICCAT observer coverage requirements of five percent for non-purse seine vessels that participated in the bigeye and yellowfin tuna fishery, including PLL (per ICCAT Recommendation 96-01), are no longer in force. There is currently no ICCAT required minimum level of observer coverage specific to PLL fishing. Nevertheless, the United States has implemented a mandatory observer program in the U.S. PLL fishery. Japan is required to have eight percent observer coverage of its vessels fishing for swordfish in the North Atlantic, which are primarily PLL vessels, however, the recommendation is not specific to vessel or gear type. ICCAT recommendation 04-01, a conservation and management recommendation for the bigeye tuna fishery, entered into force in mid-2005 and requires at least five percent observer coverage of PLL vessels over 24 meters fishing for bigeye.

ICCAT has also developed a running tabulation of the diversity of species caught by the various gears used to target tunas and tuna like species in the Atlantic and Mediterranean (Table 3-18). For all fish species, longline gear shows the highest documented diversity of catch, followed by gillnets and purse seine. For seabirds, longline gear again shows the highest diversity of catch, while for sea turtles and marine mammals, purse seine and gillnet have a higher documented diversity of species for Atlantic tuna fleets (SCRS, 2004).

Table 3-18 ICCAT Bycatch Table (LL, longline; GILL, gillnets; PS, purse-seine; BB, baitboat; HARP, harpoon; TRAP, traps). Source: SCRS, 2004.

ICCAT Bycatch Table (www.iccat.es)

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

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

Highly Migratory Species

The U.S. PLL fleet represents a small fraction of the international PLL fleet that competes on the high seas for catches of tunas and swordfish. In recent years, the proportion of U.S. PLL landings of HMS, for the fisheries in which the United States participates, has remained relatively stable in proportion to international landings. The U.S. fleet accounts for less than 0.5 percent of the landings of swordfish and tuna from the Atlantic Ocean south of 5°N. Latitude and does not operate at all in the Mediterranean Sea. Tuna and swordfish landings by foreign fleets operating in the tropical Atlantic and Mediterranean are greater than the catches from the north Atlantic area where the U.S. fleet operates. Even within the area where the U.S. fleet operates, the U.S. portion of fishing effort (in numbers of hooks fished) is less than 10 percent of the entire international fleet's effort, and likely less than that due to differences in reporting effort between ICCAT countries (NMFS, 2001).

Atlantic Sharks

There is currently no comprehensive international reporting system for Atlantic shark catches and landings. While there are some international data, not all countries report shark catches and landings and those that do use varying reporting methods. The most recent landings reports for blue, shortfin mako, and porbeagle sharks are presented in Table 3-19, Table 3-20, Table 3-22, respectively. In 2001, ICCAT passed a resolution on Atlantic sharks to determine needed improvements in data collection for Atlantic shortfin mako and blue sharks, and to conduct an interim meeting in 2003 to discuss the issue. In addition, the resolution called upon contracting parties and non-contracting parties to: (1) submit catch and effort data on Atlantic shortfin mako, porbeagle, and blue sharks; (2) encourage the release of live sharks that are caught incidentally; (3) minimize waste and discards from shark catches; and (4) voluntarily agree not to increase fishing effort targeting Atlantic porbeagle, shortfin mako and blue sharks until sustainable levels of harvest can be determined through stock assessments.

At its annual meeting in New Orleans in 2004, ICCAT adopted *Recommendation 04-10 Concerning the Conservation of Sharks Caught in Association with Fisheries Managed by ICCAT* which, among other things, bans shark finning, requires vessels to fully utilize their entire catches of sharks, encourages the release of live sharks that are caught incidentally and are not used for food, and reviews the assessment of shortfin mako sharks in 2005, and reassess blue sharks and shortfin mako no later than 2007. The ICCAT recommendation also encouraged countries to engage in research to identify shark nursery areas and collect data on shark catches.

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

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

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

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

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

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Atlantic Total		1,245	1,210	1,302	2,957	2,952	4,866	2,771	5,577	5,275	4,002	4,858	4,683	5,380	7,370	7,409	3,790
LONGLINE LANDINGS	BRAZIL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37	259
	CANADA	0	0	0	0	0	0	743	1,103	0	179	1,689	2,173	1,966	2,160	1,568	2,520
	CHINA P.R.	0	0	0	0	0	275	12	10	4	53	18	0	5	6	0	11
	CHINESE TAIPEI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	EC ESPANA	0	0	0	0	0	0	0	0	0	0	0	750	420	600	0	0
	EC PORTUGAL	0	0	0	0	0	0	0	0	0	0	0	0	0	692	1,206	1,272
	EC UNITED KINGDOM	0	0	0	0	0	0	0	0	0	0	9	0	0	3	6	5
	JAPAN	0	0	0	0	0	0	0	29,917	28,137	29,005	31,094	25,110	21,037	22,601	24,682	0
	MEXICO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0
	NAMIBIA	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	PANAMA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	0
	SOUTH AFRICA	1,387	2,257	1,583	5,726	4,669	5,569	5,710	3,966	3,318	3,337	4,220	4,713	4,602	6,926	3,586	7,266
	TRINIDAD & TOBAGO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	USA	0	0	0	0	2,596	1,589	1,044	996	850	893	494	532	742	830	1,473	0
	URUGUAY	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0
	VANUATU	0	0	0	0	0	0	0	0	0	0	0	0	2,213	0	1,906	6,616
	VENEZUELA	0	0	0	0	0	0	0	0	0	177	22	0	0	0	0	0
LONGLINE DISCARDS	MEXICO	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0
	USA	741	772	184	1136	572	618	609	185	173	97	137	105	68	0	63	76
	UK BERMUDA	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0
OTHER LANDINGS	BRASIL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	61	0
	CANADA	0	0	0	0	0	18	11	11	15	17	20	10	17	10	10	17
	COTE D'IVOIRE	0	9	13	7	17	12	15	23	10	10	9	15	15	30	15	14
	EC PORTUGAL	0	0	0	0	0	0	0	0	0	0	0	0	0	93	74	0
	EC UNITED KINGDOM	0	0	0	0	0	0	0	0	0	2	3	2	1	0	0	0
	SOUTH AFRICA	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0

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

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

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

3.4.4 Recreational Handgear

The following section describes the recreational portion of the handgear fishery, and is primarily focused upon rod and reel fishing. The HMS Handgear (rod and reel, handline, and harpoon) fishery includes both commercial and recreational fisheries and is described fully in Section 2.5.8 of the 1999 FMP. Handgear components may also be deployed as a specialized trolling gear to target surface-feeding tunas. Under this configuration, the line and leaders are elevated and actively trolled so that the baits fish on or above the water's surface. This style of fishing is often referred to as "green-stick fishing," and reports indicate that it can be extremely efficient compared to conventional fishing techniques. For more information on green-stick fishing gear and the configurations allowed under current regulations, please refer to the discussions of alternative H4 in Chapters 2 and 4 of the 2006 Consolidated HMS FMP. At present, NMFS is considering alternatives in regard to changes with greenstick use in HMS fisheries, and what NMFS should keep in mind about greenstick gear when considering a change in authorization of this gear.

3.4.4.1 Overview of History and Current Management

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

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

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

3.4.4.2 Most Recent Catch and Landings Data

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

Shark Recreational Fishery

Recreational landings of sharks are an important component of HMS fisheries. Recreational shark fishing with rod and reel is a popular sport at all social and economic levels, largely because the resource is accessible. Sharks can be caught virtually anywhere in salt water, depending upon the species. Recreational shark fisheries are oftentimes exploited in nearshore waters by private vessels and charter/headboats. However, there is also some shore-based fishing and some offshore fishing. The following tables provide a summary of landings for each of the three species groups. Amendment 1 to the 1999 Atlantic Tunas, Swordfish, and Shark FMP limited the recreational fishery to rod and reel and handline gear only.

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

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

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

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

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

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

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

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

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

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

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

3.4.4.3 Bycatch Issues and Data Associated with the Fishery

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

Bycatch can result in death or injury to discarded fish. Therefore, bycatch mortality should be incorporated into fish stock assessments, and into the evaluation of management measures. Rod and reel discard estimates from Virginia to Maine during June – October could be monitored through the expansion of survey data derived from the LPS (dockside and telephone surveys). However, the actual numbers of fish discarded for many species are so low that presenting the data by area could be misleading, particularly if the estimates are expanded for unreported effort in the future. The number of kept and released sharks reported or observed through the LPS dockside intercepts for 1997 – 2004 is presented in Table 3-26.

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

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

3.4.5 Fishery Data: Landings by Shark Species

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

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

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

Large Coastal Sharks	2000	2001	2002	2003	2004	2005
Unclassified, fins	87,820	23,988	142,565	181,431	137,375	110,613
Total (excluding fins)	**3,625,305 (1,644 mt dw)**	**3,414,967 (1,549 mt dw)**	**4,151,594 (1,883 mt dw)**	**4,292,403 (1,947 mt dw)**	**3,213,896 (1,458 mt dw)**	**3,306,583 (1,500 mt dw)**

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

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

Small coastal sharks	2000	2001	2002	2003	2004	2005
Atlantic Angel*	97	0	495	1,397	818	3,587
Blacknose	178,083	160,990	144,615	131,511	68,108	120,320
Bonnethead	69,411	63,461	36,553	38,614	29,402	33,295
Finetooth	202,572	303,184	185,120	163,407	121,036	107,327
Sharpnose, Atlantic	142,511	196,441	213,301	190,960	230,880	375,881
Sharpnose, Atlantic, fins	0	209	0	0	0	0
Sharpnose, Caribbean*	353	205	0	0	0	0
Unclassified Small Coastal	0	51	35,831	8,634	1,407	9,792
Total (excluding fins)	**593,027 (269 mt dw)**	**724,332 (329 mt dw)**	**615,915 (279 mt dw)**	**534,523 (242 mt dw)**	**451,651 (205 mt dw)**	**650,202 (295 mt dw)**

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

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

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

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

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

Table 3-30 The number of sharks and non-shark species that were discarded alive, discarded dead, and kept under the exempted fishing program during 2006, including exempted fishing permits, display permits, scientific research permits, and letters of acknowledgement. These numbers do not include fish that were reported in commercial logbooks.

Species	Number Discarded Alive	Number Discarded Dead	Number Kept	Total Number of Interactions
Shark Species				
Angel Shark	12			12
Atlantic Sharpnose Shark	2,512	354	3	2,869
Bigeye Thresher Shark	1	1	1	3
Blacknose Shark	190	44		234
Blacktip Shark	124	117	1	242
Blue Shark	52			52
Bonnethead Shark	407	28	3	438
Bull Shark	33	2		35
Caribbean Reef Shark	4	2		6
Caribbean Sharpnose Shark	3			3
Cuban Dogfish Shark	5			5
Dusky Shark	36			36
Finetooth Shark	1			1
Florida Smoothhound Shark	152	2		154
Great Hammerhead Shark	5	18		23
Lemon Shark	47	2		49
Longfin Mako Shark		1		1
Mako Shark	7			7
Night Shark	3			3
Nurse Shark	146		15	161
Porbeagle Shark	1			1
Sand Tiger Shark	21		6	27
Sandbar Shark	330	61	6	397
Sawfish	5			5
Scalloped Hammerhead Shark	33	8		41
Sevengill Shark	1			1
Silky Shark	15			15
Smooth Dogfish Shark	86	1		87
Smooth Hammerhead Shark			1	1
Spinner Shark	60	10		70
Spiny Dogfish Shark	25			25
Tiger Shark	120			120
Unidentified Shark	10			10

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

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

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

3.5 HMS Permits and Tournaments

This section provides updates for the number of permits that were issued in conjunction with HMS fishing activities. These are current through 2006 and, in some cases, May 11, 2007, depending on the table in which the data appears. Furthermore, Section 3.9.6 provides a comprehensive synthesis of recreational fishing tournaments and their role in the context of HMS management.

NMFS' HMS Management Division continues to monitor capacity in HMS fisheries. Updated permit numbers for HMS and non-HMS fisheries as of 2006 (and beyond) are included in Table 3-32. The overall number of HMS permits for Atlantic swordfish and sharks (directed and incidental) decreased between 2006 and May 11, 2007 (Table 3-32), however, these numbers are subject to change based upon on-going permit renewal or expiration.

Table 3-32 Distribution of Shark Directed and Incidental Permits and Other held in other Fisheries by State.

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

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

* of shark directed permit holders, 107 have Spanish mackerel permits, and 87 have king mackerel permits and of shark incidental permit holders, 121 have Spanish mackerel permits, and 117 have king mackerel permits.
** Totals for 2007 are as of May 11, 2007.
*** Numbers for 2005 and 2006 were taken from the Consolidated HMS FMP. Non-HMS permits were not calculated at that time.

3.5.1 Upgrading and Safety Issues

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

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

3.5.2 HMS CHB Permits

In 2002, NMFS published a final rule (67 FR 77434, Dec. 18, 2002) expanding the HMS recreational permit from tuna only to include all HMS and define CHB operations. This established a requirement that owners of charterboats or headboats that are used to fish for, take, retain, or possess Atlantic tunas, sharks, swordfish, or billfish must obtain a HMS CHB permit. This permit replaced the Atlantic Tunas CHB permit. A vessel issued a HMS CHB permit for a fishing year will not be issued an HMS Angling permit or any Atlantic Tunas permit in any category for that same fishing year, regardless of a change in the vessel's ownership. The total number of CHB increased between February 1, 2006 and April 25, 2007 (Table 3-33).

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

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

3.5.3 HMS Angling Permits

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

3.5.4 Dealer Permits

Dealer permits are required for commercial receipt of Atlantic tuna, swordfish, and sharks, and are described in further detail in the 1999 FMP for Atlantic Tunas, Swordfish, and Sharks. Dealer permits are not limited access. Fishermen caught selling HMS to unpermitted dealers and persons without a dealer permit buying HMS from fishermen could be subject to enforcement action. Similarly, persons caught buying HMS from non-commercial fishermen could also be subject to enforcement action. All dealer permit holders are required to submit reports detailing the nature of their business. For swordfish and shark permit holders (including those who *only* import swordfish), dealers must submit bi-weekly dealer reports on all HMS they purchase. Tuna dealers must submit, within 24 hours of the receipt of a bluefin tuna, a landing report for each bluefin purchased from U.S. fishermen. Dealers must also submit bi-weekly reports that include additional information on tunas that they purchase. To facilitate quota monitoring "negative reports" for shark and swordfish are also required from dealers when no purchases are made (*i.e.*, NMFS can determine who has not purchased fish versus who has neglected to report). As of May 22, 2007, there are 269 permitted shark dealers (Table 3-34). NMFS continues to automate and improve its permitting and dealer reporting systems and plans to make additional permit applications and renewals available online in the near future.

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

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

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

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

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

In order to implement the chartering recommendations of ICCAT, NMFS published a rule on December 6, 2004 (69 FR 70396), requiring U.S. vessel owners with HMS permits to apply for and obtain a chartering permit before fishing under a chartering arrangement outside U.S. waters. These permits are issued in a similar manner as other EFPs. Under this final rule and consistent with the ICCAT recommendations, vessels issued a chartering permit are not authorized to use the quota or entitlement of the United States until the chartering permit expires or is terminated. This is because of the fact that under a chartering arrangement it is assumed that vessels have attained temporary authorization to harvest another ICCAT Contracting Parties' quota. Having a chartering permit does not obviate the need to obtain a fishing license, permits, or other authorizations issued by the chartering nation in order to fish in foreign waters, or obtain other authorizations such as a High Seas Fishing Compliance Act Permit, 50 CFR 300.10 et seq. Additionally, incidental takes of, or interactions with, protected resources are included against the Incidental Take Statement specified in any relevant Biological Opinions. A U.S. vessel shall not be authorized to fish under more than one chartering arrangement at the same time. NMFS will issue chartering permits only if it determines that the chartering arrangement is in conformance with ICCAT's conservation and management programs. The number of EFPs, display permits, and SRPs issued from 2002 – 2006 by category and species are listed in Table 3-35.

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

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

3.5.6 Atlantic HMS Tournaments

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

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

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

The reasons for participation in fishing tournaments include, but are not limited to, competition, camaraderie, and the opportunity to win valuable prizes. A recent search on the Internet for fishing tournaments (December, 2004) indicated that many saltwater tournaments target HMS. It has been estimated that approximately 300 – 400 HMS fishing tournaments occur annually along the U.S. Atlantic coast, including the Gulf of Mexico and Caribbean (NMFS, 1999). These tournaments may range from smaller, club member-only events with as few as ten participating boats (40 - 60 anglers) to larger, statewide tournaments with 250 or more participating vessels (1,000 – 1,500 anglers). For the larger tournaments, corporate sponsorship from tackle manufactures, marinas, boat dealers, beverage distributors, resorts, publications, chambers of commerce, restaurants, and others are often involved. Also, some tournaments are components of larger series, including state Governors Cups (North Carolina, South Carolina), the World Billfish Series, and the MTU (Detroit Diesel) Legend Series, among others.

Many HMS fishing tournaments promote strict conservation principles in their rules. For example, minimum sizes for fish that are landed are often larger than state and Federal requirements. Also, some tournaments prohibit treble hooks and may require circle hooks on certain baits. Because tournament participants are often well-respected anglers (*i.e*. highliners), these conservation trends and ethics likely influence the general angling population in a positive manner.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

State	Number of 2006 Tournaments Awarding Points or Prizes for Small Coastal Sharks	% of Total 2006 Tournaments Awarding Points or Prizes for Small Coastal Sharks
Florida	4	66.7%
South Carolina	1	16.7%
Texas	1	16.7%
TOTAL	**6**	**100%**

3.6 Economic Status of HMS Shark Fisheries

The review of each rule, and of HMS fisheries as a whole, is facilitated when there is a baseline against which the rule or fishery may be evaluated. In this analysis, as in past SAFE reports, NMFS used 1996 as a baseline. NMFS believes that this baseline is appropriate because the Regulatory Flexibility Act (RFA) and Magnuson-Stevens Act were both amended in 1996, NMFS began to collect economic information voluntarily for vessels using the pelagic logbook in 1996, and regarding HMS specifically, no rules were implemented in 1996 that were classified as significant under RFA. Additionally, while the 1999 FMP for Atlantic Tunas, Swordfish, and Shark and the Billfish Amendment 1 were finalized in 1999, scoping for these two major documents and its final rule began in 1997. It is possible that anticipation of these documents and any potential changes in their implementing regulations could have begun to impact the decisions made by HMS fishermen and any associated businesses.

In addition to using the 1996 baseline, this DEIS also provides six years of data, when possible, in order to facilitate the analysis of trends. It also should be noted that all dollar figures are reported in nominal dollars (*i.e.,* current dollars). If analysis of real dollar (*i.e.,* constant dollar) trends controlled for inflation is desired, price indexes for 1996 to 2006 are provided in Table 3-41. To determine the real price in base year dollars, divide the base year price index by the current year price index, and then multiply this result by the price that is being adjusted for inflation. From 1996 to 2006, the Consumer Price Index (CPI-U) indicates that prices have risen by 28.5 percent, the Gross Domestic Product (GDP) Implicit Price Deflator indicates that prices have risen 23.7 percent, and the Producer Price Index (PPI) for unprocessed finfish indicates a 80.4 percent rise in prices (Table 3-41). From 2004 to 2005, the CPI, GDP Deflator, and the PPI for unprocessed finfish indicate prices rose by 3.4 percent, 3.0 percent, and 12.9 percent respectively. From 2005 to 2006, the CPI, GDP Deflator, and the PPI for unprocessed finfish indicate prices rose by 3.2 percent, 2.9 percent, and 32.2 percent respectively.

Table 3-41 **Inflation Price Indexes. The CPI-U is the standard Consumer Price Index for all urban consumers (1982-1984=100) produced by U.S. Department of Labor Bureau of Labor Statistics.** The source of the Producer Price Index (PPI) for unprocessed finfish (1982=100) is also the Bureau of Labor Statistics. The Gross Domestic Product Implicit Price Deflator (2000=100) is produced by the U.S. Department of Commerce Bureau of Economic Analysis and obtained from the Federal Reserve Bank of St. Louis (http://www.stlouisfed.org/).

Year	CPI-U	GDP Deflator	PPI Unprocessed Finfish
1996	156.9	93.8	185.5
1997	160.5	95.4	165.7
1998	163	96.5	170.7
1999	166.6	97.9	191.7
2000	172.2	100.0	182.4
2001	177.1	102.4	176.1
2002	179.9	104.2	201.5
2003	184	106.4	195.8
2004	188.9	109.4	224.1
2005	195.3	112.7	253.1
2006	201.6	116.0	334.6

3.6.1 Commercial Fisheries[2]

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

3.6.1.1 Ex-Vessel Prices

The average ex-vessel prices per lb dw for 1996 and 1999 to 2006 by shark species complex and area are summarized in Table 3-42. For both of these tables, prices are reported in nominal dollars. The ex-vessel price depends on a number of factors including the quality of the fish (*e.g.*, freshness, fat content, method of storage), the weight of the fish, the supply of fish, and consumer demand.

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

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

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

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

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

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

3.6.1.2 Revenues

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

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

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

Note: Average ex-vessel prices may have some weighting errors.
*Sandbar sharks are broken out of the large coastal shark complex for 2005 to provide baseline information for this proposed Amendment. This exaggerates the discrepancy in revenue for LCS in 2005 when compared across years.

3.6.1.3 Wholesale Market

Currently, NMFS does not collect wholesale price information from dealers. However, the wholesale price of some fish species is available off the web (http://www.st.nmfs.gov/st1/market_news/index.html). The wholesale prices presented in Table 3-44 are from the annual reports of the Fulton Fish Market. As with ex-vessel prices, wholesale prices depend on a number of factors including the quality of the fish, the weight of the fish, the supply of fish, and consumer demand.

As reported by the Fulton Fish Market, Table 3-44 indicates that the average wholesale price of shark sold in Atlantic and Gulf of Mexico states decreased from 1996 to 2004 for the mako shark. Prices for other shark species have appeared to have rebounded in 2004, when compared to 1996.

Table 3-44 The overall average wholesale price per lb of fresh HMS sold in Atlantic and Gulf of Mexico states as reported by the Fulton Fish Market. Source: NMFS, 2004.

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

3.6.2 Recreational Fisheries

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

An economic survey done by the U.S. Fish and Wildlife Service[2] in 2001 found that for the entire United States 9.1 million saltwater anglers (including anglers in state waters) went on approximately 72 million fishing trips and spent approximately $8.4 billion (USFWS, 2001). Expenditures included lodging, transportation to and from the coastal community, vessel fees, equipment rental, bait, auxiliary purchases (*e.g.*, binoculars, cameras, film, foul weather clothing, *etc.*), and fishing licenses (USFWS, 2001). Saltwater anglers spent $4.5 billion on trip-related costs and $3.9 billion on equipment (USFWS, 2001). Approximately 76 percent of the saltwater anglers surveyed fished in their home state (USFWS, 2001). Preliminary findings for the USFWS 2006 survey will be available in the spring of 2007 and final reports will be issued beginning in the fall of 2007.

Specific information regarding angler expenditures for trips targeting HMS species was extracted from the recreational fishing expenditure survey add-on (1998 in the Northeast, 1999 – 2000 in the Southeast) to the NMFS' Marine Recreational Fisheries Statistics Survey (MRFSS). These angler expenditure data were analyzed on a per person per trip-day level and reported in 2003 dollars. The expenditure data include the costs of tackle, food, lodging, bait, ice, boat fuel,

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

processing, transportation, party/charter fees, access/boat launching, and equipment rental. The overall average expenditure on HMS related trips is estimated to be $122 per person per day. Specifically, expenditures are estimated to be $85 per person per day on pelagic shark directed trips, $95 on large coastal shark directed trips, and $81 on small coastal sharks.

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

At the end of 2004, NMFS began collecting market information regarding advertised charterboat rates. This preliminary analysis of the data collected includes 99 observations of advertised rates on the internet for full day charters. Full day charters vary from six to 14 hours long with a typical trip being 10 hours. Most vessels can accommodate six passengers, but this also varies from two to 12 passengers. Table 3-45 summarizes the average charterboat rate for full day trips on vessels with HMS Charter/Headboat permits. The average price for a full day boat charter was $1,053 in 2004. Sutton *et al.*, (1999) surveyed charterboats throughout Alabama, Mississippi, Louisiana, and Texas in 1998 and found the average charterboat base fee to be $762 for a full day trip. Holland *et al.* (1999) conducted a similar study on charterboats in Florida, Georgia, South Carolina, and North Carolina and found the average fee for full day trips to be $554, $562, $661, and $701, respectively. Comparing these two studies conducted in the late 1990s to the average advertised daily HMS charterboat rate in 2004, it is apparent that there has been a significant gain in charterboat rates.

Table 3-45 Average Atlantic HMS charterboat rates for day trips. Source: NMFS searches for advertised daily charter rates of HMS Charter/Headboat permit holders. (Observations=99)

State	2004 Average Daily Charter Rate
AL	$1,783
CT	$1,500
DE	$1,060
FL	$894
LA	$1,050
MA	$777
MD	$1,167
ME	$900
NC	$1,130

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

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

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

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

Fishing tournaments can sometimes generate a substantial amount of money for surrounding communities and local businesses. Besides the entry fee to the tournament and possibly the calcutta, anglers may also pay for marina space and gas (if they have their own vessel), vessel rental (if they do not have their own vessel), meals and awards dinners (if not covered by the entry fee), hotel, fishing equipment, travel costs to and from the tournament, camera equipment, and other miscellaneous expenses. Less direct, but equally important, fishing tournaments may serve to generally promote the local tourist industry in coastal communities. In a survey of participants in the 1999 Pirates Cove Billfish Tournament, Ditton, *et al*., (2000) found that almost 80 percent of tournament anglers were from outside of the tournament's county. For this reason, tourism bureaus, chambers of commerce, resorts, and state and local governments often sponsor fishing tournaments.

3.7 Community and Social Update

According to National Standard 8 (NS 8), conservation and management measures should, consistent with conservation requirements, attempt to both provide for the continued participation of a community and, to the extent practicable, minimize the economic effects on the community. The information presented here addresses new data concerning the social and economic well-being of participants in the fishery and considers the impact of significant regulatory measures enacted in the past year.

3.7.1 Overview of Current Information and Rationale

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

The National Environmental Policy Act (NEPA) also requires federal agencies to consider the interactions of natural and human environments by using a "systematic, interdisciplinary approach which will ensure the integrated use of the natural and social sciences...in planning and decision-making" (§102(2)(A)). Moreover, agencies need to address the aesthetic, historic, cultural, economic, social, or health effects, which may be direct, indirect, or cumulative. Consideration of social impacts is a growing concern as fisheries experience increased participation and/or declines in stocks. The consequences of management actions need to be examined to better ascertain and, if necessary and possible, mitigate regulatory impacts on affected constituents.

Social impacts are generally the consequences to human populations resulting from some type of public or private action. Those consequences may include alterations to the ways in which people live, work or play, relate to one another, and organize to meet their needs. In addition, cultural impacts, which may involve changes in values and beliefs that affect people's way of identifying themselves within their occupation, communities, and society in general are included under this interpretation. Social impact analyses help determine the consequences of policy action in advance by comparing the status quo with the projected impacts. Community profiles are an initial step in the social impact assessment process. Although public hearings and scoping meetings provide input from those concerned with a particular action, they do not constitute a full overview of the fishery.

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

> "Conservation and management measures, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities by utilizing economic and social data that meet the requirements of paragraph (2), in order to: (A) provide for the sustained participation of such communities; and, (B) to the extent practicable, minimize adverse economic impacts on such communities." (§301(a)(8)). See also 50 CFR §600.345 for National Standard 8 Guidelines.

"Sustained participation" is defined to mean continued access to the fishery within the constraints of the condition of the resource (50 CFR §600.345(b)(4)). It should be clearly noted that NS 8 "does not constitute a basis for allocation of resources to a specific fishing community nor for providing preferential treatment based on residence in a fishing community" (50 CFR §600.345(b)(2). The Magnuson-Stevens Act further defines a "fishing community" as:

> " ... a community that is substantially dependent upon or substantially engaged in the harvest or processing of fishery resources to meet social and economic needs, and includes fishing vessel owners, operators, crew, and fish processors that are based in such communities." (§3(16))

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

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

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

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

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

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

The 2006 Consolidated HMS FMP used information from the 1998 Wilson et al. study for the 1999 FMP for Atlantic Tunas, Swordfish and Sharks that investigated the social and cultural characteristics of fishing communities in five states and one U.S. territory: Massachusetts, New Jersey, North Carolina, Florida, Louisiana, and Puerto Rico. These areas were selected because they each had important fishing communities that could be affected by the 1999 FMP and Atlantic Billfish Amendment, and because they are fairly evenly spread along the Atlantic and Gulf coasts and the Caribbean. In addition, the 2006 Consolidated HMS FMP used information gathered under the contract with the Virginia Institute of Marine Science (VIMS) at the College of William and Mary to re-evaluate several of the baseline communities (Kirkley, 2005). The VIMS study gathered a profile of basic sociological information for the principal states involved with the Atlantic shark fishery. From the 255 communities identified as involved in the 2001 commercial fishery, Amendment 1 to the 1999 FMP for Atlantic Tunas, Swordfish and Sharks focused on specific towns based on shark landings data, the size of the shark fishing fleet, the relationship between the geographic communities and the fishing fleets, and the existence of other community studies. While the recreational fishery is an important component in the shark fishery, participation and landings were not documented in a manner that allowed community identification. Wilson, *et al*., selected only the recreational fisheries found within the commercial fishing communities for a profile due to the lack of community-based data for the sport fishery. A detailed description of additional information used in the community profiles analysis can be found in Section 9.2.2 of the Consolidated HMS FMP. Several other chapters in this document include information that addresses the requirements described in section 9.1. Please refer to the Description of the Affected Environment in Chapter 3, the Economic Evaluation in Chapter 6, the Regulatory Impact Review (RIR) in Chapter 7, and the Initial Regulatory Flexibility Analysis (IRFA) in Chapter 8. Furthermore, each of the management alternative suites in Chapter 4 includes an assessment of the potential social and economic impacts associated with the proposed alternatives. The preferred alternative suite was selected to minimize economic impacts and provide for the sustained participation of fishing communities, while taking the necessary actions to rebuild overfished fisheries as required by the Magnuson-Stevens Act.

3.7.2 Summary of New Social and Economic Data Available

3.7.2.1 2006 Social Science Publications

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

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

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

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

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

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

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

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

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

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

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

3.7.2.2 Summary of Social Data and Information

The 2006 Consolidated HMS FMP provides a thorough analysis, by state, of HMS fisheries including the shark fishery for in the Atlantic and Gulf of Mexico states and will not be duplicated here.

3.7.2.3 Shark Community Profile Needs

For future social impact analyses, the HMS permit databases, landings information, and HMS APs should be consulted to determine the most appropriate community profiles for HMS-related fisheries. It was identified in the Consolidated HMS FMP that several new community profiles should be developed and some of the previously profiled communities may no longer be as significantly involved in the fishery as they were in the past (see Chapter 9, Section 9.5; NMFS, 2006). NMFS is currently reviewing existing HMS community profile materials and identifying gaps in existing profiles. NMFS will then identify which communities are dependent upon the HMS fisheries and should be profiled. Part of this review will entail developing guidelines and conducting any rapid assessment that may be needed as part of the identification process for new communities.

3.8 International Trade and Fish Processing

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

3.8.1 Overview of International Trade for Atlantic HMS

3.8.1.1 Trade Monitoring

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

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

3.8.2 U.S. Exports of HMS

"Exports" may include merchandise of both domestic and foreign origin. The Census Bureau defines exports of "domestic" merchandise to include commodities which are grown, produced, or manufactured in the United States (*e.g.*, fish caught by U.S. fishermen). For statistical purposes, domestic exports also include commodities of foreign origin which have been altered in the United States from the form in which they were imported, or which have been enhanced in value by further manufacture in the United States. The value of an export is the f.a.s. (free alongside ship) value defined as the value at the port of export based on a transaction price including inland freight, insurance, and other charges incurred in placing the merchandise alongside the carrier. It excludes the cost of loading the merchandise, freight, insurance, and other charges or transportation costs beyond the port of exportation.

3.8.2.1 Shark Exports

Export data for sharks is gathered by the Census Bureau, and includes trade data for sharks from any ocean area of origin. Shark exports are not categorized down to the species level with the exception of dogfish, and are not identified by specific product code other than fresh or frozen meat and fins. Due to the popular trade in shark fins and their high relative value compared to shark meat, a specific HTS code was assigned to shark fins in 1998. It should be noted that there is no tracking of other shark products besides meat and fins. Therefore, NMFS cannot track trade in shark leather, oil, or shark cartilage products.

Table 3-46 indicates the magnitude and value of shark exports by the United States from 1999 – 2006. The reduction in shark fin exports from 2001 to 2002 and 2003 is of particular note, as is the increase in the unit value of shark fins during this time period. Decreases in shark fin trade are expected to be the result of the Shark Finning Prohibition Act, which was enacted in December of 2000 and implemented by final rule in February 2002.

Table 3-46 Amount and value of U.S. shark product exports from 1999-2006. Source: Census Bureau**.**

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

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

3.8.3 U.S. Imports of Atlantic HMS

All import shipments must be reported to the U.S. Bureau of Customs and Border Protection. "General" imports are reported when a commodity enters the country, and "consumption" imports consist of entries into the United States for immediate consumption combined with withdrawals from CBP bonded warehouses. "Consumption" import data reflect the actual entry of commodities originating outside the United States into U.S. channels of consumption. As discussed previously, CBP data for certain products are provided to NMFS for use in implementing statistical document programs. U.S. Census Bureau import data are used by NMFS as well.

3.8.3.1 Shark Imports

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

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

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

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

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

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

3.9 Bycatch, Incidental Catch, and Protected Species

Bycatch in commercial and recreational fisheries has become an important issue for the fishing industry, resource managers, scientists, and the public. Bycatch can result in death or injury to the discarded fish, and it is essential that this component of total fishing-related mortality be incorporated into fish stock assessments and evaluation of management measures. Bycatch precludes other more productive uses of fishery resources and decreases the efficiency of fishing operations. Although not all discarded fish die, bycatch can become a large source of mortality, which can slow the rebuilding of overfished stocks. Bycatch imposes direct and indirect costs on fishing operations by increasing sorting time and decreasing the amount of gear available to catch target species. Incidental catch concerns also apply to populations of marine mammals, sea turtles, seabirds, and other components of ecosystems which may be protected under other applicable laws and for which there are no commercial or recreational uses but for which existence values may be high.

In 1998, NMFS developed a national bycatch plan, *Managing the Nation's Bycatch* (NMFS, 1998), which includes programs, activities, and recommendations for Federally managed fisheries. The national goal of the Agency's bycatch plan activities is to implement conservation and management measures for living marine resources that will minimize, to the extent practicable, bycatch and the mortality of bycatch that cannot be avoided. Inherent in this goal is the need to avoid bycatch, rather than create new ways to utilize bycatch. The plan also established a definition of bycatch as fishery discards, retained incidental catch, and unobserved mortalities resulting from a direct encounter with fishing gear.

3.9.1 Bycatch Reduction and the Magnuson-Stevens Act

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

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

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

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

Commercial

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

Recreational

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

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

3.9.2 Standardized Reporting of Bycatch

Section 303(a)(11) of the Magnuson-Stevens Act requires that a fishery management plan establish a standardized reporting methodology to assess the amount and type of bycatch occurring in the fishery. In 2004, NMFS published a report entitled *"Evaluating Bycatch: A*

National Approach to Standardized Bycatch Monitoring Programs," which described the current status of and guidelines for bycatch monitoring programs (NMFS, 2004a). The data collection and analyses that are used to estimate bycatch in a fishery constitute the "standardized bycatch reporting methodology" (SBRM) for that fishery (NMFS, 2004a). Appendix 5 of the report specifies the protocols for SBRMs established by NMFS throughout the country.

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

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

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

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

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

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

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

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

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

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

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

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

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

The fishery logbook systems in place are mandatory programs, and it is expected that the reporting rates are generally high (Garrison, 2005). Due to the management focus on HMS fisheries, there has been close monitoring of reporting rates, and observed trips can be directly linked to reported effort. In general, the gear characteristics and amount of observed effort is consistent with reported effort. However, under-reporting is possible, which can lead to a negative bias in bycatch estimates. Cramer (2000) compared dead discards of undersized swordfish, sailfish, white and blue marlin, and pelagic sharks from HMS logbook and POP data in the U.S. Atlantic PLL fishery. Cramer (2000) provided the ratio of catch estimated from the POP data divided by the reported catch in the HMS logbooks. The ratio indicated the amount of underreporting for each species in a given area. However, the data analyzed by Cramer (2000), was based on J-hook data from 1997 – 1999 and that gear is illegal now. In some instances, logbooks are used to provide effort information against which bycatch rates obtained from observers is multiplied to estimate bycatch. In other sectors/fisheries, self-reporting provides the primary method of reporting bycatch because of limited funding, priorities, etc.

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

3.9.2.1 U.S. Atlantic Pelagic Longline Fishery

NMFS utilizes both self-reported data (mandatory logbooks for all vessels) and observer data to monitor bycatch in the PLL fishery. The observer program has been in place since 1992 to document finfish bycatch, characterize fishery behavior, and quantify interactions with protected species (Beerkircher *et al.*, 2002). The program is mandatory for those vessels selected and all vessels with directed and indirect swordfish permits are selected. The program had a target coverage level of five percent of the U.S. fleet within the North Atlantic (waters north of 5^{o} N. latitude), as was agreed to by the United States at ICCAT. Actual coverage levels achieved from 1992 – 2003 ranged from two to nine percent depending on quarter and year. Observer coverage was 100 percent for vessels participating in the NED experimental fishery during 2001 – 2003. Overall observer coverage in 2003 was 11.5 percent of the total sets made, including the NED experiment. The program began requiring an eight percent coverage rate due to the requirements of the 2004 Biological Opinion for Atlantic Pelagic Longline Fishery for HMS. Observer coverage in 2004 ranged from 6.2 – 9.0 percent per quarter. Since 1992, data collection priorities have been to collect catch and effort data of the U.S. Atlantic PLL fleet on highly migratory fish species, although information is also collected on bycatch of protected species.

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

3.9.2.2 Shark Bottom Longline Fishery

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

Effective August 1, 2001, selected Federal permit holders that report on the Gulf of Mexico reef fish, South Atlantic snapper-grouper, king and Spanish mackerel, and shark fisheries logbook must report all species and quantities of discarded (alive and dead) sea turtles, marine mammals, birds, and finfish on a supplemental discard form. A randomly selected sample of 20 percent of the vessels with active permits in the above fisheries is selected each year. The selection process is stratified across geographic area (Gulf of Mexico and South Atlantic), gear (handline, longline, troll, gillnet, and trap), and number of fishing trips (ten or less trips and more than 11 trips). Of the 3,359 vessels with Federal permits in these fisheries in 2003, a total of 452 vessels were selected to report. Of the 3,517 vessels with Federal permits in the fisheries in 2004, 428 were selected to report. Shark fishermen can use the PLL logbook or the northeast vessel trip reports depending on the permits held by the vessel. If they use either the PLL logbook or VTR, they need to report all of the catch and effort, as well as all the bycatch or incidental catch.

3.9.2.3 Shark Gillnet Fishery

Vessels participating in the gillnet fishery for sharks are required to submit logbooks to report their catch and effort, including bycatch species. An observer program for the directed shark gillnet fishery has been in place from 1993 – 1995 and from 1998 to the present. The objectives of this program are to obtain estimates of catch and bycatch and bycatch mortality rates of protected species, juvenile sharks, and other fish species. Catch and bycatch estimates are produced to meet the mandates of the Atlantic Large Whale Take Reduction Plan and the October 2003 Biological Opinion.

During right whale calving season (15 November to 31 March), 100 percent observer coverage is required for shark gillnet vessels operating from West Palm Beach, FL, to Sebastian Inlet, FL. Outside right whale calving season, observer coverage is equal to that which would obtain a sample size needed to provide estimates of sea turtle or marine mammal interactions with an expected CV of 0.3 (in 2003, this was 33.8 percent of the total trips) (Carlson and Baremore, 2002). On June 21, 2005, NMFS proposed modifying the time and areas where 100 percent observer coverage is required during right whale calving season (70 FR 35894). NMFS implemented the final rule on June 25, 2007, (72 FR 34362) that prohibits shark gillnet fishing from November 15 to April 15, between the NC/SC border and 29° 00 N. Gillnet vessels fishing between 29° 00 N and 26° 46.5 N would be required to have 100 percent observer coverage from December 1 to March 31.

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

3.9.2.4 Recreational Handgear Fishery

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

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

The National Academy of Sciences assembled a committee to review current marine recreational fishing surveys at the request of NMFS (NAS, 2006). The committee was tasked with developing recommendations for improvements to current surveys and to recommend the implementation of possible alternative approaches. The committee's final report was published in April 2006, and NMFS is in the process of evaluating the recommendations. At the present time, no other alternative approach is available.

3.9.3 Bycatch Reduction in HMS Fisheries

The NMFS HMS bycatch reduction program includes an evaluation of current data collection programs, implementation of bycatch reduction measures such as gear modifications and time/area closures, and continued support of data collection and research relating to bycatch. Additional details on bycatch and bycatch reduction measures can be found in Section 3.5 of the 1999 FMP for Atlantic Tunas, Swordfish and Sharks (NMFS, 1999), in Regulatory Amendment 1 to the 1999 FMP for Atlantic Tunas, Swordfish and Sharks (NMFS, 2000), in Regulatory Adjustment 2 to the 1999 FMP for Atlantic Tunas, Swordfish and Sharks (NMFS, 2002), and in Amendment 1 to the 1999 FMP for Atlantic Tunas, Swordfish and Sharks (NMFS, 2003a). In addition, an HMS Bycatch Reduction Implementation Plan was developed in late 2003 which identify priority issues to be addressed in the following areas: 1) monitoring, 2) research, 3) management, and 4) education/outreach. Individual activities in each of these areas were identified and new activities may be added or removed as they are addressed or identified.

3.10 Evaluation and Monitoring of Bycatch

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

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

3.10.1 Bycatch Mortality

3.10.1.1 Introduction

The reduction of bycatch mortality is an important component of National Standard 9. Physical injuries may not be apparent to the fisherman who is quickly releasing a fish because there may be injuries associated with the stress of being hooked or caught in a net. Little is known about the mortality rates of many shark species but there are some data for certain species. Information on bycatch mortality should continue to be collected, and in the future, could be used to estimate bycatch mortality in stock assessments. For a summary of bycatch species in BLL and gillnet fisheries, please refer to Table 3-48. For all other fisheries, please refer to Table 3.107 in the Consolidated HMS FMP.

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

Table 3-48 Summary of bycatch species in BLL and gillnet fisheries, Marine Mammal Protection Act (MMPA) category, endangered Species Act (ESA) requirements, data collection, and management measures by fishery/gear type. (Excerpted from HMS Bycatch Priorities and Implementation Plan and updated through May 2006)

Fishery/Gear Type	Bycatch Species	MMPA Category	ESA Requirements	Bycatch Data Collection	Management Measures
Shark BLL	Prohibited shark species Target species after closure Sea turtles Smalltooth sawfish Non-target finfish	Category III	ITS, Terms & Conditions, RPMs	Permit requirement (1993); logbook requirement (1993); observer coverage (1994)	Quotas (1993); trip limit (1994); gear marking (1999); handling & release guidelines (2001); line clippers, dipnets, corrodible hooks, de-hooking devices, move 1 nm after an interaction (2004); South Atlantic closure, VMS (2005); additional dehooking equipment (2007)
Shark Gillnet	Prohibited shark species Sea turtles Marine mammals Non-target finfish Smalltooth sawfish	Category II	ITS, Terms & Conditions, RPMs	Permit requirement (1993); logbook requirement (1993); observer coverage (1994)	Quotas (1993); trip limit (1994); gear marking (1999); deployment restrictions (1999); 30-day closure for leatherbacks (2001); handling & release guidelines (2001); net checks (2002); whale sighting (2002); VMS (2004); closure for right whale mortality (2006); expanded closure for right whale mortality (2007)

3.10.1.2 Mortality by Fishery

Bottom Longline Fishery

The shark BLL fishery has relatively low observed bycatch rates. Historically, finfish bycatch has averaged approximately five percent in the BLL fishery. Observed protected species bycatch (sea turtles) has typically been much lower, less than 0.01 percent of the total observed catch. See Section 3.4.3.3 for more information. Disposition of discards is recorded by observers and can be used to estimate discard mortality.

Shark Gillnet Fishery

The shark gillnet fishery has relatively low observed bycatch rates. Finfish bycatch during the 2003 fishery ranged from 3.3 to 20.7 percent of the total catch. Observed protected species bycatch (sea turtles and marine mammals) was very low, less than 0.1 percent. See Section 3.4.4.2 for more information. Disposition of discards is recorded by observers and can be used to estimate discard mortality.

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

3.10.1.3 Code of Angling Ethics

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

3.10.2 Interactions of HMS Fishing Gears With Protected Species

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

3.10.2.1 Interactions and the Marine Mammal Protection Act

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

NMFS relies on both fishery-dependent and fishery-independent data to produce stock assessments for marine mammals in the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea. Draft stock assessment reports are typically published around January and final reports are typically published in the Fall. Final 2006 stock assessment reports are available and can be obtained on the web at: http://www.nmfs.noaa.gov/pr/sars/species.htm.

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

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

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

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

The final 2007 MMPA LOF was published on March 28, 2007 (72 FR 14466). The southeastern Atlantic shark gillnet fishery is classified as Category II (occasional serious injuries and mortalities). The Mid-Atlantic and Gulf of Mexico shark BLL fishery is classified as Category III (remote likelihood or no known serious injuries or mortalities). For additional information on the fisheries categories and how other fisheries are classified, see http://www.nmfs.noaa.gov/pr/interactions/lof/.

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

NMFS continues to investigate serious injuries to marine mammals as they are released from fishing gear. In April 1999, NMFS held a joint meeting of the three regional scientific review groups to further discuss the issue. NMFS is continuing to develop marine mammal serious injury guidelines and until these are published, NMFS will apply the criteria listed by the review groups to make determinations for specific fisheries. The current Biological Opinions for Atlantic HMS fisheries have resulted in a conclusion of no jeopardy for marine mammals. However, a Pelagic Longline Take Reduction Team (PLTRT) met on June 29-30, 2005. The PLTRT replaces the disbanded Atlantic Offshore Cetacean Take Reduction Team (AOCTRT). The PLTRT must develop a Take Reduction Plan (TRP) for pilot whales within 11 months. The Draft TRP has been transmitted to NMFS and was published June 8, 2006. The 1999 HMS FMP implemented several of the recommendations of the AOCTRT including: 1) a requirement that vessels fishing for HMS move one nautical mile (nm) after an entanglement with protected species; 2) limiting the length of the mainline to 24 nm in the MAB from August 1, 1999 through November 30, 2000; 3) voluntary vessel operator education workshops for HMS PLL vessels; 4) handling and release guidelines; and 5) limited access for swordfish, shark and tuna longline permits.

3.10.2.2 Interactions and the ESA

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

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

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

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

Sea Turtles

NMFS has taken several steps in the past few years to reduce sea turtle bycatch and bycatch mortality in domestic longline fisheries. On March 30, 2001, NMFS implemented via interim final rule requirements for U.S. flagged vessels with PLL gear on board to have line clippers and dipnets to remove gear on incidentally captured sea turtles (66 FR 17370). Specific handling and release guidelines designed to minimize injury to sea turtles were also implemented. NMFS published a final report which provides the detailed guidelines and protocols (Epperly *et al*., 2004) and a copy can be found at http://www.nmfs.noaa.gov/sfa/hms/Protected%20Resources/TM_524.pdf.

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

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

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

On November 28, 2003, based on the conclusion of the three-year NED experiment, and preliminary data that indicated that the Atlantic PLL fishery may have exceeded the Incidental Take Statement in the June 14, 2001, BiOp, NMFS published a Notice of Intent to prepare an SEIS to assess the potential effects on the human environment of proposed alternatives and actions under a proposed rule to reduce sea turtle bycatch (68 FR 66783). A new BiOp for the

Atlantic PLL fishery was completed on June 1, 2004. The BiOp concluded that long-term continued operation of the Atlantic PLL fishery, authorized under the 1999 FMP, was not likely to jeopardize the continued existence of loggerhead, green, hawksbill, Kemp's ridley, or olive ridley sea turtles; and was likely to jeopardize the continued existence of leatherback sea turtles.

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

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

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

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

Smalltooth sawfish

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

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

Smalltooth sawfish have been observed caught (eight known interactions, seven released alive, one released in unknown condition) in shark BLL fisheries from 1994 through 2004 (A. Morgan pers. comm., 2003). Based on these observations, expanded sawfish take estimates for 1994 – 2002 were developed for the shark BLL fishery (NMFS, 2003a). A total of 466 sawfish were estimated to have been taken in this fishery during 1994 – 2002, resulting in an average of 52 per year. It is important to note that all of the sawfish takes observed, except for one, were released alive.

3.10.2.3 Interactions with Seabirds

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

The National Plan of Action (NPOA) for Reducing the Incidental Catch of Seabirds in Longline Fisheries was released in February 2001. The NPOA for Seabirds calls for detailed assessments of longline fisheries, and, if a problem is found to exist within a longline fishery, for measures to reduce seabird bycatch within two years. NMFS, in collaboration with the appropriate Councils and in consultation with the U.S. Fish and Wildlife Service, will prepare an annual report on the status of seabird mortality for each longline fishery. The United States is committed to pursuing international cooperation, through the Department of State, NMFS, and U.S. Fish and Wildlife Service, to advocate the development of National Plans of Action within relevant international fora. NMFS intends to meet with longline fishery participants and other members of the public in the future to discuss possibilities for complying with the intent of the plan of action. Because interactions appear to be relatively low in Atlantic HMS fisheries, the adoption of immediate measures is unlikely.

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

3.10.3 Measures to Address Protected Species Concerns

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

3.10.4 Bycatch of HMS in Other Fisheries

NMFS is concerned about bycatch mortality of Atlantic HMS in any Federal or state-managed fishery which captures them. NMFS plans to address bycatch of these species in the appropriate FMPs through coordination with the responsible management body. For a complete review of bycatch of HMS in other fisheries, please refer to Section 3.9.11 in the Consolidated HMS FMP.

3.10.5 Evaluation of Other Bycatch Reduction Measures

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

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

- Atlantic Large Whale Take Reduction Plan (ALWTRP) regulations

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

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

- Atlantic Bottlenose Dolphin Take Reduction Team

Due to the observed takes of Atlantic bottlenose dolphin in the shark drift gillnet fishery, representatives of the fishery have been included in the Atlantic Bottlenose Dolphin Take Reduction Team. The Team held seven meetings during 2001 – 2003 and developed a set of recommendations which formed the basis for a TRP. NMFS published a final rule regarding this action on April 26, 2006 (71 FR 24776). Included in the final rule are: 1) effort reduction measures; 2) gear proximity rules; 3) gear or gear deployment modifications; 4) fishermen training; and 5) outreach and education measures to reduce dolphin bycatch below the stock's potential biological removal level. The final rule also includes time/area closures and size restrictions on large mesh fisheries to reduce incidental takes of endangered and threatened sea turtles as well as to reduce dolphin bycatch.

- MMPA List of Fisheries Update/Stock Assessment

NMFS continues to update the MMPA List of Fisheries and the 2007 (72 FR 14466) final list is available at http://www.nmfs.noaa.gov/pr/pdfs/fr/fr72-14466.pdf. Marine mammal stock assessment reports are also available at http://www.nmfs.noaa.gov/pr/sars/.

- Atlantic Offshore Cetacean Take Reduction Team (AOCTRT)

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

- Pelagic Longline Take Reduction Team (PLTRT)

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

- Observer coverage of shark drift gillnet fleet

On March 30, 2001, NMFS reduced the level of observer coverage required in the shark drift gillnet fishery from 100 percent year-round to 100 percent during right whale calving season and to a statistically significant level during the rest of the year. Recent scientific analyses indicate that a 33.8 percent level of coverage is statistically significant and adequate to provide reasonable estimates of sea turtle and marine mammal takes outside of the right whale calving season. The level of observer coverage necessary will be re-evaluated annually and adjusted accordingly. During the 2005 season, 33 strikenet and 31 driftnet sets were observed (Carlson and Bethea, 2006). No interactions with marine mammals were observed in either drift gillnet or strikenet sets. Four loggerhead sea turtles were observed caught in drift gillnet sets (three released alive, one released injured and assumed to be dead). One leatherback sea turtle was caught in drift gillnet gear and released alive. NMFS began placing observers on vessels with directed shark permits that were targeting species other than sharks in 2005. Management options to address issues in the shark drift gillnet fishery are considered in this document.

- Vessel monitoring systems in the PLL fishery

NMFS adopted fleet-wide VMS requirements in the Atlantic PLL fishery in May 1999, but was subsequently sued by an industry group. By order dated September 25, 2000, the U.S. District Court for the District of Columbia prevented any immediate implementation of VMS in the Atlantic PLL fishery, and instructed to "undertake further consideration of the scope of the [VMS] requirements in light of any attendant relevant conservation benefits." On October 15, 2002, the court issued a final order that denied plaintiff's objections to the VMS regulations. Based on this ruling, NMFS implemented the VMS requirement in September 2003.

- Vessel monitoring systems in other HMS fisheries

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

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4.0 ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVES

NMFS considered five alternative suites ranging from maintaining the status quo for the commercial and recreational Atlantic shark fisheries to prohibiting the retention of all Atlantic sharks by commercial and recreational fishermen. NMFS assesses the impacts of the alternative suites, which are comprised of seven key topics including: quotas; species complexes; commercial retention limits; time/area closures; reporting requirements; seasons; regions; and recreational measures. Instead of analyzing a range of alternatives under individual topics, this document analyzes a number of alternative suites that pull from a range of alternatives under all the topics (see Chapter 2 for a more detailed description). Alternative suite 1 would maintain the current Atlantic shark fishery (status quo). Alternative suite 2 would allow only directed shark permit holders to land sharks whereas Alternative suite 3 would allow directed and incidental shark permit holders to retain sandbar and non –sandbar large coastal sharks (LCS) as well as small coastal sharks (SCS) and pelagic sharks. Alternative suite 4 would establish a program where vessels with directed or incidental shark permits could participate in a research fishery for sandbar sharks. Only vessels participating in this program could land sandbar sharks. Vessels not participating in the research program could land non-sandbar LCS, SCS, and pelagic sharks. Finally, alternative suite 5 would shut down the commercial Atlantic shark fishery and only allow a catch and release recreational shark fishery (see overview Table 2.1).

NMFS also analyzed several alternatives that were outside of the scope of the five alternative suites. Alternatives 6 and 7 are different alternatives pertaining to the timing of shark stock assessment whereas alternatives 8 and 9 are different alternatives pertaining to the timing of the publication of the Stock Assessment and Fishery Evaluate (SAFE) report every year. These alternatives are mainly administrative in nature and are anticipated to have minimal associated ecological, social, and economic impacts.

NMFS used data from the Coastal Fisheries and HMS Logbooks to estimate landings and discards of sharks on different gear types from 2003 to 2005. NMFS estimated discards and bycatch from the shark bottom longline (BLL) observer program data during 2005 to 2006. In addition, NMFS used 2006 ex-vessel prices, where available, and permit information from NMFS' Southeast Regional Office. Based on these data, NMFS analyzed the ecological, social, and economic impacts associated with the different alternative suites and alternatives described below. The alternative suites and alternatives considered for shark management measures are:

Alternative Suite 1	Maintain the Existing Atlantic Commercial and Recreational Shark Fisheries (Status Quo)
Alternative Suite 2	Shark Fishery for Directed, HMS Angling, and HMS Charter/Headboat Permit Holders Only
Alternative Suite 3	Shark Fishery for Directed, Incidental, HMS Angling, and HMS Charter/Headboat Permit Holders
Alternative Suite 4	*Establish a Research Fishery for Sandbar Sharks; Shark Fishery for Directed, Incidental, HMS Angling, and HMS Charter/Headboat Permit Holders – Preferred Alternative*

Alternative Suite 5	Close Atlantic Shark Fisheries
Alternative 6	Stock Assessments for Sharks Every 2-3 Years (Status Quo)
Alternative 7	*Stock Assessments for Sharks At Least Every 5 years - Preferred Alternative*
Alternative 8	SAFE Report published in January or February of every year (Status Quo)
Alternative 9	*SAFE Report Published in the Fall of Every Year – Preferred Alternative*

4.1 Alternative Suite 1: Maintain the Existing Atlantic Commercial and Recreational Shark Fisheries (Status Quo)

Overall Summary

Alternative suite 1 (status quo) would not change current management of Atlantic shark fishery. Quotas would be as follows with overharvests deducted from and underharvests added to the next years corresponding regional trimester quota: LCS Complex (11 species, includes sandbar sharks) = 1,017 mt dw; SCS complex = 454 mt dw; Blue Sharks = 273 mt dw; Pelagic Sharks (Other than Blue and Porbeagle Sharks) = 488 mt dw; Porbeagle Sharks = 92 mt dw; and Display and Scientific Research = 60 mt ww.

Retention limits would be a 4,000 lb dw LCS trip limit for directed permit holders and 5 LCS for incidental permit holders; no retention limit for SCS or pelagic sharks for directed permit holders and 16 SCS and pelagic sharks combined for incidental permit holders; and fishermen may land sharks with fins removed except for the anal and 2nd dorsal fins. The total quantity of fins may not exceed 5 percent of the total dressed carcass weight of sharks on board.

All current BLL and pelagic longline (PLL) time/area closures including Caribbean closures to BLL for essential fish habitat (EFH) would remain in place. Dealer reports would have to be postmarked by the dealer within 10 days of the 1st and 15th of every month, and commercial fishermen would have to report in the appropriate logbook within 7 days of offloading any sharks. There would be three trimesters (January – April; May – August; and, September – December) for LCS, SCS, and pelagic sharks, and three regions (Gulf of Mexico, South Atlantic, and North Atlantic) for SCS and LCS and no regions for pelagic sharks. Finally, recreational fishermen could land bonnethead, bull, nurse, tiger, lemon, hammerheads, sandbar, Atlantic sharpnose, porbeagle, finetooth, smooth hammerhead, great hammerhead, smooth hammerhead, blacknose, shortfin mako, common thresher, oceanic whitetip, blue, spinner, and silky sharks. There would be a possession limit of 1 shark > 54” per vessel per trip, and 1 Atlantic sharpnose and 1 bonnethead per person per trip with no minimum size requirements for recreational fishermen.

Ecological Impacts

4.1.1 Quotas/Species Complexes

The current annual LCS complex quota is 1,017 mt dw and includes eleven species of LCS, including sandbar sharks. Maintaining the LCS quota at 1,017 mt dw would have negative ecological impacts for sandbar sharks, based on the most recent stock assessments. According to the 2005/2006 LCS stock assessment, NMFS determined that sandbar sharks are overfished and overfishing is occurring. The stock assessment recommended a total allowable catch (TAC) of 158.3 mt dw for sandbar sharks for a 70 percent probability of rebuilding by 2070. From 2003 to 2005, the average yearly commercial LCS landings were 1,310 mt dw and the average yearly commercial LCS discards were 162.9 mt dw (Table 4.1 and Table 4.2). Of these, 728 mt dw were average yearly commercial sandbar shark landings and average yearly commercial sandbar discards of 9.6 mt dw (Table 4.1 and Table 4.2). Thus, the existing 1,017 mt dw commercial LCS quota would allow more than the recommended 158.3 mt dw TAC for sandbar sharks to be harvested. Given the current level of fishing effort, an LCS quota of 1,017 mt dw would not be in compliance with the 2005/2006 LCS stock assessment recommendation and would lead to further overfishing and depletion of sandbar sharks.

The current annual LCS complex quota of 1,017 mt dw could also lead to negative ecological impacts for dusky sharks due to continuing bycatch and dead discards of this prohibited species. Despite its prohibited status, from 2003-2005, the average annual landings and discards for dusky sharks was 33.1 mt dw, the majority of which were landed and discarded dead on BLL (Table 4.1). The 2006 dusky shark assessment determined that this species is overfished and overfishing is occurring and stated that rebuilding could require 100 to 400 years. Under alternatives suite 1, current fishing effort in the LCS fishery would be maintained without modifications to the LCS complex quota, resulting in continued, excessive mortality rates for dusky sharks would prevent rebuilding of this species and continue overfishing.

The continued harvest of porbeagle sharks could lead to negative ecological impacts for this species. The 2005 Canadian stock assessment determined that porbeagle sharks are overfished, with a 70 percent probability of recovery in approximately 100 years. The current annual quota for porbeagle sharks is 92 mt dw. Commercial landings of porbeagle sharks between 1999 to 2004 ranged from 0.5 – 2.62 mt dw per year. In addition, data indicate that there has been nominal recreational harvest of this species since 1998 (Tables 3.24 and 3.26). If landings were to increase in the future, this could lead to overfishing and further depletion of porbeagle shark stocks.

The ecological impacts of maintaining the current LCS quota would be neutral for blacktip sharks. According to the 2005/2006 LCS stock assessment, the Gulf of Mexico blacktip shark population is healthy, whereas the status of the Atlantic population is unknown. However, the assessment recommended that catch levels of blacktip sharks should not increase in the Gulf of Mexico region and should not change in the Atlantic region.

This status quo alternative would implement existing quotas for the SCS complex of 454 mt dw/year and could have neutral ecological impacts on the SCS complex. This complex is currently being assessed. The most recent assessment workshop (May 7-11, 2007), preliminary analysis found that blacknose sharks may be overfished with overfishing occurring. The final results of the SCS assessment will not be available until after the review workshop scheduled for early August 2007. The other species in the complex (finetooth, Atlantic sharpnose, and bonnethead) were also assessed during this workshop, and preliminary results indicate that none of these species are overfished or experiencing overfishing. Based on the results of the review workshop, the Agency will make a formal determination of stock status for the species within the SCS complex and take additional action, as necessary.

The status quo alternative would maintain the 60 mt ww (43.2 mt dw) allocation for the collection of sharks for public display, exempted fishing permits, and scientific research. This quota represents less than four percent of the current commercial shark quota. Maintaining this 60 mt ww quota would result in neutral ecological impacts because the quota has never been met in the past and the Agency can regulate the number and species of sharks authorized for research and public display. In addition, the scientific permitting and required interim and annual reporting ensure compliance with authorized activities and quota levels.

Other non-target species/bycatch species (*i.e.*, teleosts, batoids, and prohibited sharks) could likely experience negative ecological impacts as a result of maintaining the annual LCS complex quota at 1,017 mt dw. According to the 2006 BLL observer report, snowy grouper made up 40 percent, by number (*i.e.*, 10 fish), of the 8 percent of teleost species caught on BLL on trips targeting sharks in the South Atlantic region. In the Gulf of Mexico region, the king snake eel made up 62.3 percent of the teleosts species. Landings of prohibited shark species, such as night sharks and Caribbean reef sharks, were also observed during BLL trips targeting sharks. Therefore, maintaining the status quo would result in continued interactions of these species in the shark fisheries.

4.1.2 Retention Limits

The current LCS directed shark permit trip limit is 4,000 lb dw per trip and the incidental permit trip limit is five LCS. Maintaining these trip limits, in conjunction with the existing LCS quota, could have negative ecological impacts on sandbar and dusky sharks. The retention limit of 4,000 lb dw, for the directed shark permit holders was put into place to limit derby-style fishing and lengthen the period of time the LCS quota remained available. The 2006 BLL observer report indicates that 70 percent of sharks caught in the South Atlantic region were sandbar sharks. Assuming an average weight of 40.5 lb dw (Cortés and Neer, 2005), this percent equates to approximately 69 sandbar sharks caught per trip in the South Atlantic region (4,000 lb dw x 70 percent = 2800 lb dw: 2800 lb dw / 40.5 lb dw [average weight of a sandbar shark] = 69 sandbar sharks). In the Gulf of Mexico region, 30 percent of sharks caught were sandbar sharks, which translates to approximately 30 sandbar sharks per trip (4000 lb dw x 30 percent = 1,200 lb dw: 1200lb dw / 40.5 lb dw [average weight of a sandbar shark] = 30 sandbar sharks). Based on the recommended TAC for sandbar sharks (158.3 mt dw), retention limits would need to be drastically reduced relative to current levels. Therefore, maintaining the retention limit of 4,000 lb dw of LCS per trip could result in fishing mortality of sandbar in excess of that recommended by the LCS stock assessments.

According to the latest BLL observer report (Hale and Carlson, 2007), approximately 24.5 mt dw of dusky sharks are discarded during directed shark BLL trips. In addition, the majority of dusky discards occur in the directed shark fishery (Table 4.1). Given these trips are conducted under the 4,000 lb dw LCS directed shark trip limit, reducing the retention limits/trip limits could also reduce dusky shark discards. Therefore, given the overfished/overfishing status of this species, negative ecological impacts would occur if the status quo were continued.

Currently, there is no trip limit for pelagic sharks, including porbeagle sharks. Therefore, given the overfished status of this species, maintaining the status quo could have negative ecological impacts for this species.

Table 4.1 Discards of sandbar sharks, non-sandbar LCS, and dusky sharks for the different alternative suites.

Alternative Suite	Estimated Dead Discards by Vessels Within Research Fishery (92 directed shark BLL trips) (mt dw)	Estimated Dead Discards on Directed Shark BLL Gear (mt dw)	Estimated Dead Discards on PLL Gear (mt dw)	Total Gillnet Discards (mt dw)	Extrapolated Discards from Snapper/Grouper & Tilefish BLL Fisheries (mt dw)	Discards (based on average historical landings) by Incidental Permit Holders in the Coastal Fisheries Logbook (mt dw)	Discards (based on average historical landings) by non-HMS Shark Permit Holders in the Coastal Fisheries Logbook (mt dw)	Total Discards in South Atlantic Region due to non-sandbar LCS Retention Limit	Total Discards (mt dw)	Percent Change in Discards Compared to Status Quo
Sandbar										
1	-	7.5	2.1	0	0	0	0	-	9.6	
2	-	0	4.3	0	0	2.3	6.1	30.5	43.2	↑450%
3	-	0.1	2.1	0	0	0	6.1	15.2	23.5	↑240%
4	0.4		4.3	0	0	2.3	6.1	0	13.1	↑36%
5	-		4.3	0	0	2.3	6.1	0	12.7	↑32%
Non-sandbar LCS										
1	-	117.4	12.6	19.9	3.5	0	0	-	153.3	
2	-	0	12.6	19.9	3.5	16.3	15.1	0	67.3	↓56%
3	-	0.7	12.6	19.9	3.5	0	15.1	0	51.7	↓66%
4	5.6	-	12.6	19.9	3.5	0	15.1	0	56.6	↓63%
5	-	0	16.5	0.4[*]	3.5	16.3	15.1	0	51.7	↓66%
Dusky[β]										
1	-	24.5	3.6	0.5	0	1.2	0.1	0	33.2[†]	
2	-	0	3.5	0.5	0	1.2	0.1	0	8.6[†]	↓74%
3	-	11.8	3.5	0.5	0	1.2	0.1	0	20.4[†]	↓38%
4	0.6	-	3.5	0.5	0	1.2	0.1	0	9.2[†]	↓72%
5	-	0	3.5	0	0	1.2	0.1	0	8.1[†]	↓76%

[*]non-shark gillnet discards

[†]includes 3.3 mt dw of recreational landings

[β]total mortality (includes discards and landings of dusky sharks)

4.1.3 Time/Area Closures

The status quo alternative would maintain the existing time/area closures relevant to the commercial shark fishery and would not implement any new time/area closures. Maintaining the current time/area closures, as described in Chapter 2, would have positive ecological impacts on target and non-target species as well as protected species, marine mammals and essential fish habitat (EFH). The time/area closures that have been implemented in recent years have been effective at reducing the bycatch of prohibited, protected and non-target HMS species (see NMFS, 2006 time/area analysis). The mid-Atlantic closed area, which is closed to BLL gear, was implemented to protect all dusky, and neonate and juvenile sandbar sharks by reducing interactions with BLL gear January through July. According to the 2003 Amendment 1 to the 1999 FMP for Atlantic Tunas, Swordfish, and Sharks, 79 percent of the dusky sharks observed caught in the Atlantic from 1994 to 2002 were caught in the time/area closure. Of these, 92 percent were neonate or juvenile dusky sharks. Therefore, without redistribution of effort, it was estimated that total catch of dusky sharks from January through July would be reduced by 79 percent. When NMFS examined a shorter time period of data (the time when dusky sharks were prohibited: 2001-2002), it was estimated that catch of dusky sharks would be reduced by 62 percent with the closure in place from January through July (and no redistribution of effort). Dusky shark catches peaked during the months of January and March (59 dusky sharks in January and March compared to the total 68 dusky sharks caught year-round). Similarly, approximately 54 percent of all sandbar sharks observed caught in the Atlantic from 1994 to 2002 were taken from January through July in the closed area. Neonate or juvenile sandbar sharks comprised 61 percent of the observed catch in the closed area during January through July. When compared to the rest of the Atlantic and Gulf of Mexico, 24 percent of adults, 81 percent of juveniles, and 100 percent of neonate sandbars were caught inside the time/area closure. The highest catches of sandbar sharks occurred in January (33 percent), followed by March (31.7 percent) and July (18.2 percent).

Comparing landings reported in the Coastal Fisheries logbooks from the South Atlantic region between 2002-2004 (without closed area) with 2005 (with closed area) indicates that landings of LCS decreased by 22.3 percent after implementation of the mid-Atlantic shark closed area. Landings of sandbar sharks in the South Atlantic region decreased by 26.7 percent in 2005 compared to 2002-2004, which could have been a result of the mid-Atlantic shark closed area. In addition, observer data from 1994 to 2004 (*i.e.,* before the implementation of the closed area) indicate that there have been 5 loggerhead sea turtles observed caught on BLL gear in the vicinity of the mid-Atlantic shark closed area, two of which were released alive. Therefore, maintaining the mid-Atlantic closed area may reduce sea turtle interactions with sea turtles and BLL gear (see Section 4.1.8), and therefore, has positive ecological impacts for protected resources.

A BLL survey was conducted by the NMFS APEX Predator Program in April through May of 2007 from the research vessel, the Delaware II. To control for sampling bias, NMFS compared catch-per-unit-effort (CPUE) inside and outside the closed area. NMFS found higher sandbar and dusky shark CPUEs inside the closed area compared to outside the closed area during the survey (Figure 4.1 and Figure 4.2, respectively), indicating that sandbar and dusky sharks are caught more often in the closed area compared to outside the closed area.

NMFS also analyzed the size ranges of sandbar and dusky sharks caught inside and outside the closed area during this survey. Of the 72 sandbar sharks caught outside the closed area, the average sandbar size was 174.7 cm total length (TL), ranging from 105.7 cm TL to 214.6 cm TL. Given the size of maturity for sandbar sharks is 147 cm TL (NMFS, 2006), 8 sandbar sharks (11 percent) of the sandbar sharks measured outside the closed area were immature whereas 64 sandbar sharks (89 percent) were mature. This is contrasted with the 117 sandbar sharks that were caught in the closed area. The average size of sandbar sharks inside the closed area was 147.1 cm TL, ranging from 111.8 cm TL to 205.4 cm TL. Of these, 65 sandbar sharks (56 percent) were immature and 52 were mature (44 percent). Therefore, more immature sandbar sharks were caught inside the closed area compared to outside the closed area.

Of the 11 dusky sharks that were caught outside the closed area during this survey, the average dusky shark size was 174.9 cm TL, ranging from 100.3 cm TL to 299.2 cm TL. Given the size of maturity for dusky sharks is 290 cm TL for males and 300 cm TL for females (NMFS, 2006), only 1 dusky shark (9 percent) outside the closed area would have been close to maturity. Of the 20 dusky sharks measured in the closed area, the average size of dusky sharks was 146.6 cm TL, ranging from 101.5 cm TL to 208.7 cm TL. Of these, 100 percent were below the size at maturity. Given the higher number of smaller, less mature sharks in the closed area, these data indicate, at least preliminarily, that the basis for the closure is justified. Therefore, maintaining the mid-Atlantic closed area would continue to reduce the number of interactions of BLL gear with sandbar and dusky sharks as well as reduce the number of interactions with immature sandbar and dusky sharks. This would provide positive ecological benefits for both of these overfished shark stocks.

Maintaining the current BLL closures in the Caribbean that were implemented February 7, 2007 (72 FR 5633), to minimize adverse impacts to EFH and to reduce fishing mortality on mutton snapper, red hind, and other reef-dwelling species could have positive ecological impacts. In addition, the current gillnet gear restrictions that limit gillnet fishing in the Atlantic Ocean during certain times of the year to prevent endangered right whales from entanglement in gillnet gear in right whale calving areas would have positive ecological impacts if maintained. The effectiveness of the other closed areas specific to PLL gear have been analyzed in Section 4.1.2 of the Consolidated HMS FMP (NMFS, 2006), and these time/area closures would be maintained under alternative suite 1.

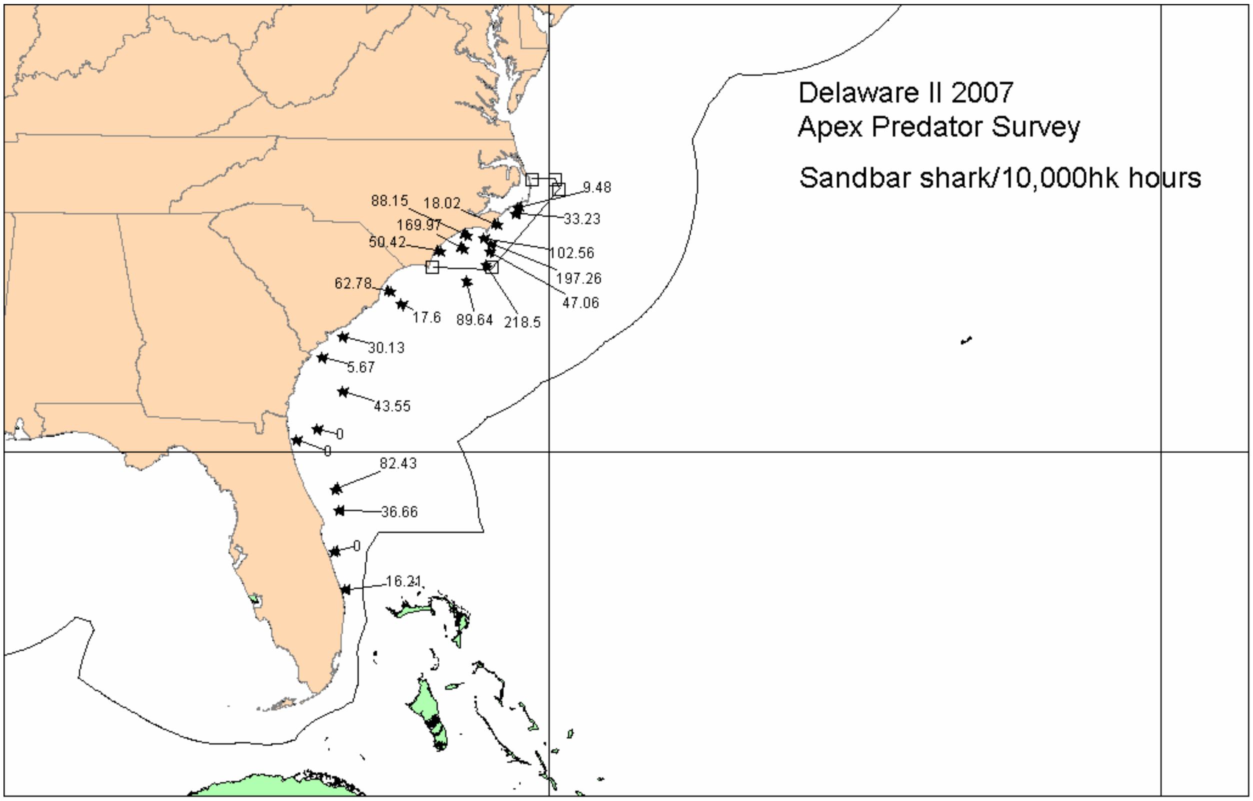

Figure 4.1 **Catch-per-unit-effort (CPUE) of sandbar sharks during the APEX Predator Program BLL survey on the research vessel, the Delaware II, during April through May, 2007. Black stars are the placement of BLL sets. The mid-Atlantic closed area and Economic Exclusive Zone (EEZ) are outlined. The numbers represent the number of sharks caught per 10,000 hooks.**

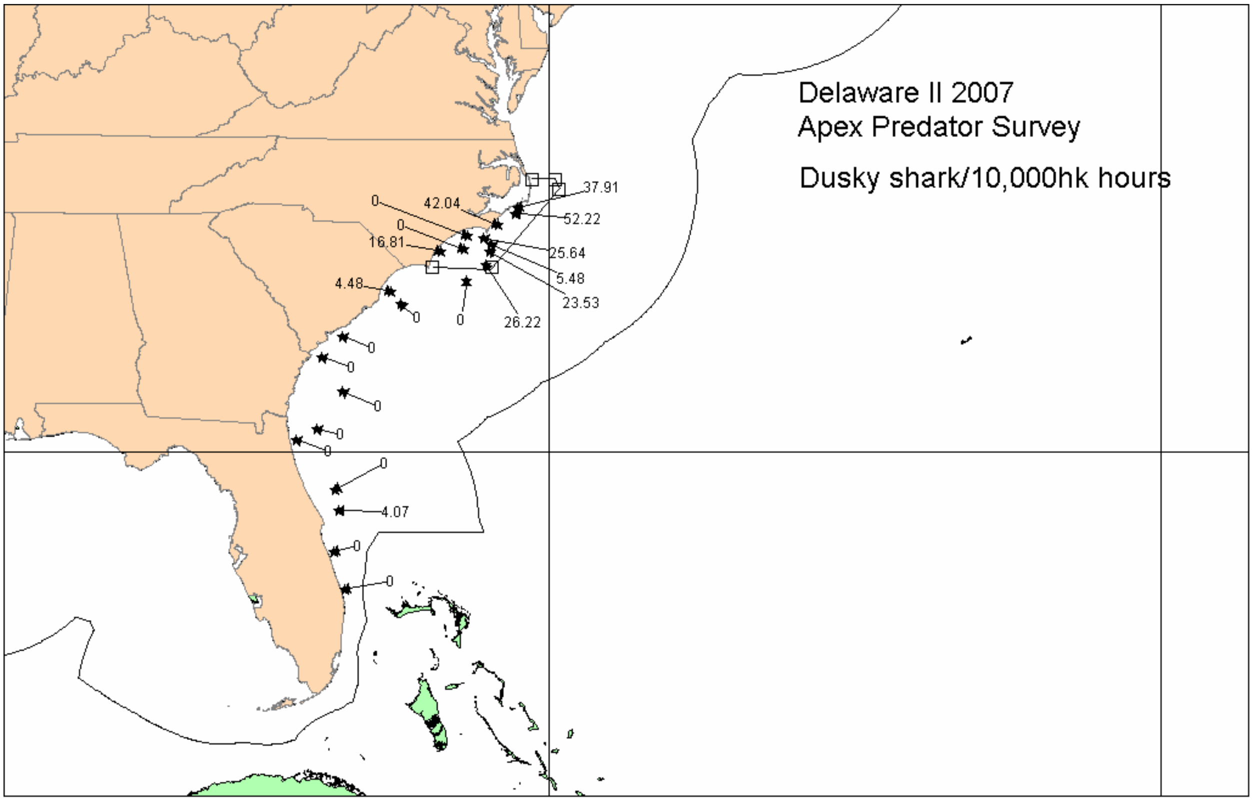

Figure 4.2 **Catch-per-unit-effort (CPUE) of dusky sharks during the APEX Predator Program BLL survey on the research vessel, the Delaware II, during April through May, 2007. Black stars are the placement of BLL sets. The mid-Atlantic closed area and Economic Exclusive Zone (EEZ) are outlined. The numbers represent the number of sharks caught per 10,000 hooks.**

4.1.4 Reporting

The current Federal shark dealer reporting requirements state that dealers must report all sharks to NMFS that are purchased from U.S. vessels via bimonthly reports that must be postmarked within 10 days of the end of each biweekly period (*i.e.*, by the 25th and 10th of each month). Reports are often received late or not at all, which makes it difficult for NMFS to accurately monitor the shark fishery and take corrective action if quotas are being exceeded. It is often difficult to track when a report was postmarked (*i.e.*, was an enveloped saved with a report) to assess if fishermen are in compliance, and reports that are faxed or e-mailed do not receive a postmark. As evidenced during the comment period of the proposed rule stage to set the 2007 first trimester season quota, non-reporting and late reports had a deleterious impact on the quotas that were originally proposed. These quotas had to be modified after the proposed rule had been published and the quantity of unreported landings resulted in a drastically shorter season for LCS in the Gulf of Mexico region. For example, during the proposed rule for the 2007 first trimester rule, the Gulf of Mexico was proposed to be open for the entire first trimester. However, due to overharvests, in part due to late reports, the Gulf of Mexico region ended up being open for only two weeks during the first trimester. However, maintaining the bimonthly Federal shark dealer reporting requirements could have neutral ecological impacts provided that the dealers report when required and in a timely fashion.

Unclassified or unidentified sharks that are reported by dealers are currently counted as LCS for quota monitoring. This may have negative ecological impacts since it does not allow the Agency to track landings of specific species for stock assessments and compromises the Agency's ability to provide accurate estimates of the species of sharks being landed for quota monitoring. This in turn may affect stock assessments, quota monitoring, and analysis of logbooks as all these are contingent upon accurate data reflecting the type and quantity of sharks being landed. Inaccurate reporting or reporting unclassified sharks for the sake of convenience may also lead to over/under harvests that could have been circumvented if dealer reports were more accurate. Furthermore, if dealer reports do not accurately reflect what vessel captains are submitting in their logbooks as being landed, this may compromise the utility of either of these fishery-dependent data sources.

4.1.5 Seasons

The LCS, SCS, and pelagic shark fishing seasons are currently managed on a trimester basis to provide fishing opportunities throughout the year and to reduce fishing effort during months critical for shark pupping. The second trimester for LCS has been delayed until July to minimize interactions with pups and pregnant females. The ecological impacts of managing the fishing seasons on a trimester basis may be neutral, slightly positive, or negative depending on the region and season considered.

4.1.6 Regions

Currently, LCS and SCS are managed by regions. The three regions include the Gulf of Mexico, South Atlantic, and North Atlantic. There are no regions for pelagic sharks. The purpose of the three regions is to provide flexibility to adjust regional quotas to reduce mortality of juvenile and reproductive female sharks, provide fishing opportunities when sharks are present in various regions, and account for differences between species' utilization of various pupping grounds. Maintaining the three regions could have neutral or slightly positive ecological impacts depending on the region considered. The 2005/2006 blacktip shark stock assessment found that this species is rebuilt in the Gulf of Mexico, whereas their status in the South Atlantic region is unknown. Maintaining distinct regions for the Gulf of Mexico and South Atlantic would be consistent with the blacktip stock assessment, allowing NMFS to continue to monitor blacktip sharks on a regional basis.

4.1.7 Recreational Measures

The current bag limit for HMS Angling permit holders is one shark greater than 54 inches (fork length) per vessel per trip as well as one Atlantic sharpnose and one bonnethead shark (both of which are in the SCS complex) per person per trip. According to recreational landings from 2003 to 2005, average annual landings of LCS, including sandbar sharks, were 340.1 mt dw. The average annual sandbar specific landings from 2003 to 2005 were 27 mt dw, and despite its prohibited status, the average annual dusky shark landings were 3.3 mt dw. Therefore, negative ecological impacts to sandbar and dusky sharks could occur if the current recreational measures stay in place. To implement the recommended TAC for sandbar sharks and to reduce the current level of fishing mortality on dusky sharks, reductions in the landings of sandbar and dusky sharks would need to be reduced in both the recreational and commercial fishing sectors.

4.1.8 Protected Resources and Essential Fish Habitat

Between 1994 through 2006, 74 sea turtles were observed caught in the BLL fishery (6 leatherback, 59 loggerheads, and 9 other sea turtles). Fourteen smalltooth sawfish and four delphinids were also observed caught in the BLL fishery between 1994 through 2006. In the gillnet fishery, between 1994 through 2006, 12 sea turtles were observed caught (11 loggerheads and 1 leatherback). To date, only one smalltooth sawfish has been one observed in the gillnet fishery in 2003. Between 1999 and 2004, 12 bottlenose dolphins and four spotted dolphins interactions were observed in the gillnet fishery. These interactions were all within the established ITS for the fisheries.

The status quo alternative suite could continue to have negative ecological impacts on protected resources and marine mammals if the current LCS quota is maintained at 1,017 mt dw. The BLL and gillnet fishing effort is not likely to decrease and therefore interactions with protected resources and marine mammals would not likely decrease, leading to continued negative impacts on sea turtles, sawfish, and marine mammals.

The status quo alternative could have negative ecological impacts for essential fish habitat because the primary gear deployed in the commercial shark fishery is BLL gear. As described in the Consolidated HMS FMP, this gear type may have potentially adverse effects on HMS and non-HMS EFH, depending on the type of bottom habitat. BLL gear principally targets LCS in the EEZ between Texas and Maine. Typically, they are placed in sandy and muddy bottom habitats where expected impacts would be minimal to low (Barnette, 2001). The 1999 NMFS EFH Workshop categorized the impact of BLL gear on mud, sand, and hard-bottom as low (Barnette, 2001). BLL gear may have some negative impact if gear is set in more complex habitats, such as hard bottom or coral reefs in the Caribbean or areas with gorgonians, or soft corals and sponges in the Gulf of Mexico (Barnette, 2001, NREFHSC, 2002; Morgan and Chuenpagdee, 2003). BLL gear set with cable groundline or heavy monofilament with weights could damage hard or soft corals and potentially become entangled in coral reefs upon retrieval, resulting in coral breakage due to line entanglement. However, the extent to which BLL gear is fished in areas with coral reef habitat has not been determined. This gear type is similar to that employed in fisheries targeting reef fish in the Gulf of Mexico and South Atlantic regions.

Social and Economic Impacts

4.1.9 Quotas/Species Complexes and Retention limits

The status quo alternative could lead to neutral socioeconomic impacts if the current LCS quota of 1,017 mt dw, in conjunction with the 4,000 lb LCS directed shark permit trip limit, is maintained. Under this alternative, the current fishing effort would not likely change which could lead to economic benefits to fishermen and associated communities in the short term. Of all Atlantic HMS, sharks bring in the lowest total gross revenues (a total of ~$4.3 million in 2005). If gross revenues for directed and incidental permit holders is averaged across the approximately 298 active directed and incidental shark permit holders, then the average annual gross revenues per shark fishing vessel is just over $14,000. However, long term, negative economic impacts could occur if current fishing mortality of sandbar sharks, an economically important species, is not decreased as recommended by the LCS stock assessment, and this species continues to be overfished. This could lead to more restrictive management measures being implemented in the directed and incidental shark fisheries. This is particularly important given the LCS overharvests under the status quo in 2006 in South Atlantic and Gulf of Mexico regions and in the Gulf of Mexico region during the first 2007 trimester.

4.1.10 Time/Area Closures

The status quo alternative would maintain the existing closures and would not add any new closures. This could have neutral economic impacts, primarily because activities related to fishing and market availability, consistent with the current closures, would remain the same. However, given the continued requests by fishermen who rely on this area, particularly fishermen from North Carolina, to re-open this area, fishermen may still be adjusting to the closed area. If no new closures are put into place for sandbar, porbeagle and dusky sharks, these species may not recover in the recommended rebuilding timeframe and result in longer term negative economic impacts.

4.1.11 Reporting

Currently, Federal shark dealers are required to report on a bimonthly basis and the economic impacts of reporting would not change under the status quo alternative because activities related to the reporting timeframe would remain the same. However, negative economic impacts could occur if shark dealers do not report when required or in a timely fashion, making it difficult for NMFS to monitor the quota and prevent overfishing of economically important species.

Unclassified or unidentified landings of sharks reported in shark dealer reports are currently counted as LCS when monitoring the quota. This may have neutral or slightly negative economic impacts. While listing sharks as unclassified may save shark dealers time in the short-term by alleviating the need to properly identify individual sharks purchased, inaccurate reporting may lead to inaccurate quota monitoring. Shark dealer reports form the basis of quota monitoring for sharks and if the reports submitted by dealers do not accurately reflect what species of sharks are being landed, seasons may close earlier than necessary, overharvests may occur impacting future seasons, and poor data used in stock assessments may lead to further restrictions.

4.1.12 Seasons

Maintaining the trimester seasons under the status quo alternative, which provides fishermen and dealers with more open seasons, would likely have neutral economic impacts. With an annual LCS quota of 1,017 mt dw, spreading the seasons out over the calendar year could potentially result in greater economic stability for fishermen and associated communities. However, if quotas are reduced to comply with the recommendations from the LCS stock assessment, trimester seasons could become less economically stable for fishermen and dealers because of the reduced amount of quota and fishing effort during the calendar year; reduced quota would result in shorter trimesters, which could lead to derby-style fishing.

4.1.13 Regions

The economic impacts of maintaining three management regions under the status quo alternative would likely be neutral. The three regions would likely continue to enhance equity amongst regional user groups since the North Atlantic region only has sharks present in their waters during certain months. No significant economic impacts are anticipated as this alternative seeks to maintain historical regional catches, which would be inconsistent with stock assessment recommendations and could lead to negative socioeconomic impacts due to depleted shark stocks in the future.

4.1.14 Recreational Measures

Neutral social and economic benefits would occur if the current bag limit for HMS Angling, HMS Charter/Headboat, and Atlantic Tuna General Category permit holders (when participating in a tournament) is maintained at one shark greater than 54 inches (fork length) per vessel per trip as well as one Atlantic sharpnose and one bonnethead shark (both of which are in the SCS complex) per person per trip. Recreational fishing and charter trips targeting sharks are important to coastal communities and shark fishing tournaments can sometimes generate a substantial amount of money for surrounding communities and local businesses especially in the northeastern United States where shark fishing is most prevalent. In 2005 and 2006, there were 60 tournaments per year with prize categories for pelagic sharks. Under the status quo, the positive socioeconomic benefits would continue.

Conclusion

The 2005 Canadian porbeagle shark stock assessment, the 2006 dusky shark assessment, and the 2005/2006 LCS stock assessment determined that porbeagle, dusky, and sandbar sharks are overfished. Overall, the status quo alternative, which would maintain the current annual LCS quota of 1,017 mt dw, in conjunction with the management measures mentioned above, would have negative ecological impacts on sandbar, dusky and porbeagle sharks, as well as protected resources and marine mammals. The social and economic impacts would likely be neutral because current fishing effort would remain the same in the short term. In the long term, as stocks continue to decline, profits may decrease as costs associated with finding and catching these depleted stocks increases. Management measures are needed to rebuild overfished stocks and prevent overfishing consistent with the mandates of the Magnuson-Stevens Act. Therefore, maintaining the LCS quota of 1,017 mt dw would be inconsistent with the Magnuson-Stevens Act and the recent LCS stock assessment that recommended a TAC of 158.3 mt dw for sandbar sharks in order for this species to rebuild by 2070. Current fishing effort, under the status quo alternative, would lead to continued overfishing of sandbar, porbeagle and dusky sharks, which would prevent these species from rebuilding in the recommended timeframe. As a result, NMFS does not prefer this alternative.

4.2 Alternative Suite 2: Shark Fishery for Directed, HMS Angling, and HMS Charter/Headboat Permit Holders Only

Overall Summary

Under alternative suite 2, NMFS would remove the sandbar shark from the LCS complex and establish a separate sandbar shark quota and a non-sandbar LCS quota (LCS complex minus sandbar sharks). Overharvests would be removed from the next season's quota. Underharvests for species that are healthy or rebuilt would be transferred to the next season's quota, up to 50 percent of the base quota. For species/complexes that are unknown, overfished, or experiencing overfishing, underharvests would not be transferred to the next season's quota. Quotas would be as follows: Sandbar = 116.6 mt dw; non-sandbar LCS = 541.2 mt dw; SCS = 454 mt dw; Blue Sharks = 273 mt dw; Pelagic Sharks (Other than Blue Sharks) = 488 mt dw; Porbeagle Sharks = Prohibited (0 mt dw quota); and Display and Scientific Research = 60 mt ww (Sandbar = 2.8 mt ww (2 mt dw); and all other shark species (except dusky sharks) = 57.2 mt ww (41.2 mt dw).

The existing BLL and PLL time/area closures, including the Caribbean BLL closures for EFH, would remain in place. In addition, NMFS would implement the 8 marine protected areas (MPAs) off South Carolina to Florida as requested by the South Atlantic Fishery Management Council (SAFMC). Retention limits would be as follows: 8 sandbar per vessel per trip and 21 non-sandbar LCS per vessel per trip for directed permit holders only; no retention limit for SCS and pelagic sharks (except porbeagle sharks) for directed permit holders; no retention of any sharks by incidental permit holders; no sandbar sharks retained with PLL onboard; no retention of porbeagle sharks by commercial or recreational fishermen; and all sharks landed with fins attached.

Dealer reports must be received by NMFS within 24 hours of sale of shark, and logbook and observer requirements would be maintained. In addition, all unclassified sharks reported would be categorized as sandbar sharks. There would be one season starting on January 1 of each year and one region. The sandbar and non-sandbar LCS fishery would close when landings of either reach 80 percent of the available quota with a five day notice, and SCS and pelagic shark fisheries would close when SCS and pelagic shark landings reach 80 percent of their respective quotas. Finally, recreational fishermen could land bonnethead, nurse, tiger, lemon, hammerheads, Atlantic sharpnose, shortfin mako, common thresher, oceanic whitetip, and blue sharks. The recreational possession limit would be 1 shark > 54" per vessel per trip, and 1 Atlantic sharpnose and 1 bonnethead per person per trip with no minimum size requirements.

Ecological Impacts

4.2.1 Quotas and Species Complexes

Under this alternative suite, NMFS would restructure the LCS complex and associated quotas as outlined below. Overharvests of quota for each category would be removed from the next season's quota (or fishing year). The carryover of underharvests for species that are not overfished or are not experiencing overfishing would be added to the base quota the following year and capped at 50 percent of the base quota. However, there would be no carryover of underharvests for species that are unknown, overfished, or experiencing overfishing. Not accounting for underharvests of overfished species would have positive ecological impacts by reducing harvests and allowing these stocks to rebuild a faster rate. Limiting the amount of underharvest accounted for healthy species should have positive ecological impacts for healthy stocks by preventing the stockpiling of quota.

Sandbar sharks

The 2005/2006 LCS assessment assessed sandbars separately and recommended a sandbar specific TAC of 158.3 mt dw. Based on this recommendation, NMFS has removed sandbar sharks from the LCS complex for alternative suites 2 through 4. Removing them from the complex allows sandbar sharks to be managed separately and gives NMFS the ability to track this separate quota more efficiently, which is critical given the status of sandbar sharks. To determine the proportion of the sandbar 158.3 mt dw TAC that would be available for the commercial fishery, NMFS accounted for mortality of sandbar sharks in all sectors of recreational and commercial fisheries. This included recreational landings, discards in the PLL fishery and non-HM fisheries (*e.g.*, the snapper/grouper and tilefish fisheries) as well as landings recorded in the Coastal Fisheries Logbook by fishermen who did not have valid or current HMS shark permits. Based on these landings and discards, the commercial sandbar quota was determined to be 116.6 mt dw (or 6,347 sandbar sharks; see Appendix A and Table A.1). This quota, combined with sandbar shark mortality in other HMS, recreational, and non-HMS fisheries, is predicted to be under the 158.3 mt dw sandbar shark TAC; therefore, this quota would be consistent with the rebuilding plan for this species and should have positive ecological impacts for sandbar sharks. A more detailed analysis of the ecological impacts of the sandbar quota under alternative suite 2 is outlined in the next section under retention limits.

Non-sandbar LCS

The 2005/2006 LCS assessment also assessed blacktip sharks separately and recommended that the catch of Atlantic and Gulf of Mexico blacktip populations not change or increase, respectively, given the unknown status for the Atlantic blacktip population and the relatively healthy status for the Gulf of Mexico population. Based on this LCS assessment, NMFS also determined that the status of the LCS complex is unknown. Given these results, NMFS established a non-sandbar LCS complex that has sandbar sharks removed from the complex (non-sandbar LCS complex = silky, tiger, blacktip, spinner, bull, lemon, nurse, scalloped hammerhead, great hammerhead, and smooth hammerhead sharks). The non-sandbar LCS quota of 541.2 mt dw is based on the average catch of these species from 2003 to 2005, as recommended by the most recent LCS stock assessment (see Appendix A and Table A.3a). A TAC was established for non-sandbar LCS based on total catch and discards from all sectors of the LCS fishery (see Appendix A and Table A.3b). Given the unknown or healthy status of these species and the larger available quota relative to the sandbar quota, alternatives 2 through 4 base management for these species in a new complex, renamed "non-sandbar LCS." Given the recommendations of the most recent LCS stock assessment, establishing quotas for these species based on past catches would have positive ecological impacts. The new non-sandbar LCS quota would maintain future catches at past catch rates, and should maintain the healthy status of the Gulf of Mexico blacktip population. In addition, setting the quota based on past catch rates would follow the recommendations of the stock assessment for the Atlantic blacktip population and the LCS complex, which were determined to have an unknown status. The non-sandbar

LCS quota should result in neutral to possible positive ecological impacts for these species. A more detailed analysis of the ecological impacts of the non-sandbar LCS quota under alternative suite 2 is outlined in the next section under retention limits.

Porbeagle sharks

Under alternative suites 2 through 4, porbeagle sharks would be added to the prohibited list for commercial and recreational fishing, resulting in a 0 mt dw commercial quota and catch and release only fishery for recreational fishermen. Sharks may be added to the prohibited list if they meet at least two of the following criteria: (1) there is sufficient biological information to indicate the stock warrants protections, such as indications of depletion or low reproductive potential or the species is on the Endangered Species Act (ESA) candidate list, (2) the species is rarely encountered or observed caught in HMS fisheries, (3) the species is not commonly encountered or observed caught as bycatch in fishing operations, or (4) the species is difficult to distinguish from other prohibited species (*i.e.*, look-alike issue). Porbeagle sharks were determined to be overfished based on the 2005 Canadian stock assessment. In addition, porbeagle sharks are often look similar to other prohibited species (*i.e.*, white sharks). Therefore, placing porbeagle sharks on the prohibited species list will prohibit landings and help rebuild this overfished species. It will also stop commercial and recreational landings of other look-alike shark species, such as white sharks which are also prohibited. A more detailed analysis of the ecological impacts of establishing a 0 mt dw commercial porbeagle shark quota is discussed in the next section under retention limits.

Exempted fishing program quota

This alternative suite would partition the 60 mt ww (43.2 mt dw) quota for exempted fishing permits (EFPs), display permits, scientific research permits (SRPs), and letters of acknowledgement (LOA) to place more stringent limits on the quantity of sandbar and dusky sharks authorized for these purposes. However, the overall 60 mt ww quota would not be modified. Under the exempted fishing program, NMFS requires that all permittees submit interim and annual reports. Interim reports include the disposition of all animals caught and discarded (*i.e.*, both alive and dead discards) under a permit. NMFS then monitors total mortality associated with the exempted fishing program by counting all animals that are either retained or discarded dead against the 60 mt ww quota. The sandbar shark quota authorized for research and public display would be limited to 2 mt dw (1 mt dw for research under EFPs, 1 mt dw for display). The remaining quota for exempted fishing permits (41.2 mt dw or 57.2 mt ww) would be authorized for all other shark species, besides dusky and sandbar sharks, under the exempted fishing program. Maintaining this quota could result in neutral ecological impacts because NMFS reduced the commercial quota by 2 mt dw to accommodate the sandbar quota authorized for research and public display. NMFS also reduced the non-sandbar LCS commercial quota by 41.2 mt dw to accommodate the collection of other species besides sandbars collected under the exempted fishing program. Therefore, total landings of sandbars would still be under the 158.3 mt dw TAC (Table A.1), and total landings of non-sandbar LCS would not exceed the 1,045.5 mt dw TAC for non-sandbar LCS (Table A.3).

In addition, given the severity of the overfished and overfishing status of dusky sharks, dusky sharks would not be allowed to be collected for public display. However, based on research needs and objectives, NMFS would review the allocation of dusky sharks for research under EFPs on a case by case basis. Therefore, reducing the amount of dusky and sandbar sharks and maintaining the number of non-sandbar LCS authorized for these purposes would result in neutral or slightly positive ecological impacts for these species.

4.2.2 Retention Limits

Fishery-wide Landings

Under alternative suite 2 through 4, NMFS would require that shark fins, including the tail, would remain attached to the shark until the first port of landing. At that point, the fins could be removed either by the fisherman or the dealer. The shark could still be headed, gutted, and bled while at sea. To ensure the sharks are stored in a manner that would maximize the value and quality of the sharks, the fins could be sliced as long as they are not removed completely from the shark (*i.e.*, they could remain attached to the shark via a small amount of uncut skin). This would reduce the likelihood of misidentifying the shark or the fins and would help with species-specific reporting by fishermen and dealers to improve data for future stock assessments. Additionally, because fishermen would no longer be able to bypass the regulations by keeping only the fins of shark that are not landed (i.e., keeping more desirable sandbar shark fins and discarding the carcass), fishing mortality of sharks overall could be reduced. This would help with the rebuilding of overfished species of sharks, such as sandbar sharks.

On average, annual sandbar landings of 1,590,917 lb dw and non-sandbar LCS landings of 1,250,638 lb dw were reported from 2003 to 2005 in the Coastal Fisheries and HMS Logbooks by directed and incidental permit holders (Table 4.9). Based on recommendations by the most recent LCS stock assessment, the commercial quota would be reduced to 116.6 mt dw and 541.2 mt dw for non-sandbar LCS (see Appendix A and Tables A.1 and A.3). However, to balance the number of sandbar discards in the South Atlantic with uncaught sandbar quota in the Gulf of Mexico, only 86.1 mt dw of sandbar sharks and 253.6 mt dw of non-sandbar LCS would be landed under alternative suite 2 (see discussion below and in Appendix A under "*Non-sandbar quota and retention limits*" and Tables A.4 and Table 4.2). This is an 88-percent reduction in landings for sandbar sharks and a 56-percent reduction in landings for non-sandbar LCS compared to the status quo, alternative suite 1 (see Table 4.2).

Table 4.2 Landings of sandbar sharks and non-sandbar LCS for the different alternative suites.

Alternative Suite	Estimated Landings by Vessels Within Research Fishery (92 directed shark BLL trips) (mt dw)	Estimated Landings by Shark Permit Holders Outside of Research Fishery (mt dw)	Estimated Landings by Directed Shark Permit Holders (mt dw)	Estimated Landings by Incidental Shark Permit Holders (mt dw)	Estimated Landings by non-HMS Shark Permit Holders in the Coastal Fisheries Logbook (mt dw)	Total Landings (mt dw)	Percent Change in Landings Compared to Status Quo
Sandbar							
1	-	-	713	9	6.1	728	-
2	-	-	86.1	0	†	86.1	↓88%
3	-	-	83.0*	22.9*	†	105.9	↓85%
4	116.6	0	-	-	†	116.6	↓84%
5	-	-	0	0	†	0	↓100%
Non-sandbar LCS							
1	-	-	549	18	15	582	-
2	-	-	253.6	0	†	253.6	↓56%
3	-	-	179.7*	49.5*	†	229.2	↓61%
4	50.2	491	-	-	†	541.2	↓7%
5	-	-	0	0	†	0	↓100%

*See Table 4.11 for this calculation.

†Landings by non-HMS permit holders were counted as discards based on historical landings (see Table 4.1).

Landings on a trip basis

Based on the reduced quotas, the retention limit for alternative suite 2 would be 8 sandbar sharks per vessel per trip and 21 non-sandbar LCS per vessel per trip (~1,032 lb dw per trip for sandbar and non-sandbar LCS) for directed shark permit holders only (incidental permit holders would not be allowed to retain any shark species) (Tables 2.1, A.2, and A.4). Currently, directed shark permit holders are subject to a 4,000 lb dw LCS trip limit. The average number of sandbar and non-sandbar LCS landed per trip was 35 sandbars and 32 non-sandbar LCS for all gear types reported in the Coastal Fisheries and HMS Logbooks. Therefore, the retention limits under alternative suite 2 would be a 77-percent reduction for sandbar sharks and a 34-percent reduction in non-sandbar LCS on a trip basis compared to the status quo. There would be no change to the trip limit for SCS and pelagic sharks for directed shark permit holders (*i.e.*, no trip limit for SCS and pelagic sharks).

Catch composition of sandbar sharks and non-sandbar LCS differed for BLL trips that directed on sharks (Hale and Carlson, 2007). Based on BLL observer program data in 2005 and 2006, on average, 69 sandbar sharks and 35 non-sandbar LCS were caught in the South Atlantic region and 30 sandbar sharks and 83 non-sandbar LCS in the Gulf of Mexico region were caught per trip (Hale and Carlson, 2007). Therefore, depending on the region and gear used, the retention limit in alternative suite 2 could result in a 73 to 88-percent reduction in sandbars kept and a 40 to 75-percent reduction in non-sandbar LCS kept on a trip basis.

Sandbar and non-sandbar LCS discards

The reduction in landings must also be balanced by any potential increase in discards. Since the non-sandbar LCS quota is higher than the sandbar quota, the retention limit for non-sandbar LCS is higher than the retention limit for sandbar sharks (Tables A.2 and A.4). As a result, sandbar sharks could be discarded as fishermen reach their sandbar shark retention limit but continue to fish to fulfill their non-sandbar LCS retention limit. To limit these discards, NMFS based the non-sandbar LCS retention limit on an average ratio of sandbars to non-sandbar LCS caught in the South Atlantic and Gulf of Mexico regions (1:2.7; Table A.4). In doing so, NMFS established a retention limit (21 non-sandbar LCS; Table A.4) that minimized the sandbar discards that could occur in the South Atlantic region while maximizing the sandbar landings that could be caught in the Gulf of Mexico region (since the sandbar to non-sandbar LCS ratio is higher in the Gulf of Mexico region than the South Atlantic region, no sandbar discards are expected in the Gulf of Mexico region given the non-sandbar LCS retention limit).

For instance, the catch ratio of sandbars to non-sandbar LCS in the Gulf of Mexico is 1:4. A non-sandbar LCS retention limit based on this ratio would be 32 non-sandbar LCS per trip with an 8 sandbar shark retention limit per trip (8 sandbars x 4 = 32 non-sandbar LCS). However, given the 1:1.4 ratio in the South Atlantic, an 8 sandbar shark retention limit/trip would equal a 11 non-sandbar LCS retention limit in the South Atlantic (8 sandbar sharks x 1.4 = 11.2 non-sandbar LCS). Therefore, setting one retention limit based on the Gulf of Mexico's catch ratio would result in excessive sandbar sharks discards.

To determine the number of sandbar discards that would occur in the South Atlantic with a non-sandbar LCS retention limit based on the Gulf of Mexico catch composition, NMFS first determined the difference in the retention limits for non-sandbar LCS based on the respective ratios in the two regions. It should be noted that setting a non-sandbar LCS retention limit using the South Atlantic ratio would result in no sandbar discards; any non-sandbar LCS retention limit above that threshold (*i.e.*, above the sandbar shark x 1.4 threshold) would result in sandbar discards, but the number of discards would depend on the difference between the two retention limits divided by South Atlantic's non-sandbar LCS ratio to sandbar sharks (*i.e.*, 1.4):

- Gulf of Mexico non-sandbar LCS retention limit = 8 sandbars x 4 = 32 non-sandbar LCS
- South Atlantic non-sandbar LCS retention limit = 8 sandbar sharks x 1.4 = 11.2 non-sandbar LCS (or 11 non-sandbar LCS)
- 32 non-sandbar LCS retention limit based on Gulf of Mexico ratio - 11 non-sandbar LCS retention limit based on South Atlantic = 21 non-sandbar LCS;
- 21 non-sandbar LCS/1.4 = 15 sandbar sharks discarded per trip in South Atlantic;
- 15 sandbar sharks x 237 South Atlantic trips = 3,555 sandbar sharks discarded in the South Atlantic; and
- 3,555 sandbar sharks x 40.5 lb dw [average commercial sandbar weight] = 143,977.565.3 lb dw or 65.3 mt dw.

Therefore, setting a non-sandbar LCS retention limit in the South Atlantic region based on the Gulf of Mexico region's catch ratio would therefore result in approximately 65.3 mt dw of sandbar shark discards. These discards would occur as fishermen meet their sandbar retention limit and continue to fish to fulfill their non-sandbar LCS retention limit in the South Atlantic.

An alternate approach would be to implement a non-sandbar LCS retention limit based on the South Atlantic catch composition. However, this would translate into approximately only 163.2 mt dw of the 541.2 mt dw of the non-sandbar LCS being harvested (116.6 mt dw sandbar quota x 1.4 = 163.2 mt dw). Another alternative would be to set separate retention limits for the Atlantic and Gulf of Mexico regions. However, as discussed in the Region section below (Section 4.2.6), under alternative suite 2, NMFS would only implement one region due to reduced quotas and to simplify quota monitoring. In addition, there could be difficulty in enforcing different regional retention limits. Therefore, NMFS would establish one retention limit that is applied everywhere. To balance the harvest of as much of the non-sandbar LCS quota as possible while limiting sandbar shark discards, NMFS chose to establish the non-sandbar LCS retention limit based on an average regional catch composition.

However, basing the non-sandbar LCS retention limit on the average regional catch composition still results in a non-sandbar LCS retention limit (*i.e.*, 21 non-sandbar LCS/trip) that is higher than the sandbar to non-sandbar LCS ratio for the South Atlantic (11 non-sandbar LCS/trip), which could result in sandbar shark discards in the South Atlantic (~30.5 mt dw; Table A.4). While this results in total discards that are 4.5 times higher than the number of sandbar discards occurring under the status quo (Table 4.1), these discards are balanced out by the amount of sandbar quota not caught in the Gulf of Mexico region based on the 21 non-sandbar LCS trip limit (~30.5 mt dw; Table A.4). This ultimately results in only 86.1 mt dw of the sandbar sharks being harvested under alternative suite 2 (*i.e.*, based on the 1:4 ratio in the Gulf of Mexico region, 21 non-sandbar LCS retention limit / 4 = 5 sandbar sharks caught per trip in the Gulf of Mexico region when the non-sandbar LCS retention limit/trip is filled. This is three less than the 8 sandbar shark per trip limit under alternative suite 2, resulting in approximately ~30.5 mt dw of sandbar shark quota uncaught in the Gulf of Mexico region). Furthermore, overall fishing effort is expected to decline compared to the status quo given the reduction in the retention limit of 73 to 88 percent for sandbars and 40 to 75 percent for non-sandbar LCS, depending on the region.

Overall, total landings and discards of sandbar sharks under alternative suite 2 are expected to be 82-percent less (608.3 mt dw) than the total landings and discards under alternative suite 1 (status quo) (Table 4.1 and Table 4.2):

- status quo: 728 mt dw in landings + 9.6 mt dw in discards = 737.6 mt dw total;
- alternative suite 2: 86.1 mt dw in landings + 43.2 mt dw in discards = 129.3 mt dw;
- 737.6 mt dw – 129.3 mt dw = 608.3 mt dw; and
- 608.3 mt dw/737.6 mt dw = 82-percent reduction.

Under alternative suite 2, the total landings and discards plus an estimated 27 mt dw of recreational landings (156.3 mt dw total) is still below the 158.3 mt dw sandbar TAC. Therefore, quotas and retention limits under alternative suite 2 would meet the rebuilding plan for sandbar sharks and would have positive ecological impacts on this stock.

Based on the non-sandbar LCS retention limit under alternative suite 2, landings for this complex would be below the proposed 541.2 mt dw non-sandbar LCS quota (253.6 mt dw of the 541.2 mt dw quota could be caught; Table 4.2 and A.4). Total harvest is anticipated to be below the non-sandbar LCS quota because of the approach taken to set non-sandbar LCS retention limits to limit the number of sandbar shark discards. The only way fishermen could potentially harvest the entire non-sandbar LCS quota would be to reduce sandbar shark landings (*i.e.*, even lower than 86.1 mt dw) to accommodate for presumably more sandbar shark discards with a higher non-sandbar LCS retention limit. Therefore, to balance landings with regulatory discards, NMFS is proposing a ratio approach for setting non-sandbar LCS retention limits, at this time. This retention limit would also decrease non-sandbar LCS discards by an estimated 56 percent under this alternative suite (Table 4.1). This is mainly due to the assumption that the lowered retention limits for sandbars and non-sandbar LCS may result in fishermen not directing on sharks with the same level of effort as they have been in the past. Therefore, non-sandbar LCS discards by shark directed BLL trips may decrease (Table 4.1). If these assumptions reflect actual changes in the fishery, then alternative suite 2 would have positive ecological impacts for non-sandbar LCS.

<u>Dusky shark discards</u>

It is also assumed that the reduction in fishing effort due to the reduced sandbar and non-sandbar LCS quotas under alternative suite 2 could result in a decrease of dead discards of dusky sharks, resulting in positive ecological impacts for this stock. Dusky sharks have been prohibited since 2000; however, they are still being landed or discarded dead as reported in the Coastal Fisheries and HMS Logbooks. Landings are also occurring in recreational fisheries. Under alternative suite 1 (status quo), it is estimated that, on average, 33.2 mt dw of dusky sharks have been landed or discarded dead (this includes recreational harvest) from 2003 to 2005 (Table 4.1). The majority of the discards under the status quo came from shark directed BLL sets (which include BLL sets fished by PLL vessels) (Table 4.1). However, mortality of dusky sharks would still be realized by other parts of the commercial and recreational fishing sector (Table 4.1). As with non-sandbar LCS, it is assumed that since retention limits for sandbars and non-sandbar LCS have been reduced, fishermen would not be directing their effort on shark as they have in the past. This is particularly pertinent for alternative suite 2, which would prohibit landings of sandbar sharks when PLL gear is onboard a vessel. Therefore, it is assumed that PLL vessels would not set BLL gear for sharks as a result of this prohibition. Given this assumption and the reduced fishing effort for sandbar and non-sandbar LCS, it is estimated that alternative suite 2 may reduce dusky shark discards and landings by 74 percent (Table 4.1).

<u>Porbeagle shark discards</u>

Finally, under alternative suite 2, porbeagle sharks would be prohibited in the commercial and recreational sectors. This is expected to have neutral or slightly positive ecological impacts for this stock. The United States has minimal landings of this species. Based on HMS Logbook data from 2001 to 2005, 1,895 porbeagle sharks were reported discarded alive, 558 were reported as discarded dead, and 78 were reported as being kept over those 5 years. Based on the number of porbeagle sharks kept from 2001 to 2005, U.S. fishermen have not been targeting porbeagle sharks. Since only 3 percent of the porbeagle sharks that were initially caught were discarded dead (1,895 discarded alive+ 558 discarded dead + 78 kept = 2,531 total porbeagle sharks caught; 558 discarded dead /2,531 total catch = 3 percent discarded dead), prohibiting the retention of porbeagle sharks is not expected to result in large numbers of dead discards. In fact, dead discards of porbeagle sharks may only increase by 2 porbeagle sharks over 5 years or 0.4 porbeagle sharks per year (3 percent x 78 porbeagle sharks kept = 2 porbeagle sharks discarded dead under alternative 2; 2 porbeagle sharks /5 years = 0.4 porbeagle per year). Given this stock is overfished, prohibiting the retention of this species would eliminate any future fishery from developing while not increasing dead discards. This may result in slightly positive ecological impacts for this stock. In addition, since most porbeagle sharks are caught on PLL gear, reductions in fishing effort associated with BLL gear are not anticipated to have significant ecological benefits for this species.

4.2.3 Time/Area Closures

Under alternative suite 2, NMFS would maintain the mid-Atlantic shark closed area and the current BLL closures in the Caribbean that were implemented in February 2007, (72 FR 5633). Therefore, the ecological impacts associated with the closures would be the same as described under alternative suite 1.

However, under alternative suite 2, NMFS would also implement the SAFMC's MPAs. The SAFMC has proposed a number of Type II MPAs from North Carolina to the Florida Keys in Amendment 14 to the Snapper Grouper FMP (Figure 4.3). Type II MPAs are closures throughout the year to most gear types except some fishing such as trolling for HMS and other coastal pelagic species that is allowed. Recent stock assessments indicate that snowy grouper, black seabass, and red porgy are overfished and snowy grouper, golden tilefish, vermilion snapper, and black sea bass are experiencing overfishing. The primary purpose of Amendment 14 is to protect the population and habitat of slow growing, long-lived deepwater snapper grouper species (speckled hind, snowy grouper, Warsaw grouper, yellowedge grouper, misty grouper, golden tilefish, and blueline tilefish) from directed fishing pressure to achieve a more natural sex ratio, age, and size structure within the proposed MPAs while minimizing adverse social and economic impacts. A total of 19 MPAs were initially considered in Amendment 14, and 8 of the MPAs were preferred in the SAFMC's final actions in June 2007. The only HMS authorized gear that has the potential to interact with the species the SAFMC is concerned about in Amendment 14 is BLL gear. HMS permitted vessels that fish with BLL gear normally target LCS, but small coastal, pelagic and dogfish species are also caught. Bycatch may include groupers, tilefishes, wahoo, skates, rays, and other species (Table 4.3).

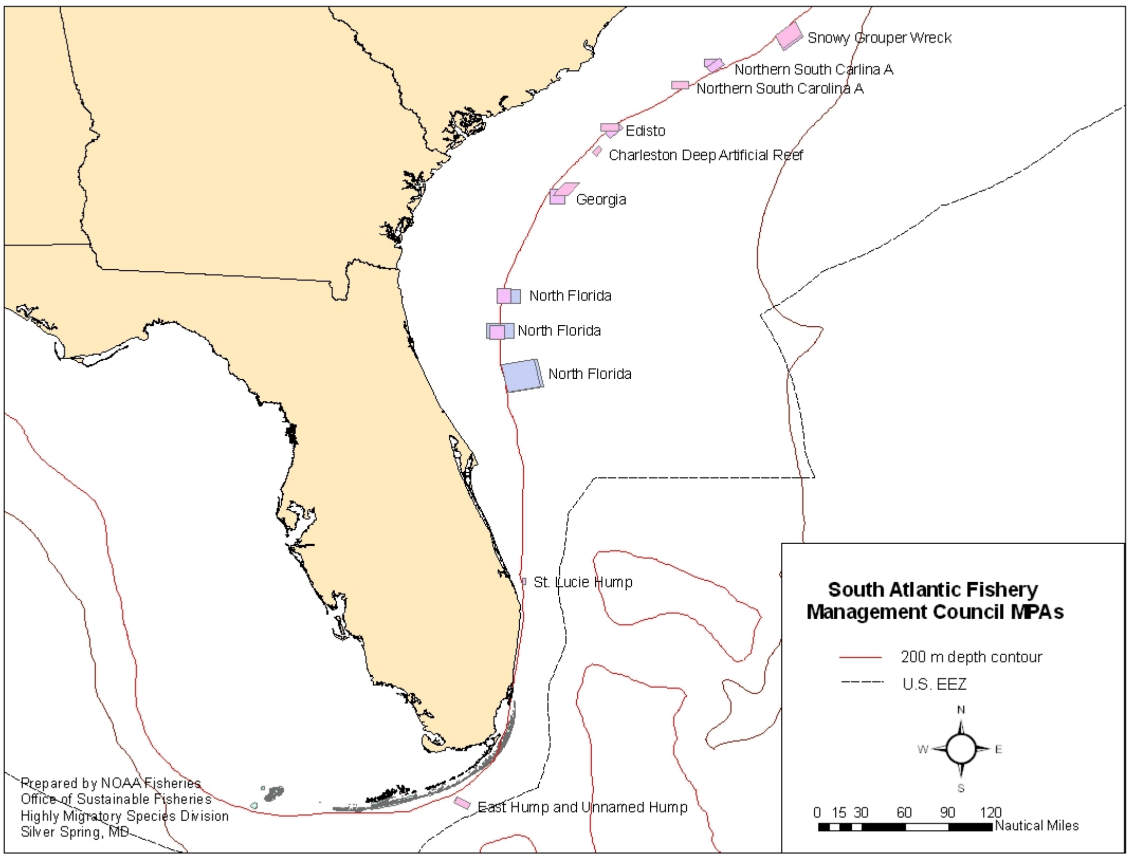

Figure 4.3 **Map showing all MPAs considered by the South Atlantic Fishery Management Council in Amendment 14. Several of the MPAs represent a number of different alternatives with the same name that overlap slightly.**

Table 4.3 **Bycatch species (number and percentage of total) caught on observed shark BLL sets from 1994-2006 in all the MPAs in comparison to observed bycatch in the rest of the Atlantic. Groupers are highlighted and total provided separately. Source: Shark BLL Observer Program, NMFS.**

Common Name	Number Caught in All MPAs	Number Caught in Atlantic	Percent In MPAs
almaco jack	1	7	14.3%
basket star	1	1	100.0%
black sea bass	0	11	0.0%
box crab	2	6	33.3%
brittle star	4	13	30.8%
clearnose skate	2	76	2.6%
cobia	2	121	1.7%
conger eel	1	8	12.5%
gag grouper	18	74	24.3%
grouper	1	121	0.8%
leopard toadfish	2	2	100.0%
mahi	3	8	37.5%
red grouper	6	186	3.2%
reticulate moray	1	1	100.0%
sharksucker	3	66	4.6%
skate	1	55	1.8%
smalltooth sawfish	1	10	10.0%
snowy grouper	2	40	5.0%
starfish	1	52	1.9%
stingray	5	168	2.9%
tilefish	0	605	0.0%
wahoo	3	6	50.0%
warsaw grouper	1	8	12.5%
yellowfin grouper	1	3	33.3%
Grand Total	**62**	**1,648**	**3.8%**
Total Groupers	**29***	**1,048**	**2.8%**

* based on the sum of gag grouper, grouper, red grouper, snowy grouper, warsaw grouper, and yellowfin grouper

In the DEIS for Amendment 14 the eight preferred MPAs include one off southern North Carolina, three off South Carolina, one off Georgia, and three off Florida with specific locations described below (Figure 4.4):

1) Snowy Grouper Wreck off North Carolina in the area that is bound by the following coordinates: The northwest corner at 33°25'N, 77°4.75'W; northeast corner at 33°34.75'N, 76°51.3'W; southwest corner at 33°15.75'N, 77°W; and the southeast corner at 33°25.5'N, 76°46.5'W.

2) Northern South Carolina MPA (South Carolina A MPA) in the area bounded by the following coordinates: The northwest corner at 32°53.5'N, 78°16.75'W; the northeast corner at 32°53.5'N, 78°4.75'W; the southwest corner at 32°48.5'N, 78°16.75'W; and the southeast corner at 32°48.5'N, 78°4.75'W.

3) Edisto MPA in the area bounded by the following coordinates: The northwest corner at 32°24'N, 79°6'W; the northeast corner at 32°24'N, 78°54'W; the southwest corner at 32°18.5'N, 79°6'W; and the southeast corner at 32°18.5'N, 78°54'W (formerly named “Proposed SC A(5)”)

4) Georgia MPA (Tilefish MPA) in the area bounded by the following coordinates: The northwest corner at 31°43'N, 79°31'W; the northeast corner at 31°43'N, 79°21'W; the southwest corner at 31°34'N, 79°39'W; and the southeast corner at 31°34'N, 79°29'W (formerly named “Proposed GA(3)”)

5) North Florida MPA (Jacksonville/St. Augustine Ridge MPA) in the area bounded by the following coordinates: The northwest corner at 30°29'N, 80°14'W; the northeast corner at 30°29'N, 80°2' W; the southwest corner at 30°19'N, 80°14'W; and the southeast corner at 30°19'N, 80°2'W

6) St. Lucie Hump MPA in the area bounded by the following coordinates: The northwest corner at 27°8'N, 80°W; the northeast corner at 27°8'N, 79°58'W; the southwest corner at 27°4'N, 80°W; and the southeast corner at 27°4'N, 79°58'W (formerly named “Sea Bass Rocks (4)”)

7) East Hump/Un-named Hump MPA in the area bounded by the following coordinates: The northwest corner at 24°36.5'N, 80°45.5'W; the northeast corner at 24°32'N, 80°36'W; the southwest corner at 24°32.5'N, 80°48'W; and the southeast corner at 24°27.5'N, 80°38.5'W

8) Charleston Deep Artificial Reef MPA off the Coast of South Carolina in the area identified by the following boundaries: The northwest corner at 32°08.58'N, 79°07.82'W; the northeast corner at 32°06.06'N, 79°04.99'W; the southwest corner at 32°04.07'N, 79°12.11'W; and the southeast corner at 32°01.47'N, 79°09.28'W.

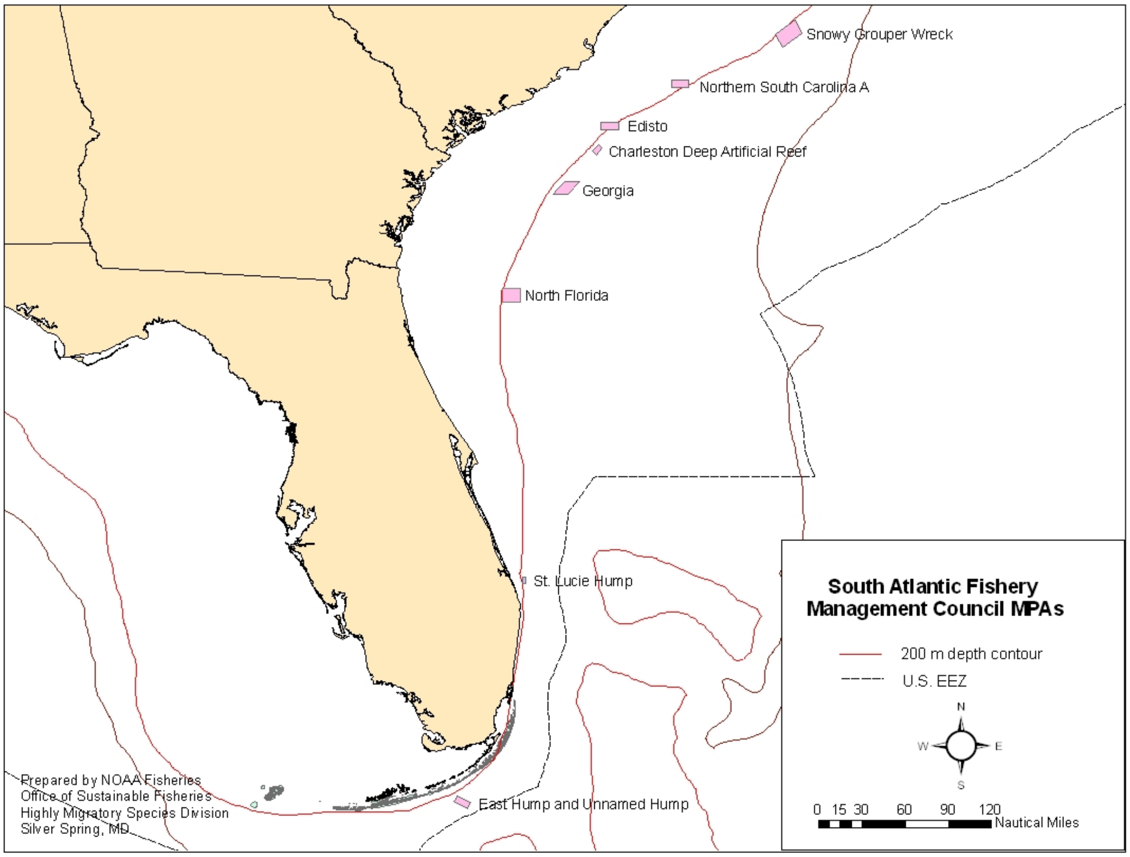

Figure 4.4 Map showing only the preferred SAFMC MPAs. A total of eight MPAs were preferred in SAFMC's final action for Amendment 14.

NMFS agreed to coordinate with the SAFMC to analyze the ecological and socio-economic impacts of the MPAs on HMS fisheries in Amendment 2 and to consider rulemaking to prohibit shark BLL gear in the preferred MPAs. This approach should result in implementation of measures consistent with the SAFMC process and the current timeline for Amendment 14. NMFS has addressed a number of SAFMC actions in a similar way including the Gulf of Mexico Madison-Swanson Steamboat Lumps closures and the Caribbean SFA closures.

As described below, the ecological impact of shark BLL gear on the snapper grouper complex is considered to be minimal, and catches of sharks in the area are also low compared to other areas of the South Atlantic. Thus, the ecological consequences of closing the eight preferred MPAs are considered to be minimal. Under alternative suite 2, NMFS would close the preferred to MPAs to shark BLL gear based on enforceability concerns raised by the SAFMC.

NMFS used shark BLL observer program data from 1994 to 2006 to evaluate the impact of the shark BLL fishery on the snapper-grouper complex within the proposed MPAs. Using a Geographic Information System (GIS), NMFS plotted the locations of all observed sets on the all the proposed MPAs originally considered in the South Atlantic region (Figure 4.5 and Figure 4.6). The figures provide an overview of the number and locations of sets that intersected all the MPAs originally considered. The northernmost areas are shown in Figure 4.5 and the southernmost areas are shown in Figure 4.6. The points on the maps indicate the beginning and ending locations (reported as degrees and minutes of latitude and longitude by observers) of the sets connected by a line between the two points. Since most of the proposed MPAs are relatively small (<10 nautical miles in diameter), the sets tend to either start or end outside of the MPAs. In most cases, only a portion of the set intersected with an MPA and few, if any sets, were entirely within the MPAs (Figure 4.7). However, if a set intersected any portion of an MPA, then all bycatch reported on that set was counted as occurring in the MPA regardless of where on the set it occurred. NMFS used this approach because it was not possible to determine where on a set the bycatch actually occurred. Of the sets that intersected the MPAs, a large portion of each set actually occurred primarily outside the MPAs. As a result, the number of bycatch species reported as occurring in the MPAs is most likely an overestimate.

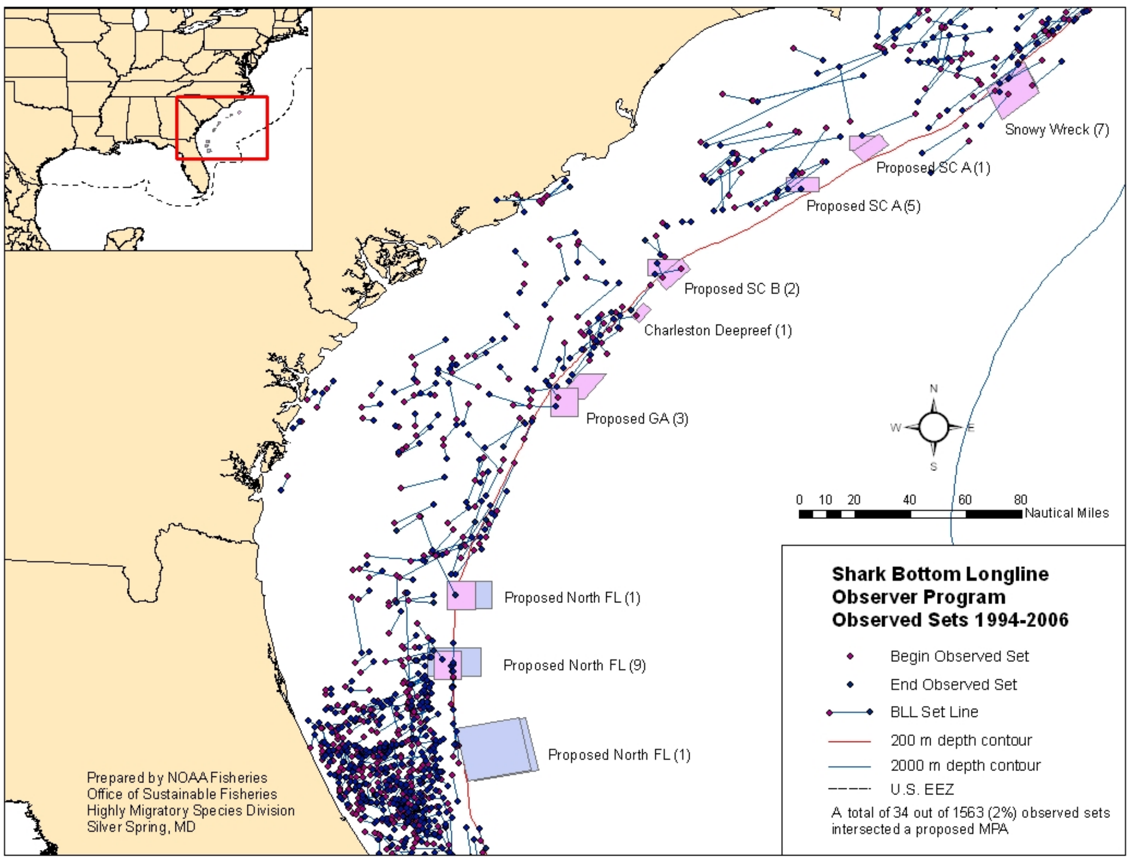

Figure 4.5 **All shark BLL sets observed from 1994-2006 overlayed on the MPAs originally considered for the northern zone. A total (both northern and southern zones) of 34 out of 1,563 (2%) of observed sets intersected the considered MPAs. Note that most sets are shoreward of the 200 m depth contour. Source: Shark BLL Observer Program, NMFS.**

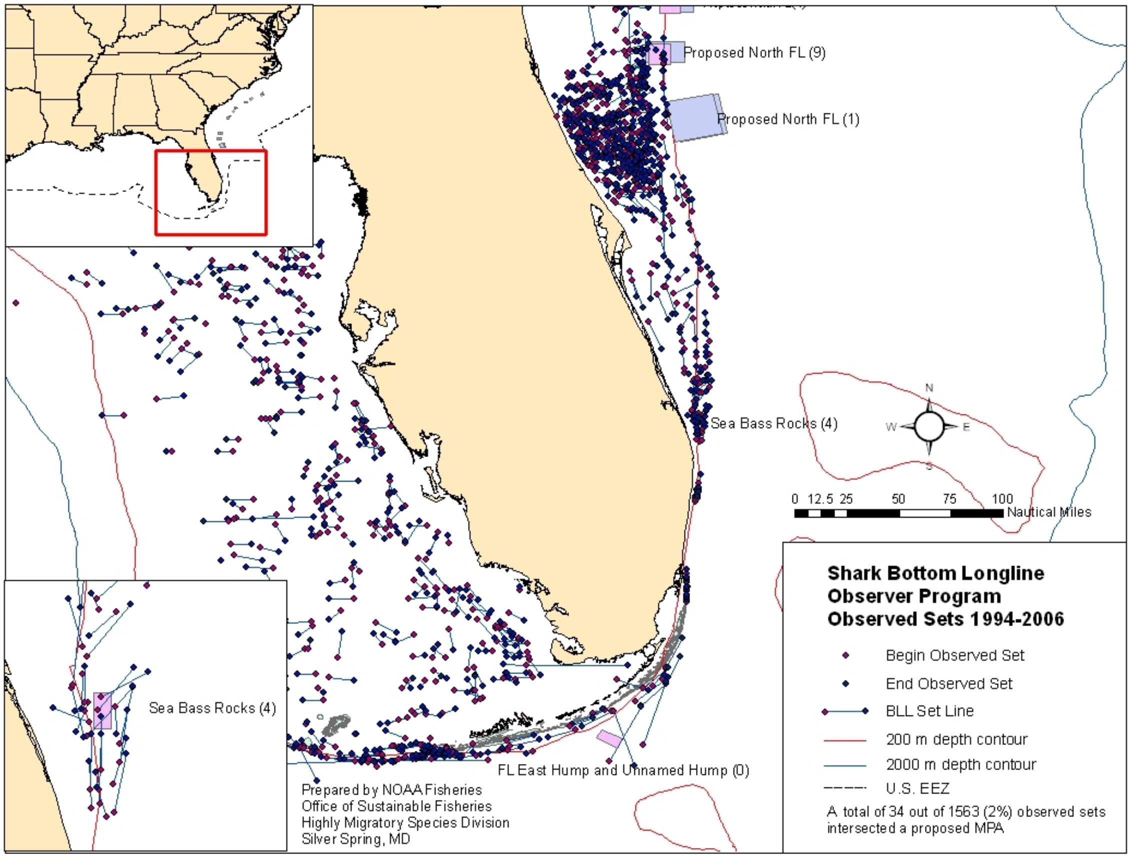

Figure 4.6 **All shark BLL sets observed from 1994-2006 overlaid on the MPAs originally considered for the southern zone. Source: Shark BLL Observer Program, NMFS.**

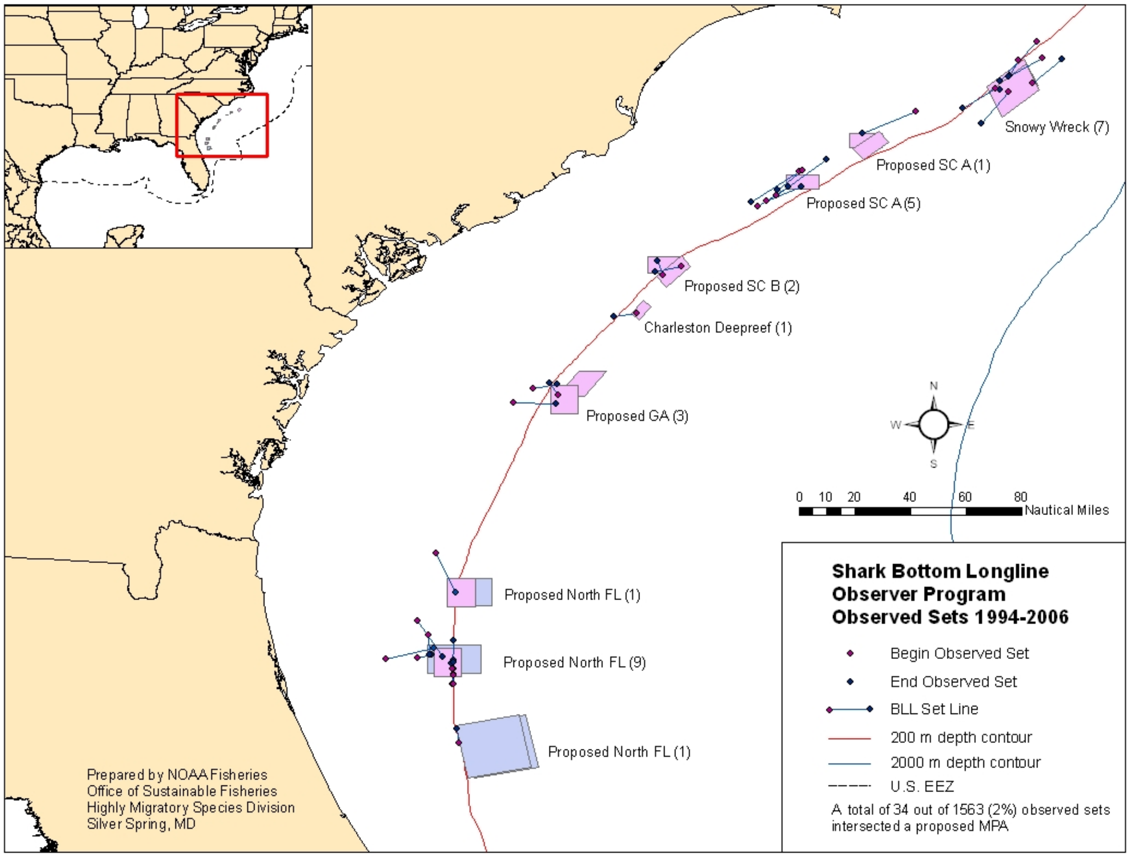

Figure 4.7 **Observed shark BLL sets that intersected MPAs originally considered in the northern zone. Source: Shark BLL Observer Program, NMFS.**

Of the 1,563 observed sets over the approximately twelve-year period, a total of 34 sets intersected the proposed MPAs that were originally considered by the SAFMC (Figure 4.7 and Table 4.3). Of those, only two sets occurred entirely within the boundary of the MPAs (one in Snowy Grouper Wreck and one in North Florida MPA). A concentration of observed sets is apparent in the areas north of Cape Canaveral. The remaining sets tend to be more widely spaced and although observer coverage is not necessarily uniform, the level of observer coverage was based on the level of fishing effort in the different areas. Each MPA has a number next to it in parentheses that indicates the number of observed sets that intersected the MPA.

Figure 4.8 and Figure 4.9 show only those sets that intersected the MPAs that were originally considered. The Snowy Grouper Wreck MPA had the highest number of observed sets with seven (Figure 4.7 and Figure 4.8). The middle sites for North Florida had nine sets. Most of them had one, two, or fewer than three sets in any given MPA. Table 4.3 and Table 4.4 show all of the bycatch and all of the sharks, respectively, that were caught on sets that may have intersected an MPA. As evident from Figures 4.5 and 4.6, few sets occurred in the MPAs because they are located on the edge of the shelf in deeper water where currents are strong and gear may be lost. Most BLL sets occur shoreward of the 200 m depth contour with the exception of the Snowy Grouper Wreck MPA (Figure 4.7). The few sets that did occur in the MPAs should not be considered representative of overall shark fishing effort, and may in fact be considered anomalous based on the low number of observed sets that occurred in these areas.

Only 34 sets (2 percent) of the 1,563 observed sets occurred in the MPAs that were originally considered by the SAFMC. The fact that very few sets occurred in the MPAs supports the argument that there is very little shark fishing effort and associated bycatch in the MPAs, and hence, supports the overall conclusion of minimal ecological impacts.

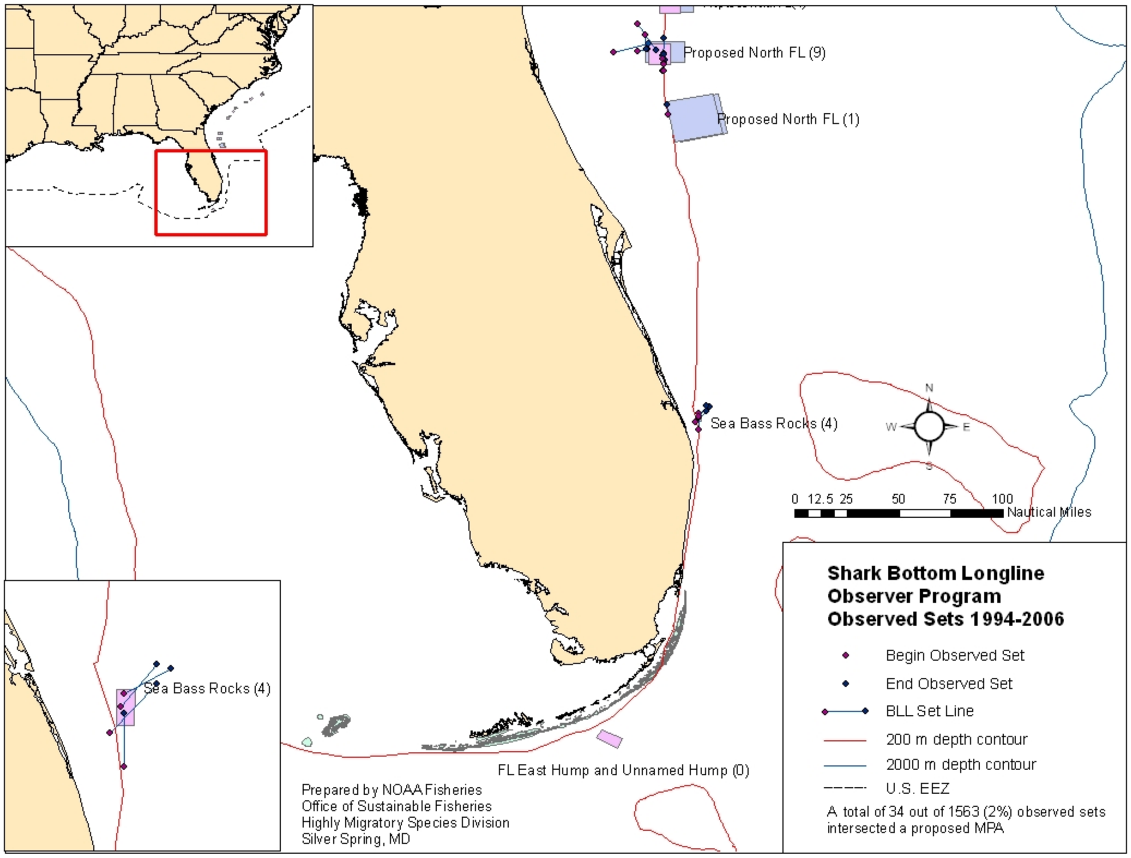

Figure 4.8 Observed shark BLL sets that intersected MPAs originally considered in the southern zone. Source: Shark BLL Observer Program, NMFS.

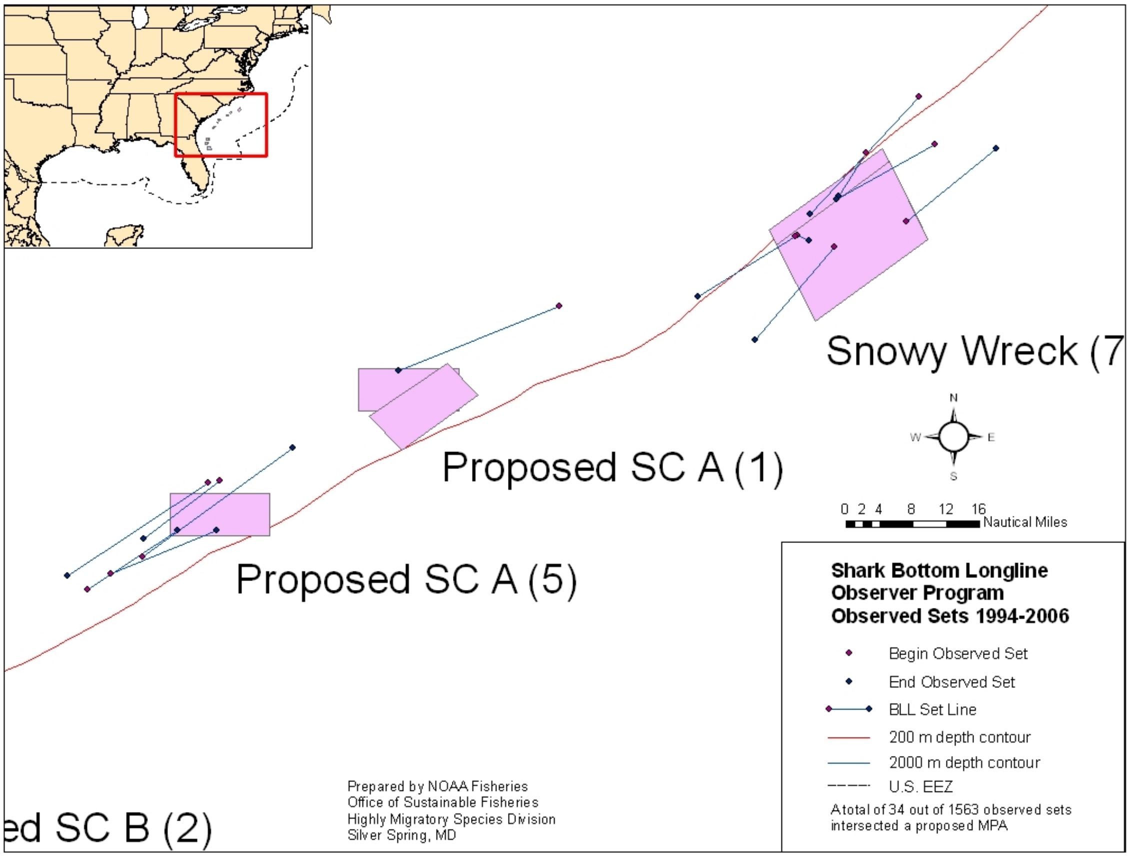

Figure 4.9 **Close-up showing the extent of overlap of sets with the MPAs. The number of sets that intersected the MPAs is in parentheses. Since at least one end of each set intersected the MPAs, all bycatch on the sets was considered to have occurred inside the MPAs. Source: Shark BLL Observer Program, NMFS.**

Table 4.4 Shark species (number and percentage of total) caught on observed shark BLL sets from 1994-2006 in all the MPAs in comparison to observed shark catch during the same period in the rest of the Atlantic. Source: Shark BLL Observer Program, NMFS.

Species	Number Caught in All MPAs	Number Caught in Atlantic	Percent of Total
Atlantic sharpnose	75	14,836	0.5%
bigeye thresher	12	21	57.1%
blacknose	47	1,116	4.2%
bull	5	194	2.6%
Carcharhinus spp	1	13	7.7%
dusky	32	1,736	1.8%
great hammerhead	6	251	2.4%
lemon	2	98	2.0%
night	2	145	1.4%
nurse	4	945	0.4%
sand tiger	1	410	0.2%
sandbar	1,012	19,849	5.1%
scalloped hammerhead	29	61	47.5%
shortfin mako	5	105	4.8%
silky	30	544	5.5%
sixgill	1	6	16.7%
smooth dogfish	1	538	0.2%
spinner	2	220	0.0%
tiger	549	6,929	7.9%
unidentified	1	11	9.1%
Grand Total	**1,817**	**48,028**	**3.8%**

NMFS attempted to estimate the total bycatch within the proposed MPAs (Siegfried *et al.* 2006a). NMFS also expanded coastal shark catches to obtain overall estimates of sharks caught within the proposed MPAs (Siegfried *et al.* 2006b). NMFS used the observed bycatch in the MPAs and fishing effort reported in the Coastal Fisheries Logbook to provide expanded take estimates (Siegfried *et al*. 2006a). The proposed MPA total areas were calculated as proportions of each grid used to report fishing effort in the Coastal Fisheries Logbook. NMFS then calculated the proportion of sets with bycatch using a generalized linear model (GLM). Thus, the bycatch estimates reflect a subset of the actual shark BLL effort in these areas, as opposed to all effort in the Atlantic. Only one MPA, Snowy Wreck, had sufficient data to produce expanded bycatch estimates. Low sample sizes prohibited estimating the impact of the shark BLL fishery on bycatch in other MPAs in a statistically robust fashion (Siegfried *et al*., 2006a). A similar approach was used to estimate total shark catches in the MPAs (Siegfried *et al*., 2006b).

Due to the small amount of bycatch that occurred in the MPAs, it was not possible to calculate expanded estimates for most MPAs. Based on the low estimate of total expanded bycatch, it is likely the shark BLL fishery has minimal impact on the proposed MPAs. If additional data becomes available, expanded take estimates could be calculated for those MPAs for which NMFS was unable to provide estimates in the current analysis. It should be noted that the shark observer program is one of the most comprehensive, long-term, and well documented datasets available. Similar observer program data are not available for the snapper grouper fishery. Although data from the Coastal Fisheries Logbook were used to derive expanded take estimates, they do not provide specific latitude and longitude coordinates of set locations to determine the exact bycatch that occurred in MPAs. Siegfried *et al*. (2006b) used a similar approach to estimate expanded catches of sharks. Sharks catches were considerably higher than snapper grouper bycatch and data were thus sufficient to produce expanded estimates.

Given that only 34 out of 1,563 observed trips (2 percent) intersected the MPAs that were originally considered, the impact of shark longline vessels on the snapper grouper complex in the MPAs is expected to be minimal. Taking all 34 sets that occurred in the MPAs into account, only 28 grouper were observed caught over a 12 year period (Table 4.3). Of these, only one species that was observed caught (snowy grouper) is from a stock that is considered overfished with overfishing occurring. Two individuals of this species were caught (Table 4.3). As described above, NMFS attempted to calculate the expanded bycatch of snapper grouper in the MPAs but was able to do so for only one MPA (Snowy Grouper Wreck). For Snowy Grouper Wreck MPA, NMFS estimated that 0.0061 snapper-grouper for grid 3376 per thousand hooks and 0.0586 per thousand hooks for grid 3377 would be caught.

A total of 1,816 sharks, or 2.6 percent of the total number of sharks observed, were observed caught on sets that intersected the MPAs originally considered by the SAFMC (Table 4.4). Based on expanded catch estimates, a total of 25,395 sharks were estimated to be caught in the MPAs each year (Table 4.5). NMFS is addressing overall quotas and retention limits in separate alternatives. If the MPAs were closed to BLL gear, this could have a positive impact on shark populations by reducing overall mortality and landings of sharks in the South Atlantic. The total number of sharks caught annually in the MPAs is likely an overestimate because most of the catch recorded on the sets did not occur entirely within the MPA as described above. Thus, the actual number of sharks caught in the MPAs may be lower.

For the eight preferred MPAs (Figure 4.4), only 21 fish (4.8 percent of total) were reported as bycatch, and of those, only 13 individuals were comprised of grouper species (Table 4.6). No snowy grouper were observed caught in the preferred MPAs. For sharks, 818 sharks were observed caught in the preferred eight MPAs (1.6 percent of total) with the majority of the catch comprised of sandbar shark (Table 4.7).

Table 4.5 Expanded take estimates for sharks by number per year for proposed MPAs. Source Siegfried *et al*., 2006b.

Grid	MPA Included	Percent of Grid Area for Each MPA	Estimated Number of Sharks Caught Per Year
2480	East Hump / Unnamed Hump	1.45	840
2779	St Lucie Hump	0.22	93
2979	North Florida	6.65	583
	North Florida	5.29	463
2980	North Florida	0.00	0
	North Florida	5.68	7144
	North Florida	1.39	1751
	North Florida	7.04	8856
3080	North Florida	2.78	817
	North Florida	1.38	406
	North Florida	3.34	980
	North Florida	1.39	407
3179	Georgia	2.50	298
	Georgia	2.78	331
3277	Northern South Carolina	0.05	1
3278	Edisto	0.92	456
	Edisto	1.37	683
	Northern South Carolina	1.66	825
3279	Edisto	0.92	284
	Edisto	0.24	73
3376	Snowy	3.92	24
	Snowy	4.17	26
3476	Charleston artificial reef	0.18	54
	Total		**25,395**

Table 4.6 Bycatch species (number and percentage of total) observed caught on shark BLL sets in the preferred MPAs in comparison to observed bycatch in the rest of the Atlantic. Groupers are highlighted and total provided separately. Source: Shark BLL Observer Program, NMFS.

Common Name	Number Caught in Preferred MPAs	Number Caught in Atlantic	Percent of Total
brittle star	1	13	7.7%
cobia	1	121	0.8%
conger eel	1	8	12.5%
gag grouper	8	74	10.8%
mahi	1	8	12.5%
red grouper	3	186	1.6%
reticulate moray	1	1	100.0%
skate	1	55	1.8%
stingray	1	168	0.6%
wahoo	1	6	16.7%
warsaw grouper	1	8	0.0%
yellowfin grouper	1	4	25.0%
Grand Total	**21**	**652**	**4.8%**
Total Groupers	**13**	**272**	**4.8%**

Table 4.7 Shark species (number and percentage of total) caught on observed shark BLL sets in the preferred MPAs. Source: Shark BLL Observer Program, NMFS.

Species	Number Caught in Preferred MPAs	Number Caught in Atlantic	Percent of Total
Atlantic sharpnose	17	14,836	0.1%
bigeye thresher	12	21	57.1%
blacktip	43	2,716	1.6%
bull	3	194	1.5%
Carcharhinus spp	1	13	7.7%
dusky	27	1,736	1.6%
great hammerhead	2	251	0.8%
lemon	2	98	2.0%
night	2	145	1.4%
nurse	1	945	0.1%
sand tiger	1	410	0.2%
sandbar	530	19,849	2.7%
scalloped hammerhead	27	61	44.3%
shortfin mako	4	105	3.8%
silky	14	544	2.6%
smooth dogfish	1	538	0.2%
spinner	2	220	0.9%
tiger	128	6,929	1.8%
unidentified	1	11	9.1%
Grand Total	**818**	**49,622**	**1.6%**

The SAFMC has expressed concern about habitat impacts of shark BLL gear in the MPAs. In the Consolidated HMS FMP, NMFS completed a review of all HMS (and other state and Federally managed gears) that may have an impact on HMS EFH. In addition, NMFS considered the impact of HMS gears on EFH for other Federally managed species. NMFS concluded that BLL gear was the only gear that has the potential to impact EFH, specifically benthic habitat types. However, the degree to which the gear would impact EFH also depends on the substrate that makes up the EFH. Certain substrates, such as complex coral reef habitat, would be more susceptible to damage than would mud and sand substrates because of the extended time for habitat recovery. The impact of shark BLL gear on benthic habitat has not been rigorously studied and conclusions are mixed. For example, the 1999 NMFS EFH Workshop categorized the impact of BLL gear on mud, sand, and hard-bottom as low (Barnette 2001). BLL gear may have some negative impact if gear is set in more complex habitats, such as sponges or coral reefs, however only small portions of some of the MPAs are characterized as being comprised of hard bottom and none of the areas are considered to have sponge or coral habitat. BLL gear in the shark fishery is primarily used in sandy and/or mud habitats where it is expected to have minimal impacts.

On November 7, 2006, NMFS published a Notice of Intent (71 FR 65088) to prepare an Environmental Impact Statement to examine management alternatives for revising existing HMS EFH, consider additional Habitat Areas of Particular Concern (HAPCs), and to identify ways to avoid or minimize, to the extent practicable, adverse fishing impacts on EFH consistent with the

Magnuson-Stevens Reauthorization Act and other relevant Federal laws. In the amendment, NMFS would consider the impact of BLL gear on EFH. Depending on the outcome of the analysis, NMFS may consider alternatives to prohibit BLL if it is found to have more than a minimal and not temporary impact on EFH. Factors that NMFS would consider include the overlap of BLL gear with EFH, the duration and extent of the impact, and the susceptibility of the habitat to damage from BLL gear consistent with previous guidance issued by NMFS.

The SAFMC has also expressed concerns about the enforceability of prohibiting only snapper/grouper BLL gear and not shark BLL gear in the MPAs. Since the gears are virtually indistinguishable, and many fishermen hold both types of permits, prohibiting only one type of gear could create an enforcement loophole. Thus, based on enforcement concerns, NMFS would close the preferred MPAs to shark BLL gear under alternative suite 2.

4.2.4 Reporting

This alternative suite would increase dealer reporting frequency, resulting in positive ecological impacts. Shark dealer reports are the basis for monitoring commercial shark quotas. Increasing the reporting frequency for dealers from bimonthly, to reports *received* within 24 hours of when shark products were purchased would provide the Agency with more "real-time" data on the quantity of sharks being landed relative to their respective quotas. Quotas for sandbar sharks would be much lower than in the past, therefore, increased reporting frequency would enhance the Agency's ability to provide landings updates and possibly close fisheries, if necessary, to prevent overharvests. Effectiveness of increased reporting requirements for shark dealers would be contingent upon shark dealers understanding their responsibilities and submitting data in a timely manner. Reporting requirements for dealers would be closely linked with fishing seasons. Shark fisheries for sandbar and non-sandbar LCS would *both* be closed once the fishery lands 80 percent of *either* quota; therefore, getting this information as soon as possible would reduce the likelihood of allowing fishing to take place after a quota has been met. Other reporting requirements, including the need to take an observer if selected and submission of vessel logbooks, would remain the same.

This alternative suite would also modify how unclassified sharks are accounted for by the Agency regarding quota monitoring. Currently, all sharks that are listed on shark dealer reports as unclassified are counted against the LCS quota. Alternative suites 2 through 4 would modify this procedure to ensure that shark dealers do not intentionally mis-report and take the time to properly identify what species of sharks they are purchasing from fishermen. These suites would change the regulations to count all unclassified sharks against the sandbar shark quota. This is the smallest commercial quota for any species complex and these sharks are also the most valuable because of their fins. By counting all unclassified sharks as sandbar sharks, positive ecological impacts are expected. This change may reduce the likelihood of exceeding the sandbar and/or non-sandbar LCS quota and might encourage shark fishermen to properly identify what they are landing without providing the incentive to mis-report in order to keep the sandbar fishery open longer. Mandatory shark identification workshops for dealers coupled with the requirements to leave all fins on all sharks is expected to improve species specific reporting for sharks which may improve quota monitoring, stock assessments, and the utility of data attained from shark dealers and vessel owners.

4.2.5 Seasons

This alternative suite would open all shark fisheries when this amendment becomes effective in 2008. On January 1, 2008, until the effective date of this amendment all of the Atlantic shark fisheries would be closed. Atlantic shark fisheries would open on January 1 in 2009 and thereafter, depending upon available quota. Seasons would be closed within 5 days notice (*i.e.*, within 5 days of filing with the Federal Register) of any quota being 80 percent filled in effort to prevent overfishing. Seasons for non-sandbar LCS and sandbar sharks would both close when either quota reaches 80 percent of their respective quota because of concerns regarding sandbar shark bycatch that might occur if the non-sandbar LCS fishery were kept open after the sandbar quota had been filled. The Agency wants to prevent individual from mis-labeling sandbar sharks as non-sandbar LCS in order to keep the sandbar shark fishery open longer. Furthermore, all shark dealer reports listing unclassified sharks would be counted as sandbar sharks to encourage dealers to properly identify what sharks they are purchasing. Seasons for SCS and pelagic sharks would be closed individually upon achieving 80 percent of their respective quotas. Upon achieving 80 percent of landings, fishermen would be given 5 days notice from the date of filing with the Office of the Federal Register prior to the closure. Official notice would be made via the Federal Register, however, the public would also be informed simultaneously via the HMS website and email notice listserve. Fishing effort might increase as a result of providing this 5-day advance notice as fishermen and dealers would know that the season is ending; however, they would still be bound by the retention limits for individual trips as described in Section 4.2.1.

Commercial shark fisheries have been managed on a trimester basis since 2003 because they provide a higher degree of resolution on which to manage seasonal fisheries. Furthermore, trimesters may reduce fishing mortality during peak pupping seasons and may be used to address other bycatch concerns. As described above, this alternative suite would implement reduced quotas and retention limits for sandbar sharks, which is one of the most valuable sharks in commercial fisheries because of its fin value. It is estimated that the reductions in fishing effort as a result of these reduced retention limits and quotas could provide ecological benefits to all shark species. Ecological benefits of minimizing fishing mortality during peak pupping seasons or having a higher degree of resolution on which to manage fisheries seasonally could be replaced by the fact that this alternative suite would implement a drastic reduction in the quota for sandbar sharks and reduced retention limits for both sandbar sharks and non-sandbar LCS. The ecological benefits of the timing of when fishing mortality occurs is secondary to the fact overall fishing mortality and effort for sharks is expected to decrease significantly.

4.2.6 Regions

This alternative suite would implement one region for commercial Atlantic shark fisheries. The ecological impacts are expected to be neutral. The regions were implemented in 2004 to address regional differences in fisheries, seasonal variation in shark pupping, and to provide fishing opportunities for regions that do not have sharks present throughout the year. Given the reduction in quotas and retention limits under this alternative suite, spreading the available quota amongst regions could result in shorter seasons and derby-style fishing; derby-style fishing could be worse for releasing bycatch alive. In addition, having one region and season simplifies quota monitoring and would relieve confusion, especially around bordering regions, between fishermen and dealers in different regions regarding when dealers can accept shark products. Under the status quo, dealers cannot accept shark products after a region has closed for a given season, even if the sharks were caught in another region that was open at the same time. Under alternative suite 2, the shark fishing season would close everywhere at the same time, simplifying this entire process. Therefore, managing the fishery based on one region given the reduced quotas is not expected to result in negative ecological impacts for Atlantic sharks, protected resources, or other bycatch.

4.2.7 Recreational Measures

This suite would restrict the species of Atlantic sharks that could be possessed by anglers in possession of a HMS Charter/Headboat permit, HMS Angling permit, or Atlantic Tuna General Category permit (if participating in a registered HMS tournament). The Agency is attempting to restrict landings of sharks to those species that are relatively simple to identify. Restricting the shark species that could be retained by recreational anglers could result in positive ecological impacts. Tables 3.22 to 3.26 describe recreational landings of sharks by species from 1998 to 2004. SCS comprise the majority of recreationally landed sharks (by number), followed by LCS, and pelagic sharks. The only shark species that these permit holders would be authorized to possess under this alternative suite include: bonnethead, nurse, tiger, great hammerhead, smooth hammerhead, scalloped hammerhead, lemon, Atlantic sharpnose, shortfin mako, common thresher, oceanic whitetip, and blue sharks (Table 4.8). These sharks are easier to identify than other shark species and are less likely to be confused with dusky or sandbar sharks.

Table 4.8 List of recreational sharks that could be harvested under the different alternatives suites.

Species Currently Authorized to be Harvested in Recreational Fisheries (25) *Italicized species would no longer be authorized for retention*	Species Authorized to be Harvested in Recreational Fisheries as Stated in Alternative Suites 2-4 (18)
LCS: *sandbar*, *blacktip, bull*, smooth hammerhead, scalloped hammerhead, great hammerhead, *silky*, spinner, nurse, lemon, and tiger **SCS**: *finetooth*, Atlantic sharpnose, *blacknose*, and bonnethead **Pelagics**: shortfin mako, blue, oceanic whitetip, and *porbeagle*	**No retention of sandbar sharks** **Non-sandbar LCS**: smooth hammerhead, scalloped hammerhead, great hammerhead, nurse, lemon, and tiger **SCS**: Atlantic sharpnose, and bonnethead **Pelagics**: shortfin mako, blue, and oceanic whitetip

Species that were previously authorized, but would no longer be allowed to be possessed in recreational fisheries include: sandbar, bull, blacktip, porbeagle, blacknose, and finetooth sharks. Average landings of sandbar, bull, blacktip, porbeagle, silky, and finetooth sharks from 2002 to 2004 were 5,784, 3,374, 36,625, 0, 3,374, 1,426, and 1,765, respectively. Ecological benefits of no longer allowing these species to be landed are variable depending upon the species. The Agency is most concerned about recreational anglers landing sandbar and dusky sharks. This action would reduce the likelihood that these sharks could be mistakenly identified and then landed. Between 2002 to 2004, there were 5,784 sharks per year of sandbar sharks landed in recreational fisheries per year. Considering the stock status of sandbar sharks, ecological impacts would likely be positive as it would reduce the number of sandbar sharks landed and/or confused with species that look similar. Ecological impacts of prohibiting sandbar sharks would likely be positive for dusky sharks as well because they are frequently mistaken for sandbar sharks. Silky sharks are easily confused with dusky sharks; therefore, prohibiting the retention of silky sharks could result in fewer dusky sharks landed. In addition, NMFS is prohibiting the recreational landing of blacknose sharks depending on the results of the latest SCS assessment. Preliminary results form the SCS Assessment Workshop indicate that this species may be overfished with overfishing occurring. Despite the fact that this alternative suite could result in positive ecological impacts, there would likely continue to be landings of sandbar sharks illegally, and/or some level of post-release mortality for fish that are caught and released. Outreach efforts to provide recreational anglers with updated regulations and tips for proper identification of shark species that are authorized to be possessed may improve compliance with these measures.

4.2.8 Ecological Impacts of Alternative Suite 2 on Protected Resources and EFH

This alternative suite would have positive impacts on protected resources, including sea turtles, marine mammals, and smalltooth sawfish as it is expected to reduce fishing effort with gillnet and BLL gear significantly. The protected resources section of alternative suite 1 and Section 3.4 discuss current interactions with protected resources in the shark BLL and gillnet fisheries. The quotas and retention limits for sandbar and non-sandbar LCS sharks would likely reduce overall fishing effort and the number and duration of trips targeting sharks with BLL and/or gillnet gear. Furthermore, soak time might also be reduced as directed permit holders would know that they would only be allowed to possess 8 sandbar sharks per vessel per trip. Fishing effort would decrease the most in the BLL fishery as this gear is most effective for targeting sandbar and most non-sandbar LCS species. Fishing effort in the gillnet fishery would likely decrease less as this fishery mainly targets small coastal sharks and blacktip sharks. There is the possibility that some of the current fishing effort in the BLL fishery would transfer to the gillnet fishery to target species that have more liberal retention limits (*i.e.*, SCS and blacktip sharks). Furthermore, this alternative suite would limit the participants in the shark fishery to only those who possess a directed shark permit. This would reduce the number of trips setting gillnet or longline gear for sharks, and in turn, reduce the likelihood of an interaction with any protected resources. It is difficult to predict how overall fishing effort in longline and gillnet fisheries would change as a result of this alternative suite.

Ecological impacts to EFH would likely be positive as a result of this alternative suite compared to the status quo given the reduction in BLL effort as a result of reduced shark quotas. BLL gear is generally regarded as the HMS gear type most likely to potentially impact EFH of HMS and/or non-HMS. BLL gear may have some negative impact if gear is set in more complex habitats, such as hard bottom or coral reefs in the Caribbean or areas with gorgonians, or soft corals and sponges in the Gulf of Mexico (Barnette, 2001, NREFHSC, 2002; Morgan and Chuenpagdee, 2003). BLL gear set with cable groundline or heavy monofilament with weights could damage hard or soft corals and potentially become entangled in coral reefs upon retrieval, resulting in coral breakage due to line entanglement. However, the extent to which BLL gear is fished in areas with coral reef habitat targeting sharks has not been determined.

This alternative suite would reduce the number of sets with BLL gear targeting sharks because retention limits for sandbar sharks and non-sandbar LCS would be much less than current retention limits. Furthermore, fishermen might also minimize their soak time or shorten the length of longline they deploy, knowing they could only possess eight sandbar sharks and 21 non-sandbar LCS/trip.

Social and Economic Impacts

4.2.9 Species Complexes

Sandbar sharks

Placing sandbar sharks in their own management category should have neutral economic and social impacts for fishermen. Establishing a separate category for sandbar sharks from the LCS complex is mainly administrative in nature and would affect how the Agency monitors the sandbar shark quota. The establishment of a separate sandbar category would not impact fishermen, as they already record shark interactions to the species level in their logbooks. However, the economic and social impacts of reducing the sandbar quota and retention limits would have significant economic impacts and are discussed in the next section.

Non-sandbar LCS

Establishing a non-sandbar LCS complex should also have neutral economic and social impacts on shark fishermen. The non-sandbar LCS complex is similar to how the LCS complex has been managed in the past. The new complex would be established to help avoid confusion with the past LCS complex. In addition, while the Agency has managed sharks on a complex basis, fishermen have recorded shark interactions on a species basis in the logbooks, so there should be no negative impacts to fishermen by the restructuring of the LCS complex. However, the non-sandbar LCS quota reduction could have negative economic and social impacts. These impacts are discussed in the next section in combination with retention limits.

Porbeagle Sharks

Placing porbeagle sharks on the prohibited list for commercial and recreational fishing would result in no commercial or recreational landings of this species. This would have neutral economic and social impacts. This species is not targeted by U.S. fishermen, and is predominately caught, and discarded alive, in the U.S. swordfish and tuna PLL fishery. In addition, most recreational fishermen target mako, blue, and threshers sharks from the pelagic management unit (Table 3.24), therefore catch and release of porbeagle sharks is not expected to have much, if any, negative economic and social impacts on recreational fishermen. Porbeagle sharks are usually caught in the Northeast Distant area by commercial fishermen and a few recreational catches have been reported from Maine through Virginia (Table 3.26); therefore, fishermen in the North Atlantic would be affected the most by placing porbeagle sharks on the prohibited species list. A more detailed analysis of the economic impacts of establishing a 0 mt dw commercial porbeagle shark quota is discussed in the next section under quota and retention limits.

4.2.10 Quotas and Retention Limits

Alternative suite 2 would only allow sharks to be retained by shark directed permit holders. As of 2007, there were 220 shark directed, 285 shark incidental, 336 shark dealers permit holders. 143 vessels with directed shark permits and 155 vessels with shark incidental permits reported landings in the Coastal Fisheries Logbook from 2003 to 2005 and could be considered active. In addition, shark dealers could also be negatively impacted due to the reduction in the sandbar and other LCS quotas and retention limits, which would reduce the overall amount of sharks being landed.

Alternative suite 2 would also maintain the 60 mt ww (43.2 mt dw) shark display and research quota. However, 2 mt dw would be allocated specifically for sandbar sharks, the remaining 41.2 mt dw would be allocated for all species besides sandbars, and dusky sharks would not be allowed to be collected for display. This is expected to have minimal impacts on collectors of sharks for public display and shark researchers. On average, 2 mt dw of sandbar sharks per year have been collected under the exempted research program from 2000 to 2006. Therefore, there would not be an appreciable decrease in sandbar allocation compared to what was collected in past years. Thus, minimal negative economic impacts are anticipated. Ninety-four dusky sharks have been collected under the exempted fishing program from 2000 to 2006 (or 13 dusky sharks per year). Due to the prohibition of dusky shark collection under alternative suite 2 for public display, this could have a negative economic impact on a few collectors, although the majority of dusky shark collections have been for shark research under EFPs. Collectors and researchers would still have the majority of the shark display and research quota (41.2 mt dw or 57.2 mt ww) available for all non-sandbar LCS beside dusky sharks.

<u>Fishery level impacts</u>

Of all Atlantic HMS, sharks bring in the lowest total gross revenues (in total ~$4.3 million in 2005; Table 3.43). On average, total annual sandbar landings of 1,590,917 lb dw and total annual non-sandbar LCS landings of 1,250,638 lb dw were reported from 2003 to 2005 in the Coastal Fisheries and HMS Logbooks. In 2006 ex-vessel prices, this is equivalent to $3,824,589 (Table 4.9). Under this alternative suite, the commercial quotas would be reduced to 116.6 mt dw and 541.2 mt dw for non-sandbar LCS; however, to balance discards of sandbar sharks in the South Atlantic with uncaught sandbar quota in the Gulf of Mexico, the non-sandbar LCS retention limit was lowered such that only 86.1 mt dw of sandbar sharks and 253.6 of non-sandbar LCS could be landed under alternative 2 (see discussion in Appendix A under "*Non-sandbar quota and retention limits*" and Table 4.2). In 2006 prices, assuming 5 percent of the landings are fins and 95 percent of the landings are carcass weight, this is equivalent to $1,026,032 (Table 4.9). This is a 73-percent reduction compared to the current gross revenues under alternative suite 1 ($3,824,589; Table 4.9).

On average, 1.5 mt dw (3,402 lb dw) of porbeagle sharks were commercially landed between 2002 and 2004 (NMFS, 2006). Based on 2006 ex-vessel prices, this is equivalent to $6,081 fishery-wide (assuming 5 percent of the landings are fins and 95 percent of the landings are carcass weight) (Table 4.9). However, since porbeagle sharks would be placed on the prohibited list under alternative suite 2, there would an estimated reduction in gross revenues of $6,081 to the fishery by prohibiting porbeagle shark landings.

Table 4.9 **Gross revenues under alternative suite 1, status quo. Fin weight was estimated to be 5 percent of total landings. Carcass weight was estimated to be 95 percent of total landings.**

Alternative Suite 1	Landings (lb dw)	2006 Ex-Vessel Price (per lb dw)	Gross Revenues	Total Gross Revenues
Fishery-Wide (directed and incidental permit holders)				
Avg. sandbar shark landings	1,590,917			
Avg. non-sandbar LCS landings	1,250,638			
Sandbar shark fins	79,546	$18.84	$1,498,644	
Sandbar shark carcass	1,511,371	$0.39	$589,435	
				$2,088,079
Non-sandbar LCS fins	62,532	$18.84	$1,178,101	
Non-sandbar LCS carcass	1,188,106	$0.47	$558,410	
				$1,736,511
Total shark fishery				**$3,824,589**
Avg. porbeagle shark landings	3,402			
Porbeagle shark fins	170.1	$18.84	$3,205	
Porbeagle shark carcass	3,232	$0.89	$2,876	
				$6,081
Directed Permit Holders				
Avg. sandbar shark landings	1,571,851			
Avg. non-sandbar LCS landings	1,210,643			
Sandbar shark fins	78,593	$18.84	$1,480,684	
Sandbar shark carcass	1,493,258	$0.39	$582,371	
				$2,063,054
Non-sandbar LCS fins	60,532	$18.84	$1,140,425	
Non-sandbar LCS carcass	1,150,111	$0.47	$540,552	
				$1,680,977
Total revenues from sharks based on directed permit holders' landings				**$3,744,032**
Incidental Permit Holders				
Avg. sandbar shark landings	19,066			
Avg. non-sandbar LCS landings	39,995			
Sandbar shark fins	953	$18.84	$17,960	
Sandbar shark carcass	18,113	$0.39	$7,064	
				$25,024
Non-sandbar LCS fins	2,000	$18.84	$37,675	
Non-sandbar LCS carcass	37,995	$0.47	$17,858	
				$55,533
Total revenues from sharks based on incidental permit holders' landings				**$80,558**

In alternative suite 2, overharvests of quota for each category would be removed from the next season's quota. This is currently done under the status quo; therefore, it is not anticipated to result in any more negative economic impacts than what fishermen currently experience under the status quo regulations. Underharvests for species that are not overfished or are not experiencing overfishing would be capped at 50 percent carryover of the base quota applied to the next season's quota. If the underharvest exceeds 50 percent of the baseline quota, then only 50 percent of the baseline quota could be carried over to the same season of the subsequent year. Currently, all of the underharvest for a given complex has been applied to the next year, same trimester's base quota. This has been most significant for small coastal sharks (SCS), which, on average from 2004 through the first season of 2006, had only had 55 percent of the SCS quota filled. Since nearly full harvests or overharvests have typically occurred for the LCS complex, application of underharvest to LCS base quota to future seasons has not been an issue. The economic impact of reducing the amount of underharvest that could be carried over would depend on the amount of the underharvest, but would most likely have the largest economic effects for SCS. In addition, since there would be no regions or seasons under alternative suite 2, the amount of SCS underharvests expected from a full year of fishing in all regions is unknown at this time.

However, unlike the status quo, underharvests for species that are unknown, overfished, or experiencing overfishing would not be carried over to the same season of the following year, This could have a negative economic impact depending on the quota. For instance, the overfished/overfishing status of sandbar sharks and the unknown status of the LCS complex would preclude any underharvest of the sandbar or non-sandbar LCS quota from being applied to the following season's base quota. However, given the reduced sandbar quota and since the non-sandbar LCS quota is based on current catches of LCS species (except sandbar sharks), underharvests of sandbar sharks or non-sandbar LCS are not anticipated. Therefore, this may not result in negative socioeconomic impacts. In addition, underharvest carry-overs are currently not applied for pelagic sharks. Since the status of all pelagic sharks are either unknown or overfished, this would not change compared to the status quo.

Finally, alternative suite 2 would require that all shark fins (dorsal, second dorsal, pectoral, pelvic, anal, and caudal fins) remain attached to the shark through landing. In the short-term, this alternative could change the foundation of the U.S. Atlantic shark fin market. At this time and since the fishery began in the 1980s, most shark fins sold in the United States are landed separately from the shark. In 1993, shark fins were required to be removed from the vessel at the first port of landing. This prevented fishermen from drying shark fins onboard their vessel over time in order to increase the value of the fin. Under alternative suite 2, shark fishermen would not be allowed to remove the fins from the shark until sharks are landed. Costa Rica has implemented a similar regulation that allows fishermen to cut the fins mostly off the shark, as long as a small piece of skin keeps the fins attached to the shark until landing. According to a discussion on the Elasmo-L listserve, this practice has allowed fishermen to receive the expected revenues from both fins and meat because the fins could be fully removed from the shark at the dock without thawing the shark. However, the removal of fins at the time of offloading could still increase offloading time. The vessel owner/operator would need to decide whether the benefit of selling the fins separately from the shark outweighs the cost of having the crew remove the fins during offloading. While the fins would likely still be of high quality once dried, it is possible that the ex-vessel price of fins packed in ice with the rest of the shark would not be as high as fins that had begun drying. Additionally, if the shark cannot be packed in ice properly due to maintaining the fins on the shark, the quality of the meat, and therefore its value, could also decrease. The social impact of requiring sharks to be landed with their fins on may be realized as the market adjusts itself to processing wet fins. However, the overall socioeconomic impact of this measure could be significant given the reductions in the overall sandbar quota, which is the most lucrative shark due to the value of its fins.

Directed permit holder impacts

On average, directed permit holders landed 1,571,851 lb dw of sandbar sharks and 1,210,643 of non-sandbar LCS from 2003 to 2005 based on data from the Coastal Fisheries and HMS Logbooks. In 2006 ex-vessel prices, this is equivalent to gross revenues of $3,744,032 (assuming 5 percent of the landings are fins and 95 percent of the landings are carcass weight) (Table 4.9). If gross revenues for directed permit holders are averaged across the approximately 143 active directed shark permit holders, then the average annual gross revenues per shark fishing vessel is just over $26,000 from shark revenues. Under alternative suite 2, average annual gross revenues for directed permit holders would be estimated to be $1,026,032 (Table 4.10). This is a 73-percent overall reduction in average annual gross revenues compared to 2003 to 2005 (Table 4.10). These reduced gross revenues averaged across the 143 active directed permit holders are just over $7,000 per directed shark fishing vessel. Since the states of Florida, New Jersey, and North Carolina have the most directed shark permits (Table 3.32), these states would be most negatively impacted by alternative suite 2.

Table 4.10 Gross revenues under alternative suite 2. Fin weight was estimated to be 5 percent of total quota. Carcass weight was estimated to be 95 percent of total quota.

Alternative Suite 2	Quota (mt dw)	Quota (lb dw)	2006 Ex-Vessel Price (per lb dw)	Gross Revenues	Total Gross Revenue	% Reduction from Status Quo
Fishery-Wide & Directed Permit Holder Impacts						
Sandbar shark	86.1	189,816				
Non-sandbar LCS	253.6	559,087				
Sandbar shark fins		9,480	$18.84	$178,599		
Sandbar shark carcass		180,336	$0.39	$70,331		
					$248,930	
Non-sandbar LCS fins		27,998	$18.84	$527,490		
Non-sandbar LCS carcass		531,088	$0.47	$249,611		
					$777,102	
Total revenues from sandbar and non-sandbar LCS landings					**$1,026,032**	**↓73%**
Status quo revenues based on directed & incidental permit holders' landings of sandbar and non-sandbar LCS					$3,824,589	

In addition, retention of sandbar sharks on PLL gear would be prohibited under alternative suite 2. On average, 80,825 lb dw of sandbar sharks were reported landed on PLL gear by directed shark permit holders from 2003 to 2005 (HMS Logbook). In 2006 ex-vessel prices, this is equivalent to $106,802 in gross revenues. Given an average of 16.7 vessels landed sandbar sharks with PLL gear from 2003 to 2005, prohibition of sandbar sharks on PLL gear could result in a loss of gross revenues of $6,395 per vessel ($106,802 / 16.7 vessels = $6,395 per vessel).

Gross revenues under the status quo were based on a 4,000 lb dw LCS trip limit for directed shark permit holders. These revenues were estimated from landings using all gear types, averaged across all regions. Given this, the average number of sandbars and non-sandbar LCS landed per trip was 35 sandbars and 32 non-sandbar LCS averaged as reported in the Coastal Fisheries and HMS Logbooks. Based on 2006 ex-vessel prices, this is equivalent to $3,358 per trip (Table 4.11). However, regional gross revenues may vary based on gear type and catch composition. For instance, regional trip revenue estimates were made based on species catch composition from the BLL observer program data (Hale and Carlson, 2007). These estimates were made because BLL trips targeting sharks can have very different species catch compositions than gillnet or rod and reel trips, and the species catch composition may also vary from region to region. Therefore, gross revenues and economic impact to fishermen may vary, depending on the gear type employed and area fished. Observer data indicate that between 2005 and 2006, 69 sandbar sharks and 35 non-sandbar LCS were caught per trip in the South Atlantic region, and 30 sandbar sharks and 83 non-sandbar LCS were caught per trip in the Gulf of Mexico region (Hale and Carlson, 2007). Therefore, based on these numbers and 2006 ex-vessel prices, South Atlantic trips averaged $4,743 per trip and Gulf of Mexico trips averaged $5,853 per trip (Table 4.11) (whereas the overall averaged gross revenues for directed shark permit holders was estimated as $3,358 per trip; Table 4.11).

Table 4.11 Gross revenues on a trip basis in the South Atlantic (SA) and Gulf of Mexico (GOM) under alternative suite 1, status quo.

Alternative Suite 1	Average Number of Sandbars	Average Number of Trips	Landings (lb dw)*	Fin Weight (5% of landings per trip)	Fin 2006 Ex-Vessel Price (lb dw)	Fin Revenues Per Trip	Carcass Weight (95% of landings per trip)	Carcass 2006 Ex-Vessel Price (lb dw)	Carcass Revenues Per Trip	Total Gross Revenues Per Trip
Trips by Directed Permit Holders										
Avg. sandbar sharks per trip	35	1,108	1,416	71	$18.84	$1,335	1,347	$0.39	$525	$1,860
Avg. non-sandbar LCS per trip	32	1,108	1,078	54	$18.84	$1,016	1,024	$0.47	$482	$1,497
Trip total revenues from sharks										**$3,358**
Trips by Incidental Permit Holders										
Avg. sandbar sharks per trip	2	305	81	4	$18.84	$77	77	$0.39	$30	$107
Avg. non-sandbar LCS per trip	3	347	101	5	$18.84	$96	96	$0.47	$45	$141
Trip total revenues from sharks										**$248**
Regionally based BLL trips (Directed Permit Holders)										
Avg. sandbar sharks per trip in SA	69		2,795	140	$16.20	$2,264	2,655	$0.38	$1,009	$3,272
Avg. sandbar sharks per trip in GOM	30		1,215	61	$20.65	$1,255	1,154	$0.40	$462	$1,716
Avg. non-sandbar LCS per trip in SA	35		1,180	59	$16.20	$955	1,121	$0.46	$515	$1,471
Avg. non-sandbar LCS per trip in GOM	83		2,797	140	$20.65	$2,888	2,657	$0.47	$1,249	$4,137
Total SA trip revenues from sharks										**$4,743**

Alternative Suite 1	Average Number of Sandbars	Average Number of Trips	Landings (lb dw)*	Fin Weight (5% of landings per trip)	Fin 2006 Ex-Vessel Price (lb dw)	Fin Revenues Per Trip	Carcass Weight (95% of landings per trip)	Carcass 2006 Ex-Vessel Price (lb dw)	Carcass Revenues Per Trip	Total Gross Revenues Per Trip
Total GOM trip revenues from sharks										**$5,853**

*Average sandbar shark weight = 40.5 lb dw and average non-sandbar LCS weight = 33.7 lb dw (Cortes and Neer, 2005).

Under alternative suite 2, the retention limits are 8 sandbars per trip and 21 non-sandbar LCS per trip. Non-sandbar LCS retention limits are based on the average ratio of sandbars to non-sandbar LCS caught in the South Atlantic and Gulf of Mexico regions to limit sandbar shark discards by fishermen deploying non-selective gear (Hale and Carlson, 2007). In the Gulf of Mexico, the ratio of sandbars to other LCS caught is 1:4 which, based on an 8 sandbar per trip retention limit, would equal 32 non-sandbar LCS per trip. However, such a high non-sandbar LCS retention limit would result in a sandbar discards in the South Atlantic (~65.3 mt dw). Therefore, a 21 non-sandbar LCS per trip retention limit was set to balance discards versus catch in the two regions (see Table A.4). This results in approximately 5 sandbar sharks being caught in the Gulf of Mexico region when the non-sandbar LCS retention limit per trip is filled (and therefore, only 86.1 mt dw of sandbar sharks would be landed). Therefore, gross revenues on a trip basis are estimated to be $1,262 of gross revenue per trip in the South Atlantic and $1,333 of gross revenue per trip in the Gulf of Mexico (Table 4.12). Thus, alternative suite 2 could result in a 73-percent reduction in gross revenues for fishermen using BLL gear in the South Atlantic and a 77-percent reduction in gross revenues for fishermen using BLL gear in the Gulf of Mexico. Overall, from 2003 to 2005, there were 124 vessels that averaged more than 324 lb dw (or 8 sandbar sharks) of sandbar per trip (Figure A.3). It is estimated that these vessels would be most negatively affected by retention limits under alternative suite 2.

Table 4.12 Gross revenues on a trip basis in the South Atlantic (SA) and Gulf of Mexico (GOM) under alternative suite 2.

Alternative Suite 2	Number of sandbars	Landings (lb dw)*	Fin Weight (5% of landings per trip)	Fin 2006 ex-vessel price (lb dw)	Fin Revenues	Carcass Weight (95% of landings per trip)	Carcass 2006 Ex-Vessel Price (lb dw)	Carcass Revenues	Total Gross Revenues
Regionally based BLL trips									
Total sandbar sharks per trip in SA	8	324	16	$16.20	262	308	$0.38	$117	$379
Total sandbar sharks per trip in GOM	5	203	10	$20.65	209	192	$0.40	$77	$286
Total non-sandbar LCS per trip in SA	21	708	35	$16.20	573	672	$0.46	$309	$883
Total non-sandbar LCS per trip in GOM	21	708	35	$20.65	731	672	$0.47	$316	$1,047
SA trip total revenues from sharks									**$1,262**
GOM trip total revenues from sharks									**$1,333**

*Average sandbar shark weight = 40.5 lb dw and average non-sandbar LCS weight = 33.7 lb dw (Cortes and Neer, 2005).

Incidental permit holder impacts

On average, 66 incidental permit holders landed 19,066 lb dw per year of sandbar sharks and 39,995 lb dw per year of non-sandbar LCS from 2003 to 2005 in the Coastal Fisheries and HMS Logbooks. Using 2006 ex-vessel prices, this is equivalent to gross revenues of $80,558 (assuming 5 percent of the landings are fins and 95 percent of the landings are carcass weight) (Table 4.9). Gross revenues averaged across the 66 vessels with incidental permits landing sharks were just over $1,221 per vessel. Since incidental permit holders would not be able to land any sharks under alternative suite 2, the 66 active vessels would be most negatively affected by this alternative suite. The states of Florida, Louisiana, New Jersey, and North Carolina had the most incidental shark permit holders as of 2007 (144, 37, 20, and 16, respectively; Table 3.32); therefore, these states would be most negatively impacted by alternative suite 2.

4.2.11 Time/Area Closures

Under alternative suite 2, NMFS would maintain the mid-Atlantic shark closed area and the current BLL closures in the Caribbean that were implemented in February 2007 (72 FR 5633). Therefore, the economic impacts associated with the closures would be the same as described under alternative suite 1.

However, under alternative suite 2, NMFS would consider implementing the SAFMC MPAs. Based on observer program data, the number of sets and targeted catch in the preferred MPAs is considered to be minimal. The preferred MPAs are generally small (< 10 miles wide) and vessels should be able to make minor adjustments to fishing locations to avoid the MPAs. Most of the observed shark BLL sets occurred shoreward of the MPAs. Affected vessels would forego some loss of revenue from the reduced bycatch of grouper and other species caught on shark BLL sets in the proposed MPAs, however, these losses are expected to be minimal. Based on the expanded catch estimates (Siegfried et al. 2006b), the total shark catches for the proposed MPAs were 25,395 and this equates to approximately $1,060,083 in gross revenues on shark landings based on 2006 ex-vessel prices for shark (assuming 5 percent of the landings are fins and 95 percent of the landings are carcass weight) (Table 3.41 in Chapter 3). However, this may be an overestimate if all the catches did not occur in the MPAs. Since there are approximately 285 number of shark limited access permits in Florida, this would amount to a loss of revenue of approximately $3,722 per vessel per year in Florida.

4.2.12 Reporting

Reporting burden would be increased significantly for Atlantic shark dealers as a result of this alternative suite resulting in negative economic impacts. Currently, shark dealer reports must be submitted bimonthly, regardless of whether or not the dealer actually purchased any shark products. Reporting frequency would be increased to 24 hours of when shark products were purchased. Thus, dealer landings reports would need to be received within 24 hours of the product being purchased. While the increased reporting burden would not impact shark dealer expenditures per se, it would result in more time spent submitting dealer reports, which represents an opportunity cost for dealers since that would be time they could not spend conducting other activities related to their business. Furthermore, in order to comply with the requirement that dealer reports must be *received* by the Agency within 24 hours, it is assumed that dealers would have to submit dealer reports electronically or via facsimile. Dealers that do not currently possess a computer or fax machine would have to purchase one of these items. The increased reporting burden implemented in this alternative suite would be subject to approval under the Paperwork Reduction Act. Reporting requirements for shark vessel permit holders, including the need to take an observer if selected and the need to submit vessel logbooks within seven days of completing a fishing trip would not be modified, resulting in neutral economic impacts.

Alternative suites 2 through 4 would modify the procedure for accounting for sharks that are reported by dealers as unclassified or unidentified. Currently, these sharks are counted against the LCS quota. This would be modified such that these sharks would be classified as sandbar sharks. As a result of the proposed measures, sandbar sharks would have the lowest commercial quota. However, sandbar sharks have the highest commercial value of any Atlantic shark because of their fin. This requirement will improve the accuracy of dealer reports and number of dealer reports that include species-specific information on all sharks that are purchased. These data form the basis of quota monitoring and stock assessments. Furthermore, if shark dealers are provided with an incentive to mis-identify the species of shark being purchased in order to keep the sandbar shark season open longer, this may result in overharvests. While the short-term impacts of this measure may be negative because it requires more of the dealer's time to properly identify sharks, long-term effects may be positive. Potential overharvests or inappropriately short seasons coupled with potentially inaccurate stock assessments results could occur as a result of mis-identified or unidentified landings included in dealer reports. This measure coupled with mandatory shark identification workshops for shark dealers and the proposed requirement for fishermen to leave all shark fins could improve the accuracy of shark dealer reports.

4.2.13 Seasons

Coupled with the measures included under regions (Section 4.2.5), this alternative suite would likely have negative economic impacts on vessels and dealers in the North Atlantic. Opening seasons on the effective date of this amendment in 2008 in all regions and then on January 1 in 2009 and thereafter, depending on available quota, would provide an advantage to vessels participating in shark fisheries in the South Atlantic and Gulf of Mexico regions as these regions have a wider variety of LCS and SCS sharks present year-round. Participants in the North Atlantic region could experience negative impacts relative to the status quo as they would likely not be able to fish for sharks starting January 1, unless they moved to fish in another region; historically, these participants have only had significant landings of LCS and pelagic sharks. Furthermore, closing both the sandbar and non-sandbar LCS fisheries, regardless of which quota is filled first, to minimize bycatch and dead discards of sandbar sharks could exacerbate the negative economic impacts in all regions. Landings in the North Atlantic regions have averaged 62.3 mt dw per year for LCS (including sandbar sharks) between 2004 and 2006. The majority of these LCS were landed between April and June in the North Atlantic region. Assuming that the entire quota is filled, and seasons for sandbar and non-sandbar LCS are closed before April, this could result in losses in gross revenues of approximately \$32,963 for vessels in the North Atlantic, based on 2005 ex-vessel prices (LCS = \$0.24 per lb dw in the North Atlantic; \$0.24 lb dw x 137,346.6 lb dw = \$32,963; no price information is available for fins in the North

Atlantic; Table 3.42). There are 107 directed and incidental shark permit holders in the states that comprise the North Atlantic region; therefore, losses are anticipated to be around $308 in gross revenues per vessel ($32,963 total gross revenues / 107 vessels = $308 per vessel). However, depending on their past involvement in the shark fishery, economic impacts to individual vessel owners would vary.

Vessels and dealers in the South Atlantic and Gulf of Mexico regions would experience a comparative advantage over vessels in the North Atlantic, however, reduced quotas and retention limits for sandbar sharks and non-sandbar LCS sharks would result in negative economic impacts for vessels and dealers in all locales. There is a possibility that the reduced retention limits for sandbar and non-sandbar LCS sharks, coupled with the increased reporting frequency for dealers may result in minor positive economic impacts by keeping shark fishing seasons for LCS and sandbar sharks open for an extended portion of the year. In 2006, shark seasons for LCS were open a total of 4, 19, and 18 weeks in the North Atlantic, South Atlantic, and Gulf of Mexico, respectively. The first trimester was excluded from the North Atlantic calculation as landings for LCS are almost zero during these months (January – April). In 2007, shark seasons for LCS were 3, 4, and 5 weeks for the North Atlantic, South Atlantic, and Gulf of Mexico, respectively. Extensive over harvests in 2006 were responsible for short seasons in 2007. This alternative suite may result in longer shark seasons, which could have some minor economic impacts as it may provide for a longer portion of the year when vessels could land and sell shark products.

As mentioned in Section 4.2.5, the Agency anticipates that providing five days notice once 80 percent of the quota has been harvested would reduce the likelihood of an overharvest and provide a buffer for landings that may occur outside of NMFS jurisdiction after a season has closed. Further, this would implement necessary accountability measures under the Magnuson-Stevens Act. However, the Agency is seeking specific comments on the potential economic impacts of choosing 80 percent as the threshold to close a specific shark fishery with five days notice.

4.2.14 Regions

As stated in Section 4.2.4, this alternative suite would likely have negative economic impacts on regions that do not have sharks present year round. The North Atlantic region would be disadvantaged as a result of reverting back to one region, versus three, because the quota would likely be harvested in southern regions before sharks are present in the North Atlantic. Vessels could either move to southern areas to participate in the shark fishery in areas where sharks are present year-round or redistribute fishing effort to other fisheries. Dealers in the North Atlantic region would also be affected, possibly even more so than vessel owners, as the likelihood of having a consistent and predictable source of shark products would be decreased.

4.2.15 Recreational Measures

Participants in recreational shark fisheries would experience negative economic impacts as a result of reducing the species of sharks that could be legally landed (Table 4.8). Charter/Headboat operators would be most affected as a result of these measures as they may see a reduction in the number of charters that customers are willing to hire. Since retention of blacktip sharks would be prohibited in the recreational fishery, these impacts may be most pronounced in areas where blacktip sharks are frequently encountered, including the South Atlantic and Gulf of Mexico regions. Recreational landings data indicates that there are more landings of blacktip sharks than any other species that could no longer be possessed as a result of this alternative suite. It is presumed that blacktip sharks are kept more than any other LCS because of the higher quality of their flesh and the fact that they are more abundant than other LCS in coastal waters. Charter/Headboat operators specializing in sharks may see the number of charters decline because some fishermen insist on keeping a blacktip or sandbar sharks. Prohibiting the other species (finetooth, silky, bull, blacknose, and porbeagle) is not expected to have adverse impacts as these species are not as frequently encountered in recreational fisheries for sharks.

Tournaments offering prize categories for sharks may also experience negative economic impacts as a result of prohibiting six additional species of sharks for retention in recreational fisheries. The majority of tournaments specializing in sharks are in the North Atlantic region, specifically Rhode Island, New York, and Massachusetts. In 2005 and 2006, there were 60 tournaments/year with prize categories for pelagic sharks. Species most commonly targeted in these tournaments including common thresher, oceanic whitetip, blue, shortfin mako, and porbeagle. Of these, only porbeagle would be prohibited from retention as stocks are overfished. Tournaments are generally won by shortfin mako or common thresher, therefore, significant economic impacts as a result of prohibiting porbeagle retention in shark fishing tournaments are not anticipated.

Conclusions

This alternative suite could have positive ecological impacts for most species of sharks, bycatch, and protected resources as a result of significantly reduced retention limits and quotas for sandbar sharks and reduced retention limits for non-sandbar LCS. Interactions with protected resources may decrease as a result of reduced BLL and gillnet fishing effort targeting sharks; however, it is assumed that some of this fishing effort would be displaced to other gillnet and BLL fisheries in which participants are permitted, which may interact with protected resources. In addition, alternative suite 2 would require that sharks be landed with their fins still attached; this requirement could prevent fishermen from keeping the fins from sharks that are not landed, resulting in a reduction of overall shark mortality. This, combined with a retention limit of only 8 sandbar sharks for directed permit holders, would likely considerably reduce directed fishing effort for sharks.

The shark fishery for incidental permit holders would be closed; therefore, sharks caught in pursuit of other species with BLL gear or gillnet gear by incidental permit holders would be discarded, possibly dead. This is particularly true for sandbar shark discards based on how retention limits for sandbar and non-sandbar LCS would be established (see Section 4.2.2). However, despite the possible increase in discards of sharks, the reduced fishing effort and landings could still result in positive ecological impacts for sandbar and dusky shark (see Section 4.2.2). In addition, this suite represents an increase in reporting burden for shark dealers (24 hours versus bimonthly reporting) that would result in negative economic impacts but positive ecological impacts as it would enable the Agency to better monitor shark quotas, reducing the likelihood of overharvest. Under alternative suite 2 NMFS would maintain the current time/area closures and implement eight MPAs that are being preferred in the SAFMC's Amendment 14A. NMFS proposed these MPAs due to enforceability issues where the gears for different fisheries (*i.e.*, shark BLL gear and snapper/grouper BLL gear) are virtually indistinguishable, and many fishermen hold both types of permits. Therefore, prohibiting only one type of gear could create an enforcement loophole.

Directed shark permit holders would have a slightly higher retention limit for sandbar and non-sandbar LCS compared to alternative suites 3 and 5; however, economic benefits derived from shark products would be limited to directed permit holders and would still represent an estimated 73-percent reduction in gross revenues compared to the status quo (Table 4.10). These losses in gross revenues may be exacerbated by the requirement to land shark with their fins attached. In addition, eliminating regions and seasons represents an economic disadvantage to the North Atlantic region as sharks are not present in these waters year-round, meaning the quota may be caught in some years before sharks are present in these areas. The elimination of seasons and regions combined with limiting underharvest carry-overs may have negative economic impacts on fishermen, especially for regions that consistently had underharvests of species like SCS. Given the lowered retention limits for sandbar and non-sandbar LCS, it is anticipated that there may not be a directed shark fishery as a result of alternative suite 2. While an observer program would still operate under alternative suite 2, without a directed shark fishery, it is anticipated that the fishery dependent data collection would be limited, which could compromise data collection for future stock assessments. Alternative suite 4 would accomplish reduced quotas and retention limits to rebuild depleted shark stocks as well as the collection of fishery-dependent data for future stock assessments and biological samples for shark research. In addition, it would afford a small universe of shark fishermen to continue to fish and make gross revenues on shark landings as they have in the past. Therefore, this alternative suite is not preferred because concerns of data collection, economic impacts to shark fishermen, and because of additional reporting burden on shark dealers.

4.3 Alternative Suite 3: Shark Fishery for Directed, Incidental, HMS Angling, and HMS Charter/Headboat Permit Holders

Overall Summary

Under alternative suite 3, NMFS would remove the sandbar shark from the LCS complex and establish a separate sandbar shark quota and a non-sandbar LCS quota (LCS complex minus sandbar sharks). Overharvests would be removed from the next season's quota. Underharvests for species that are healthy or rebuilt would be transferred to the next season's quota, up to 50 percent of the base quota. For species/complexes that are unknown, overfished, or experiencing overfishing, underharvests would not be transferred to the next season's quota. Quotas would be as follows: Sandbar = 116.6 mt dw; non-sandbar LCS = 541.2 mt dw; SCS = 454 mt dw; Blue Sharks = 273 mt dw; Pelagic Sharks (Other than Blue Sharks) = 488 mt dw; Porbeagle Sharks = Prohibited (0 mt dw quota); and Display and Scientific Research = 60 mt ww (Sandbar = 2.8 mt ww (2 mt dw); and all other shark species (except dusky sharks) = 57.2 mt ww (41.2 mt dw).

The existing BLL and PLL time/area closures, including the Caribbean BLL closures for EFH, would remain in place. In addition, NMFS would implement the 8 MPAs off South Carolina to Florida as requested by the SAFMC. Retention limits would be as follows: 4 sandbar per vessel per trip and 10 non-sandbar LCS per vessel per trip for directed and incidental permit holders; no retention limit for SCS and pelagic sharks (except porbeagle sharks) for directed permit holders; 16 SCS and pelagic sharks (except porbeagle sharks) combined for incidental permit holders; no retention of porbeagle sharks by commercial or recreational fishermen; and all sharks landed with fins attached.

Dealer reports must be received by NMFS within 14 days, and logbook and observer requirements would be maintained. In addition, all unclassified sharks reported would be categorized as sandbar sharks. There would be one season starting on January 1 of each year and one region. The sandbar and non-sandbar LCS fishery would close when landings of either reach 80 percent of the available quota with a five day notice, and SCS and pelagic shark fisheries would close when SCS and pelagic shark landings reach 80 percent of their respective quotas. Finally, recreational fishermen could land bonnethead, nurse, tiger, lemon, hammerheads, Atlantic sharpnose, shortfin mako, common thresher, oceanic whitetip, and blue sharks. The recreational possession limit would be 1 shark > 54" per vessel per trip, and 1 Atlantic sharpnose and 1 bonnethead per person per trip with no minimum size requirements.

Ecological Impacts

4.3.1 Quotas/Species Complexes

As with alternative suite 2, overharvests of quota for each category would be removed from the next season's quota. Underharvests for species that are not overfished or are not experiencing overfishing would be capped at 50 percent carryover of the base quota applied to the next season's quota. However, underharvests for species that are unknown, overfished, or experiencing overfishing would not be carried over to the next season's quota. This is anticipated to have positive ecological impacts for species that are not overfished and no overfishing is occurring by preventing stockpiling of quota. This would also have positive ecological impacts for species that are unknown, overfished, or experiencing overfishing by allowing these stocks to rebuild at a faster rate.

Species complexes

Under alternative suite 3, NMFS would structure quotas and species complexes as they are outlined for alternative suite 2. Therefore, the ecological impacts associated with the species complexes would be the same as described in alternative suite 2. A more detailed analysis of the ecological impacts of the quotas under alternative suite 3 is outlined in the next section under retention limits.

Exempted fishing program

Finally, as with alternative suite 2, alternative suite 3 would partition the 60 mt ww (43.2 mt dw) quota for exempted fishing permits, display permits, scientific research permits, and letters of acknowledgement to place more stringent limits on the quantity of sandbar and dusky sharks authorized for these purposes. Therefore, the ecological impacts of the 60 mt ww quota for exempted fishing permits would have the same ecological impacts as outlined under alternative suite 2.

4.3.2 Retention Limits

Fishery-wide landings

As with alternative suite 2, alternative suite 3 would require that shark fins remain attached to the shark until the first port of landing. The fins could be removed either by the fisherman or the dealer after landing. The shark could still be headed, gutted, and bled while at sea. To ensure the sharks are stored in a manner that would maximize the value and quality of the sharks, the fins could be sliced as long as they are not removed completely from the shark (*i.e.*, they could remain attached to the shark via a small amount of uncut skin). This would result in less of a chance of misidentifying the shark or the fins, which would help with species-specific reporting by fishermen and dealers and improve data for future stock assessments. Additionally, because fishermen would no longer be able to bypass the regulations by keeping the fins of shark that are not landed, fishing mortality of sharks overall could be reduced. This would help with the rebuilding of overfished species of sharks, such as sandbar sharks.

Overall commercial quotas under alternative suite 3 would be reduced to 116.6 mt dw and 541.2 mt dw for sandbar and non-sandbar LCS (see Appendix A and Tables A.1 and A.3). However, to balance discards of sandbar sharks in the South Atlantic with uncaught sandbar quota in the Gulf of Mexico, the non-sandbar LCS retention limit was lowered such that only 105.9 mt dw of sandbar sharks and 229.2 mt dw of non-sandbar LCS would potentially be landed under alternative suite 3 (see discussion below and in Appendix A under "*Non-sandbar quota and retention limits"* and Tables A.4 and Table 4.2). These landings (105.9 mt dw of sandbar sharks and 229.2 mt dw non-sandbar LCS; Table 4.13) would be spread out over directed and incidental permit holders' past effort or a total of 1,143 trips (Table A.2). Based on this past effort, it was assumed 1,108 trips would be made by directed permit holders (see Table A.2; 790 trips+80 trips+237.7 trips = 1,108 trips). This directed fishing effort of 1,108 trips is 78 percent of the total expected fishing effort (*i.e.*, 1,108 trips / 1,143 trips = 78 percent; Table 4.14). Based on this estimated effort, it is anticipated that approximately 83 mt dw (183,073 lb dw) of sandbar sharks (78 percent x 105.9 mt dw = 83 mt dw) and 180 mt dw (396,225 lb dw) of the non-sandbar LCS (78 percent x 229.2 mt dw = 180 mt dw) would be landed by directed permit holders (Table 4.2 and Table 4.14). Based on the status quo, this is an 88-percent reduction in sandbar landings and a 67-percent reduction in non-sandbar LCS landings for directed permit holders (Table 4.9).

Similarly, based on past effort, it was assumed 305 trips could be made by incidental permit holders (see Table A.2; 49.7 trips + 255.3 trips = 305 trips). This is 22 percent of the expected fishing effort (305 trips / 1,413 trips = 22 percent; Table A.2 and Table 4.14). Based on this estimate effort, it is anticipated that approximately 23 mt dw (50,395 lb dw) of sandbar sharks (22 percent x 105.9 mt dw = 23 mt dw) and 50 mt dw (109,069 lb dw) of the non-sandbar LCS (22 percent x 229.2 mt dw = 50 mt dw) would be landed by incidental permit holders (Table 4.2 and Table 4.14). This equates to almost three times more landings of sandbar sharks and non-sandbar LCS for incidental permit holders than what is landed under the status quo (Table 4.2). Despite this increase for incidental permit holder, total sandbar landings of 105.9 mt dw would be an 85-percent reduction in landings for sandbar sharks fishery-wide compared to the status quo (Table 4.2). Total 229.2 mt dw non-sandbar LCS landings would be a 61-percent reduction in landings for non-sandbar LCS fishery-wide compared to the status quo (see Table 4.2).

Table 4.13 Gross revenues under alternative suite 3. Fin weight was estimated to be 5 percent of total quota. Carcass weight was estimated to be 95 percent of total quota.

Alternative Suite 3	Quota (mt dw)	Quota (lb dw)	2006 ex-vessel price (per lb dw)	Gross Revenues	Total Gross Revenue	% Reduction from Status Quo
Fishery-Wide Impacts						
Sandbar shark	105.9	233,467				
Non-sandbar LCS	229.2	505,294				
Sandbar shark fins		11,673	$18.84	$219,926		
Sandbar shark carcass		221,794	$0.39	$86,500		
					$306,426	
Non-sandbar LCS fins		25,265	$18.84	$475,987		
Non-sandbar LCS carcass		480,030	$0.47	$225,614		
					$701,601	
Total revenues from sandbar and non-sandbar LCS landings					**$1,008,027**	**↓74%**
Status quo revenues based on directed & incidental permit holders' landings of sandbar and non-sandbar LCS					$3,824,589	

Table 4.14 Gross revenues for directed and incidental permit holders under alternative suite 3.

Alternative Suite 3	Predicted # of Trips	Trip Limit	Quota (lb dw)	Total Trips (directed and incidental permit holder trips)	% of Fishing Effort	Amount of Quota (lb dw) (Quota x % of Fishing Effort)	Fin Weight (5% of landings per trip)	Fin 2006 ex-vessel price (lb dw)	Fin Revenues	Carcass Weight (95% of landings per trip)	Carcass 2006 ex-vessel price (lb dw)	Carcass Revenues	Total Gross Revenues
Impacts On Directed Permit Holders													
Sandbar sharks	1,108	4	233,467	1,143	78%	183,073 (83 mt dw)	9,154	$18.94	$173,370	173,919	$0.39	$67,828	$241,198
Non-sandbar LCS	1,108	10	505,294	1,143	78%	396,225 (180 mt dw)	19,811	$18.94	$375,225	376,414	$0.47	$176,915	$552,140
Total revenues from sandbar and non-sandbar LCS landings													**$793,338**
Status quo revenues based on directed permit holders' landings of sandbar and non-sandbar LCS													$3,744,032
Impacts On Incidental Permit Holders													
Sandbar sharks	305	4	233,467	1,413	22%	50,395 (23 mt dw)	2,520	$18.94	$47,724	47,875	$0.39	$18,671	$66,395
Non-sandbar LCS	305	10	505,294	1,413	22%	109,069 (50 mt dw)	5,453	$18.94	$103,289	103,616	$0.47	$48,699	$151,988

Alternative Suite 3	Predicted # of Trips	Trip Limit	Quota (lb dw)	Total Trips (directed and incidental permit holder trips)	% of Fishing Effort	Amount of Quota (lb dw) (Quota x % of Fishing Effort)	Fin Weight (5% of landings per trip)	Fin 2006 ex-vessel price (lb dw)	Fin Revenues	Carcass Weight (95% of landings per trip)	Carcass 2006 ex-vessel price (lb dw)	Carcass Revenues	Total Gross Revenues
Total revenues from sandbar and non-sandbar LCS landings													**$218,383**
Status quo revenues based on incidental permit holders' landings of sandbar and non-sandbar LCS													$80,558

Landings on a trip basis

The retention limits for alternative suite 3 would be 4 sandbar sharks per vessel per trip (compared to 8 under alternative suite 2) and 10 non-sandbar LCS per vessel per trip (compared to 21 under alternative suite 2) for directed and incidental shark permit holders. Thus, under alternative suite 3, retention limits for sandbar sharks and non-sandbar sharks would be the same for directed and incidental permit holders (see below and Appendix A). Given the reduction in sandbar shark quota and for ease of enforcement, NMFS has removed the distinction between the two classes of permits in terms of sandbar and non-sandbar LCS under alternative suite 3. In addition, the status quo retention limits for SCS and pelagic sharks would still apply (*i.e.*, no trip limit for directed shark permit holders; 16 SCS and pelagic sharks combined for incidental permit holders). Currently, there is a 4,000 lb dw LCS trip limit for directed shark permit holders and 5 LCS trip limit for incidental permit holders. The average number of sandbars and non-sandbar LCS landed per trip for directed permit holders was 35 sandbars and 32 non-sandbar LCS and 2 sandbar sharks and 3 non-sandbar LCS for incidental permit holders from 2003 to 2005 (Table 4.11). Therefore, the retention limits under alternative suite 3 would be a 91-percent reduction for sandbar sharks and a 69-percent reduction in non-sandbar LCS for directed permit holders. However, for incidental permit holders, the retention limits of 4 sandbar sharks and 10 non-sandbar sharks would represent an increase compared to what is landed in the incidental fishery under the status quo. For sandbar sharks, the proposed retention limits would represent twice as many sandbar sharks than what is landed under the status quo (*i.e.*, 2 sandbar sharks per trip) and approximately 3 times as many non-sandbar LCS than what is landed under the status quo (*i.e.*, 3 non-sandbar LCS per trip).

However, catch composition of sandbar sharks and non-sandbar LCS differed for BLL trips that directed on sharks (Hale and Carlson, 2007). Based on BLL observer program data, on average, 69 sandbar sharks and 35 non-sandbar LCS were caught in the South Atlantic region and 30 sandbar sharks and 83 non-sandbar LCS in the Gulf of Mexico region per trip (Hale and Carlson, 2007; Table 4.11). Therefore, depending on the region and gear used, the retention limit in alternative suite 3 could result in an 84 to 97-percent reduction in sandbars kept and a 71 to 90-percent reduction in non-sandbar LCS kept on a per trip basis.

Sandbar and non-Sandbar LCS discards

The reduction in landings must also be balanced by any potential increase in discards. As with alternative suite 2, in order to reduce the number of sandbar discards that would occur as fishermen fulfill their non-sandbar LCS retention limit, NMFS based the retention limit of non-sandbar LCS on an average ratio of sandbars to non-sandbar LCS caught in the South Atlantic and Gulf of Mexico regions (1:2.7; Table A.4). In doing so, NMFS set a retention limit (10 non-sandbar LCS per trip; Table A.4) that minimized the sandbar discards that would occur in the South Atlantic region while maximizing the sandbar landings in the Gulf of Mexico region (since the sandbar to non-sandbar LCS ratio is higher in the Gulf of Mexico region than in the South Atlantic region, no sandbar discards are expected in the Gulf of Mexico region given the non-sandbar LCS retention limit).

For instance, the catch ratio of sandbars to non-sandbar LCS in the Gulf of Mexico region is 1:4. A non-sandbar LCS retention limit based on this ratio would result in a 16 non-sandbar LCS retention limit with a 4 sandbar shark retention limit per trip (4 sandbars x 4 = 16 non-sandbar LCS). However, given the 1:1.4 ratio in the South Atlantic, a 4 sandbar shark retention limit per trip would equal a 6 non-sandbar LCS retention limit in the South Atlantic region (4 sandbar sharks x 1.4 = 5.6 non-sandbar LCS). Therefore, setting one retention limit based on the Gulf of Mexico's catch ratio would result in excessive sandbar sharks discards in the South Atlantic region.

To determine the number of sandbar discards that would occur in the South Atlantic with a non-sandbar LCS retention limit based on the Gulf of Mexico catch composition, NMFS first determined the difference in the retention limits for non-sandbar LCS based on the respective ratios in the two regions. It should be noted that setting a non-sandbar LCS retention limit using the South Atlantic ratio would result in no sandbar discards; any non-sandbar LCS retention limit above that threshold (*i.e.*, above the sandbar shark x 1.4 threshold) would result in sandbar discards, but the number of discards would depend on the difference between the two retention limits divided by the South Atlantic's non-sandbar LCS ratio to sandbar sharks (*i.e.*, 1.4):

- Gulf of Mexico non-sandbar LCS retention limit = 4 sandbars x 4 = 16 non-sandbar LCS
- South Atlantic non-sandbar LCS retention limit = 4 sandbar sharks x 1.4 = 5.6 non-sandbar LCS (or 6 non-sandbar LCS)
- 16 non-sandbar LCS retention limit based on Gulf of Mexico 1:4 ratio - 6 non-sandbar LCS retention limit based on South Atlantic 1:1.4 ratio = 10 non-sandbar LCS;
- 10 non-sandbar LCS /1.4 = 7 sandbar sharks discarded per trip;
- 7 sandbar sharks x 290 South Atlantic trips = 2,071 sandbar sharks discarded in the South Atlantic; and
- 2,071 sandbar sharks x 40.5 lb dw [average commercial sandbar weight] = 83,875.5 lb dw or 38 mt dw.

Therefore, setting a non-sandbar LCS retention limit in the South Atlantic based on the Gulf of Mexico's catch ratio could result in approximately 38 mt dw of sandbar shark discards. These discards would occur as fishermen meet their sandbar retention limit but continue to fish to fulfill their non-sandbar LCS retention limit in the South Atlantic.

An alternate approach would be to implement a non-sandbar LCS retention limit based on the South Atlantic catch composition. However, this would translate into approximately only 163.2 mt dw of the 541.2 mt dw of the non-sandbar LCS being harvested (116.6 mt dw sandbar quota x 1.4 = 163.2 mt dw). Another alternative would be to set separate retention limits for the Atlantic and Gulf of Mexico regions. However, as discussed in the Region section below (Section 4.3.6), under alternative 3, NMFS would only implement one region due to reduced quotas and to simplify quota monitoring. In addition, there could be difficulty in enforcing different regional retention limits. Therefore, NMFS would establish one retention limit that is applied everywhere. To balance the harvest of as much of the non-sandbar LCS quota as possible while limiting sandbar shark discards, NMFS chose to establish non-sandbar LCS retention limits based on an average regional catch composition.

However, basing the non-sandbar LCS retention limit on the average regional catch composition still results in a non-sandbar LCS retention limit under alternative suite 3 (10 non-sandbar LCS per trip) that is higher than the sandbars to non-sandbar LCS ratio for the South Atlantic (6 non-sandbar LCS per trip), which could result in sandbar shark discards in the South Atlantic (~15.4 mt dw; Table A.4). While this results in total discards that are 2.5 times higher than sandbar discards under the status quo (Table 4.1), these discards are offset by the amount of sandbar landings not caught in the Gulf of Mexico region based on the 10 non-sandbar LCS trip limit (~10.7 mt dw; Table A.4). This ultimately could result in only 105.9 mt dw of the 116.6 mt dw sandbar quota being harvested under alternative suite 3 (*i.e.*, based on the 1:4 ratio in the Gulf of Mexico, 10 non-sandbar LCS retention limit / 4 = 3 sandbar sharks caught per trip in the Gulf of Mexico region when the non-sandbar LCS retention limit is filled. This is one less than the four sandbar shark trip limit under alternative suite 3, resulting in approximately ~10.7 mt dw of sandbar shark quota being uncaught in the Gulf of Mexico region).

Overall total landings and discards of sandbar sharks under alternative suite 3 is 82-percent less (608.2 mt dw) than the total landings and discards under alternative suite 1, the status quo (Table 4.1 and Table 4.2):

- status quo: 728 mt dw in landings + 9.6 mt dw in discards = 737.6 mt dw total;
- alternative suite 3: 105.9 mt dw in landings + 23.5 mt dw in discards = 129.4 mt dw;
- 737.6 mt dw – 129.4 mt dw = 608.2 mt dw;
- 608.2 mt dw / 737.6 mt dw = 82-percent reduction in discards.

Under alternative suite 3, the total commercial landings and discards plus an estimated 27 mt dw of recreational landings (156.4 mt dw total) is still below the 158.3 mt dw sandbar TAC. Therefore, quotas and retention limits under alternative suite 3 would meet the rebuilding plan for sandbar sharks and would have positive ecological impacts on this stock.

Based on the LCS retention limit under alternative suite 3, non-sandbar LCS landings would be below the non-sandbar LCS quota (229.2 mt dw of the 541.2 mt dw quota are estimated to be caught; Table 4.2). This is due to the ratio approach taken under alternative suite 3 to limit the number of sandbar shark discards. The only way fishermen could potentially harvest the entire non-sandbar LCS quota would be to reduce sandbar shark landings (*i.e.*, even lower than 105.9 mt dw) to accommodate for presumably more sandbar shark discards with a higher non-sandbar LCS retention limit. Therefore, to balance sandbar landings with regulatory discards, NMFS is proposing a ratio approach for setting non-sandbar LCS retention limits, at this time. In addition, this retention limit would decrease non-sandbar LCS discards by an estimated 66 percent compared to the status quo (Table 4.1). Under the status quo, fishermen would continue to direct on sharks with a 4,000 lb dw directed LCS trip limit. This resulted in 117.4 non-sandbar LCS in the past (Table 4.1). However, under alternative suite 3, fishermen will only be able to retain a total of 14 sandbar and non-sandbar LCS per trip or an approximate 500 lb dw combined sandbar and non-sandbar LCS trip limit. This is an 86 percent reduction in the retention limit compared to the status quo. Therefore, it is assumed that fishermen will no longer be able to direct on sandbar and non-sandbar LCS as they have in the past. Rather, they will catch sharks incidentally as they target other species. Fisheries that target other fish and incidentally catch sharks tend to be lower in their discards of sharks (Carlson and Bethea, 2007; Hale and Carlson, 2007). However, since sandbar sharks could be retained on PLL gear under alternative suite 3, it is assumed that PLL vessels may set some BLL gear to catch sharks resulting in some discards of non-sandbar LCS on BLL gear set by PLL fishermen (Table 4.1). Finally, because the retention limit of non-sandbar LCS (*i.e.*, 10 non-sandbar LCS per trip) would be above the average number of non-sandbar LCS that incidental permit holders have retained in the past (*i.e.*, 3 non-sandbar LCS per trip; Table 4.11), it is assumed that incidental permit holders would not discard non-sandbar LCS. If these assumptions hold true, then alternative suite 3 would have positive ecological impacts for non-sandbar LCS.

Dusky shark discards

It is also assumed that any reduction in fishing effort due to the reduced sandbar and non-sandbar LCS quotas under alternative suite 3 could result in a slight decrease of dead discards of dusky sharks, resulting in some positive ecological impacts for this stock. As mentioned in alternative suite 2, it is estimated that, on average, 33.2 mt dw of dusky sharks have been landed or discarded dead (this includes recreational harvest) from 2003 to 2005 (Table 4.1). The majority of the discards under the status quo came from shark directed BLL sets (which include BLL sets fished by PLL vessels) (Table 4.1). As with non-sandbar LCS, it is assumed that since retention limits for sandbars and non-sandbar LCS have been reduced, fishermen would not be directing their effort on shark as they have in the past. However, sandbar sharks could be retained on PLL gear under alternative suite 3; therefore, it is assumed that PLL vessels may set BLL gear to catch sharks, resulting in discards of dusky sharks on BLL gear set by PLL fishermen (Table 4.1). In addition, mortality of dusky sharks would still be realized by other parts of the commercial and recreational fishing sector (Table 4.1). Therefore, it is estimated that alternative suite 3 may reduce dusky shark discards and landings by only 38 percent (Table 4.1).

Porbeagle shark discards

Under alternative suite 3, porbeagle sharks would also be prohibited in the commercial and recreational sectors. As with alternative suite 2, based on HMS Logbook data from 2001 to 2005, 1,895 porbeagle sharks were reported discarded alive, 558 were reported as discarded dead, and 78 were reported as being kept over those 5 years. Therefore, the prohibition is expected to have neutral to slightly positive ecological impacts for this stock since the United States makes minimal landings of this species. As described in alternative suite 2, prohibiting the retention of porbeagle sharks is anticipated to increase dead discards by approximately 0.4 porbeagle sharks per year. Prohibition of porbeagle sharks would prevent any potential increase in fishing effort for this species, and increase the likelihood that porbeagle sharks would rebuild in the timeframe recommended by the stock assessment (100 years).

4.3.3 Time/Area Closures

Under alternative suite 3, NMFS would maintain the mid-Atlantic shark closed area to BLL gear and the current BLL closures in the Caribbean that were implemented in February

2007, (72 FR 5633). Therefore, the ecological impacts associated with these closures would be the same as described under alternative suite 1. In addition, under alternative suite 3 NMFS would implement the SAFMC's MPAs as described under alternative suite 2. Therefore, the ecological impacts associated with the MPAs would be the same as described in alternative suite 2.

4.3.4 Reporting

This alternative suite would modify the reporting frequency for dealers and could result in positive ecological impacts. The requirement for dealer reports to be post-marked within 10 days after each reporting period (1st through 15th and 16th through last day of month), would be modified to state that dealer reports must be *received* by NMFS not later than 10 days after each reporting period (i.e., 25th and 10th of each month). Shark dealers would have to submit these reports in advance of the 10th and 25th of each month to ensure time for delivery, depending on the means employed for report submission. Requiring that all dealer reports are actually received by the Agency in a more timely fashion would help enforce cases against dealers who are not in compliance with the bimonthly reporting requirement. Timely bimonthly report will allow the Agency to better assess quantities of sharks landed and whether or not a closure or other management measures are warranted to prevent overharvests. This could decrease the likelihood that extensive overharvests of sharks would occur. Dealers would still be required to submit reports indicating that no sharks, swordfish, or tuna were purchased during inactive periods. Requirements for vessel logbooks and observer coverage would remain unchanged.

As described in alternative suite 2, sharks reported as unclassified on shark dealer reports would be counted as sandbar sharks. This is expected to result in ecological benefits as it may decrease the likelihood of overharvests, improve the accuracy of shark dealer reports, and improve the utility of these data for future stock assessments.

4.3.5 Seasons

This alternative suite would implement the same measures as alternative suite 2 for seasons. The fishing season would open for all shark species/complexes when this amendment becomes effective in 2008, and then on January 1 in 2009 and thereafter, depending upon available quota. Upon reaching 80 percent of a species/complexes quota, NMFS would take action to close that fishery within five days of filing with the Federal Register. Closing the fishery at 80 percent would provide a buffer that may account for landings that occur outside of NMFS' jurisdiction (*i.e.*, state waters). NMFS would establish one season based on how the retention limits were determined; NMFS anticipates that the lowered retention limits under alternative suite 3 would allow the fishery to stay open longer than what was historically experienced under a 4,000 lb dw LCS directed trip limit. Sandbar and non-sandbar LCS would both close if landings for either species/complex reach 80 percent of the quota. Positive ecological impacts could be expected as a result of implementing these measures because, coupled with conservative retention limits, these seasons are expected to decrease the likelihood of overharvesting a species/complex quota. Therefore, the ecological impacts are expected to be the same as under alternative suite 2.

As stated in alternative suite 2, NMFS is seeking public comment specific to the establishment closing the fishery with five days notice when landings reach 80 percent of any given quota.

4.3.6 Regions

This alternative suite would implement the same measures as alternative suite 2 for regions. Sharks would no longer be managed on a regional basis in the North Atlantic, South Atlantic, and Gulf of Mexico due to reduced quotas, retention limits, and to simplify quota monitoring. Rather, there would be one region with fisheries opening at the same time for all locales subject to available quota. Therefore, the ecological impacts are expected to be the same as under alternative suite 2. The ecological impacts associated with setting one retention limit for non-sandbar LCS based on one average regional retention limit is discussed above in Section 4.3.2.

4.3.7 Recreational Measures

Recreational measures would be the same as those outlined for alternative suite 2. Recreational Anglers (HMS Angling, HMS Charter Headboat, and Atlantic Tuna General Category permit holders participating in a registered HMS tournament) would only be able to possess species of shark that are easy to identify. Participants would no longer be able to possess: finetooth, blacktip, sandbar, bull, silky, porbeagle, spinner, and blacknose sharks. Reducing the likelihood that sandbar, dusky, and porbeagle are landed in recreational fisheries could have positive ecological impacts because all of these species are overfished and both sandbar and dusky sharks are experiencing overfishing. Therefore, the ecological impacts are expected to be the same as under alternative suite 2.

4.3.8 Ecological Impacts of Alternative Suite 3 on Protected Resources and EFH

This alternative suite would have positive impacts on protected resources, including sea turtles, marine mammals, and smalltooth sawfish as it is expected to reduce fishing effort with gillnet and BLL gear significantly. The protected resources section of alternative suite 1 and Section 3.4 discuss current interactions with protected resources in the shark BLL and shark gillnet fisheries. As outlined under alternative suite 2, the reduced quotas and retention limits for sandbar and non-sandbar LCS would likely reduce the number and duration of trips targeting sharks with BLL and/or gillnet gear and the associated interactions with protected resources. However, as with alternative suite 2, it is difficult to assess how the overall reduction in effort associated with decreased quotas and retention limits would translate into quantitative numbers of reduced interactions with protected resources. Consequently, the ecological impacts of alternative suite 3 on protected resources and EFH would be the same as described under alternative suite 2. One difference between alternative suite 2 and 3 is sandbar sharks would be allowed to be retained on PLL gear under alternative suite 3, whereas retention of sandbar sharks on PLL gear is prohibited under alternative suite 2. Because sandbar sharks could be retained on PLL gear, PLL fishermen may set BLL gear to catch sharks. Therefore, there may be more interactions with protected resources and prohibited species, such as dusky sharks, on BLL gear set by PLL fishermen under alternative suite 3 compared to alternative suite 2 (approximately 11.8 mt dw, Table 4.1).

4.3.9 Species Complexes

Under alternative suite 3, NMFS would structure species complexes as they are outlined for alternative suite 2. Therefore, the economic impacts of species complexes would be the same as described in alternative suite 2. The associated economic impacts of the reduced quotas for sandbar sharks, non-sandbar LCS, and porbeagle sharks are discussed in combination with the next section on retention limits.

4.3.10 Quotas and Retention Limits

Alternative suite 3 would allow sharks to be retained by shark directed and incidental permit holders. Therefore, the available sandbar and non-sandbar LCS quota would be spread over a larger universe of commercial permit holders. However, unlike the status quo or alternative suite 2, the retention limits for sandbar sharks and non-sandbar LCS would be the same for both directed and incidental permit holders. Due to the reduced sandbar shark quota and for ease of enforcement, NMFS is proposing to remove the distinction between the two classes of permit in terms of retention limits for sandbar sharks and non-sandbar LCS. Since directed permit holders presumably make a greater percentage of their gross revenues from shark landings, they are expected to have larger negative socioeconomic impacts compared to incidental permit holders. Since the states of Florida, New Jersey, and North Carolina have the most directed permit holders, it is anticipated that these states would have the largest negative socioeconomic impacts under alternative suite 3 (Table 3.32). As with alternative suite 2, shark dealers could also experience negative impacts due to the reduction in the sandbar and other LCS quotas and retention limits, which would reduce the overall amount of sharks being landed.

As with alternative suite 2, NMFS would also maintain the 60 mt ww (43.2 mt dw) shark display and research quota under alternative suite 3. Therefore, the socioeconomic impacts associated with the 60 mt ww shark display and research quota would be the same as described under alternative suite 2.

<u>Fishery level impacts</u>

Under alternative suite 3, the commercial quotas would be reduced to 116.6 mt dw and 541.2 mt dw for non-sandbar LCS. However, to balance discards of sandbar sharks in the South Atlantic with uncaught sandbar quota in the Gulf of Mexico, the non-sandbar LCS retention limit was lowered such that only 105.9 mt dw (233,467 lb dw) of sandbar sharks and 229.2 mt dw (505,294 lb dw) of non-sandbar LCS would be landed under alternative suite 3 (see discussion in Appendix A under "*Non-sandbar quota and retention limits*" and Table A.4 and Table 4.2). Based on 2006 ex-vessel prices, assuming 5 percent of the landings are fins and 95 percent of the landings are carcass weight, this is equivalent to $1,008,027 (Table 4.13). This is a reduction of about 74 percent compared to the current gross revenues under alternative suite 1 ($3,824,589; Table 4.9).

As with alternative suite 2, porbeagle sharks would be placed on the prohibited list under alternative suite 3. Based on the average porbeagle shark landings from 2002 to 2004 (1.5 mt dw or 3,402 lb dw) and 2006 ex-vessel prices, this is equivalent to a $6,081 gross revenue loss in porbeagle shark landings under alternative suite 3 (Table 4.9).

In alternative suite 3, under and overharvests of quota for each category would be removed from the next season's quota, as described under alternative suite 3. Therefore, the socioeconomic impacts associated with the application of under and overharvests would be the same as described under alternative suite 2.

Finally, alternative suite 3 would require that shark fins remain attached to the shark through the first port of landing. As described under alternative suite 2, the overall socioeconomic impact of this could be significant given the reductions in the overall sandbar quota, which are the most lucrative shark due to the value of its fins. Therefore, the impacts of requiring that shark fins remain attached to the shark during the first port of landing are anticipated to be the same as described under alternative suite 2.

Directed permit holder impacts

As stated under alternative suite 2, on average, directed permit holders landed 1,571,851 lb dw of sandbar sharks per year and 1,210,643 of non-sandbar LCS per year from 2003 to 2005 in the Coastal Fisheries and HMS Logbooks. In 2006 ex-vessel prices, this is equivalent to gross revenues of $3,744,032 (assuming 5 percent of the landings are fins and 95 percent of the landings are carcass weight) (Table 4.9). However, given the retention limits for non-sandbar LCS (see Appendix A), it is anticipated that only 105.9 mt dw (233,467 lb dw) of the sandbar sharks and 229.2 mt dw (505,294 lb dw) of non-sandbar LCS would be landed under alternative suite 3. These landings would be spread over directed and incidental permit holders' past effort or a total of 1,143 trips (Table A.2). Based on this past effort, it was assumed 1,108 trips would be made by directed permit holders (see Table A.2; 790 trips+80 trips+237.7 trips = 1,108 trips). This directed fishing effort of 1,108 trips is 78 percent of the total expected fishing effort (*i.e.*, 1,108 trips / 1,143 trips = 78 percent; Table 4.14). Using this estimated effort, it is anticipated that approximately 83 mt dw (183,073 lb dw) of sandbar sharks (78 percent x 105.9 mt dw = 83 mt dw) and 180 mt dw (396,225 lb dw) of non-sandbar LCS (78 percent x 229.2 mt dw = 180 mt dw) would be landed by directed permit holders (Table 4.14). Based on 2006 ex-vessel prices, this is equivalent to $793,338 gross revenues for directed permit holders. This is a 79 percent overall reduction in gross revenues compared to 2003 to 2005 (gross revenues based on current directed permit holders' landings were $3,744,032; Table 4.9). Again, since the states of Florida, New Jersey, and North Carolina have the most directed permit holders, it is anticipated that these states would experience the largest negative socioeconomic impacts under alternative suite 3 (Table 3.32).

As stated in alternative 2, the status quo revenue was based on a 4,000 lb dw LCS trip limit for directed shark permit holders with average South Atlantic trips at $4,743 per trip and average Gulf of Mexico trips at $5,853 per trip (Table 4.11). Under alternative suite 3, the retention limits would be 4 sandbars per trip and 10 non-sandbar LCS per trip. However, since the ratio of sandbars to non-sandbar LCS caught in the Gulf of Mexico is 1:4, only approximately 3 sandbar sharks would be caught in the Gulf of Mexico region when the 10 non-sandbar LCS retention limit per trip is filled (10 non-sandbar LCS / 4 = 2.5 sandbar sharks). Therefore, gross revenues on a trip basis are estimated to be $610 per trip in the South Atlantic and $670 per trip in the Gulf of Mexico (Table 4.15). From 2003 to 2005, there were 128 vessels that averaged more than 163 lb dw (or 4 sandbar sharks) of sandbar per trip (Figure A.3). Therefore, these vessels would be most negatively affected by retention limits under alternative suite 3.

Table 4.15 Gross revenues on a trip basis in the South Atlantic (SA) and Gulf of Mexico (GOM) under alternative suite 3.

Alternative Suite 2	Number of sandbars	Landings (lb dw)*	Fin Weight (5% of landings per trip)	Fin 2006 ex-vessel price (lb dw)	Fin revenue	Carcass Weight (95% of landings per trip)	Carcass 2006 ex-vessel price (lb dw)	Carcass Revenue	Total gross revenue
Regionally based BLL trips (Directed and Incidental Permit Holders)									
Total sandbar sharks per trip in SA	4	162	8	$16.20	$131	154	$0.38	$58	$190
Total sandbar sharks per trip in GOM	3	122	6	$20.65	$125	115	$0.40	$46	$172
Total non-sandbar LCS per trip in SA	10	337	17	$16.20	$273	320	$0.46	$147	$420
Total non-sandbar LCS per trip in GOM	10	337	17	$20.65	$348	320	$0.47	$150	$498
SA trip total revenues from sharks									**$610**
GOM trip total revenues from sharks									**$670**

Incidental permit holder impacts

On average, incidental permit holders landed 19,066 lb dw of sandbar sharks and 39,995 lb dw of non-sandbar LCS from 2003 to 2005 as reported in the Coastal Fisheries and HMS Logbooks. In 2006 ex-vessel prices, this is equivalent to gross revenues of $80,558 (assuming 5 percent of the landings are fins and 95 percent of the landings are carcass weight) (Table 4.9). Again, based on the non-sandbar LCS retention limits, it is predicted that 105.9 mt dw of sandbar sharks would be landed and 229.2 mt dw of non-sandbar LCS would be landed under alternative suite 3. This was averaged over directed and incidental permit holders' past effort or 1,413 trips (Table A.2). Based on past effort, it was assumed 305 trips could be made by incidental permit holders (see Table A.2; 49.7 trips + 255.3 trips = 305 trips). This is 22 percent of the expected fishing effort (305 trips / 1,413 trips = 22 percent; Table A.2 and Table 4.14). Based on this estimate effort, it is anticipated that approximately 23 mt dw (50,395 lb dw) of sandbar sharks (22 percent x 105.9 mt dw = 23 mt dw) and 50 mt dw (109,069 lb dw) of the non-sandbar LCS (22 percent x 229.2 mt dw = 50 mt dw) are anticipated to be landed by incidental permit holders (Table 4.14). Based on 2006 ex-vessel prices, this is equivalent to $218,383 gross revenues for incidental permit holders (Table 4.14). This would result in gross revenues that are 2.7 times higher compared to 2003 to 2005 (gross revenues based on current incidental permit holders' landings were $80,558; Table 4.9).

This increase in gross revenues is due to the increase in retention limits for incidental permit holders. Under the status quo, incidental permit holders can retain 5 sharks from the LCS complex. However, under alternative suite 3, incidental permit holders would be able to retain 4 sandbars and 10 non-sandbar LCS or 14 LCS total. This retention limit is almost 3 times higher than what is currently allowed under the status quo. On average, incidental permit holders have been landing 2 sandbar sharks and 3 non-sandbar LCS per trip. Based on 2006 ex-vessel prices, this is equivalent to $248 per trip (Table 4.11). However, under alternative suite 3, incidental permit holders would potentially make equivalent gross revenues per trip as directed permit holders: $610 per trip in the South Atlantic and $670 per trip in the Gulf of Mexico (Table 4.15). This would result in gross revenues for incidental permit holders that are 2 to 3 times higher than gross revenues in 2003 to 2005 depending on future fishing effort and catch composition. Therefore, there would be positive economic impacts for incidental permit holders under alternative suite 3. Since approximately 66 vessels with incidental permit holders landed sandbar sharks or non-sandbar LCS from 2003 to 2005 in the Coastal Fisheries and HMS Logbooks, these 66 vessels would have the largest economic benefits under alternative suite 3. However, if sharks become profitable for incidental permit holders under alternative suite 3, then more vessels with incidental permits may actively land sandbars and non-sandbar LCS in the future. Finally, the states of Florida, Louisiana, New Jersey, and North Carolina had the most incidental shark permit holders in 2007 (Table 3.32). Therefore, these states would see the largest socioeconomic benefits under alternative suite 3.

4.3.11 Time/Area Closures

Under alternative suite 3, NMFS would maintain the mid-Atlantic shark closed area to BLL gear and the current BLL closures in the Caribbean that were implemented in February 2007, (72 FR 5633). Therefore, the economic impacts associated with these closures would be the same as described under alternative suite 1. In addition, under alternative suite 3, NMFS would implement the SAFMC's MPAs as described under alternative suite 2. Therefore, the economic impacts associated with the MPAs would be the same as described in alternative suite 2.

4.3.12 Reporting

This alternative suite could result in neutral economic impacts. Shark dealers would still be required to submit landings data twice a month, however, they would need to ensure that it is actually *received* by the Agency within 10 days of a bimonthly reporting period ending. Currently, shark dealers simply have to ensure that the landings reports submitted to NMFS are *post-marked* within 10 days of the end of a reporting period. Additional burden is not expected as a result of modifying the regulations to ensure that dealer reports are actually received. Furthermore, more timely reporting and receipt of information by the Agency may result in a decreased likelihood that quotas would be exceeded and overharvests removed from forthcoming shark seasons resulting in neutral or slightly positive economic impacts.

As described in alternative suite 2, this suite would change how sharks listed as unclassified on shark dealer reports are accounted for under quota monitoring. Unclassified sharks would be counted as sandbar sharks, and not as LCS, which is the current procedure under quota monitoring. Properly identifying sharks may result in negative economic impacts in the short-term because it may take slightly more time. Submission of accurate shark dealer data may result in positive economic impacts in the long-term as it would improve quota monitoring, decrease the likelihood of extensive overharvests and subsequent closures, and improve the results from stock assessments by ensuring data is more accurate and includes species specific information.

4.3.13 Seasons

Under alternative suite 3, NMFS would establish one season that would open when this amendment becomes effective in 2008, and then on January 1 in 2009 and thereafter, depending on available quota. Based on how the retention limits were determined (*i.e.*, NMFS accounted for mortality in all other fisheries, and then spread the available quota over the number of historical trips taken by directed and incidental permit holders; see Appendix A), NMFS anticipates that the lowered retention limits under alternative suite 3 would allow the fishery to stay open longer than what was historically experienced under a 4,000 lb dw LCS directed trip limit. However, as described above, when coupled with the measures included under regions (Section 4.2.5), this alternative suite could have negative economic impacts on vessels and dealers in the North Atlantic, depending on when shark quotas were filled throughout the year. Thus, this alternative suite is expected to similar socioeconomic impacts due to establishing one season as discussed under alternative suite 2.

As mentioned in Section 4.2.5, the Agency anticipates that providing five days notice once 80 percent of the quota has been harvested would reduce the likelihood of an overharvest, account for landings that may occur outside of NMFS jurisdiction after a season had been closed, and would implement the necessary accountability measures under the Magnuson-Stevens Act.

However, the Agency is seeking specific comments on the potential economic impacts of choosing 80 percent as the threshold to close a specific shark fishery with five days notice.

4.3.14 Regions

Similar to alternative suite 2, eliminating regions would likely have negative economic impacts on regions that do not have sharks present year round. The North Atlantic region would be disadvantaged as a result of reverting back to one region, versus three, as they would not have a secure regional trimester quota to ensure they would have a shark fishery in adjacent waters when sharks are present. Vessels could either move to southern areas to participate in the shark fishery in areas where sharks are present year-round or redistribute fishing effort to other fisheries. Dealers in the North Atlantic region would also be affected, possibly even more so than vessels, as the likelihood of having shark products consistently would be decreased.

4.3.15 Recreational Measures

As under alternative suite 2, this suite would restrict the species of Atlantic sharks that could be possessed by anglers in possession of a HMS Charter/Headboat permit, HMS Angling permit, or a Atlantic Tuna General Category permit (if participating in a registered HMS tournament). The Agency would restrict landings of sharks to those species that are relatively simple to identify. Therefore, recreational shark fisheries would experience similar negative economic impacts as under alternative suite 2 as a result of reducing the number of shark species that could be legally landed (Table 4.8).

Conclusions

This alternative suite could have similar positive ecological impacts for most species of sharks, bycatch, and protected resources as a result of significantly reduced retention limits and quotas for sandbar sharks and reduced retention limits for non-sandbar LCS as under alternative suite 2. Alternative suite 3 would require that sharks be landed with their fins still attached, similar to alternative suite 3; this requirement could prevent fishermen from keeping the fins from sharks that are not landed, resulting in a reduction of overall shark mortality. These positive ecological impacts would likely be more pronounced for some species under alternative suite 3 compared to alternative suite 2 because retention limits, and subsequent discards, would be lower under alternative suite 3 (Table 4.1). Since this alternative suite would allow directed and incidental permit holders to retain sharks, fewer discards of sandbar sharks are anticipated (Table 4.1).

Under alternative suite 3, NMFS would maintain the current time/area closures and implement eight MPAs that are being preferred in the SAFMC's Amendment 14A. This is due to enforceability issues where the gears for different fisheries (*i.e.*, shark BLL gear and snapper/grouper BLL gear) are virtually indistinguishable, and many fishermen hold both types of permits. However, despite these time/area closures, alternative suite 3 would have a smaller reduction in dead discards of dusky sharks compared to alternative suite 2 since sandbar sharks would be allowed to be retained on PLL gear under alternative suite 3 (Table 4.1).

While most ecological impacts are positive under alternative suite 3, overall, economic impacts would vary depending on permit type. For instance, the retention limits under alternative suite 3 are higher than retention limits for incidental permit holders under the status quo, possibly resulting in positive economic impacts for incidental shark permit holders (Table 4.9 and Table 4.14). However, negative economic impacts are expected for directed permit holders (79-percent reduction in gross revenues compared to the status quo; Table 4.9 and Table 4.14). These losses in gross revenues may be exacerbated by the requirement to land shark with their fins attached. In addition, eliminating regions and seasons would represent an economic disadvantage to the North Atlantic region as sharks are not present in these waters year-round, meaning the quota may be filled in some years before sharks are present in these areas. The elimination of seasons and regions combined with limiting underharvest carry-overs may have negative economic impacts on fishermen, especially for regions that consistently had underharvests of species like SCS.

NMFS would also rely on dealer reports on a biweekly basis to monitor the sandbar, non-sandbar LCS, SCS, and pelagic shark quotas. If dealers fail to report in a timely fashion, overharvests could occur, especially for the much reduced 116.6 mt dw sandbar quota. Finally, given the retention limits for sandbar and non-sandbar LCS are significantly lower than what is under the status quo (91 and 69-percent reduction in sandbar and non-sandbar LCS retention limits, respectively for directed permit holders), it is anticipated that there would be no directed shark fishery as a result of alternative suite 3. While an observer program would still operate under alternative suite 3, without a directed shark fishery, it is anticipated that the fishery dependent data collection would be limited, which could compromise data collection for future stock assessments. Alternative suite 4 would likely accomplish the necessary reductions in quota, retention limits, and fishing effort to prevent overfishing and allow stocks to rebuild while collecting valuable scientific data for the Agency. Therefore, due to concerns over dusky discards, quota monitoring, and data collection, NMFS is not preferring alternative suite 3 at this time.

4.4 Alternative Suite 4: Establish a Research Fishery for Sandbar Sharks; Shark Fishery for Directed, Incidental, HMS Angling, and HMS Charter/Headboat Permit Holders – Preferred Alternative

Overall Summary

As with alternative suites 2 and 3, under alternative suite 4, NMFS would remove the sandbar shark from the LCS complex and establish a separate sandbar shark quota and a non-sandbar LCS quota (LCS complex minus sandbar sharks). Overharvests would be removed from the next season's quota. Underharvests for species that are healthy or rebuilt would be transferred to the next season's quota, up to 50 percent of the base quota. For species/complexes that are unknown, overfished, or experiencing overfishing, underharvests would not be transferred to the next season's quota. Quotas would be as follows: Sandbar = 116.6 mt dw; non-sandbar LCS = 541.2 mt dw; SCS = 454 mt dw; Blue Sharks = 273 mt dw; Pelagic Sharks (Other than Blue Sharks) = 488 mt dw; Porbeagle Sharks = Prohibited (0 mt dw quota); and Display and Scientific Research = 60 mt ww (Sandbar = 2.8 mt ww (2 mt dw); and all other shark species (except dusky sharks) = 57.2 mt ww (41.2 mt dw).

Alternative suite 4 would establish a small research fishery that would harvest the entire 116.6 mt dw sandbar quota. Vessels within the research fishery could also retain non-sandbar LCS, SCS, and pelagic sharks (except porbeagle sharks). Vessels with commercial shark permits outside of the research fishery could only retain non-sandbar LCS as well as SCS and pelagic sharks (except porbeagle sharks) (see Table 2.1). The existing BLL and PLL time/area closures, including the Caribbean BLL closures for EFH, would remain in place. In addition, NMFS would implement the eight MPAs off South Carolina to Florida as requested by the SAFMC.

Retention limits for sandbar sharks and non-sandbar LCS in the research fishery would be based upon research objectives; no sandbar sharks may be landed outside of research program; 22 non-sandbar LCS per vessel per trip for directed and incidental permit holders not participating in research program; no trip limit for SCS or pelagic sharks (except porbeagle sharks) for directed permit holders; 16 SCS and pelagic sharks (except porbeagle sharks) combined for incidental permit holders; no retention of porbeagle sharks by commercial or recreational fishermen; and all sharks landed with fins attached.

Dealer reports must be received by NMFS within 14 days, and there would be 100 percent observer coverage for vessels participating in sandbar shark research program. Other logbook and observer requirements would be maintained for vessels not participating in research program, and all unclassified sharks reported would be categorized as sandbar sharks. There would be one season starting on January 1 of each year and one region. The sandbar and non-sandbar LCS fishery would close when landings of either reach 80 percent of the available quota with a five day notice, and SCS and pelagic shark fisheries would close when SCS and pelagic shark landings reach 80 percent of their respective quotas. Finally, recreational fishermen could land bonnethead, nurse, tiger, lemon, hammerheads, Atlantic sharpnose, shortfin mako, common thresher, oceanic whitetip, and blue sharks. The recreational possession limit would be 1 shark > 54” per vessel per trip, and 1 Atlantic sharpnose and 1 bonnethead per person per trip with no minimum size requirements.

Ecological Impacts

4.4.1 Quotas/Species Complexes

Under alternative suite 4, NMFS would structure species complexes as they are outlined for alternative suite 2. The commercial sandbar shark quota would remain at 116.6 mt dw and the commercial non-sandbar LCS quota would remain at 541.2 mt dw. The shark display and research quota would have 2 mt dw (2.8 mt ww) allocated for sandbar sharks and 41.2 mt dw (57.2 mt ww) allocated for all non-sandbar LCS species (except dusky sharks). Porbeagle sharks would be added to the prohibited species list. The commercial quotas would be divided among participants operating within and outside a shark research fishery. All of the 116.6 mt dw (257,056 lb dw) quota for sandbar sharks would be allocated to the vessels operating in the research fishery. NMFS determined this quota by accounting for sandbar shark mortality that occurs in recreational and non-HMS fisheries, including discards as the result of fishermen targeting other shark species outside the research fishery. This assumes that shark fishermen outside the research fishery would be fishing in a manner similar to how incidental permit have fished historically, therefore, they would have comparable sandbar shark discards as incidental permit holders have had in the past (see Table 4.1 and calculation of sandbar quota in Appendix

A and Table A.1). It is anticipated that 50 mt dw (110,230 lb dw) of the non-sandbar LCS quota would be caught incidentally while fishermen fulfilled the 116.6 mt dw of sandbar quota in the research fishery (see Appendix A, Table A.5). The remaining non-sandbar LCS quota would be allocated to vessels fishing outside the shark research fishery. Despite the division of the quotas among vessels operating within and outside of a research fishery, the total quota for sandbar sharks and non-sandbar LCS would still be based on recommendation from the most recent LCS stock assessment. Therefore, this level of fishing effort would allow sandbar sharks to rebuild and stop overfishing of this stock while keeping fishing mortality consistent with past landings for blacktip sharks. As such, the species complexes and associated quotas would have positive ecological impacts under alternative suite 4. A more detailed analysis of the ecological impacts of the quotas under alternative suite 4 is outlined in the next section under retention limits. Finally, under and overharvests would be applied as they have been outlined for alternative suite 2, and therefore, there would be similar ecological impacts associated with under and overharvests as described under alternative suite 2.

4.4.2 Retention Limits

As with alternative suites 2 and 3, alternative suite 4 would require that shark fins remain on the shark until the first port of landing, and therefore, is expected to have similar ecological benefits as described for alternative suites 2 and 3.

Alternative suite 4 would establish a program where vessels with directed and incidental shark permits could apply and be selected to participate in a research fishery for sharks. Only vessels participating in this program could land sandbar sharks. Vessels not participating in the research program would still be able to land non-sandbar LCS, SCS, and pelagic sharks subject to the retention limits described in Chapter 2 and Appendix A (Tables 2.1 and A.5). Each year NMFS would publish a call for proposals that outlined the shark research objectives for the year. Shark fishermen who were interested in participating would apply for the shark research fishery under the exempted fishing program within the Highly Migratory Species Management Division. Based on the research objectives for a given year, NMFS scientists and managers would select a few vessels (*i.e.*, 5-10 vessels) each year to conduct the prescribed research. Selection criteria of vessels include the ability of the vessel to meet the Agency's annual research objectives, flexibility to fish in the region and season required, and the ability to carry a NMFS-approved observer. Vessels that do not have recent and/or excessive number of fishery regulation violations, as determined by the Office of Law Enforcement, will be ranked higher than vessels that do have recent and/or excessive number of fishery regulation violations. Selected vessels would work with NMFS to conduct shark research; vessels selected for the research fishery would be subject to 100 percent observer coverage; however, fishermen in the shark research fishery would be afforded higher trip limits and could sell their catch, including sandbar sharks, compared to vessels outside the research fishery. This research fishery would allow the collection of fishery-dependent data for future stock assessments while allowing NMFS and fishermen to conduct cooperative research to meet the shark research objectives for the Agency.

Vessels operating within the research fishery would be allowed to harvest the entire 116.6 mt dw sandbar shark quota (however, the shark fishery would shut down once 80 percent of the sandbar shark or non-sandbar LCS quota was met to account for state landings and ensure the 116.6 mt dw commercial sandbar quota was not overharvested). Retention limits for sandbar sharks and non-sandbar LCS would depend on the research objectives of a given year. For example, assuming a catch composition of 70 percent sandbar sharks (and hence, 30 percent non-sandbar LCS) the 116.6 mt dw sandbar quota could be fulfilled in 92 trips with a 4,000 lb dw sandbar and non-sandbar LCS trip limit (70 percent x 4,000 lb dw trip limit = 2,800 lb dw sandbar sharks per trip; 92 trips x 2,800 lb dw of sandbar sharks = 257,600 lb dw or 116.6 mt dw; see Appendix A, Table A.2). Based on this catch composition, it is anticipated that 50 mt dw (110,230 lb dw) of the non-sandbar LCS quota would be caught incidentally while fishermen fulfilled the 116.6 mt dw of sandbar quota in the research fishery (30 percent x 4,000 lb dw = 1,200 lb dw of non-sandbar LCS; 92 trips x 1,200 lb dw of non-sandbar LCS per trip = 110,400 lb dw or 50 mt dw; see Appendix A, Table A.5). Actual landings and species composition of trips within the shark research fishery may vary. However, based on this level of harvest of the non-sandbar LCS quota within the research fishery, vessels operating outside of the research fishery would have an estimated 491 mt dw (1,082,459 lb dw) of non-sandbar LCS quota available to them. In total, incidental and directed permit holders are anticipated to land the 116.6 mt dw (257,056 lb dw) and 541.2 mt dw (1,193,130 lb dw) for sandbar and non-sandbar LCS, respectively. Compared to the average annual sandbar landings of 1,590,917 lb dw and non-sandbar LCS landings of 1,250,638 lb dw that were reported from 2003 to 2005 in the Coastal Fisheries and HMS Logbooks by directed and incidental permit holders (Table 4.9), this would be an 84-percent decrease in sandbar landings and a 7-percent decrease in non-sandbar LCS landings under alternative suite 4 (Table 4.2). This reduction in fishing effort is expected to have positive ecological impacts for sandbar sharks.

Vessels operating outside the research fishery would be allowed to retain 22 non-sandbar LCS per trip. On average, directed permit holders landed 32 non-sandbar LCS per trip as reported in the Coastal Fisheries and HMS Logbooks from 2003 to 2005. Therefore, this would be a 31-percent reduction in non-sandbar LCS per trip for directed permit holders. However, on average, incidental permit holders landed 3 non-sandbar LCS per trip as reported in the Coastal Fisheries and HMS Logbooks from 2003 to 2005. Therefore, the number of non-sandbar LCS kept per trip would increase by more than 7 times for incidental permit holders under alternative suite 4. Total landings of non-sandbar LCS by vessels outside the research fishery would be limited to approximately 491 mt dw (depending on how much of the non-sandbar LCS quota is landed in the research fishery), such that the total 541.2 mt dw of the LCS quota would not be exceeded (Table A.5). It is difficult to estimate how modifications to retention limits, implementation of a shark research program, and prohibiting sandbars from being landed outside this program would impact catch composition of BLL sets for sharks.

Since the universe of vessels operating in the research fishery would be limited (*i.e.*, likely 5-10 vessels), it is anticipated that sandbar discards would occur on PLL gear by vessels operating outside the research fishery (approximately 4.3 mt dw; Table 4.1). Shark discards in the research fishery are anticipated to occur as they have during directed shark trips in the past (approximately 0.4 mt dw of sandbar sharks; Table 4.1). In addition, fishermen outside the research fishery would not be allowed to keep sandbar sharks, and assuming they would fish incidentally for sharks as they target other species, it is anticipated that this would result in approximately 2.3 mt dw of sandbar discards per year (Table 4.1). Discards of sandbar sharks under alternative suite 4 could increase by 36 percent compared to the status quo (Table 4.1), however, overall commercial landings and discards would still be reduced by 82 percent compared to the status quo (Table 4.1 and Table 4.2) because of reductions to the commercial quota and by limiting the number of participants:

- status quo: 728 mt dw in landings + 9.6 mt dw in discards = 737.6 mt dw total;
- alternative suite 4: 116.6 mt dw in landings + 13.1 mt dw in discards = 129.7 mt dw; and
- 737.6 mt dw / 129.7 mt dw = 607.9 mt dw; 607.9 mt dw / 737.6 mt dw = 82-percent reduction in discards.

Under alternative suite 4, the total commercial landings and discards plus an estimated 27 mt dw of recreational landings (156.7 mt dw total) is still below the 158.3 mt dw sandbar TAC. Therefore, quotas and retention limits under alternative suite 4 would meet the rebuilding plan for sandbar sharks and would have positive ecological impacts on this stock.

Since the limited number of vessels in the research fishery would be directing on sharks, it is assumed that non-sandbar LCS discards would occur as they have in the past when there were shark directed BLL trips. However, given the non-sandbar LCS retention limit under alternative suite 4 for vessels outside the research fishery (*i.e.*, 22 non-sandbar LCS per trip) is higher than what incidental permit holders have landed in the past (*i.e.*, 3 non-sandbar LCS per trip), discards of non-sandbar LCS by incidental permit holders operating outside the research fishery are estimated to decrease by 63-percent decrease in non-sandbar LCS discards under alternative suite 4 (Table 4.1).

A limited number of dusky discards would continue to occur within, and outside of, the shark research fishery. The universe of vessels and the number of sets deployed in the research fishery would be limited, further limiting the number of interactions with dusky sharks. These sets would all be subject to 100 percent observer coverage, which would provide the Agency with additional information on oceanographic conditions or other factors that might correspond to increased dusky shark abundance. Outside of the research fishery, the limited retention limit for non-sandbar LCS is expected to reduce fishing effort, thereby, reducing the likelihood of interactions with dusky sharks on BLL gear. Dusky sharks are also caught on PLL gear that is set for shark or other HMS. Assuming that there would not be any PLL vessels in the shark research fishery since this gear is not generally used to target sandbar sharks, it is anticipated that the PLL vessels would not continue to set BLL gear for sharks. By calculating the number of dusky discards that are anticipated to still occur based on past landings and discards reported Coastal Fisheries and HMS Logbooks (*i.e.*, landings and discards in the PLL fishery and other fisheries using gillnet and BLL gear; see Table 4.1), it is anticipated that dusky discards could decrease by 72 percent under alternative suite 4, resulting in positive ecological impacts for this stock.

Porbeagle sharks would also be prohibited in the commercial and recreational sectors under alternative suite 4. As with alternative suites 2 and 3, based on HMS Logbook data from 2001 to 2005, 1,895 porbeagle sharks were reported discarded alive, 558 were reported as discarded dead, and 78 were reported as being kept over those 5 years. Therefore, the prohibition is expected to have neutral to slightly positive ecological impacts for this stock since the United States has minimal landings of this species as described under alternative suite 2.

Finally, as with alternative suites 2 and 3, alternative suite 4 would partition the 60 mt ww (43.2 mt dw) quota for exempted fishing permits, display permits, scientific research permits, and letters of acknowledgement to place more stringent limits on the quantity of sandbar and dusky sharks authorized for these purposes. This quota would be separate from the commercial quotas set up for the small research shark fishery that would be conducted by industry vessels outlined above. Therefore, the ecological impacts associated with the 60 mt ww quota would be the same ecological impacts as those under alternative suite 2.

4.4.3 Time/Area Closures

Under alternative suite 4, NMFS would maintain the mid-Atlantic shark closed area and the current BLL closures in the Caribbean that were implemented in February 2007, (72 FR 5633). Therefore, the ecological impacts associated with these closures would be the same as described under alternative suite 1. In addition, under alternative suite 4, NMFS would consider implementing the SAFMC's MPAs as described under alternative suite 2. Therefore, the ecological impacts associated with the MPAs would be the same as described in alternative suite 2.

4.4.4 Reporting

Reporting requirements for shark dealers would be the same as described in alternative suite 3 (Section 4.3.4) and could have neutral ecological impacts. Participants selected to participate in the shark research program would be subject to 100 percent observer coverage as a requirement for eligibility to participate in the program. Increasing observer coverage for vessels participating in this program would result in positive ecological impacts because observer reports could be used to monitor landings, bycatch, and interactions with protected resources in near "real-time." Vessels outside the shark research program would still be required to carry an observer if selected and all vessels would still be required to complete logbooks within 48 hours of fishing activity and then submit the logbooks to NMFS within seven days.

As described in alternative suites 2 and 3, counting all unclassified sharks from shark dealer reports as sandbar sharks under quota monitoring would reduce the likelihood of overharvests, improve the accuracy of shark dealer reporting, and increase the quality of data used in stock assessments by ensuring that shark dealer reports more accurately reflect what sharks were purchased by dealers resulting in positive ecological impacts.

4.4.5 Seasons

Seasons would be the same as described for alternative suites 2 and 3, however, since all sandbar sharks would be landed by a limited number of vessels participating in a shark research program, the Agency would have more information concerning when the sandbar shark quota is expected to be reached. This may result in positive ecological impacts because it may reduce the likelihood of overharvests. The Agency is interested in collecting biological samples from sandbar and non-sandbar LCS throughout the year, therefore, the Agency would determine when the research vessels would fish to ensure adequate spatial and temporal sampling throughout the year. Fishing effort, non-LCS landings, and sandbar discards outside the research fishery would be monitored via biweekly dealer reports and the shark observer program. Once the non-sandbar LCS quota reaches 80 percent, the sandbar and non-sandbar fishery would be closed within 5 days. SCS and pelagic shark quotas (minus porbeagle sharks) would be monitored and closed in the same way. Closing the fishery with five days notice upon achieving 80 percent of a respective quota would provide a buffer for landings that may occur outside of NMFS' jurisdiction (*i.e.*, state waters) after a season has been closed. The Agency is seeking public comment specific to the appropriateness of closing the fishery with five days notice upon reaching 80 percent of respective quotas.

4.4.6 Regions

As described in alternative suites 2 and 3, this alternative suite would implement a single region. All of the sandbar quota and approximately 50 mt dw of the non-sandbar LCS would likely be landed in the shark research program. One of the criteria for participation in the shark research program would be to ensure that the Agency maintains adequate regional coverage when selecting vessels to attain a variety of biological samples from different regions and at different times of year. Therefore, the ecological impacts associated with one region under alternative suite 4 would be the same as the ecological impacts outlined for alternative suite 2.

4.4.7 Recreational Measures

Recreational measures would be the same as those outlined for alternative suite 2 and 3. Recreational Anglers (HMS Angling, HMS Charter Headboat, and Atlantic Tuna General Category permit holders participating in a registered HMS tournament) would only be able to possess shark species that are easy to identify (Table 4.8). Participants would no longer be able to possess: finetooth, blacktip, sandbar, bull, silky, porbeagle, spinner, and blacknose sharks. Reducing the likelihood that sandbar, dusky, and porbeagle are landed in recreational fisheries could have positive ecological impacts because all of these species are overfished and both sandbar and dusky sharks are experiencing overfishing. Therefore, the ecological impacts are expected to be the same as under alternative suite 2.

4.4.8 Ecological Impacts of Alternative Suite 4 on Protected Resources and EFH

This alternative suite could have positive impacts on protected resources, including sea turtles, marine mammals, and smalltooth sawfish as it is expected to reduce overall fishing effort targeting sharks with gillnet and BLL gear while increasing the level of observer coverage on a limited number of vessels participating in a shark research program. The protected resources section of alternative suite 1 and Section 3.4 discuss current interactions with protected resources in the shark BLL and shark gillnet fisheries. This alternative would implement the same quotas for sandbar and non-sandbar LCS, which are expected to reduce fishing effort, prevent overfishing, and rebuild overfished stocks. Retention limits for non-sandbar LCS would also be reduced significantly (22 non-sandbar LCS per vessel per trip) for vessels with shark permits outside the shark research program. While vessels in the shark research program would fish under the trip limits dictated by the research objectives in a given year, there would be a significant reduction in the number of trips directing on sharks because the quota for sandbar sharks would be drastically reduced. In addition, all of these trips would be subject to 100 percent observer coverage. Furthermore, the Agency would determine when these trips would take place throughout the year to ensure regional and seasonal sampling by scientific observers. This shark research program may also provide additional documentation and additional opportunities for data collection on interactions with protected resources via observer reports.

As described under alternative suites 2 and 3, shark fishermen outside of the shark research program could reduce the number, duration, and frequency of trips targeting sharks with BLL and/or gillnet gear. In addition, ecological impacts to EFH would likely be positive and similar as those outlined under alternative suite 2.

Social and Economic Impacts

4.4.9 Species Complexes

Under alternative suite 4, NMFS would structure species complexes as they are outlined for alternative suites 2 and 3. Therefore, the economic impacts associated with species complexes would be the same as described in alternative suite 2. The associated economic impacts of the quota reductions for sandbar sharks and non-sandbar LCS and the division of those quotas among vessels inside and outside of a research fishery are described in the next section in combination with retention limits.

4.4.10 Quotas and Retention Limits

Alternative suite 4 would establish shark research fishery for sandbar sharks. Only incidental or directed permit holder that apply and are selected to participate in this program could land sandbar sharks. Vessels not participating in the research program would still be able to land non-sandbar LCS, SCS, and pelagic sharks subject to the retention limits described in Chapter 2 and Appendix A (Tables 2.1 and A.5). Based on the limited number of vessels that could fish for sandbar sharks under a research fishery, most current directed and incidental permit holders would not be allowed to land sandbar sharks, resulting in significant negative socioeconomic impacts for these permit holders. In addition, given the reduced non-sandbar LCS trip limit for vessels outside the research fishery and since directed permit holders presumably make a greater percentage of their gross revenues from shark landings, it is anticipated that there would be negative socioeconomic impacts on directed permit holders outside the research fishery compared to incidental permit holders. Since Florida, New Jersey, North Carolina, and Louisiana have the most directed and incidental shark incidental permit holders, it is anticipated that these states would have the largest negative socioeconomic impacts by the reduced non-sandbar LCS retention limits (Table 3.32). As with alternative suites 2 and 3, shark dealers could also experience negative impacts due to the reduction in the sandbar and other LCS quotas and retention limits, which would reduce the overall amount of sharks being landed.

As with alternative suites 2 and 3, NMFS would also maintain the 60 mt ww (43.2 mt dw) shark display and research quota under alternative suite 3. Therefore, the socioeconomic impacts associated with the 60 mt ww shark display and research quota would be the same as described for alternative suites 2 and 3.

Fishery level impacts

Under alternative suite 4, the commercial quotas would be reduced to 116.6 mt dw for sandbar sharks and 541.2 mt dw for non-sandbar LCS; however, these quotas would be divided among vessels operating within a small research fishery and vessels operating outside the research fishery. All of the 116.6 mt dw (257,056 lb dw) quota for sandbar sharks would be allocated to the vessels operating in the research fishery. In addition, it is anticipated that 50 mt dw (110,230 lb dw) of the non-sandbar LCS quota would be caught while fishermen fulfilled the 116.6 mt dw of sandbar quota in the research fishery (see Section 4.4.2 and Appendix A, Table A.5). Therefore, in 2006 ex-vessel prices, it is estimated that vessels operating in the research fishery could make $490,411 in gross revenues of sandbar and non-sandbar LCS landings (Table 4.16). Since 5 to 10 vessels are anticipated to participate in the research fishery, it is estimated that a vessel could make between $98,082 (*i.e.*, 5 boats) to $49,041 (*i.e.*, 10 boats) in gross revenues on sandbar shark and non-sandbar LCS landings.

Table 4.16 Gross revenues under alternative suite 4.

Alternative Suite 5	mt dw	lb dw	2006 Ex-Vessel Price	Total Gross Revenues	% Reduction from Status Quo
Vessels in the research fishery					
Sandbar shark	116.6	257,056			
Non-sandbar LCS	50	110,230			
Sandbar shark fins		12,853	$18.84	$242,147	
Sandbar shark carcass		244,204	$0.39	$95,239	
Non-sandbar LCS fins		5,512	$18.84	$103,837	
Non-sandbar LCS carcass		104,719	$0.47	$49,218	
Total revenues from sandbar and non-sandbar LCS landings				$490,441	
Total revenues from sharks per trip				$5,331	
Vessels outside the research fishery					
Non-sandbar LCS	491	1,082,459			
Non-sandbar LCS fins		54,123	$18.84	$1,019,676	
Non-sandbar LCS carcass		1,028,336	$0.47	$483,318	
Total revenues from non-sandbar LCS landings				$1,502,994	
Total revenues from sharks per trip (total revenues / 1,460 trips)				$1,365	
Total revenues under alternative suite 4 from sandbar and non-sandbar LCS landings				**$1,993,435**	**↓48%**

Gross revenues of sandbar sharks and non-sandbar LCS by directed and incidental permit holders under status quo				$3,824,589	

Vessels operating outside of the research fishery would have an estimated 491 mt dw (1,082,459 lb dw) of non-sandbar LCS quota available to them depending on non-sandbar LCS landings in the shark research fishery (see Section 4.4.2). In 2006 ex-vessel prices, this is equivalent to $1,502,994 in gross revenues (Table 4.16). In total, vessels operating within, and outside, of the research fishery are expected to have gross revenues of $1,993,435 in sandbar and non-sandbar LCS landings (Table 4.16). This is a 48-percent reduction in gross revenues from sandbar sharks and non-sandbar LCS under the status quo (gross revenues based on current directed and incidental permit holders' landings were $3,824,589; Table 4.9). This is less of a reduction compared to alternative suite 2 and 3 because the entire sandbar and non-sandbar LCS quotas could be harvested under alternative suite 4. Because the states of Florida, Louisiana, New Jersey, and North Carolina have the most incidental and direct shark permit holders (Table 3.32), it is anticipated that these states would have the largest negative socioeconomic impact by these reductions in quotas of different shark species.

As with alternative suites 2 and 3, porbeagle sharks would be placed on the prohibited list under alternative suite 4. Based on the average porbeagle shark landings from 2002 to 2004 (1.5 mt dw or 3,402 lb dw) and 2006 ex-vessel prices, this is equivalent to a $6,081 gross revenues loss in porbeagle shark landings under alternative suite 3 (Table 4.9).

In alternative suite 4, under and overharvests would be applied to the next season as described for alternative suite 2. Therefore, it is anticipated that the socioeconomic impacts of the application of under and overharvests would be the same as described for alternatives suites 2 and 3. In addition, alternative suite 4 would require that shark fins remain on the shark through the first port of landings. As with alternative suites 2 and 3, the overall socioeconomic impact of this could be significant given the reduction in the sandbar quota, which is the most lucrative shark due to the value of its fins. Therefore, the socioeconomic impacts associated with landing sharks with their fins on would be the same as described for alternative suite 2.

<u>Directed and Incidental permit holder impacts in the research fishery</u>

Currently directed permit holders have a 4,000 lb dw LCS trip limit. Vessels operating within a shark research fishery may experience similar trip limits, depending on the research objectives of the fishery. However, the overall quota for sandbar sharks in the research fishery would be reduced to 116.6 mt dw. Assuming the catch composition is 70 percent sandbar sharks, and there is a 4,000 lb dw trip limit, 92 trips would fulfill the sandbar shark quota (see Section 4.4.2 and Appendix A, Table A.2). Given this catch composition, 30 percent of 4,000 lb dw trip would be non-sandbar LCS. If 92 trips were made with these trip limits and catch compositions, it is estimated that 50 mt dw of non-sandbar LCS would also be caught in the research fishery (see Section 4.4.2 and Appendix A, Table A.5). Based on these landings, the research fishery would have estimated overall gross revenues of $490,411 or $5,331 per trip in gross revenues (assuming these are BLL trips; Table 4.16). On average, directed permit holders reported 1,108 trips per year (using a combination of gear types) in the Coastal Fisheries and HMS logbooks that landed sandbar sharks and non-sandbar LCS from 2003 to 2005 (Table 4.11). While 92 trips represents a greater than 90 percent reduction in the average number of trips taken by directed permit holders from 2003 to 2005, these trips would be divided across a much smaller universe of vessels, therefore, minimizing the economic impacts for vessels that are selected to participate in the research fishery. Since Florida, New Jersey, North Carolina, and Louisiana have the most directed shark incidental permit holders, it is anticipated that these states would have the largest negative socioeconomic impacts given the limitation of only a few vessels inside the research fishery being able to maintain higher trip limits than those vessels operating outside the research fishery.

Incidental permit holders took, on average, 305 trips per year that landed sandbar sharks and 347 trips per year that landed non-sandbar LCS in 2003 to 2005 (Table 4.11). On average, they landed 2 sandbars and 3 non-sandbar LCS per trip for total estimated gross revenues of $248 per trip (Table 4.11). However, under alternative suite 4, incidental fishermen would have the same retention limits as directed shark permit holders, and therefore, receive the same gross revenues from shark landings as directed shark permit holders. Given gross revenues for directed shark permit holders would be $5,331 per trip under alternative suite 4, the same gross revenues for incidental permit holders would be almost 21 times higher than gross revenues under the status quo ($5,331/$248 = 21.4 times higher). Therefore, positive economic impacts may be realized by the few incidental permit holders that may participate in the research fishery.

Directed and Incidental permit holders outside the research fishery

Directed and incidental permit holders operating outside the research fishery would still be able to retain 22 non-sandbar LCS per trip until the remaining 491 mt dw non-sandbar LCS quota is filled. Based on 2006 ex-vessel prices, this quota could result in gross revenues of $1,502,994 (Table 4.16). Given the 22 LCS trip limit (741.4 lb dw non-sandbar LCS per trip) and the 491 mt dw (1,082,459 lb dw) of non-sandbar LCS quota, approximately 1,460 trips (1,082,459 lb dw / 741.4 lb dw per trip) could be made by directed and incidental permit holders to fulfill the non-sandbar LCS quota. This is equivalent to approximately $1,365 per trip in non-sandbar LCS gross revenues (Table 4.16).

On average, directed permit holders made 1,108 trips that landed non-sandbar LCS from 2003 to 2005 resulting in gross revenues of $1,497 per trip in non-sandbar LCS landings (Table 4.11). Therefore, directed permit holders operating outside of the research fishery could take an 8-percent reduction in gross revenues per trip for non-sandbar LCS landings ($1,497 - $1,365 = $132; $132/$1,497 = 8-percent reduction). In addition, on a trip basis, directed permit holders made approximately $1,860 in gross revenues from sandbar sharks (Table 4.11). Therefore, directed permit holders could lose $1,993 in combined gross revenues earned from non-sandbar LCS and sandbar shark landings per trip ($1,497+$1,860 = $3,358; $3,358 - $1,365 = $1,993; Table 4.11), which is a 59-percent reduction in gross revenues per trip ($1,993/$3,358 = 59 reduction) for directed permit holders operating outside of the research fishery compared to the status quo. Since an average of 141 vessels with directed shark permits reported sandbar landings in the Coastal Fisheries and HMS Logbooks from 2003 to 2005 and most directed permit holders are located in Florida, New Jersey, and North Carolina (Table 3.32), it is anticipated that these 141 active vessels in these states would be most negatively impacted by alternative suite 4.

On average, incidental permit holders made 347 trips per year that landed an average of 3 non-sandbar LCS per trip from 2003 to 2005. This resulted in average gross revenues of $141 per trip in non-sandbar LCS landings (Table 4.11). However, under alternative suite 4, incidental permit holders operating outside of the research fishery could retain 22 non-sandbar LCS per trip, resulting in $1,365 per trip in non-sandbar LCS gross revenues. This would be an increase in gross revenues of almost 10 times the trip average under the status quo ($1,365 per trip/$141 per trip= 9.6). However, incidental permit holders outside the research fishery would not be able to land sandbar sharks, equating to a $25,024 loss in gross revenues from sandbar landings for incidental permit holders (Table 4.9). Therefore, the lost revenues in sandbar landings could be offset by the 10 fold increase in gross revenues from non-sandbar LCS landings on a trip basis. For instance, if fishing effort by incidental permit holders stayed constant (*i.e.*, 347 trips), and the gross revenues of $1,365 per trip were realized by incidental permit holders, this would equate to $473,655 in gross revenues from non-sandbar LCS by incidental permit holders (347 trips x $1,365/trip = $473,655). A loss of $25,024 in gross revenues from sandbar landings makes the incidental fishery's net gross revenues in non-sandbar LCS landings equal to $448,631 ($473,655 - $25,024 = $448,631). Given the total gross revenues for sandbar and non-sandbar LCS landings was $80,558 under the status quo (Table 4.9), incidental permit holders operating outside of the research fishery could still increase their gross revenues by almost 6 times under alternative suite 4 compared to the status quo. Since most incidental shark permit holders are in the states of Florida, Louisiana, New Jersey, and North Carolina (Table 3.32), these states would benefit the most from this increase in gross revenues.

4.4.11 Time/Area Closures

Under alternative suite 4, NMFS would maintain the mid-Atlantic shark closed area to BLL gear and the current BLL closures in the Caribbean that were implemented in February 2007, (72 FR 5633). Therefore, the economic impacts associated with these closures would be the same as described under alternative suite 1. In addition, NMFS would also implement the SAFMC's MPAs as described under alternative suite 2. Therefore, the economic impacts associated with the MPAs would be the same as described in alternative suite 2.

4.4.12 Reporting

This alternative suite could result in neutral economic impacts, similar to alternative suite 3. Shark dealers would be still be required to submit landings data twice a month, however, they would need to ensure that it is actually *received* by the Agency within 10 days of a bimonthly reporting period ending. Currently, shark dealers simply have to ensure that the landings reports submitted to NMFS are *post-marked* within 10 days of the end of a reporting period. Additional burden is not expected as a result of modifying the regulations to ensure that dealer reports are actually received. Furthermore, timelier reporting and receipt of information by the Agency may result in a decreased likelihood that quotas would be exceeded and overharvests removed from forthcoming shark seasons.

This alternative suite would increase the level of observer coverage for a limited number of vessels that would apply and be selected for participation in a shark research program. One-hundred percent observer coverage would be a requirement for consideration under this program. Vessels outside the shark research program would still be required to take an observer if selected. All vessels would still be required to complete and submit commercial logbooks in the same timeframe.

As described in alternative suites 2 and 3, this suite would change how sharks listed as unclassified on shark dealer reports are accounted for under quota monitoring. Unclassified sharks would be counted as sandbar sharks, and not as LCS, which is the current procedure under quota monitoring. Properly identifying sharks would result in negative economic impacts in the short-term because it takes more time. Submission of accurate shark dealer data may result in positive economic impacts in the long-term as it would improve quota monitoring, decrease the likelihood of extensive overharvests and subsequent closures, and improve the results from stock assessments by ensuring data is more accurate and includes species specific information.

4.4.13 Seasons

The same negative economic impacts for the North Atlantic region described in alternative suites 2 and 3 would exist for alternative suite 4. Furthermore, seasons would be closed within five days notice of any species/complex attaining 80 percent of their quota. The primary difference between alternative suite 4 and the other alternatives would be that there would be a limited number of vessels that would be selected to participate in a shark research program, and would be able to land sandbar, non-sandbar LCS, and other species/complex year-round if quota was available. As described in alternative suites 2 and 3, seasons for sandbar and non-sandbar LCS would both be closed with five days notice if either achieves 80 percent of their respective species/complex quota. This could result in negative economic impacts as it would limit the number of trips that may be scheduled for all vessels.

4.4.14 Regions

As stated in alternative suites 2 and 3, eliminating regions would likely have negative economic impacts on regions that do not have sharks present year round. The North Atlantic region would be disadvantaged as a result of reverting back to one region, versus three under the status quo, as they would not have a secure regional trimester quota which increased the likelihood that they would have a shark fishery when sharks are present in the summer months. However, this alternative suite would implement a shark research program that would allow a limited number of vessels to conduct fishing activities in all regions throughout the year. Vessels outside the research fishery could either move to southern areas to participate in the shark fishery in areas where sharks are present year-round or redistribute fishing effort to other fisheries. Dealers in the North Atlantic region would most likely be negatively affected, possibly even more so than vessels, as the likelihood of consistently having shark products would decrease.

4.4.15 Recreational Measures

As described under alternative suites 2 and 3, participants in recreational shark fisheries would experience negative economic impacts as a result of reducing the number of sharks that could be legally landed (Table 4.8). Therefore, the socioeconomic impacts associated with the recreational measures under alternative suite 4 would be the same as outlined for alternative suites 2 and 3.

Conclusion

This alternative suite is preferred at this time because it implements quotas and retention limits necessary to rebuild and stop overfishing of several shark species; it maximizes scientific data collection by implementing a limited research fishery for sandbar sharks to continue with 100 percent observer coverage; and mitigates some of the significant economic impacts that are necessary and expected under all alternative suites to reduce fishing mortality as prescribed by recent stock assessments. This alternative suite strikes a balance between positive ecological impacts that must be achieved to rebuild and stop overfishing on depleted stocks while minimizing the severity of negative economic impacts that would occur as a result of these measures. By allowing a limited number of historical participants to continue to harvest sharks, the Agency ensures that data for stock assessments and life history samples would continue to be collected. This would also allow a small pool of individuals to continue to collect revenues from sharks as they have in the past. Individuals not selected to participate in the shark research program could still land 22 non-sandbar LCS per vessel per trip, which would limit the number of trips targeting non-sandbar LCS sharks, however, would still afford the opportunity to keep some sharks that are landed incidentally, preventing excessive discards.

However, some negative economic impacts may still occur under alternative suite 4. For instance, fishermen outside the research fishery would not be able to land sandbar sharks and would be subject to a limited non-sandbar LCS quota, resulting in 48-percent reduction in gross revenues compared to the status quo (Table 4.16). These losses in gross revenues may be exacerbated by the requirement to land shark with their fins attached. In addition, eliminating regions and seasons represents an economic disadvantage to the North Atlantic region as sharks are not present in these waters year-round, meaning the quota may be filled in some years before sharks are present in these areas. The elimination of seasons and regions combined with limiting underharvest carry-overs may have negative economic impacts on fishermen, especially for regions that consistently had underharvests of species like SCS. However, incidental permit holders would have higher retention limits of sandbar and non-sandbar LCS inside the research fishery as well as they would experience higher retention limits of non-sandbar LCS outside the research fishery. Therefore, they might experience positive economic benefits under alternative suite 4.

Since only a few vessels would be participating in the research fishery, interactions with protected resources may decrease as a result of less BLL and gillnet fishing effort targeting sharks. However, it is assumed that some of this fishing effort may be displaced to other gillnet and BLL fisheries in which participants are permitted, which may interact with protected resources. In addition, alternative suite 4 would require that sharks be landed with their fins still attached; this requirement could prevent fishermen from keeping the fins from sharks that are not landed, resulting in a reduction of overall shark mortality.

Sandbar landings within the research fishery would be monitored by shark observer reports. These reports would be submitted at the conclusion of a fishing trip; therefore allowing near real-time quota monitoring of the sandbar quota as well as other species of sharks landed in the shark fishery. This is especially critical for the 116.6 mt dw sandbar quota. Non-sandbar LCS, SCS and pelagic sharks caught outside would be monitored by biweekly dealer reports. Given the reduced trip limit for non-sandbar LCS, if dealer reports are submitted on a timely basis, then NMFS anticipates quota monitoring would be improved, reducing the likelihood of overharvests. This would be economically beneficial to fishermen as well as ecologically beneficial to the shark stocks.

4.5 Alternative Suite 5: Close Atlantic Shark Fisheries

Ecological Impacts

4.5.1 Quotas, Species Complexes and Retention Limits

This alternative suite would prohibit the landing of all sharks in commercial and recreational fisheries. This alternative suite could have positive ecological impacts for sandbar sharks. The 2005/2006 stock assessment for sandbar sharks recommends a total allowable catch of 220 mt ww (158.3 mt dw) per year to rebuild the stock by 2070. A quota of 0 mt dw would expedite the time necessary for rebuilding sandbar sharks stocks. However, even if landings of sandbar sharks were prohibited in Federal waters, there would still continue to be dead discards, illegal landings, and landings in state waters that must be accounted for. Based on landings reported in the Coastal Fisheries Logbook, landings and discards in the HMS Logbook, and discards reported in by the BLL observer program (Hale and Carlson, 2007), it is estimated that there would continue to be approximately 39.7 mt dw per year of sandbar sharks landed in state waters, landed illegally or discarded dead in recreational and commercial fisheries (Table 4.1 plus 27 mt dw due to potential recreational landings). This level of fishing mortality represents a decrease of 118.3 mt dw compared to the fishing mortality level recommended by the sandbar shark stock assessment and could have positive ecological impacts on a species that is overfished and experiencing overfishing. Compared to current fishing mortality levels, implementing this alternative suite could result in a decrease in total landings and discards of sandbar sharks of approximately 86 percent by number of sharks or 95 percent by weight (assuming mean commercial sandbar weight = 40.5 lb dw; Cortés and Neer, 2005).

Dusky sharks have been a prohibited species since 2000, however, they continue to be landed and/or discarded in longline, gillnet, and recreational fisheries pursuing sharks and other species. This alternative suite could have positive ecological impacts as it would prohibit landings of all shark species. Presumably, this could reduce fishing effort for all sharks in longline, gillnet, and recreational fisheries. Closing Atlantic shark fisheries could reduce the number of dusky sharks that are caught as bycatch and then discarded dead, however, it would not likely affect the number of dusky sharks that are landed illegally by commercial or recreational participants or dusky sharks landed in state waters. Approximately 8.1 mt dw of dusky sharks would likely continue to be landed in state waters, landed illegally or discarded dead in commercial and recreational fisheries (Table 4.1). This represents a 75-percent reduction in weight (34 percent by number) of dusky sharks that are currently being landed or discarded.

Closing the Atlantic shark fisheries could result in positive ecological impacts for other species in the LCS complex (non-sandbar LCS than sandbar sharks). In 2005/2006, stock assessments for the LCS complex (including sandbar sharks) and blacktip sharks in the Gulf of Mexico and South Atlantic were conducted. The results of these assessments indicate that it is not appropriate to assess the species included in the LCS complex as a group, so the LCS complex status was declared to be unknown. Blacktip sharks in the Gulf of Mexico are healthy, whereas, in the South Atlantic they are unknown. The stock assessment for blacktip shark recommended maintaining current fishing mortality levels in the Gulf of Mexico region and not increasing landings in the South Atlantic region. Most of the species that comprise the LCS complex, with the exception of sandbar and blacktip sharks, have limited landings data available and/or are not encountered frequently in commercial fisheries or fisheries surveys. There are limited landings data available for these species but life history studies indicate that these species generally mature later, and have fewer pups, than other sharks landed in commercial and recreational fisheries. Closing the Atlantic shark fisheries would minimize but not eliminate landings of non-sandbar LCS as these species would still be caught illegally, discarded dead, or landed in state waters. It is estimated that 51.7 mt dw per year of non-sandbar LCS sharks would continue to be discarded or landed in state waters (Table 4.1). This represents a 66-percent reduction in landings of non-sandbar LCS, resulting in positive ecological impacts.

This alternative suite would also close the fishery for SCS to further reduce fishing effort and assist in rebuilding of overfished shark species that could be caught when targeting SCS. The ecological impacts of closing the SCS fishery could likely be positive for the SCS complex. The SCS complex, and individual species comprising the complex, are currently being assessed following the SEDAR methodology. Preliminary results from the assessment workshop indicate that blacknose sharks are overfished and experiencing overfishing. Finetooth, bonnethead, Atlantic sharpnose sharks, and the SCS complex are not overfished or experiencing overfishing. The Agency may take additional measures, as necessary, once results of the stock assessment are reviewed and final determinations are made. On average, recreational SCS fisheries landed 306.4 mt dw per year between 2003-2005. Commercial fisheries landed approximately 250 mt dw per year during the same time period. The majority of commercially landed SCS are caught with gillnet gear. Minimizing gillnet fishing effort may also result in positive ecological impacts for species that are caught incidentally in these fisheries. However, illegal landings of SCS, dead discards, and landings in state waters would continue to occur, despite closing the SCS fishery.

In addition, this alternative suite would close the fishery for pelagic sharks and could likely result in positive impacts for pelagic sharks. As described in Chapter 3, stock assessments have been conducted for blue, shortfin mako, and porbeagle sharks. Stock assessments for blue and shortfin mako shark stocks conducted by the Standing Committee on Research and Statistics (SCRS) of ICCAT in 2005, indicated that results of both these assessments should be considered preliminary due to limitations on quality and quantity of catch data available. These species will be assessed again in 2008 by the SCRS. The stock assessment for porbeagle sharks, conducted by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), indicates that porbeagle are overfished but are not experiencing overfishing. The estimated rebuilding time frame is 100 years. NMFS has reviewed the Canadian stock assessment and deemed it to be the best available science and appropriate for management in U.S. waters. There were 4,700 pelagic sharks landed per year in recreational fisheries from 2002 to 2004. During the same time period, commercial fisheries landed 587,925 pelagic sharks per year (266 mt dw). The commercial fishery landed an average of 1.54 mt dw per year of porbeagles from 2002-2004. Dead discards and illegal landings of pelagic sharks would continue to occur if landings are prohibited; however, the Agency assumes that these levels of fishing mortality would be significantly less than current levels.

Ecological impacts for prohibited shark species are expected to be positive, despite the fact that it is already illegal to land these sharks. As described above, drastic reductions in fishing effort as a result of closing the Atlantic shark fishery would result in less effort targeting sharks. Reductions in longline and gillnet effort targeting sharks are expected to reduce bycatch and discards of prohibited sharks.

This alternative suite would partition the 60 mt ww quota for exempted fishing permits, display permits, scientific research permits, and letters of acknowledgement to place more stringent limits on the quantity of sandbar and dusky sharks authorized for these purposes. However, the overall 60 mt ww quota would not be modified. This quota represents less than five percent of the current commercial quota. Maintaining this quota could result in neutral ecological impacts because the quota has never been met in the past, and the Agency could strictly regulate the number and species of sharks authorized for exempted fishing and public display. Reducing the amount of dusky and sandbar sharks authorized for these purposes could result in neutral or slightly positive ecological impacts for these species. The sandbar sharks harvested under this program have ranged from 57 to 110 sharks per year from 2004 to 2006. Ecological impacts on other species would be neutral. The sandbar shark quota authorized for research and public display would be limited to 2 mt dw (1 mt dw for research, 1 mt dw for display). Dusky sharks would not be allowed for public display due to concerns regarding their stock status and their performance in captivity. However, based on research needs and objectives, NMFS would review the allocation of dusky sharks for research on a case by case basis. The remaining quota for exempted fishing permits (41.2 mt dw or 57.2 mt ww) would be authorized for all other shark species, besides dusky and sandbar sharks, under the exempted fishing program.

Closing Atlantic shark fisheries would likely have positive impacts on non-shark species that are incidentally landed with gillnet and BLL gear used to target sharks. Vessels targeting sharks with BLL gear in the Gulf of Mexico effectively target sharks, as observer reports from 2005-2006 indicate that sharks comprise 92 percent of the total catch, however, there are other species that are caught while targeting sharks. Some of these species include: grouper, king snake eel, red drum, and snapper (various spp.). In the South Atlantic region, sharks comprised a majority (95 percent) of the total catch, however; grouper, snapper, cownose ray, smooth dogfish, mutton snapper, and spiny dogfish, were also caught by vessels targeting sharks. Closing the Atlantic shark fishery would significantly reduce shark fishing effort with BLL gear, resulting in positive ecological impacts to some of the species that are landed incidentally by shark fishermen deploying BLL gear. Similar to BLL fisheries targeting sharks, observer reports from the gillnet fishery indicate that there are non-shark species caught with this gear by fishermen targeting sharks.

Observer reports from the gillnet fishery between 2004 and 2005 indicate that non-shark bycatch varies considerably depending on how gillnets are fished. Strike gillnets catch 99 percent sharks, drift gillnets catch 71 percent sharks, and sink gillnets catch 82 percent sharks.

Non-shark species commonly caught in drift and sink gillnet gear includes: little tunny, king and Spanish mackerel, great barracuda, cobia, southern kingfish, guitarfish, sailfish, and gulf flounder. Significant reductions in directed shark gillnet fishing effort as a result of closing shark fisheries could likely result in positive ecological impacts for these species.

Some of the positive ecological impacts that closing the Atlantic shark fishery on other non-shark species may be mitigated by the fact that displaced shark fishermen would likely transfer fishing effort to other BLL and gillnet fisheries. It is difficult to predict exactly which fisheries would receive the majority of the fishing effort that is redistributed to other fisheries by closing the shark fishery. Currently, the majority of shark fishing effort takes place in the Gulf of Mexico and South Atlantic regions. Judging by the other permits that shark directed and incidental fishermen possess, it seems likely that effort would likely increase in several other managed-fisheries in the South Atlantic and Gulf of Mexico regions, including: snapper grouper, reef fish, tilefish, Spanish mackerel, King mackerel, and dolphin/ wahoo. These affects are discussed in more detail in under the cumulative impacts section in Section 4.14.

4.5.2 Time/Area Closures

The existing seasonal BLL closures affecting the Atlantic shark fishery would no longer be necessary as this alternative suite closes the Atlantic shark fishery and would no longer allow the use of BLL gear by shark permit holders. In isolation, removing the time/area closures could have neutral ecological impacts on sharks and incidentally landed species as the shark fishery would no longer exist. Currently, NMFS prohibits gillnet fishing or gillnet possession during annual restricted periods associated with the right whale calving season. Limited exemptions to the fishing prohibitions are provided for gillnet fishing for sharks and for Spanish mackerel south of 29°00' N. lat. An exemption to the possession prohibition is provided for transiting through the area if gear is stowed in accordance with this final rule. The southeast U.S. restricted area would be expanded north to approximately the border between North and South Carolina and divided into two regions, north and south. North of 29 N, the restricted period would be from Nov. 15- April 15. South of 29 N latitude the restricted area would be in effect from Dec. 1 through March 31 of each year. Positive ecological impacts for right whales, protected resources, and other bycatch could likely occur as a result of maintaining these closures.

4.5.3 Reporting

This alternative suite would have neutral ecological impacts concerning reporting. Shark dealer reports would no longer be submitted by dealers twice a month as they would no longer be allowed to purchase sharks. Commercial fishermen with Federal HMS permits would still be required to submit landings data via logbooks within seven days of offloading, however, this data would not include any information concerning sharks as they would no longer be landed. Currently, 20 percent of fishermen whom submit data via the Coastal Fisheries Logbook are selected to provide information on any discards that occurred during the fishing trip. The percentage selected would be increased to improve monitoring of sharks that are likely to be landed and discarded in other BLL and gillnet fisheries so that this information could be incorporated into stock assessments in the future. The need to take an observer on directed shark trips would no longer be necessary as this alternative suite would close the Atlantic shark fishery. Furthermore, the Agency would lose a critical source of fisheries dependant information from the

BLL and gillnet fisheries as a result of this alternative suite. Closing the Atlantic shark fishery would negate the need to have observer programs for the BLL and gillnet fisheries. Because information attained from these programs is used to monitor protected resource interactions, gather biological samples, conduct stock assessments, and better understand shark fishing practices, this alternative suite is currently not preferred. .

4.5.4 Seasons

Seasons for the commercial Atlantic shark fishery would no longer apply as this alternative suite would close the fishery.

4.5.5 Regions

Regions for the commercial Atlantic shark fishery would no longer apply as this alternative suite would close the fishery.

4.5.6 Recreational Measures

Closing the recreational fishery for Atlantic sharks would have positive ecological impacts because recreational landings of sharks would decrease significantly. The level of recreational fishing effort and landings vary by shark species. The most commonly landed species include: blacktip, sandbar, spinner, bull, lemon, nurse, shortfin mako, Atlantic sharpnose, bonnethead, and blacknose sharks. Tables 3.23 to 3.26 show the landings for various shark species from 1998-2005. There would likely be some level of fishing mortality in recreational fisheries despite prohibiting landings of sharks as a result of post-release mortality and/or sharks that are landed illegally. However, it is assumed that landings would decrease dramatically, especially since it would alleviate the need for fishermen to positively identify sharks before determining whether or not the species could be landed. Rather, all Atlantic sharks (except for spiny dogfish which are managed by NEFMC and MAFMC) would be prohibited from retention. Directed outreach efforts focusing on the recreational fishing community may help to improve understanding of, and compliance with, shark fishing regulations.

4.5.7 Protected Resources and EFH

Prohibiting use of BLL gear would have positive ecological impacts on protected resources, including: sea turtles, smalltooth sawfish, and marine mammals. From 1994-2006, the BLL shark fishery caught 74 sea turtles (6 leatherback, 59 loggerheads, and 9 other sea turtles). Fourteen smalltooth sawfish and four delphinids were also observed caught in the BLL fishery during the same time period. Interactions with BLL gear and protected resources in fisheries targeting sharks would likely decrease as a result of this alternative suite. Bottom longline effort would still remain, and possibly increase, in other fisheries that target other species with BLL, including: snapper grouper, reef fish, and tilefish. However, those fisheries are subject to different Biological Opinions and Incidental Take Statements than the shark fishery.

Closing the shark gillnet fishery would have positive ecological impacts for protected resources. Between 1994 through 2006, 12 sea turtles were observed; 11 loggerheads, and 1 leatherback. There has been one smalltooth sawfish observed in the gillnet fishery which occurred in 2003. From 1999 – 2004, observed takes in the gillnet fishery of marine mammals totaled 12 bottlenose dolphins and four spotted dolphins.

Closing all Atlantic shark fisheries would have positive ecological impacts for essential fish habitat because the primary gear deployed in the commercial shark fishery is BLL gear. This gear type may have potentially adverse effects on HMS and non-HMS EFH. Bottom longlines principally target large coastal sharks in the EEZ between Texas and Maine. Typically they are placed in sandy and muddy bottom habitats where expected impacts would be minimal to low (Barnette, 2001). The 1999 NMFS EFH Workshop categorized the impact of BLL gear on mud, sand, and hard-bottom as low (Barnette, 2001). Bottom longline may have some negative impact if gear is set in more complex habitats, such as hardbottom or coral reefs in the Caribbean or areas with gorgonians, or soft corals and sponges in the Gulf of Mexico (Barnette, 2001, NREFHSC, 2002; Morgan and Chuenpagdee, 2003). Bottom longline set with cable groundline or heavy monofilament with weights could damage hard or soft corals and potentially become entangled in coral reefs upon retrieval, resulting in coral breakage due to line entanglement. However, the extent to which BLL gear is fished in areas with coral reef habitat has not been determined. This gear type is similar to that employed in fisheries targeting reef fish in the Gulf of Mexico and South Atlantic regions.

Bottom longline gear may have a detrimental effect on non-HMS EFH if it is placed in coral reefs, hard bottom, or SAV habitats. Bottom longline gear in HMS fisheries is primarily used in sandy and/or muddy habitats where it is expected to have minimal to low impacts. However, this alternative would close shark fisheries and it is expected that participants would transfer effort to other BLL fisheries targeting reef fish, and snapper grouper, which are found at different depths and over different bottom types, which may have negative ecological impacts on non-HMS EFH.

Social and Economic Impacts

4.5.8 Quotas, Species Complexes, and Retention limits

Alternative Suite 5 would have significant economic and social impacts on a variety of small entities, including: commercial shark permit holders, shark dealers, and other secondary industries dependent on the shark fishery such as gear manufacturers, bait and ice suppliers. The level of economic impact would be directly proportional to the amount of revenues that each entity has realized from past participation in the shark fishery. Permit holders would be impacted differently depending on the quantity of sharks landed in the past. Vessels targeting sharks (directed permit holders) landed an annual average of 1,262 mt dw of LCS, 184.5 mt dw SCS, and 29.84 mt dw pelagic sharks per year between 2003-2005. The gross revenues based on 2006 ex-vessel prices of these landings are estimated at $3,877,003, $593,853, and $117,920 for LCS, SCS, and pelagic sharks, respectively, based on price information provided in Table 3.42. While it is assumed that few directed shark permit holders subsist entirely on revenues attained from the shark fishery, impacts would still be severe for those participants that depend on any income from participating in the directed shark fishery at certain times of the year. Because of the extensive economic impacts to shark directed permit holders as a result of this alternative suite, it is assumed that directed permit holders would likely pursue one of the following options as a result of closing the Atlantic shark fishery: (1) transfer fishing effort to other fisheries for which they are already permitted (snapper grouper, king and Spanish mackerel, tilefish, lobster, dolphin/wahoo, etc), (2) acquire the necessary permits to participate in other fisheries (both open access and/or limited access fisheries), or (3) relinquish all permits and leave the fishing industry. Table 3.32 displays the other permits held by directed shark permit holders as of May 2007.

Incidental permit holders would face negative economic and social impacts as a result of closing the Atlantic shark fishery, however, not as severe as directed permit holders. It is assumed that incidental permit holders receive the majority of their fishing income from participating in other fisheries depending on the region and the type of gear predominantly fished (i.e., swordfish, tunas, snapper grouper, tilefish, dolphin/wahoo, lobster, etc.). It is estimated that, on average, between 2003 to 2005 incidental permit holders landed 26.8 mt dw LCS, 15.3 mt dw SCS, and 8.11 mt dw pelagics per year. This equates in gross revenues based on 2006 ex-vessel prices for these landings of $82,333, $49,246, and $32,049 for the respective species complexes. Incidental permit holders would likely have to increase effort in these other fisheries to replace lost revenues from landing sharks. Table 3.32 shows the other permits possessed by incidental shark permit holders. Furthermore, these vessels may seek other permits (open access or limited access transferred from another vessel) or leave the fishing industry entirely.

This alternative suite would also have negative economic and social impacts for shark dealers as they would no longer be authorized to purchase shark products from Federally permitted shark fishermen Dealers would still be able to purchase shark products from state-permitted shark fishermen, depending on state-specific regulations. Shark dealers also maintain permits to purchase other regionally caught fish products. Due to the brevity of the LCS shark fishing season, which is the shark fishery that accounts for the majority of the shark product revenue due to the fin value, many dealers also get revenue from purchasing fish products other than sharks. The majority of shark dealer permit holders hold permits to purchase other fish products, including swordfish, tunas, snapper grouper, tilefish, mackerel, lobster, and dolphin/wahoo among others (Table 3.34). It is difficult to assume, on an individual dealer basis, the quantity of revenues received exclusively from shark products.

Shark fin dealers, specializing in the purchase of shark fins from Federal and state permitted dealers, would also experience negative social and economic impacts as a result of closing the shark fishery. These dealers receive virtually all of their income from purchasing shark fins and shipping them to exporters. Exporters then transport the fins to global and domestic markets. This alternative suite would likely force shark fin dealers to leave the industry or focus on purchasing other fishery products, resulting in significant economic impacts to the individuals involved in this trade.

Closing the Atlantic shark fishery would have negative economic impacts on global shark fin markets. As a result of this alternative suite, U.S. flagged vessels would no longer be able to contribute to the global demand for shark fins. This would disadvantage U.S. shark fishermen as global markets would likely need to purchase their shark fins from other markets. However, the U.S. is not a significant producer of shark products globally. Based on data from the United Nations Food and Agriculture Organization (FAO), less than one percent of global shark landings occur in the U.S. Atlantic.

It is difficult to estimate the economic and social impacts that would be experienced by various small entities that support the shark fishery, e.g., purveyors of bait, ice, fishing gear, and fishing gear manufactures. However, these impacts would likely be negative. It is difficult to estimate these impacts as it is uncertain to what extent vessels that were fishing for sharks would redistribute their fishing effort to other fisheries, or simply cease fishing operations. If the majority of vessels affected by a shark fishery closure simply displace effort to other fisheries it is assumed that they would still be dependant on small entities for their bait, ice, and gear as these are products are essential for fishing excursions targeting any species. Redistributing effort to other fisheries would mitigate negative economic impacts. However, if a significant number of vessels cease fishing operations or scale back considerably, then severe economic consequences would be imparted on these support industries as a result.

4.5.9 Time/Area Closures

Seasonal time area closures for BLL gear would no longer be applicable as a result of this alternative. Currently, NMFS prohibits gillnet fishing or gillnet possession during annual restricted periods associated with the right whale calving season. Limited exemptions to the fishing prohibitions are provided for gillnet fishing for sharks and for Spanish mackerel south of 29°00' N. lat. An exemption to the possession prohibition is provided for transiting through the area if gear is stowed in accordance with this final rule. The southeast U.S. restricted area would be expanded north to approximately the border between North and South Carolina and divided into two regions, north and south. North of 29 N, the restricted period would be from Nov. 15-April 15. South of 29 N latitude the restricted area would be in effect from Dec. 1 through March 31 of each year. Maintaining these closures would likely not result in economic or social impacts to shark gillnet fishermen.

4.5.10 Reporting

This alternative suite would increase the proportion of fishermen completing the Coastal Fisheries Logbook and the proportion of fishermen selected to report information on fish that are discarded. Increasing the number of fishermen who are selected to provide this data is not expected to have economic or social impacts. Currently, 20 percent of the fishermen completing this logbook are selected. This percentage would be increased to facilitate improved data available for shark interactions with longline and gillnet gear. This information would be especially useful because sharks could no longer be landed and the existing logbook only requires fishermen to provide data on landed fish. Shark dealers would no longer be required to submit dealer reports regarding sharks purchased. Increased reporting burden would be subject to approval under the Paperwork Reduction Act.

4.5.11 Seasons

Seasons for the commercial Atlantic shark fishery would no longer apply as this alternative suite would close the fishery.

4.5.12 Regions

Regions for the commercial Atlantic shark fishery would no longer apply as this alternative suite would close the fishery.

4.5.13 Recreational Measures

Closing the Atlantic recreational shark fishery would have negative economic and social impacts. These impacts would be most pronounced for Charter/Headboat operators whom specialize in landing sharks and operators of shark tournaments that have prize categories for landing sharks. It is difficult to estimate the number of Charter/Headboat operators that specialize in shark charters as the permit covers any participant targeting swordfish, sharks, tunas, and billfish. Many Charter/Headboat operators target a variety of species depending on client interests, weather, time of year, and oceanographic conditions. Charter/Headboat operators specializing in shark fishing charters would have to target other HMS or non-HMS species to replace revenues lost as a result of customers not being able to land sharks. However, not all customers necessarily want to land sharks. Charter/Headboat operators would still be able to catch sharks, however, all sharks regardless of species would need to be released in a manner that maximizes their chances of survival. Catering business operations to clientele interested in catch and release fishing for sharks might mitigate some of the negative economic impacts. Shark tournaments that reward prizes for landing sharks would be negatively impacted as a result of this alternative suite. There have been 79 tournaments per year that had a prize category for sharks from 2005-2006. The majority of these tournaments target pelagic sharks and are held in the North Atlantic and Gulf of Mexico regions. These tournaments would either modify their rules to only allow points/prizes for released sharks or these tournaments would cease to exist. Economic impacts on small entities such as restaurants, hotels, gear manufacturers, retail stores selling fishing supplies, and marinas in the vicinity of where these tournaments are held would also experience negative economic impacts.

HMS Angling permit holders would also experience negative impacts, despite the fact that they would still be able to catch and release sharks. Taxidermists that process anglers' catches also may be impacted if the shark fishery is closed and there is no longer a need to provide shark casts or mountings. Landings would not be permitted by any recreational anglers as a result of this alternative suite.

Conclusion

Recent stock assessments for sandbar, dusky, and porbeagle sharks indicate that these species are overfished. The primary objective of this amendment is to reduce fishing mortality for these species and allow them the opportunity to rebuild. This alternative suite would have the most significant positive ecological impacts for sharks, protected resources, and EFH of the alternative suites considered in this document. However, closing the Atlantic shark fishery would also incur the most significant economic impacts on U.S. shark fishermen, shark dealers, shark tournament operators, and others involved in supporting industries. There are numerous species of shark that are not overfished or experiencing overfishing, and therefore, do not warrant a full closure of the Atlantic shark fishery at this time. Furthermore, by closing the shark fishery, the Agency would lose a valuable source of fishery dependent data (through logbooks and the sharks BLL observer program) that would influence the ability to conduct future shark stock assessments. Other alternative suites contained in this chapter would strike an appropriate balance between preventing overfishing and allowing overfished shark stocks to rebuild, while considering the economic needs of the shark fishing community by allowing some retention of sharks.

Alternatives Modifying the Stock Assessment and SAFE Report Schedules

The 1999 FMP established that stock assessments be conducted for each species or species group every two to three years. HMS stock assessments are crucial in order to define stock boundaries, monitor rebuilding plans, improve knowledge of stock dynamics, and incorporate additional data in a timely manner. Since 2000, there have been two stock assessments completed by NMFS for LCS (2002, 2005/2006) and one assessment completed/ and one in progress for SCS (May 2002 and 2007). Other assessments have been completed by other entities, including: SCS (August 2002 by Mote Marine Laboratory), two assessments for pelagic sharks (2004 by ICCAT), and the porbeagle assessment completed by Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The Agency is aware of another stock assessment being conducted by the Standing Committee on Research and Statistics (SCRS) of ICCAT for shortfin mako and blue sharks in 2008.

The Agency is considering alternatives that would modify the frequency of stock assessments for sharks that are conducted by the Agency as well as the publication of the SAFE report each year. Changing the stock assessment frequency from every 2-3 years to at least every five years would continue to ensure that stock assessments are conducted using the best scientific information available. Currently, the frequency of stock assessments makes it difficult to discern whether or not management measures that are implemented as a result of past stock assessments have been effective prior to subsequent assessments. This makes it difficult to ascertain the impacts that management measures may be having on the stock based on the prior assessment. Further, the Agency has adopted the Southeast Data Assessment and Review (SEDAR) process for completing stock assessments, which requires three separate workshops, and generally requires more time to complete a stock assessment than in the past. For example, the most recent stock assessment for LCS was started in 2005 and completed in 2006, employing fisheries data through 2004. Management measures based on this assessment will be implemented in 2008 with the next assessment occurring in 2009 according to the existing stock assessment frequency guidelines. One year of management measures may not be representative of their effectiveness. Thus, results from a 2009 stock assessment may not reflect management measures made in the past, and while they may be representative of the most up-to-date stock data, they may not be representative of the best available science. Changing the stock assessment frequency to at least every five years would allow more time for current management measures to take effect and their results to be detected in the next stock assessment.

National Standard (NS) 2 of the Magnuson-Stevens Act requires that NMFS take into account the best scientific information available in developing FMPs and implementing regulations. For HMS, except sharks, NMFS relies on SCRS analyses. For sharks, NMFS uses the SEDAR process as outlined above. The guidelines for implementation of NS 2 require preparation of an annual SAFE report. The SAFE report will largely rely on SCRS assessments, shark SEDAR stock assessments, and any new fishery information. The guidelines for the SAFE report are outlined in the 1999 FMP (see Section 3.10.2).

The 1999 FMP for Atlantic Tunas, Swordfish and Sharks stated that the HMS Management Division would publish an annual SAFE report for Atlantic tunas, swordfish, billfish, and sharks every January or February. The SAFE report follows the guidelines specified in NS 2 and are used by NMFS to develop and evaluate regulatory adjustments under the framework procedure or the FMP amendment process. This information provides the basis for determining annual harvest levels from each stock, documenting significant trends or changes in the resource, the bycatch, and the fishery over time, and assessing the relative success of existing state and Federal fishery management programs. In addition, the SAFE report is used to update or expand previous environmental and regulatory impact documents, and ecosystem and habitat requirements, including EFH.

4.6 Alternative 6: Stock Assessments for Sharks Every 2-3 Years (Status Quo)

Rebuilding plans for sharks recommended in recent stock assessments are generally much longer in duration (*i.e.*, 100-400 years for dusky sharks, 70 years for sandbar sharks, and 100 years for porbeagle sharks) than those for other fish species because of shark life history traits. The likelihood of being able to detect if management measures have had any impact on stock status or fishing mortality when only 2-3 years have elapsed between assessments is reduced. Therefore, the Agency is proposing to increase the amount of time between shark stock assessments. These alternatives would not modify any stock assessments that are already scheduled and would not affect the frequency of stock assessments conducted for other HMS species (which are dictated by ICCAT). The timing or frequency of stock assessments completed by other management entities, governments, or Regional Fisheries Management Organizations (*i.e.*, ICCAT) would also not be affected by these proposed measures.

Ecological Impacts

Ecological impacts of conducting stock assessments every 2-3 years could be neutral. Assessments have been completed on this timeframe since the 1999 HMS FMP became effective. Since 2000, there have been two stock assessments completed by NMFS for LCS (2002, 2005/2006) and one assessment completed and one in progress for SCS (May 2002 and 2007). Other assessments have been completed by other entities, including: SCS (August 2002 by Mote Marine Laboratory), two assessments for pelagic sharks (2004 by ICCAT), and the 2005 porbeagle assessment completed by Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The Agency is aware of another stock assessment being conducted by the Standing Committee on Research and Statistics (SCRS) of ICCAT for shortfin mako and blue sharks in 2008. The timing of stock assessments is secondary to the actual management measures that are implemented, if necessary, to address overfishing and overfished stocks as far as potential ecological impacts. For fish species with life history traits such as sharks, having relatively few offspring and reaching sexual maturity at a later age, stock status is not expected to change as drastically on a year to year basis. However, as stock assessment methodologies change it is possible that having more frequent stock assessments may increase the likelihood that scientists could avail of new, more statistically robust techniques to incorporate into models designed to estimate stock status.

Social and Economic Impacts

Economic impacts of conducting stock assessments every 2-3 years could be neutral. The timing of the stock assessments does not generally have a direct economic impact, however, measures that are necessary to prevent overfishing and/or rebuild overfished stocks generally have a negative economic impact on small entities that depend on landings sharks for their livelihood. If conducting stock assessments more frequently would continue to result in the implementation of measures that require reductions in fishing mortality to maintain consistency with National Standard 1, then negative economic impacts could occur as a result. Alternatively, if results were positive for certain shark stocks, then assessing shark populations more frequently would have positive economic impacts. As additional data become available, it is difficult to predict the results of forthcoming stock assessments and the economic ramifications of the measures that need to be implemented as a result. However, the Agency has adopted the SEDAR approach to stock assessments which encourages full participation from industry, environmentalists, academics and other parties affected by stock assessments to participate at all workshops.

4.7 Alternative 7: Stock Assessments for Sharks At Least Every 5 Years. Preferred Alternative

Ecological Impacts

Ecological impacts of conducting stock assessments could be neutral or slightly negative. Conducting stock assessments on a more frequent basis allows scientists to revisit past and current methodologies on a more frequent basis to ensure that the appropriate methods are being employed for the assessment of the stock. Generally, more frequent assessments allow managers to assess past management initiatives to ensure that they are consistent with rebuilding plans and the need to prevent overfishing, if necessary. Because of the duration of time required to complete stock assessments and the subsequent time frame to implement recommended management measures, stock assessments every two to three years may not fully reflect the implemented changes. Recent assessments for sandbar, porbeagle, and dusky sharks indicate that they are all overfished. Management measures to reduce fishing mortality that could lead to rebuilding are being implemented in this rulemaking. Since the measures being considered call for such drastic reductions in fishing mortality, quotas, and retention limits it does not seem likely that an assessment in the near future could require even more stringent measures, therefore, ecological impacts are likely neutral.

Social and Economic Impacts

Economic impacts of conducting stock assessment could be variable depending on the results of the stock assessment and management measures necessary. Scheduling stock assessments so that there is more time between assessments allows participants in shark fisheries to adapt to management measures implemented in the past. This provides participants with the opportunity to decide if, and to what degree, they may continue to stay engaged in shark fisheries. More frequent stock assessments would have positive economic impacts if information attained from assessments indicated that quota levels and fishing mortality may be increased for certain species because fishermen would be able to harvest more sharks. Furthermore, participants may experience negative economic impacts if the results change dramatically and additional measures are needed to reduce fishing effort and mortality.

Conclusion

Alternative 7, conducting shark stock assessments by NMFS at least once every 5 years, is preferred at this time because it increases the interval between stock assessments allowing management measures enough time to be implemented and evaluated. Under the current schedule, SEDAR assessments may take up to one year, and by the time determinations are made and rulemaking is implemented to address these determinations, NMFS is already preparing for another stock assessment (assessments every 2-3 years). The Agency does not anticipate that there would be extensive negative ecological consequences as a result of having less frequent assessments because stock assessment methodologies, while dynamic, do not change drastically. In addition, while more frequent stock assessments (*i.e.*, stock assessments every 2 to 3 year) may be representative of the most up-to-date stock data, they may not be representative of the best available science. Changing the stock assessment frequency to at least every five years would allow more time for current management measures to take effect and their results to be detected in the next subsequent stock assessment. Furthermore, by following the SEDAR process, the Agency would still be able to incorporate new methods into stock assessments because all members of the scientific community and general public are invited to attend and exchange ideas. Economic impacts would be contingent upon the findings of future assessments and the management measures necessary; however, fishermen may expect some benefit from not having to be concerned with a new suite of management measures affecting them every 2-3 years as a result of new assessments for sharks.

4.8 Alternative 8: SAFE Report Published in January or February of Every Year (Status Quo)

Ecological Impacts

There are no specific ecological impacts associated with publishing the SAFE report in January or February of each year, rather this is an administrative deadline set by NMFS. As long as the SAFE report is published each year according to the guidelines of NS 2 (*i.e.*, it summarizes the best available scientific information concerning the past, present, and possible future condition of the stock, marine ecosystems, and fisheries being managed under Federal regulation) such that framework actions and the FMP amendment processes could address management issues appropriately, maintaining the publication date of January or February under the status quo would have neutral ecological impacts. In addition, recently published SAFE reports have been released later in the year.

Social and Economic Impacts

There are no negative social or economic impacts associated with NMFS publishing a safe report each year in either January or February as this deadline is mainly administration in nature. By publishing the SAFE report annually according to NS 2, framework actions and FMP amendments could base annual harvest levels from each stock, document significant trends or changes in the resource, the bycatch, and the fishery over time, and assess the relative success of existing state and Federal fishery management program. In doing so, management actions could appropriately address the fishery to minimize negative social and economic impacts to fishermen. However, the timing of the SAFE report within the calendar year would not affect any of these issues, therefore, maintaining the status quo would result in neutral social and economic impacts.

4.9 Alternative 9: SAFE Report Published in the Fall of Every Year

Ecological Impacts

Publishing a SAFE report in the fall of every year would allow NMFS more flexibility to balance other responsibilities throughout the calendar year, as necessary. Under alternative 9, a SAFE report would still be published every year according to NS 2 to help NMFS develop and evaluate regulatory adjustments under the framework procedure or the FMP amendment process. However, as mentioned under alternative 8, the timing of the publication is administrative in nature. Therefore, allowing the SAFE report to be published in the fall (or earlier, if necessary) would have no negative ecological impacts.

Social and Economic Impacts

There are no negative social or economic impacts associated with publishing the SAFE report in the fall of every year. Publishing the SAFE report in the fall would give the Agency more discretionary time to develop a SAFE report each year according to the guidelines under NS 2. However, since a SAFE report would still be published on an annual basis, it would provide the needed information so management actions could appropriately address the fishery to minimize negative social and economic impacts to fishermen. Therefore, publishing a SAFE report each year in the fall would have neutral social and economic impacts.

Conclusion

Both alternative 8, to publish a SAFE report in January or February of each year, and alternative 9, to publish a SAFE report in the fall of each year, would have no ecological, social, or economic impacts on fishermen and related industries. However, NMFS is preferring alternative 9 to allow for more discretionary time to develop a SAFE report each year according to the guidelines under NS 2. This would give NMFS more flexibility to balance other responsibilities throughout the calendar year, while still developing a SAFE report year based on the best available science to characterize the different fisheries and marine ecosystems managed under Federal regulations. The annual SAFE report would still be used to develop and evaluate regulatory adjustments under the framework procedure or the FMP amendment process as it is currently under the status quo.

4.10 Impacts on Essential Fish Habitat

The Magnuson-Stevens Act requires NMFS to evaluate the potential adverse effects of fishing activities on EFH. If NMFS determines that fishing gears are having an adverse affect on HMS EFH, or other species' EFH, then NMFS must include management measures that minimize adverse effects to the extent practicable. At this time, there is no evidence to suggest that implementing any of the preferred alternatives suites or alternatives in this amendment would adversely affect EFH to the extent that detrimental effects could be identified on the habitat or fisheries. Ecological impacts to EFH due to actions in this rulemaking would likely be positive as the preferred alternative suite would reduce shark BLL fishing effort as a result of reduced shark quotas. However, given the Consolidated HMS FMP gave a preliminary determination that BLL gear may be considered to have an adverse affect on EFH, and the Gulf of Mexico and Caribbean Fishery Management Council EFH FEIS's (2004) suggest that BLL gear may have an adverse effect on coral reef habitat, which serves as EFH for certain, reef fishes, NMFS will make a determination of shark BLL gear impacts on EFH in Amendment 1 to the Consolidated HMS FMP. In Amendment 1, NMFS will assess whether HMS BLL gear used primarily to target sharks is fished in coral reef areas, and if so, the intensity, extent, and frequency of such impacts, including any measures to minimize potential impacts. Based on this determination, NMFS would then take any necessary action regarding BLL gear.

4.11 Impacts on Protected Resources

NMFS does not believe that any of the proposed actions would trigger re-initiation of consultation under 50 C.F.R. 402.16. The preferred alternative suite 4 could have positive impacts on protected resources, including sea turtles, marine mammals, smalltooth sawfish, and prohibited shark species, such as dusky sharks, since it is expected to reduce overall fishing effort targeting sharks with gillnet and BLL gear. In addition, the preferred alternative suite 4 would increase the level of observer coverage on a limited number of vessels participating in a shark research program. This alternative would implement the quotas for sandbar and non-sandbar LCS, which are expected to reduce fishing effort, prevent overfishing, and rebuild overfished stocks. Such reductions are anticipated to also reduce interactions with prohibited dusky sharks by 72 percent. Retention limits for non-sandbar LCS would also be reduced significantly (22 non-sandbar LCS per vessel per trip) for vessels with shark permits outside the shark research program. While trip limits for vessels in the shark research program would be dictated by the research objectives, there would be a significant reduction in the number of trips because the quota for sandbar sharks would be drastically reduced. In addition, all of these trips would be subject to 100 percent observer coverage. Furthermore, the Agency would determine when these trips would take place throughout the year to ensure regional and seasonal sampling by scientific observers. This shark research program may also provide additional documentation and additional opportunities for data collection on interactions with protected resources via observer reports.

Shark fishermen outside of the shark research program could reduce the number, duration, and frequency of trips targeting sharks with BLL and/or gillnet gear. Furthermore, soak time might also be reduced given the reduced trip limits of 22 non-sandbar LCS per vessel per trip, which may increase post-release survival of any protected resources caught on BLL gear. Fishing effort would most likely decrease the most in the BLL fishery as this gear is the most effective gear for targeting sandbar and most LCS species. There may not be a pronounced decrease in fishing effort in the gillnet fishery as this fishery mainly targets small coastal sharks and blacktip sharks. There is the possibility that some of the current fishing effort in the BLL fishery would transfer to the gillnet fishery to target species that have more liberal retention limits (*i.e.*, SCS for directed permit holders). However, it is difficult to precisely predict how much fishing effort in longline and gillnet fisheries would change as a result of this alternative suite.

The other preferred alternatives, alternative 7, to conduct stock assessments for sharks every 5-6 years, and alternative 9, to have NMFS publish a SAFE Report in the fall of every calendar year, are not anticipated to have any significant negative ecological impacts on protected resources because they are largely administrative in nature.

4.12 Environmental Justice

Executive Order 12898 requires agencies to identify and address disproportionately high and adverse environmental effects of its regulations on the activities of minority and low-income populations. To determine whether environmental justice concerns exist, the demographics of the affected area should be examined to ascertain whether minority populations and low-income populations are present. If so, a determination must be made as to whether implementation of the alternatives may cause disproportionately high and adverse human health or environmental effects on these populations.

The communities of Dulac, Louisiana and Fort Pierce, Florida have significant populations of Native Americans and African-Americans, respectively. The 2000 Census data indicates that Native Americans made up 39 percent of the Dulac population, specifically the Houma Indians, which is not Federally recognized tribe. About 30 percent of the Dulac population was living below poverty level in 2000. In 2000, Black-Americans were about 41 percent of the Fort Pierce, Florida population with about 30 percent of the entire Fort Pierce population living below the poverty line. These two communities also have significant populations of low-income residents. In addition to Dulac and Fort Pierce, there is a diffuse Vietnamese-American population in Louisiana, actively participating in the PLL fishery, and commuting to fishing ports, but not living in "fishing communities" as defined by the Magnuson-Stevens Act and identified in Chapter 9 of this document. In reviewing the social impacts of the preferred alternatives of Amendment 2 to the Consolidated HMS FMP, none are expected to have a disproportionate impact on these minority and low-income populations. Greater information about potential social impacts of each preferred alternative suite is briefly described below with detailed information provided in earlier this Chapter. Demographic data indicate that coastal counties with fishing communities are variable in terms of social indicators like income, employment, and race and ethnic composition.

The preferred alternative suite 4, to establish as small shark research fishery, has the potential to have adverse economic and social impacts throughout the fishery. NMFS does not anticipate that these effects would fall disproportionately on minority or low-income populations. Alternative suite 4 was designed to reduce quotas and retention limits necessary to rebuild and stop overfishing of several shark species. It would also maximize scientific data collection by implementing a limited research fishery for sandbar sharks to continue with 100 percent observer coverage. In doing so, it would help mitigate some of the significant economic impacts that are necessary and expected under all alternative suites to reduce fishing mortality as prescribed by recent stock assessments. This alternative suite strikes an appropriate balance between positive ecological impacts that must be achieved to rebuild and stop overfishing on overfished stocks while minimizing the severity of negative economic impacts that would occur as a result of these measures. By allowing a limited number of historical participants to continue to harvest sharks in a manner resembling how the fishery was traditionally executed, the Agency ensures that data for stock assessments and life history samples would continue to be collected. This would also allow a small pool of individuals to continue to collect revenues from sharks as they have in the past. Individuals not selected to participate in the shark research program could still land 22 non-sandbar LCS per vessel per trip, which would limit the number of trips targeting non-sandbar LCS sharks and prevent excessive discards. NMFS believes that while this would have negative economic and social impacts in the short-term, these measures are necessary to rebuild several shark stocks and prevent other species of sharks from becoming overfished.

The other preferred alternatives, alternative 7, to conduct stock assessments for sharks at least once every five years, and alternative 9, to have NMFS publish a SAFE Report in the fall of every calendar year, are not anticipated to have any significant negative social or economic impacts on HMS-related communities and are not anticipated to have an impact on minority or low-income population because they are largely administrative in nature.

4.13 Coastal Zone Management Act

The Coastal Zone Management Act (CZMA, 1972, reauthorized 1996) requires that Federal actions be consistent to the extent practicable, with the enforceable policies of all state coastal zone management programs. NMFS has determined that the preferred alternative suites and alternatives would be implemented in a manner consistent to the maximum extent practicable with the enforceable policies of the coastal states in the Atlantic, Gulf of Mexico, and Caribbean that have Federally approved coastal zone management programs. NMFS will ask for states' concurrence with this determination during the proposed rule stage. NMFS has worked closely with states in the past and will continue to work with the states to ensure consistency between state and Federal regulations.

4.14 Cumulative Impacts

Cumulative impact is the impact on the environment, which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR § 1508.7). A cumulative impact includes the total effect on a natural resource, ecosystem, or human community due to past, present, and future activities or actions of Federal, non–Federal, public, and private entities. Cumulative impacts may also include the effects of natural processes and events, depending on the specific resource in question. Cumulative impacts include the total of all impacts to a particular resource that have occurred, are occurring, and will likely occur as a result of any action or influence, including the direct and reasonably foreseeable indirect impacts of a Federal activity. The goal of this section is to describe the cumulative ecological, economic and social impacts of past, present and reasonably foreseeable future actions with regard to the management measures presented in this document. Table 4.17 describes the overall impacts anticipated from each of the alternatives considered.

Table 4.17 Comparison of alternative suites and alternatives considered. (+) denotes positive impact, (-) denotes negative impact, (0) denotes neutral impact.

Alternative	Alternative Description	Ecological Impacts	Social Impacts	Economic Impacts
Alternative Suite 1	Maintain the existing Atlantic commercial and recreational shark fisheries (Status Quo)	--	0	0
Alternative Suite 2	Establish a limited shark fishery for directed permit holders only	+	-	-
Alternative Suite 3	Establish a limited shark fishery for directed and incidental permit holders	+	-	-
Alternative Suite 4	*Establish a research shark fishery allowing a small directed LCS fishery*	+	-	-
Alternative Suite 5	Close all Atlantic shark fisheries	++	--	--
Alternative 6	Stock assessments for sharks every 2-3 years	0	0	0
Alternative 7	*Stock assessments for sharks every 5-6 years*	0	0	0
Alternative 8	SAFE report published in January or February of every year	0	0	0
Alternative 9	*SAFE report published in the fall of every year*	0	0	0

4.15 Past, Present, and Reasonably Foreseeable Actions

As discussed in Section 3.1, NMFS has taken a number of actions in the past in order to, among other things, rebuild overfished and prevent overfishing of Atlantic sharks. These actions have included FMPs, FMP amendments, and framework actions. The goals and objectives of these past rules are summarized in Section 3.1. NMFS is required to take similar actions in this document, and can reasonably expect to implement regulations in the future to address the management and conservation of Atlantic sharks. The need and objectives of this document are described in earlier sections, particularly Chapter 1, and are not repeated here.

Other recent actions within HMS fisheries that may affect shark fishermen both directly and indirectly include the 2007 second and third season Atlantic shark rule, which set the fishing seasons and quotas for the second and third trimesters of 2007 (72 FR 20765; April 26, 2007); a rule that suspended the circle hook requirement for billfish tournaments in 2007 (72 FR 26735; May 7, 2007); a rule modifying the dehooking requirements for bottom longine fishermen (72 FR 5633; February 7, 2007); a swordfish rule that allows the swordfish fishery additional opportunities for U.S. vessels to more fully harvest the domestic swordfish quota (72 FR 31688; June 7, 2007). Reasonable future actions may include: changes to time/area closures; modifications to EFH descriptions; modifications to swordfish quotas; modifying handling and release requirements for sea turtles in other HMS fisheries; authorization of green stick fishing gear for Atlantic tunas including bluefin tuna; and, actions taken to reduce protected species interactions in HMS fisheries, particularly in the PLL fishery (*e.g.*, implementation of the Pelagic Longline Take Reduction Plan and/or reinitiating consultation under Section 7 of the Endangered Species Act). These are measures that, while not all directly related to sharks, could be implemented in other rulemakings and affect participants in shark fisheries in conjunction with the preferred alternative suite selected in this rulemaking.

In general, preferred alternative suite 4 would implement quotas and retention limits necessary to rebuild and stop overfishing of several shark species; it maximizes scientific data collection by implementing a limited research fishery for sandbar sharks to continue with 100 percent observer coverage; and mitigate some of the significant economic impacts that are necessary and expected under all the alternative suites to reduce fishing mortality as prescribed by recent stock assessments. While NMFS has evaluated the cumulative ecological and socioeconomic impacts of this preferred alternative suite below, NMFS also evaluated how other non-HMS fisheries may be impacted by the preferred alternative suite. In particular, NMFS evaluated other fisheries that vessels currently maintain permits for, shark fishermen's ability to enter other fisheries, and the subsequent impacts those fisheries might experience as a result of redirected shark fishing effort.

As part of this analysis, NMFS investigated the different types of commercial permits that directed and incidental shark permit holders currently have in addition to their HMS permits (see Table 3.42). NMFS found that many directed and incidental shark permit holders also have Gulf of Mexico reef fish, dolphin/wahoo, mackerel (including king and Spanish mackerel), and South Atlantic snapper/grouper commercial permits. A few fishermen also have lobster and non-HMS Charter/Headboat permits. NMFS also evaluated the ability of shark fishermen to move into these other fisheries (*i.e.*, Gulf of Mexico reef fish, dolphin/wahoo, mackerel, and South Atlantic snapper/grouper fisheries) as a result of quota and retention limit reductions in the Atlantic shark fishery under preferred alternative suite 4. Shark fishermen may also participate in shark fisheries in state waters or may participate in other HMS fisheries for which they may already possess permits. Table 3.42 includes vessels that possess swordfish permits in addition to commercial shark permits. An overview of each fishery is listed below, and the cumulative ecological and socioeconomic impacts of the preferred alternative, including impacts of any redistributed effort to other fisheries, are discussed below.

<u>Gulf of Mexico Reef Fish Fishery</u>

The Gulf of Mexico Fishery Management Council (Council) originally established the Gulf of Mexico Reef Fish FMP in 1984. Twenty seven amendments have been made to this plan and there are currently four additional amendments under development.

A Gulf of Mexico commercial reef fish vessel permit allows the harvest and sale of all reef fish listed in the Reef Fish FMP under quota (where applicable) and in excess of the bag limits (where applicable), except goliath grouper (all harvest prohibited), Nassau grouper (all harvest prohibited), and red snapper. Fishermen wanting to harvest and sell red snapper must also possess individual fishing quota (IFQ) shares. Issuance of new reef fish permits is under a moratorium. Access to this fishery is limited to existing permits holders. However, existing permits are transferable. In 2007, shark directed and incidental permit holders possessed 153

Gulf of Mexico reef fish permits, which represent 29% of all shark permit holders. These Gulf of Mexico reef fish permits held by shark permitted vessels are concentrated in Florida and represent 84% of the 153 GOM reef fish permits.

A portion of reef fish permit holders also possess IFQ shares, which allow them to land red snapper in addition to other reef fish. Anyone commercially fishing for red snapper now must possess an IFQ allocation and follow the established reporting protocol. Quota shares are freely transferable to any other reef fish permit holders during the first 5 years following implementation of the IFQ program and then to anyone thereafter. Shark permit holders that also possess a reef fish permit, but did not receive an IFQ allocation will likely find that it will be costly to attain such an allocation.

The Gulf of Mexico Reef Fish FMP authorizes the use of longline, hook and line, handline, bandit gear, rod and reel, buoy gear, spear, powerhead, cast net, and trawl. There is a 6,000 lbs gutted weight trip limit for all groupers, deep-water and shallow-water, combined. A 2007 interim rule for red snapper set the commercial quota at 3.315 million pounds (mp) and reduced the commercial size limit to 13 inches. In June 2007, the Council approved Joint Reef Fish Amendment 27/Shrimp Amendment 14. If implemented by NOAA Fisheries Service, this amendment would reduce the commercial quota to 2.55 mp between 2008 and 2010. The amendment would also reduce the commercial minimum size limit to 13 inches total length, require the use of non-stainless steel circle hooks, venting tools, and dehooking devices when fishing for reef fish, establish a red snapper bycatch mortality reduction goal for the shrimp trawl fishery, and establish, if necessary, shrimp fishery seasonal closures if the reduction target is not met.

The Gulf of Mexico Fishery Management Council is working on other actions including: Reef Fish Amendments 30A and 30B to address overfishing of gag, greater amberjack, and gray triggerfish; Reef Fish Amendment 29 to establish a grouper IFQ program; and a generic aquaculture amendment.

Approximately 30 percent of all shark permit holders already possess the limited access permits necessary to participate in the Gulf of Mexico reef fish fishery. Of these, the Agency did not estimate the number of vessels that were selected to participate in the red snapper fishery since the inception of an IFQ program for that fishery because permits to participate in this fishery are no longer being issued. Since the fishery is limited access and has extensive measures in place to control effort and harvest levels, it is not likely that shark fishermen will be able to compensate all potential losses from reductions in quota and retention limits proposed for sharks solely by transferring effort to the Gulf of Mexico reef fish fishery.

<u>Dolphin/Wahoo Fishery</u>

In the Gulf of Mexico, dolphin are included in the management unit under the Coastal Migratory Pelagic Resources FMP, and a charter/headboat vessel permit is required to fish for or possess dolphin in the Gulf of Mexico. Otherwise, there are no regulations controlling the harvest of these species in the Gulf of Mexico.

In the South Atlantic, historically, the dolphin/wahoo fishery has been a recreational fishery (NMFS, 2003). However, during the 1990s, commercial landings in the Atlantic Ocean increased, due in part to an increasing number of pelagic longliners targeting dolphin (NMFS, 2003). As a result, the South Atlantic Fishery Management Council, in cooperation with Mid-Atlantic and New England Fishery Management Councils, developed a comprehensive FMP for both dolphin and wahoo in the Atlantic Ocean (NMFS, 2003). This FMP was approved in December of 2003. The final rule implementing the regulations in this FMP was published on May 27, 2004 (69 FR 30235). Owing to the significant importance of the dolphin/wahoo fishery to the recreational fishing community in the Atlantic, the overall goal of the FMP was to adopt a precautionary and risk-averse approach to management that set harvest limits based on the status quo at that time, which was average catch and effort levels from 1993 to 1997 (NMFS, 2003). These limits were implemented to deter shifts in the historical PLL fisheries for sharks, tunas, and swordfish or expansions into nearshore coastal waters to target dolphin, which could create user conflicts and possible localized depletion in abundance (NMFS, 2003).

As such, the dolphin/wahoo fishery is an open access fishery where people can purchase a vessel, dealer, or operator permit in the South Atlantic. Operators of commercial vessels, charter vessels, and headboats in the South Atlantic that fish south of 39° North Latitude are required to have a Federal vessel permit for dolphin/wahoo and must have and display operator permits. There is no trip limit for dolphin for a vessel with a commercial Federal vessel permit. However, there is a 500 pound commercial trip limit for wahoo for vessels with such a permit. For commercially permitted vessels fishing north of 39° North Latitude that do not have a Federal commercial vessel permit for dolphin/wahoo, there is a trip limit of 200 pounds of dolphin and wahoo. In addition, there is a 20-inch fork length minimum size limit for dolphin off the coasts of Georgia and Florida with no size restrictions elsewhere, and PLL fishing for dolphin and wahoo is prohibited in areas closed to the use of such gear for HMS. Dolphin and wahoo longline vessels must also comply with sea turtle protection measures. Finally, there is also a non-binding 1.5 million pound (or 13 percent of the total harvest) cap on commercial landings for dolphin. Should the catch exceed this level, the South Atlantic Fishery Management Council would review the data and evaluate the need for additional regulations, which may be established through a framework action.

The recreational dolphin fishery has the same minimum size. In addition, there is a recreational bag limit of 2 wahoo per person per day and 10 dolphin per person per day or 60 dolphin per boat per day, whichever is less (headboats are excluded from the boat limit). There is a prohibition on recreational sale of dolphin and wahoo caught under the bag limit unless the seller holds the necessary commercial permits.

The authorized gears for dolphin and wahoo fishery are hook-and-line gear including manual, electric, and hydraulic rods and reels; bandit gear; handlines; longlines; and spearfishing (including powerheads) gear. Pelagic longline vessels permitted in the shark and swordfish fisheries are subject to the hook size regulations regarding the HMS fishery, which has impacted their ability to simultaneously fish for dolphin by attaching smaller-hooked gangions directly to their PLL gear. The total 1999 recreational harvest accounted for 91% (10,127,970 pounds total recreational harvest and 1,050,090 pounds commercial harvest) of the total U.S. harvest (NMFS, 2003).

The commercial fishery for wahoo appears to be incidental to fishing for dolphin or other pelagic species. Like dolphin, the recreational landings of wahoo account for a larger proportion of the total harvest in the Gulf of Mexico and Atlantic Ocean. In 1999, the total commercial harvest amounted to 99,159 pounds, compared to 1.41 million pounds harvested by recreational anglers (NMFS, 2003).

The dolphin/wahoo fishery is extremely seasonal in nature. This seasonality would influence the number of displaced shark fishermen's ability to direct effort towards dolphin and wahoo. In addition, there have been no formal stock assessments for dolphin or wahoo. The status of wahoo is considered unknown, and time-series data seems to indicate neither a decline in stock abundance nor a decrease in mean size of individual dolphin fish (SAFMC, 1998). However, a precautionary approach to management was taken in 2003 since the dolphin and wahoo tend to aggregate, they are economically valuable before the age of maturity, and there is high interannual variability in these stocks due to environmental factors. Therefore, the 2003 FMP set harvest limits based on the status quo at that time.

As of 2007, 256 dolphin/wahoo permit holders also have directed and incidental shark permits (Table 3.42). 156 of these dolphin/wahoo permit holders are from the state of Florida (Table 3.42). Since the dolphin/wahoo fishery is an open access fishery, shark permit holders who do not currently have a dolphin/wahoo permit would be able to enter the fishery in the South Atlantic. Fishermen in the Gulf of Mexico could switch to the dolphin/wahoo fishery without trip limits or any permit requirements. In addition, shark fishermen could modify their gear so that a greater proportion of their catch is dolphin and wahoo. These species are pelagic in nature; therefore, BLL gear would have to be placed near the surface of the water column, essentially converting it to PLL gear. Pelagic longline regulations include hook requirements of 18/0 (with an offset not to exceed 10°) or 16/0 non-offset circle hooks if they also possess HMS permits for swordfish and/or tunas. These larger hooks would make it difficult to catch small dolphin and wahoo, thus limiting catch to larger individuals. In addition, because of the seasonal nature of this fishery, directed fishing year-round would be difficult.

Spanish mackerel

In the South Atlantic, fisheries for Spanish mackerel (*Scomberomorus maculatus*) are important for commercial participants who also engage in shark fisheries. Fisheries are managed by the South Atlantic Fishery Management Council and the Gulf of Mexico Fishery Management Council under the FMP for Coastal Migratory Pelagic Resources and its amendments. A stock assessment for Spanish mackerel was completed in 2003/2004. The assessment was done on the Atlantic and Gulf of Mexico population and found that neither population were overfished or experiencing overfishing (SEFSC, 2007).

Authorized gear include for Spanish mackerel in the South Atlantic include automatic reel, bandit gear, rod and reel, cast net, run-around gill nets, and stab nets; in the Gulf of Mexico, all gears are legal except drift and long gillnets and purse seines. However, there is an incidental catch allowance for vessels with purse seines onboard. A minimum size of 3.5" (8.9 cm) stretched mesh is required for all run-around gill nets and soak time is limited to one hour. The fishing year in the South Atlantic is from March 1 through the end of February, The fishing year in the Gulf of Mexico is April 1 through March 31. A federal vessel permit is required for commercial fisheries; however, the fishery is open to new participants who can demonstrate they meet an income requirement.

In the South Atlantic, the fishery is managed in two zones with differing regulations: a northern zone (Georgia to New York) and a southern zone (east coast of FL to Dade-Monroe County). Catch restrictions vary by month and are dependant on the percentage of each zones allocation that is actually harvested. The majority of landings occur off of Florida, where the commercial trip limit from April – November is 3,500 lb/trip. Trip limits are unlimited on weekdays beginning December 1 with a 1,500 lb trip limit on weekends until 75 percent of the quota is reached, and 1,500 lb daily trip limits are established. When 100 percent of the adjusted quota is met, trip limits are reduced to 500 pounds through the end of fishing year. (SAFMC, 2007a).

Gillnets were the predominant gear type for Spanish mackerel prior to the net ban in Florida. Currently, approximately 60 percent of the overall catch comes from cast nets and approximately 25 percent are caught with gillnets, the remainder being caught with other authorized gears. In Florida, the majority of the effort is still in state waters, where gillnets are not allowed. Some netting occurs in Federal waters, however, the cast net is used more often. Fishing effort follows the fish migrating north to waters off North Carolina in the summer and then following the fish back to Florida during the winter months. Sinknets are the primary gear type off North Carolina.

Shark fishermen could transfer fishing effort to Spanish mackerel fisheries to replace some of the lost revenues as a result of measures proposed in this rulemaking. Many vessels that deploy gillnets for sharks also possess Spanish mackerel permits. Of vessels that possess directed shark permits, 107 also possess Spanish mackerel permits. There are currently 121 Spanish mackerel permits possessed by shark incidental permit holders (Table 3.42). Because the commercial fishery for Spanish mackerel is not limited access, with only an income qualifier restriction, and the stocks are healthy, this could be an attractive fishery for participants to engage in, especially those who possess vessels that are already set up for fishing with gillnet or castnet gear.

NMFS recently published a final rule (June 25, 2007, 72 FR 34632) revising regulations implementing the Atlantic Large Whale Take Reduction Plan (ALWTRP) by expanding the Southeast U.S. Restricted Area and modifying regulations pertaining to gillnetting within the Southeast U.S. Restricted Area. NMFS is prohibiting gillnet fishing or gillnet possession during annual restricted periods associated with the right whale calving season. Limited exemptions to the fishing prohibitions are provided for gillnet fishing for sharks and for Spanish mackerel south of 29°00' N. lat. An exemption to the possession prohibition is provided for transiting through the area if gear is stowed in accordance with this final rule. This action is required to meet the goals of the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA). This action is necessary to protect northern right whales from serious injury or mortality from entanglement in gillnet gear in their calving area in Atlantic Ocean waters off the Southeast U.S.

King Mackerel

Commercial fisheries for king mackerel (*Scomberomorus cavalla*) are also an important source of revenue for participants in the Atlantic and Gulf of Mexico regions. A stock assessment was conducted for king mackerel in 2005. The assessment determined that the Atlantic and Gulf of Mexico migratory groups of king mackerel are not overfished or experiencing overfishing. Permits in the commercial fishery are limited access and there is currently a permit moratorium in place. The minimum size for king mackerel is 24" (61 cm); however, vessels may possess up to five percent of the fish on board as undersized fish. In the South Atlantic, the fishing season is March 1 through the end of February, or until the quota is met. In the Gulf of Mexico, the fishing year is July 1 through June 30.

In the South Atlantic, trip limits vary by region and time of year, including:

- From New York to Flager/Volusia County, Florida from April 1 to March 31, the trip limit is 3,500 pounds;
- From Flager/Volusia to Volusia/Brevard County lines from April to October 31, the trip limit is 75 fish; and,
- In Monroe County, Florida, from April 1 to October 31, the trip limit is 1,250 pounds.

Authorized gear for king mackerel varies by region, including: rod and reel, bandit gear, handline, automatic reel, gillnets and long gillnets (except north of Cape Lookout, NC); PLL, run-around gillnets (>4.75" (12.1 cm) stretched mesh); and purse seine (no more than 400,000 lbs may be harvested by purse seine) (SAFMC, 2007c).

In the Gulf of Mexico, trip limits are established according to regional sub-divisions, each with their own quota.

- From the Florida/Alabama state boundary through Texas, the trip limit is 3,000 pounds.
- From The Florida/Alabama state boundary to the Lee/Collier County, Florida, boundary, the trip limit is 1,250 pounds.
- From the Lee/Collier County boundary to the Monroe/Miami-Dade County boundaries, from November 1 through March 31, the trip limit is 1,250 pounds.
- From the Monroe/Miami-Dade County boundary to the Broward/Volusia County boundary, from November 1 through March 31, the trip limit is 50 fish until February 1, when it increases to 75 fish if 75% of the quota is not taken.

There are 87 king mackerel permits maintained by shark directed permit holders. Incidental shark permit holders possess 117 permits (Table 3.32). The king mackerel fishery is limited access so entry by those who do not currently possess a permit would be more difficult. Because 204 shark fishermen also have king mackerel permits, it is anticipated that shark fishermen may increase fishing effort in king mackerel fisheries. Vessels that are already set up to deploy run-around gillnets, PLL, bandit gear, or other gillnets are most likely to increase fishing effort in the king mackerel fishery as they would have the least difficulty reconfiguring their vessel.

South Atlantic Snapper/Grouper Fishery

The South Atlantic Fishery Management Council (SAFMC) manages the 73 species that comprise the South Atlantic snapper/grouper fishery management unit (FMU). In 1998, Amendment 8 to the snapper/grouper FMP was implemented initiating a limited access program. Recent stock assessments were conducted for two deepwater snapper/grouper species, snowy grouper and golden tilefish as well as some shallower snapper/grouper species (red porgy, vermilion snapper, and black sea bass). Snowy grouper, black sea bass, and red porgy were found to be overfished. Red porgy and golden tilefish were determined to not be overfished, and the overfished status of vermilion snapper was unknown. Snowy grouper, golden tilefish, black sea bass, and vermilion snapper were determined to be experiencing overfishing.

NMFS implemented the final rule for Amendment 13C to the FMP for the South Atlantic snapper/grouper Fishery on October 23, 2006 (71 FR 55096). The intent of the amendment was to reduce harvests, end overfishing, and achieve optimum yield. The management measures included in the final rule were reductions in annual commercial quotas for snowy grouper and golden tilefish. Quotas were specified for black sea bass, red porgy, and vermilion snapper, and commercial trip limits were increased for red porgy. Amendment 14 was recently approved for submission to NMFS by the SAFMC during their June 2007 meeting and would establish eight MPAs off South Atlantic states to protect a portion of the population and habitat of deepwater snapper/grouper species from directed fishing pressure. Amendment 14 includes a measure to prohibit use of shark BLL gear in the MPAs. If Amendment 14 is approved by NMFS, harvest would be prohibited for all species in the snapper/grouper complex in these eight MPAs. The proposed rule for Amendment 14 should be available for public comment during the fall of 2007. In this rulemaking, MPAs proposed by the SAFMC are analyzed and included in several of the alternative suites, including the preferred alternative suite.

At its December 2006 Council meeting the SAFMC voted to explore an Individual Fishing Quota (IFQ) program as a possible management tool for the snapper/grouper fishery. An IFQ for the snapper/grouper fishery would eliminate restrictive trip limitations, eliminate discards by requiring 100 percent retention of catch, and fishermen would be required to cover their catch with their quota. The SAMFC is still exploring how the allocation would work, who would be eligible to participate, how the program would be enforced, and who would pay the cost recovery fee. The SAFMC has formed a Limited Access Privilege Program (LAPP) Exploratory Workgroup to discuss these issues in public meetings. The public meetings will be held throughout the summer and fall of 2007. The 114 shark directed and incidental permit holders that already possess limited access permits in the snapper/grouper fishery may benefit from this future IFQ program as it may mitigate the more restrictive management measures that are in place for some of the snapper/grouper species. However, entrance into the snapper/grouper fishery would be difficult due to the need to find two transferable limited access permits available for purchase, the restrictive management measures that are currently in place to reduce harvests and end overfishing and because of the possibility of the change in management structure to an IFQ program.

Currently, 114 shark directed and incidental permit holders also hold permits in the South Atlantic snapper/grouper fishery. Of the 114 permits, 102 of those permit holders possess the transferable snapper/grouper permit with an unlimited trip limit and 12 hold the non-transferable snapper/grouper permit with a 225 lb trip limit. New entrants into the snapper/grouper fishery must obtain two existing snapper/grouper transferable permits and exchange them for one new permit. Allowable commercial gear for the snapper/grouper fishery includes vertical hook and line including bandit gear, black sea bass pots, sink nets (North Carolina only), and BLL. Vessels with BLL gear onboard may only possess snowy grouper, one warsaw grouper, yellowedge grouper, misty grouper, golden tilefish, blueline tilefish, and sand tilefish. No other snapper/grouper species may be possessed or harvested.

4.16 Cumulative Ecological Impacts

The preferred alternative suite 4, which would establish a small research fishery that could harvest the full sandbar quota as well as other shark species and allow vessels outside the research fishery to retain non-sandbar LCS, SCS, and pelagic sharks, would provide positive ecological impacts by allowing overfished sandbar, dusky, and porbeagle sharks to rebuild and stop overfishing of sandbar and dusky sharks. By allowing a limited number of historical participants to continue to harvest sharks in a manner resembling how the fishery was traditionally executed in addition to meeting other research objectives, the Agency would ensure that data for stock assessments and life history samples would continue to be collected, which would help with future management of these stocks. However, the number of trips these participants could make would be limited by the sandbar quota, thus limiting fishing effort and sandbar mortality and allowing this stock to rebuild. Individuals not selected to participate in the shark research program could still land 22 non-sandbar LCS/vessel/trip, which would limit the number of trips targeting non-sandbar LCS sharks, and prevent overfishing of these species. However, this retention limit would still afford the opportunity to keep some sharks that are landed incidentally, preventing excessive discards of these species. In addition, alternative suite 4 would require that sharks be landed with their fins still attached; this requirement could prevent fishermen from keeping the fins from sharks that are not landed, resulting in a reduction of overall shark mortality.

Since only a few vessels would likely be participating in the research fishery, interactions with protected resources may decrease as a result of less BLL and gillnet fishing effort targeting sharks. It is assumed that some of this fishing effort may be displaced to other gillnet and BLL fisheries in which participants are permitted, which may interact with protected resources. However, other fisheries such as the South Atlantic snapper/grouper and Gulf of Mexico reef fish fisheries are limited access fisheries. If fishermen do not currently hold permits in these fisheries, it would be difficult and expensive for them to enter these fisheries in the future. In addition, for shark fishermen that are currently permitted in these fisheries, strict retention limits and quotas are either in place or about to be implemented, which would protect these stocks from further overfishing and being further overfished by any redirected shark fishing effort. Therefore, redistributed effort is not anticipated to result in a significant increase in bycatch or interactions with protected resources.

Other fisheries that are still open access that shark fishermen could pursue, such as the mackerel fishery and the dolphin/wahoo fishery, generally have few interactions with protected resources and little bycatch compared to directed shark fishing trips (see NMFS, 2003 and Carlson and Bethea, 2007). Therefore, redistributed effort into these fisheries is not anticipated to increase interactions with protected resources or result in significant increases in bycatch. In addition, retention limits, quotas and other effort controls are in place for these fisheries to protect the stocks from overfishing and from being overfished.

In addition to these impacts, cumulative ecological impacts on HMS stocks and fisheries due to actions under consideration by Regional Fishery Management Councils, Interstate Marine Fisheries Commissions, or other management bodies may be slightly positive. NMFS has recently backstopped the Caribbean Fishery Management Council's area closures that could have minor positive benefits for Atlantic HMS (72 FR 5633, February 7, 2007). NMFS also recently published a rule that requires sea turtle handling and release equipment in the shark BLL fishery (72 FR 5633, February 7, 2007). The South Atlantic Fishery Management Council is considering management measures including time/area closures for BLL gear to protect grouper species that may have some impacts on HMS fishermen, particularly the shark fishermen. Under this rule, charter/headboat fishermen would also need to comply with the protected resources dehooking requirements. The Gulf of Mexico Fishery Management Council recently proposed regulations that would implement similar dehooking requirements to those required in the HMS PLL fishery and to those proposed for the HMS BLL fishery (71 FR 45428, August 9, 2006). NMFS has also recently implemented workshops for the safe handling and release and identification of protected resources for all HMS gillnet and longline fishery participants, and identification workshops for shark dealers (71 FR 58058, October 2, 2006). In addition, the Atlantic States Marine Fisheries Commission is developing an interstate shark fishery management plan, which would likely have positive ecological impacts because many shark nursery areas are located in state waters.

4.17 Cumulative Social and Economic Impacts

The preferred alternative 4 would allow a small pool of vessels to continue to collect reduced revenues from sharks. Significant negative economic impacts would still likely occur under alternative suite 4. For instance, shark fishermen outside the research fishery would not be able to land sandbar sharks and would have their non-sandbar LCS retention limit reduced, resulting in 48 percent reduction in gross revenues compared to the status quo (Table 4.16). These losses in gross revenues may be exacerbated by the requirement to land shark with their fins attached. In addition, eliminating regions and seasons represents an economic disadvantage to the North Atlantic region as sharks are not present in these waters year-round, meaning the quota may be filled in some years before sharks are present in these areas. The elimination of seasons and regions combined with limiting underharvest carry-overs may have negative economic impacts on fishermen, especially for regions that consistently had underharvests of species like SCS. However, incidental permit holders would have higher retention limits of sandbar and non-sandbar LCS inside the research fishery as well as the potential to land higher retention limits of non-sandbar LCS outside the research fishery. Therefore, they might experience positive economic benefits under alternative suite 4. Since most incidental permit holders are in the states of Florida, Louisiana, and New Jersey, these states are anticipated to experience the largest socioeconomic benefits under alternative suite 4.

It is unlikely that shark fishermen would be able to recuperate all of the economic losses that are likely with the proposed measures for the shark fishery by switching to other southeast fisheries due to quota reductions and/or limited access programs in these other fisheries. The Agency presumes that since some shark fishermen also possess several permits in other fisheries, they do not receive all of their revenues from shark-products. At the present time, it is estimated that fishermen make decisions about which fisheries to participate in based on the ex-vessel prices they can expect from a given species of fish, seasonality, quotas, trip limits, and other factors. In the past, revenues received from sharks likely comprised a larger share of their overall revenues from fishing activities than is expected in the future. However, it could be difficult for all lost shark revenues to be replaced by transferring more effort to other fisheries in which they have historically participated.

For instance, there are limited-access permit programs in place for the South Atlantic snapper/grouper fishery as well as the Gulf of Mexico reef fish fishery, where no new permits are being issued. Therefore, if shark fishermen do not currently possess a South Atlantic snapper/grouper permit or a Gulf of Mexico reef fish permit, it would be difficult and costly to enter these fisheries in the future. There are also quota reductions proposed for many reef fish species (see above), which would affect current Gulf of Mexico reef fish permit holders. Shark fishermen who have shark and reef fish permits could be experiencing economic hardships in both fisheries.

In addition, there is an IFQ program in place for the Gulf of Mexico red snapper fishery, with limitations on transfers during the first 5 years (see above), and a new IFQ program will be implemented in the near future for the South Atlantic snapper/grouper fishery. These IFQ programs could benefit current South Atlantic snapper/grouper or Gulf of Mexico red snapper permit holders; however, it would make it difficult and expensive for shark fishermen who do not currently possess these permits to enter these fisheries in the future.

As mentioned above, the dolphin/wahoo fishery is an open access fishery, especially in the Gulf of Mexico. However, redistribution of commercial shark fishing effort into this fishery may result in user conflicts between recreational and commercial fishermen. Additionally, commercial PLL fishermen that currently fish for dolphin and wahoo could suffer economically if a large proportion of the shark fishermen redirect to the dolphin/wahoo fishery, given the 1.5 million pounds commercial landings cap (or 13 percent of total landings, whichever is greater) for the dolphin fishery. If this cap is exceeded, the SAFMC may decide to take more stringent measures in this fishery to reduce overall catch. More importantly, due to the seasonality of the dolphin/wahoo fishery, it would be difficult for commercial fishermen to direct on dolphin/wahoo (S. Branstetter, personal communication). Finally, it would be difficult for shark fishermen using PLL gear to catch smaller dolphin and wahoo due to hook requirements in the PLL fishery (see discussion above). Shark fishermen would have to either target larger fish with larger circle hooks or relinquish their HMS permit(s) so that they could use smaller hook sizes to target smaller dolphin/wahoo. The latter would preclude them from retaining any HMS catch.

It is likely that shark fishermen using gillnet gear for sharks would transfer some fishing effort to the Spanish mackerel fishery. Participants currently using other gears for sharks may consider purchasing the necessary gear (*e.g.*, gillnets, etc.) to become involved in this fishery. Since this fishery is not limited access, transferring effort into this fishery would not require paying exorbitant costs to acquire permits from other vessels. Furthermore, since the stock status of Spanish mackerel is healthy, there does not appear to be any significant restrictions on quotas or other effort controls necessary at this time or in the foreseeable future. However, this fishery is seasonal, so year-round revenues from Spanish mackerel may not be realized. Rather, participants in North Carolina would be expected to fish for Spanish mackerel in the summer while participants in Florida could target these fish in the winter.

The commercial fishery for King mackerel is managed via a limited access permit system, and shark fishermen who do not currently possess a King mackerel permit may have a difficult time entering this fishery. However, there are 204 participants in the shark fishery that currently possess these king mackerel permits. Therefore, effort in this fishery is expected to increase as a result of shark management measures proposed in this rulemaking.

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5.0 MITIGATION AND UNAVOIDABLE IMPACTS

Ecological Impacts Summary of the Preferred Alternatives

The management measures in preferred alternative suite 4: *Research Set Aside Allowing Small Directed LCS Fishery*, are not likely to have significant adverse ecological impacts to target and non-target species. All issues considered are either predicted to result in neutral or positive ecological impacts. The preferred alternative suite was designed to reduce mortality of shark species based on the results of previous shark assessments (for a thorough description of the most recent assessments, please refer to Chapter 3). The preferred alternative suite was also designed to reduce mortality of sea turtles and other protected species.

In alternative suite 4, the *Quotas/Species Complexes* measure would have positive ecological impacts on all shark species. Establishing the quotas and species complexes as described in alternative suite 4 would maintain a level of fishing effort that would allow sandbar shark stocks to rebuild and end overfishing of this stock as well as maintain the current status of blacktip sharks which are not overfished. Allocating the sandbar quota solely among vessels operating within a research fishery while allowing non-sandbar LCS to be caught by vessels operating within and outside a research fishery, was constructed to maintain proper quota levels in order to rebuild these species based on recommendations from the most recent LCS stock assessment. Structuring the fishery in this way would continue to provide valuable data on these shark stocks necessary for the effective management of these species while still allowing a limited number of vessels to remain active in the fishery.

In alternative suite 4, the *Retention Limits* measure would have positive ecological impacts on sandbar and dusky sharks. Only vessels participating in the research fishery would be allowed to land sandbar sharks. This reduction in fishing effort is anticipated to yield an 84 percent decrease in sandbar landings. Even though discards of sandbar sharks could occur after the sandbar quota is reached and non-sandbar LCS are still being targeted, this would be offset by the proposed sandbar shark quota reduction of 82 percent compared to the status quo, which would keep all landings plus discards of sandbar sharks below the recommended sandbar TAC of 116 mt dw. Since the vessels participating in the research fishery would be directing on sharks, it is assumed that discards of dusky sharks would occur. However, the number of PLL vessels that can land sandbar sharks would be limited by the research fishery, so it is anticipated that the PLL vessels would not set BLL gear for sharks, leading to an anticipated 72 percent decrease of dusky shark discards compared to the status quo.

The *Retention Limits* measure would have neutral ecological impacts for non-sandbar LCS and porbeagle sharks. Since all vessels with incidental or directed shark permits could target non-sandbar LCS, but under a reduced quota compared to the status quo, this is anticipated to result in a 7 percent decrease in non-sandbar LCS landings. Retention limits of non-sandbar LCS for incidental permit holders are larger than past retention limits. Therefore, discards of non-sandbar LCS are not anticipated to occur for incidental permit holders, leading to an anticipated 72 percent decrease in non-sandbar LCS discards. Possession and landing of porbeagle sharks would be prohibited in commercial and recreational sectors. This prohibition, coupled with reductions in the amount of effort with BLL gear would not change the numbers of porbeagle landed, as these sharks are primarily targeted with PLL gear and the United States has had minimal landings of this species.

In alternative suite 4, the *Time/Area Closures* measure would have positive ecological impacts on target and non-target species as well as protected species, marine mammals, and essential fish habitat. Maintaining the time/area closures as they have been implemented in recent years would further the positive ecological effects that have been observed in reduction of bycatch of prohibited, non-prohibited, and non-target HMS species. The closure areas specific to BLL gear have also been effective in reducing dusky and neonate and juvenile sandbar shark interactions and, in the Caribbean, could have positive ecological impacts to EFH, mutton snapper, red hind, and other reef-dwelling species (see Section 4.1.3). Maintaining current gillnet restrictions could have positive ecological impacts on endangered right whales.

In alternative suite 4, the *Reporting* measure would have positive ecological impacts. Requiring that all dealer reports are actually *received* by the Agency in a more timely fashion would provide more frequent reports of shark landings in order to better assess quantities of sharks landed and whether or not a closure or other management measures are warranted to prevent overfishing. This would decrease the likelihood that extensive overharvests of sharks would occur. In addition, increasing observer coverage to 100 percent for vessels in the research fishery would be used to monitor landings, bycatch, and interactions with protected resources in near "real-time."

In alternative suite 4, the *Seasons* measure would result in neutral ecological impacts. Having one season rather than three seasons may result in most of the landings occurring early in the year. This should not have a negative ecological impact as most pupping occurs in the spring or early summer. Since all sandbar sharks and most of the non-sandbar LCS would be landed by a limited number of vessels participating in the research fishery, NMFS would have some information regarding when sandbar and non-sandbar LCS quotas would likely be reached. The *Regions* measure would also result in neutral ecological impacts. Implementing one region was chosen over maintaining three regions because, under potential reduced fishing effort, it is not likely that maintaining regions would provide any ecological benefits for shark species, bycatch, or protected resources.

In the preferred alternative suite, the *Recreational* measures would result in positive ecological impacts. Requiring recreational anglers to possess species that are easy to identify while prohibiting retention of species that are frequently misidentified with sandbar and dusky sharks, would remove the possibility that a recreational angler might misidentify and actually land a species that is overfished or experiencing overfishing. This would decrease the possibility that sandbar, dusky, and porbeagle sharks are landed, as they are sometimes mistaken for species that are not overfished or experiencing overfishing.

Alternative suite 4 would result in positive ecological impacts to protected resources and EFH. The *Quotas/Species Complexes* and *Retention Limits* measures would significantly reduce the number of trips, thus reducing fishing effort. These measures, in combination with other measures such as *Reporting* and increasing observer coverage for the research fishery, may result in increased data collection on protected resources and EFH. In addition, the reduction in usage of BLL gear would reduce impacts to complex habitats, such as coral reefs in the Caribbean or areas with soft corals in the Gulf of Mexico if these are areas in which sharks would be targeted.

Social and Economic Impacts Summary of the Preferred Alternatives

All management measures in preferred alternative suite 4: *Research Set Aside Allowing Small Directed LSC Fishery*, are likely to have neutral or negative economic impacts on fishermen and the associated communities. However, NMFS believes that alternative suite 4, strikes a balance between positive ecological impacts that must be achieved to rebuild stocks and end overfishing while minimizing the severity of economic impacts that will occur as a result.

In alternative suite 4, the *Quotas/Species Complexes* and *Retention Limits* measures would have negative economic consequences for fishermen. Based on the limited number of boats that could fish for sandbar sharks in the research shark fishery, most current directed and incidental permit holders would be prohibited from landing sandbar sharks. However, directed and incidental permit holders outside the research fishery would still be able to land non-sandbar LCS, SCS, and pelagic shark species.

The *Time/Area Closures* measure in the preferred alternative suite would have neutral to negative economic consequences. This measure would maintain the status quo in addition to implementing 8 additional MPA closures in the South Atlantic. These additional 8 MPAs would be closed to BLL gear which could have negative economic impacts. However, the overall impact of these closures in comparison to other measures being preferred by this alternative, such as reduced quotas and retention limits, is anticipated to be minor.

In alternative suite 4, the *Reporting* measures would have neutral economic impacts. Shark dealers would still be required to submit landings reports twice a month. Additional burden is not expected as a result of changing the pertinent date of post-marking to receipt by the Agency.

The, *Seasons* and *Regions* measures in alternative suite 4, would result in negative economic impacts to fishermen and dealers in the North Atlantic region. Opening the seasons on January 1, in all regions would provide benefits to vessels in the South Atlantic and Gulf of Mexico regions as a larger variety of LCS and SCS are present there year-round. The North Atlantic fishermen may have to redistribute effort to another region which may not be cost effective with reduced quotas and retention limits for sandbar and non-sandbar LCS.

The *Recreational* measures would result in negative economic impacts. Recreational fishermen may not be as willing to go shark fishing if the number of species that can be retained is reduced and Charter/headboat operators may see a reduction in the amount of charters that customers are willing to hire. This would be especially true in areas where blacktip sharks are more frequently encountered, as well as areas where other sandbar and dusky look-alike sharks are frequently encountered.

5.1 Mitigation Measures

No mitigation measures were specifically considered for the preferred alternative suite, Alternative suite 4 and its corresponding management measures regarding *Quotas/Species Complexes, Retention Limits, Time/Area Closures, Reporting, Seasons, Regions, Recreational Measures*, and *Protected Resources and EFH*. This is because the preferred alternative suite was specifically selected to mitigate any potential adverse impacts. As a result, mitigation was explicitly addressed in the analyses conducted for selecting the preferred alternative suite in other Sections of this DEIS including Chapters 4, 6, 7, 8, and 9. NMFS would monitor the impacts of the management measures in the preferred alternative suite and would consider other mitigation measures in the future as necessary.

As stated above, mitigation measures were explicitly addressed in the analyses conducted for selecting the management measures in the preferred alternative suite. For example, in analyzing possible quotas and retention limits, the preferred research fishery approach was selected because it may balance the need to end overfishing based on recent assessments, while allowing a limited number of vessels to direct on sharks and provide scientific data on the status of shark stocks for future management actions. To mitigate some of these impacts, directed and incidental permit holders outside of the research fishery would still be allowed to land non-sandbar LCS, SCS, and pelagic sharks. The quotas and retention limits proposed in the preferred alternative suite complies with the mandate to end overfishing, while still providing a reasonable opportunity to target sharks and harvest the allocated quota. It also provides additional information on shark species, bycatch, protected resources, and EFH which are all necessary for management of the fishery.

Similarly, for time/area closures, other than implementing the 8 MPAs at the request of the SAFMC, NMFS is maintaining the current time/area closures and has opted not to implement additional large closures that were considered an option to reduce overall fishing mortality.

For dealer reporting, requiring all dealer reports to be *received* by the Agency within ten days of the end of the reporting period would provide clarity and eliminate ambiguities regarding late reporting, without imposing additional, more stringent reporting requirements that were also considered an option in other alternative suites.

For seasons, the preferred measure to open on January 1 and close within 5 days notice of any quota being 80 percent filled may balance the need to predict landings for non-research vessels with the security of knowing what the research vessels are landing. In addition, implementing one region was chosen over maintaining three regions because it is not likely that maintaining regions would provide any ecological benefits for shark species, bycatch, or protected resources. Finally, requiring recreational anglers to land species that are easily identifiable is proposed to balance the need to end overfishing with the needs of the recreational constituency.

In summary, while many of the actions taken in this amendment impose additional restrictions on the shark fishery, NMFS specifically selected alternatives that minimize economic impacts while accomplishing the mandate to end overfishing and implement a rebuilding plan for overfished shark stocks.

5.2 Unavoidable Adverse Impacts

In general, there are no unavoidable adverse impacts expected as a result of the preferred alternative suite and corresponding management measures of *Time/Area Closures, Reporting, Seasons, Regions, Recreational Measures*, and *Protected Resources and EFH*. NMFS would continue to monitor the impact of the management measures in the preferred alternative suite and would propose additional management measures, as necessary, to avoid any unanticipated adverse impacts.

However, there are unavoidable adverse socioeconomic impacts as a result of the preferred alternative suite and corresponding management measures of *Quotas/Species Complexes* and *Retention Limits.* NMFS must administer and operate under the National Standards of the Magnuson-Stevens Act which includes a mandate to prevent overfishing and rebuild overfished stocks. In trying to maintain shark stocks and meet the Magnuson-Stevens Act mandate of ending overfishing, NMFS would significantly reduce fishing effort under the preferred alternative suite. This might result in directed and incidental shark permit holders and dealers redirecting to other fisheries and/or leaving the fishing industry due to lowered quotas and thus decreased effort and landings. Participants in recreational shark fisheries would experience negative economic impacts as a result of reducing the number of sharks that could be legally landed. Charter/Headboat operators would be most affected as a result of these measures as they may see a reduction in the number of charters that customers are willing to hire. In addition, reporting burden would be increased significantly for Atlantic shark dealers as a result of this alternative suite resulting in negative economic impacts. While the increased reporting burden would not impact shark dealer expenditures per se, it would result in more time spent submitting dealer reports, which represents an opportunity cost for fishermen since that would be time they could not spend conducting other activities related to their business. In the analyses for selecting the preferred alternative suite, NMFS had determined that the management measures in alternative suite 4 are necessary in order to comply with the Magnuson-Stevens Act mandate to end overfishing. In addition, the preferred alternative suite has been determined to be the most feasible alternative to rebuild shark stocks according to the most recent assessments.

As described above, in aggregate, the preferred alternative suite and its corresponding management measures are expected to have positive or neutral conservation benefits for shark species, bycatch species, and protected resources. This is because the preferred alternative suite was specifically selected to mitigate any potential adverse impacts. Any resulting economic or social impacts, beyond those described above, are unavoidable.

5.3 Irreversible and Irretrievable Commitment of Resources

The management measures in the preferred alternative suite would not result in any irreversible and irretrievable commitment of resources. There may be some minor ecological impacts because the Atlantic shark fishery would still remain open, however, the Agency expects fishing effort and bycatch levels to decrease considerably because of the reduced quotas and retention limits being proposed. The preferred alternative suite would increase observer coverage levels and provide more documentation of interactions with bycatch and protected resources. These data would assist the Agency in developing additional management measures in the future that may further reduce any deleterious impacts from shark fisheries on bycatch and protected resources.

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6.0 ECONOMIC EVALUATION

This section assesses the economic impacts of the alternatives presented in this document. Additional economic and social considerations and information are discussed in Chapters 3, 4, 7, 8, and 9 of this document.

6.1 Number of Vessel and Dealer Permit Holders

In order to examine the baseline universe of entities potentially affected by the preferred alternatives, NMFS analyzed the number of permits that were issued as of May 2007 in conjunction with HMS fishing activities.

As of May 11, 2007, there were a total of 529 commercial permit holders in the Atlantic shark fishery (231 directed and 298 incidental permits). Table 6.1 provides a summary of these permit holders by region. Further detail regarding commercial permit holders is provided in Chapter 3 and the HMS FMP.

Table 6.1 Distribution of Shark Limited Access Permits (by address of permit) holder between 2001 and 2007. Data for 2001-2005 are as of October 1 for each year. (NAT: North Atlantic, SAT: South Atlantic, FL: Florida, GOM: Gulf of Mexico)

Region/State	# Directed Shark	# Incidental Shark
NAT	45	59
SAT	23	28
FL	141	144
GOM	10	51
Other	1	3
No Vessel ID	11	13
2007**	231	298
2006	240	312
2005	235	320
2004	241	348
2003	251	359
2002	251	376

* Number of permit holders in each category, and state, is subject to change as permits are renewed or expire.
** Totals for 2007 are as of May 11, 2007

As of May 22, 2007, there were a total of 269 Atlantic shark dealer permit holders. Table 6.2 provides a summary of shark dealer permit holders by region. Further detail regarding shark dealer permits holders is provided in the Final Consolidated HMS FMP. All dealer permit holders are required to submit reports detailing the nature of their business. For shark permit holders, dealers must submit bi-weekly dealer reports on all HMS they purchase. To facilitate quota monitoring "negative reports" for shark 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).

Table 6.2 Number of shark dealer permits issued in each state as of October 2002-2005. Permits for 2006 are as of February 1, 2006 and permits for 2007 are as of May 22, 2007. The actual number of permits per region may change as permit holders move or sell their businesses.

Region/State/Country	Atlantic shark dealers
NAT	59
SAT	46
FL	102
GOM	35
Other	27
Totals 2007	269
2006	336
2005	228
2004	230
2003	254
2002	267

6.2 Gross Revenue of the Commercial Shark Fishermen

NMFS calculates gross revenues by combining current federal permit holders with their reported logbook landings for 2004. These landings are then multiplied by average prices (by region) for LCS flesh, LCS fins, and SCS flesh obtained from dealer reporting.

Table 6.3 **Estimates of the total ex-vessel annual revenues of Atlantic Shark HMS fisheries.** Sources: NMFS, 1997; NMFS 2004a; Cortes, 2003; Coastal Fisheries and HMS Logbooks 2005.

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

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

Of all Atlantic HMS, sharks bring in the lowest total gross revenues (~$4.3 million total in 2005). If gross revenues for directed permit holders is averaged across the approximately 138 active directed shark permit holders, then the average annual gross revenues per shark fishing vessel is just over $31,000.

Table 6.4 provides data on the prices shark fishermen received at the dock. The average values for ex-vessel prices from the Southeast Science Center Accumulative Landings System (ALS) and dealer reports from the Northeast were used to construct the table. Table 6.4 reports ex-vessel prices by region, shark complex, and year.

The ex-vessel price data indicates somewhat stable ex-vessel prices since 2003. The ex-vessel prices for sandbar shark have been broken out from the large coastal shark complex in order to analyze the proposed new sandbar and LCS other quota categories. However, in 2006 sandbar ex-vessel prices declined somewhat in both the South Atlantic and Gulf of Mexico regions. The LCS other ex-vessel prices have followed a very similar trend pattern. Pelagic shark prices appear to have been higher in the North Atlantic and Gulf of Mexico versus the South Atlantic from 2003 to 2006. Small coastal shark ex-vessel prices have been steadily trending upward in all regions since 2003. Finally, shark fin ex-vessel prices have been fluctuating in the $14 to $20 range since 2003.

Table 6.4 Ex-vessel price per pound dw by region, shark complex and year. Source: Accumulative Landings System maintained by the Southeast Fisheries Science Center.

		Year			
Region	**Shark Complex**	**2003**	**2004**	**2005**	**2006**
North Atlantic	Large coastal sharks, other*	$1.17	$1.32	$0.35	
	Sandbar sharks*	-	-	$0.62	
	Pelagic sharks	$1.17	$1.38	$1.40	
	Small coastal sharks	$0.38	$0.44	$0.43	
South Atlantic	Large coastal sharks, other	$0.35	$0.41	$0.49	$0.46
	Sandbar sharks	$0.45	$0.35	$0.42	$0.38
	Pelagic sharks	$0.74	$0.65	$0.70	$0.72
	Shark fins	$16.83	$14.20	$15.42	$16.20
	Small coastal sharks	$0.51	$0.60	$0.61	$0.55
Gulf of Mexico	Large coastal sharks, other	$0.39	$0.36	$0.49	$0.47
	Sandbar sharks	$0.39	$0.40	$0.45	$0.40
	Pelagic sharks	$1.04	$1.04	$1.09	$1.21
	Shark fins	$17.91	$17.91	$20.21	$20.65
	Small coastal sharks	$0.40	$0.45	$0.55	$0.53

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

6.3 Variable Costs and Net Revenues of Commercial Shark Fishermen

In 2003, NMFS initiated mandatory cost-earnings reporting for selected vessels to improve the economic data available for all HMS fisheries. In the past, most of the studies regarding PLL variable costs and net revenues available to NMFS analyzed dated data from 1996 and 1997. The HMS FMP provides a summary of several past studies on the variable costs and net revenues of longline fleets.

An analysis of the 2004 HMS logbook cost-earnings data provides updated information regarding the costs and revenue of a cross section of vessels operating in the HMS fisheries. The data contains a total of 579 trips taken by 51 different vessels. As described in Larkin *et al*. (2000), median values are reported. Median gross revenues per trip for 2004 were approximately $12,112. Median total costs per trip were $4,345 (compared to $3,320 in the Larkin *et al*. (2000) study), with fuel costs making up $567 (13 percent) of those costs. Median net revenue in this sample was $6,728 per trip (compared to $8,624 in the Larkin *et al*. (2000) study). The typical trip was nine days long and involved six sets. The median number of crew was three and the average share paid to crew was 11 percent of net revenue ($740 per trip). The captain share of net revenue was 20 percent ($1,346) and the owner share was reported to be 50 percent ($3,364). The 2004 cost earnings information is similar to the findings of the 1996 study, but gross revenues appear to be lower than the Porter *et al.* (2001) study of 1997 operations.

6.4 Expected Economic Impacts of the Atlantic Shark HMS FMP Amendment Suite Alternatives

In this rulemaking, NMFS considered five suites of alternatives to address shark management measures that will meet the objectives of the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (MSRA) and the HMS FMP. The expected economic impacts of the five suites of alternatives considered and analyzed are discussed below. An overview of the five suites of alternatives is presented in Table 2.1.

6.4.1 Alternative Suite 1: Maintaining the Existing Atlantic Commercial and Recreational Shark Fisheries (Status Quo)

Quotas/Species Complexes and Retention limits

The status quo alternative could lead to neutral socioeconomic impacts if the current LCS quota of 1,017 mt dw, in conjunction with the 4,000 lb LCS directed shark permit trip limit, is maintained. Under this alternative the current fishing effort would not likely change, which could lead to economic benefits to fishermen and associated communities in the short term. Of all Atlantic HMS, sharks bring in the lowest total gross revenues (approximately $4.3 million total in 2005). If gross revenues for directed and incidental permit holders is averaged across the approximately 298 active directed and incidental shark permit holders, then the average annual gross revenues per shark fishing vessel is just over $14,000. However, long term, negative economic impacts could occur if current fishing mortality of sandbar sharks, an economically important species, is not decreased as recommended by the LCS stock assessment, and this species continues to be overfished. This could lead to more restrictive management measures being implemented in the directed and incidental shark fisheries. This is particularly important given the LCS overharvests under the status quo in 2006 in South Atlantic and Gulf of Mexico regions and in the Gulf of Mexico region during the first 2007 trimester.

Time/Area Closures

The status quo alternative would maintain the existing closures and would not add any new closures. This could have neutral economic impacts, primarily because activities related to fishing and market availability, consistent with the current closures, would remain the same. However, if no new closures are put into place, overfished species, such as the sandbar shark, may not recover in the recommended rebuilding timeframe and lead to longer term negative economic impacts.

Reporting

Currently, Federal shark dealers are required to report on a bimonthly basis and the economic impacts of reporting would not change under the status quo alternative because activities related to the reporting timeframe would remain the same. However, negative economic impacts could occur if shark dealers do not report when required or in a timely fashion, making it difficult for NMFS to monitor the quota and prevent overfishing of economically important species.

Unclassified or unidentified landings of sharks reported in shark dealers reports are currently counted as LCS by the Agency. This may have neutral or slightly negative economic impacts. While listing sharks as unclassified may save shark dealers time in the short-term by alleviating the need to properly identify individual sharks purchased, inaccurate reporting may lead to inaccurate quota monitoring. Shark dealer reports form the basis of quota monitoring for sharks and if the reports submitted by dealers do not accurately reflect what species of sharks are being landed, seasons may close earlier than necessary, overharvests may occur impacting future seasons, and data used in stock assessments may lead to further restrictions in fishing mortality as a result of assessments models that are run with data that is incorrect or does not provide information on specific species being landed.

Seasons

Maintaining the trimester seasons under the status quo alternative, which provides fishermen and dealers with more open seasons, would likely have neutral economic impacts. With an annual LCS quota of 1,017 mt dw, spreading the seasons out over the calendar year could potentially result in greater economic stability for fishermen and associated communities. However, if quotas are reduced to comply with the recommendations from the LCS stock assessment, trimester seasons could become less economically stable for fishermen and dealers because of the reduced amount of quota and fishing effort during the calendar year.

Regions

The economic impacts of maintaining three management regions under the status quo alternative would likely be neutral. The three regions would likely continue to enhance equity amongst regional user groups, provided that the North Atlantic region only has sharks present in their waters during certain months. No significant economic impacts are anticipated as this alternative seeks to maintain historical regional catches.

Recreational Measures

Neutral social and economic benefits would occur if the current bag limit for HMS Angling permit holders is maintained at one shark greater than 54 inches per vessel per trip as well as one Atlantic sharpnose and one bonnethead shark (both of which are in the SCS complex) per person per trip. Recreational fishing and charter trips targeting sharks are very important to coastal communities and shark fishing tournaments can sometimes generate a substantial amount of money for surrounding communities and local businesses especially in the northeastern United States where shark fishing is most prevalent. In 2005 and 2006, there were 60 tournaments/year with prize categories for pelagic sharks.

6.4.2 Alternative Suite 2: Shark Fishery for Directed, HMS Angling, and HMS Charter/Headboat Permit Holders Only

Species Complexes

<u>Sandbar sharks</u>

Removing sandbar sharks from the LCS complex should have neutral economic and social impacts for fishermen. Establishing a separate category for sandbar sharks from the LCS complex is mainly administrative in nature and would affect how the Agency monitors the sandbar shark quota. The establishment of a separate sandbar category would not impact fishermen, as they already record shark interactions to the species level in their logbooks. However, the economic and social impacts of reducing the sandbar quota and retention limits would have significant economic impacts and are discussed in the next section.

<u>Non-sandbar LCS</u>

Establishing a non-sandbar LCS complex should also have neutral economic and social impacts on shark fishermen. The non-sandbar LCS complex is similar to how the LCS complex has been managed in the past. The new complex would be established to help avoid confusion with the past LCS complex. In addition, while the Agency has managed sharks on a complex basis, fishermen have recorded shark interactions on a species basis in the logbooks, so there should be no negative impacts to fishermen by the restructuring of the LCS complex. However, the non-sandbar LCS quota reduction could have negative economic and social impacts. These impacts are discussed in the next section in combination with retention limits.

Quotas and Retention Limits

Alternative suite 2 would only allow sharks to be retained by shark directed permit holders. Therefore, incidental permit holders would be affected by alternative suite 2. Since the majority of incidental shark permit holders are in the states of Florida, Louisiana, New Jersey, and North Carolina as of 2007 (Table 3.32), these states would be most negatively impacted by alternative suite 2. As of 2007, there were 231 shark directed, 298 shark incidental, and 269 shark dealers permit holders. One hundred forty-three vessels with directed shark permits and 155 vessels with shark incidental permits reported landings in the Coastal Fisheries Logbook from 2003 to 2005 and could be considered active. In addition, shark dealers could also be negatively impacted due to the reduction in the sandbar and other LCS quotas and retention limits, which would reduce the overall amount of sharks being landed.

Alternative suite 2 would also maintain the 60 mt ww (43.2 mt dw) shark display and research quota. However, 2 mt dw would be allocated specifically for sandbar sharks, the remaining 41.2 mt dw would be allocated for all species besides sandbars, and dusky sharks would not be allowed to be collected for display. This is expected to have minimal impacts on collectors of sharks for public display and shark researchers. On average, 2 mt dw of sandbar sharks per year have been collected under the exempted research program from 2000 to 2006. Therefore, there would not be an appreciable decrease in sandbar allocation compared to what was collected in past years. Thus, minimal negative economic impacts are anticipated. Ninety-four dusky sharks have been collected under the exempted fishing program from 2000 to 2006 (or 13 dusky sharks per year). Due to the prohibition of dusky shark collection under alternative suite 2 for public display, this could have a negative economic impact on a few collectors, although the majority of dusky shark collections have been for shark research. Collectors and researchers would still have the majority of the shark display and research quota (41.2 mt dw or 57.2 mt ww) available for all non-sandbar LCS beside dusky sharks.

<u>Fishery level impacts</u>

Of all Atlantic HMS, sharks bring in the lowest total gross revenues (~$7.1 million total in 2004; NMFS, 2006). On average, total sandbar landings of 1,590,917 lb dw and total non-sandbar LCS landings of 1,250,638 lb dw were reported from 2003 to 2005 in the Coastal Fisheries and HMS Logbooks. In 2006 ex-vessel prices, this is equivalent to $3,824,589 (Table 4.9). Under this alternative suite, the commercial quotas would be reduced to 116.6 mt dw for sandbar sharks and 541.2 mt dw for non-sandbar LCS; however, to balance discards of sandbar sharks in the South Atlantic with uncaught sandbar quota in the Gulf of Mexico, the non-sandbar LCS retention limit was lowered such that only 86.1 mt dw of sandbar sharks and 253.6 of non-sandbar LCS could be landed under alternative suite 2 (see discussion in Appendix A under "*Non-sandbar quota and retention limits*" and Table 4.2). In 2006 prices, assuming 5 percent of the landings are fins and 95 percent of the landings are carcass weight, this is equivalent to $1,026,032 (Table 4.9). This is a 73 percent reduction compared to the current gross revenues under alternative suite 1 ($3,824,589; Table 4.9).

On average, 1.5 mt dw (3,402 lb dw) of porbeagle sharks were commercially landed between 2002 and 2004 (NMFS, 2006). Based on 2006 ex-vessel prices, this is equivalent to $6,081 fishery-wide (assuming 5 percent of the landings are fins and 95 percent of the landings are carcass weight) (Table 4.9). However, since porbeagle sharks would be placed on the prohibited list under alternative suite 2, there would an estimated reduction in gross revenues of $6,081 to the fishery by prohibiting porbeagle shark landings.

In alternative suite 2, overharvests of quota for each category would be removed from the next season's quota. This is currently done under the status quo; therefore, it is not anticipated to result in any more negative economic impacts than what fishermen currently experience under the status quo regulations. Underharvests for species that are not overfished or are not experiencing overfishing would have up to 50 percent of the base quota applied to the next season's quota. Currently all of the underharvest for a given complex has been applied to the next year, same trimester's base quota. This has been most significant for small coastal sharks (SCS), which, on average from 2004 through the first season of 2006, had only had 55 percent of the SCS quota filled. Since nearly full harvests or overharvests have typically occurred for the LCS complex, application of underharvest to LCS base quota to future seasons has not been an issue. The economic impact of reducing the amount of underharvest that could be applied to the base quota would depend on the amount of the underharvest, but would most likely have the largest economic effects for SCS. In addition, since there would be no regions or seasons under alternative suite 2, the amount of SCS underharvests expected from a full year of fishing in all regions is unknown at this time.

However, unlike the status quo, underharvests for species where the status of the species is unknown, overfished, or experiencing overfishing would not be transferred to the next season's quota. This could have a negative economic impact depending on the quota. For instance, the overfished/overfishing status of sandbar sharks and the unknown status of the LCS complex would preclude any underharvest of the sandbar or non-sandbar LCS quota from being applied to the following season's base quota. However, given the reduced sandbar quota and since the non-sandbar LCS quota is based on current catches of LCS species (except sandbar sharks), underharvests of sandbar sharks or non-sandbar LCS are not anticipated. Therefore, this may not result in negative socioeconomic impacts. In addition, underharvest carry-overs are currently not applied for pelagic sharks. Since the status of all pelagic sharks are either unknown or overfished, this would not change compared to the status quo.

Finally, alternative suite 2 would require that shark fins remain on the shark. In the short-term, this alternative could change the foundation of the U.S. Atlantic shark fin market. At this time and since the fishery began in the 1980s, most shark fins sold in the United States are landed separately from the shark. In 1993, shark fins were required to be removed from the vessel at the first port of landing. This prevented fishermen from drying shark fins onboard their vessel over time in order to increase the value of the fin. Under alternative suite 2, shark fishermen would not be allowed to remove the fins from the shark until sharks are landed. Costa Rica has implemented a similar regulation that allows fishermen to cut the fins mostly off the shark, as long as a small piece of skin keeps the fins attached to the shark until landing. According to a discussion on the Elasmo-L listserve, this practice has allowed fishermen to receive the expected revenues for both the fin and the meat because the fin could be fully removed from the shark at the dock without thawing the shark. The vessel owner/operator would need to decide whether the benefit of selling the fins separate from the shark outweighs the cost of having the crew remove the fins during offloading. While the fins would likely still be of high quality once dry, it is unlikely that the ex-vessel price of fins packed in ice with the rest of the shark would be as high as fins that had begun drying. Additionally, if the shark cannot be packed in ice properly due to maintaining the fins on the shark, the quality of the meat, and therefore its value, could also decrease. The social impact of requiring sharks be landed with their fins on may be realized as the market adjust itself to accepting all wet fins. However, the overall socioeconomic impact of this could be significant given the reductions in the overall sandbar quota, which are the most lucrative shark due to the value of its fins.

Directed permit holder impacts

On average, directed permit holders landed 1,571,851 lb dw of sandbar sharks and 1,210,643 of non-sandbar LCS from 2003 to 2005 in the Coastal Fisheries and HMS Logbooks. In 2006 ex-vessel prices, this is equivalent to annual gross revenues of $3,744,032 (assuming 5 percent of the landings are fins and 95 percent of the landings are carcass weight) (Table 4.9). If gross revenues for directed permit holders are averaged across the approximately 143 active directed shark permit holders, then the average annual gross revenues per shark fishing vessel is just over $26,000 from shark revenues. Under alternative suite 2, gross revenues for directed permit holders would be estimated to be $1,026,032 (Table 4.10). This is a 73 percent overall reduction in gross revenues compared to 2003 to 2005 (Table 4.10). These reduced gross revenues averaged across the 143 active directed permit holders are just over $7,000 per directed shark fishing vessel. Since the states of Florida, New Jersey, and North Carolina have the most directed shark permits (Table 3.32), these states would be most negatively impacted by alternative suite 2.

In addition, retention of sandbar sharks on pelagic longline (PLL) gear would be prohibited under alternative suite 2. On average, 80,825 lb dw of sandbar sharks were reported landed on PLL gear by directed shark permit holders from 2003 to 2005 (HMS Logbook). In 2006 ex-vessel prices, this is equivalent to $106,802 in gross revenues. Given an average of 16.7 vessels landed sandbar sharks with PLL gear from 2003 to 2005, prohibition of sandbar sharks on PLL gear could result in a loss of gross revenues of $6,395 per vessel ($106,802 / 16.7 vessels = $6,395 per vessel).

Gross revenues under the status quo revenue were based on a 4,000 lb dw LCS trip limit for directed shark permit holders. The average number of sandbars and non-sandbar LCS landed per trip was 35 sandbars and 32 non-sandbar LCS for all gear types reported in the Coastal Fisheries and HMS Logbooks. Based on 2006 ex-vessel prices, this is equivalent to $3,358 per trip (Table 4.11). Revenue estimates on a regional trip basis were also based on species composition data attained from the BLL observer program data (Hale and Carlson, 2007). Observer data indicate that between 2005 and 2006, 69 sandbar sharks and 35 non-sandbar LCS were caught per trip in the South Atlantic region, and 30 sandbar sharks and 83 non-sandbar LCS were caught per trip in the Gulf of Mexico region (Hale and Carlson, 2007). Based on these numbers and 2006 ex-vessel prices, South Atlantic trips averaged $4,743/trip and Gulf of Mexico trips averaged $5,853/trip (Table 4.11).

Under alternative suite 2, the retention limits are 8 sandbars/trip and 21 non-sandbar LCS/trip. Non-sandbar LCS retention limits are based on the average ratio of sandbars to non-sandbar LCS caught in the South Atlantic and Gulf of Mexico regions to limit sandbar shark discards by fishermen deploying non-selective gear (Hale and Carlson, 2007). In the Gulf of Mexico, the ratio of sandbars to other LCS caught is 1:4, which based on an 8 sandbar/trip retention limit, would equal 32 non-sandbar LCS/trip. However, such a high non-sandbar LCS retention limit would result in a sandbar discards in the South Atlantic (~65.3 mt dw). A 21 non-sandbar LCS/trip retention limit was set to balance discards versus catch in the two regions (see Table A.4). This results in approximately 5 sandbar sharks being caught in the Gulf of Mexico region when the non-sandbar LCS retention limit/trip is filled (and therefore, only 86.1 mt dw of the sandbar quota would be filled). Therefore, gross revenues (including fins) on a trip basis are estimated to be $1,262 of gross revenue per trip in the South Atlantic and $1,333 of gross revenue per trip in the Gulf of Mexico (Table 4.12). From 2003 to 2005, there were 124 vessels that averaged more than 324 lb dw (or 8 sandbar sharks) of sandbar/trip (Figure A.3). Therefore, these vessels would be most negatively affected by retention limits under alternative suite 2.

<u>Incidental permit holder impacts</u>

On average, 66 incidental permit holders landed 19,066 lb dw/year of sandbar sharks and 39,995 lb dw/year of non-sandbar LCS from 2003 to 2005 in the Coastal Fisheries and HMS Logbooks. Using 2006 ex-vessel prices, this is equivalent to gross revenues of $80,558 (assuming 5 percent of the landings are fins and 95 percent of the landings are carcass weight) (Table 4.9). Gross revenues averaged across the 66 vessels with incidental permits landing sharks were just over $1,221 per vessel. Since incidental permit holders would not be able to land any sharks under alternative suite 2, the 66 active vessels would be most negatively affected by this alternative suite. The states of Florida, Louisiana, New Jersey, and North Carolina had the most incidental shark permit holders as of 2007 (144, 37, 20, and 16, respectively; Table 3.32); therefore, these states would be most negatively impacted by alternative suite 2.

Time/Area Closures

Under alternative suite 2, NMFS would maintain the mid-Atlantic shark closed area and the current BLL closures in the Caribbean that were implemented in February 2007, (72 FR 5633). Therefore, the economic impacts associated with the closures would be the same as described under alternative suite 1.

However, under alternative suite 2, NMFS would consider implementing the South Atlantic Fishery Management Council MPAs. Based on observer program data, the number of sets and targeted catch in the preferred MPAs is considered to be minimal. The preferred MPAs are generally small (< 10 miles wide) and vessels should be able to make minor adjustments to fishing locations to avoid the MPAs. Most of the observed shark BLL sets occurred shoreward of the MPAs. Affected vessels would forego some loss of revenue from the reduced bycatch of grouper and other species caught on shark BLL sets in the proposed MPAs, however, these losses are expected to be minimal. Based on the expanded catch estimates (Siegfried et al. 2006b), the total numbers of shark catches for the proposed MPAs were 25,395 and this equates to approximately $1,060,083 based on 2006 ex-vessel prices for shark (assuming 5 percent of the landings are fins and 95 percent of the landings are carcass weight) (Table 3.42). Since there are approximately 285 shark limited access permits in Florida, this would amount to a loss of revenue of approximately $3,722 per vessel per year in Florida.

Reporting

The reporting burden would be increased significantly for Atlantic shark dealers as a result of this alternative suite resulting in negative economic impacts. Currently, shark dealer reports must be submitted bimonthly, regardless of whether or not the dealer actually purchased any shark products. Reporting frequency would be increased to 24 hours of when shark products were purchased. While the increased reporting burden would not impact shark dealer expenditures per se, it would result in more time spent submitting dealer reports, which represents an opportunity cost for dealers since that would be time they could not spend conducting other activities related to their business. Furthermore, in order to comply with the requirement that dealer reports must be *received* by the Agency within 24 hours, it is assumed that dealers would have to submit dealer reports electronically or via facsimile. Dealers that do not currently possess a computer or fax machine would have to purchase one of these items. The increased reporting burden implemented in this alternative suite would be subject to authorization under the Paperwork Reduction Act. Reporting requirements for shark vessel permit holders, including the need to take an observer if selected and the need to submit vessel logbooks within seven days of completing a fishing trip would not be modified, resulting in neutral economic impacts.

Alternative suite 2 would modify the procedure for accounting for sharks that are reported by dealers as unclassified or unidentified. Currently, these sharks are counted against the LCS quota. This would be modified such that these sharks would be classified as sandbar sharks. As a result of the proposed measures, sandbar sharks would have the lowest commercial quota. However, sandbars have the highest commercial value of any Atlantic shark because of their fin. The intent of this requirement is to improve the accuracy of dealer reports and number of dealer reports that include species specific information on all sharks that are purchased. These data form the basis of quota monitoring and stock assessments. Furthermore, if shark dealers mis-identify the species of shark being purchased in order to keep the sandbar shark season open longer, this may result in overharvests. While the short-term impacts of this measure may be negative as it would require more of the dealer’s time to properly identify sharks, long-term effects may be positive. Potential overharvests or inappropriately short seasons coupled with potentially inaccurate stock assessments results could occur as a result of mis-identified or unidentified landings included in dealer reports. This measure coupled with mandatory shark identification workshops for shark dealers and the proposed requirement for fishermen to leave all shark fins attached to sharks at first point of landing could improve the accuracy of shark dealer reports.

Seasons

Coupled with the measures included under regions (Section 4.2.5), this alternative suite would likely have negative economic impacts on vessels and dealers in the North Atlantic. Opening seasons simultaneously in all regions would provide an advantage to vessels participating in shark fisheries in the South Atlantic and Gulf of Mexico regions as these regions have a wider variety of LCS and SCS sharks present year-round. Participants in the North Atlantic region would suffer as they would not be able to fish for sharks starting January 1 (since sharks would not have migrated north at this time), unless they moved to fish in another region. Moving to other regions to fish may not be cost effective with reduced quotas and retention limits for sandbar and non-sandbar LCS. Historically, these participants have only had significant landings of LCS and pelagic sharks. There is a possibility that the quota could be filled and the season closed for sandbar and non-sandbar LCS before participants in the North Atlantic have had the opportunity to land these sharks once they became available in this region. Furthermore, the fact that sandbar and non-sandbar LCS would both close regardless of which quota is filled, to minimize bycatch and dead discards of sandbar sharks, would exacerbate the negative economic impacts. Landings in the North Atlantic regions have averaged 62.3 mt dw/year for LCS (including sandbar sharks) between 2004-2006. The majority of LCS are landed in the second trimester in the North Atlantic region. Assuming that the entire quota is filled, and seasons for sandbar and non-sandbar LCS are closed before these sharks arrive offshore of the states in the North Atlantic region, this would result in loses in gross revenue of approximately $32,963 in 2005 ex-vessel prices (LCS = $0.24 per lb dw in the North Atlantic; $0.24/lb dw x 137,346.6 lb dw = $32,963; no price information is available for fins in the North Atlantic; Table 3.42). There are 107 directed and incidental shark permit holders in the states that comprise the North Atlantic region; therefore, losses are anticipated to be around $308 in gross revenues per vessel ($32,963 total gross revenues / 107 vessels = $308 per vessel). However, depending on their past involvement in the shark fishery, economic impacts to individual vessel owners would vary.

Vessels and dealers in the South Atlantic and Gulf of Mexico regions could experience a comparative advantage over vessels in the North Atlantic, however, reduced quotas and retention limits for sandbar sharks and non-sandbar LCS sharks would result in negative economic impacts for vessels and dealers in all locales. Furthermore, closing both non-sandbar LCS and sandbar sharks to minimize bycatch and dead discards of sandbar sharks on BLL gear would also result in negative economic impacts as this may result in a portion of either quota being unutilized. There is a possibility that the reduced retention limits for sandbar and non-sandbar LCS sharks, coupled with the drastically increased reporting frequency for dealers may result in minor positive economic impacts by keeping shark fishing seasons for LCS and sandbar sharks open for an extended portion of the year. In 2006, shark seasons for LCS were open a total of 4, 19, and 18 weeks in the North Atlantic, South Atlantic, and Gulf of Mexico, respectively. The first trimester was excluded from the North Atlantic calculation as landings for LCS are almost zero during these months (January – April). In 2007, shark seasons for LCS were 3, 4, and 5 weeks for the North Atlantic, South Atlantic, and Gulf of Mexico, respectively. Extensive over harvests in 2006 were responsible for short seasons in 2007. The retention limits associated with this alternative suite should result in longer shark seasons which may have some minor economic impacts as it may provide for a greater proportion of the year when vessels could land and sell shark products.

Regions

As stated in Section 4.2.4, this alternative suite would likely have negative economic impacts on regions that do not have sharks present year round. The North Atlantic region could be disadvantaged as a result of reverting back to one region, versus three, as they would not have a secure regional trimester quota which increased the likelihood that they would have a shark fishery in adjacent waters when sharks are present. Vessels could either move to southern areas to participate in the shark fishery in areas where sharks are present year-round or redistribute fishing effort to other fisheries. Dealers in all regions, but particularly in the North Atlantic region, would also be affected, possibly even more so than vessels, as the likelihood of having shark products consistently would be decreased.

Recreational Measures

Participants in recreational shark fisheries may experience negative economic impacts as a result of reducing the number of sharks that could be legally landed (Table 4.8). Charter/Headboat operators would be most affected as a result of these measures as they may see a reduction in the number of charters that customers are willing to hire. These impacts may be most pronounced in areas where blacktip sharks are frequently encountered, including the South Atlantic and Gulf of Mexico regions. Recreational landings data indicate that there are more landings of blacktip sharks than any other species that could no longer be possessed as a result of this alternative suite. It is presumed that blacktip sharks are kept more than any other LCS because of the higher quality of their flesh and the fact that they are more abundant than other LCS in coastal waters. Charter/Headboat operators specializing in sharks may see the number of charters decline because some fishermen insist on keeping blacktip or sandbar sharks. Prohibiting the other species (finetooth, silky, bull, blacknose, and porbeagle) is not expected to have adverse impacts as these species are not as frequently encountered in recreational fisheries for sharks.

Tournaments offering prize categories for sharks may also experience negative economic impacts as a result of prohibiting six additional species of sharks for retention in recreational fisheries. The majority of tournaments specializing in sharks are in the North Atlantic region: specifically Rhode Island, New York, and Massachusetts. In 2005 and 2006, there were 60 tournaments/year with prize categories for pelagic sharks.

Species most commonly targeted in these tournaments including common thresher, oceanic whitetip, blue, shortfin mako, and porbeagle. Of these, only porbeagle would be prohibited from retention as stocks are overfished. Tournaments are generally won by shortfin mako or common thresher, therefore, significant economic impacts as a result of prohibiting porbeagle retention in shark fishing tournaments are not anticipated.

6.4.3 Alternative Suite 3: Shark Fishery for Directed, Incidental, HMS Angling, and HMS Charter/Headboat Permit Holders

Species Complexes

Under alternative suite 3, NMFS would structure species complexes as they are outlined for alternative suite 2. Therefore, the economic impacts of species complexes would be the same as described in alternative suite 2. The associated economic impacts of the reduced quotas for sandbar sharks and non-sandbar LCS are discussed in combination with the next section on retention limits.

Quotas and Retention Limits

Alternative suite 3 would allow sharks to be retained by shark directed and incidental permit holders. Therefore, the available sandbar and non-sandbar LCS quota would be spread over a larger universe of commercial permit holders. However, unlike the status quo or alternative suite 2, the retention limits for sandbar sharks and non-sandbar LCS would be the same for both directed and incidental permit holders. Since directed permit holders presumably make a greater percentage of their gross revenues from shark landings, they are expected to have larger negative socioeconomic impacts compared to incidental permit holders. Since the states of Florida, New Jersey, and North Carolina have the most directed permit holders; therefore, it is anticipated that these states would have the largest negative socioeconomic impacts under alternative suite 3 (Table 3.32). As with alternative suite 2, shark dealers could also experience negative impacts due to the reduction in the sandbar and other LCS quotas and retention limits, which would reduce the overall amount of sharks being landed.

As with alternative suite 2, NMFS would also maintain the 60 mt ww (43.2 mt dw) shark display and research quota under alternative suite 3. The economic impacts of this quota are the same as those discussed in Section 6.4.2.

<u>Fishery level impacts</u>

Under alternative suite 3, the commercial quotas would be reduced to 116.6 mt dw for sandbar sharks and 541.2 mt dw for non-sandbar LCS. However, given the non-sandbar LCS retention limit, only 105.9 mt dw (233,467 lb dw) of the sandbar quota and 229.2 mt dw (505,294 lb dw) of non-sandbar LCS quota would be landed under alternative suite 3 to balance discards of sandbar sharks in the South Atlantic with uncaught sandbar quota in the Gulf of Mexico (see discussion in Appendix A under "*Non-sandbar quota and retention limits*" and Tables A.4 and 4.2). Based on 2006 ex-vessel prices, assuming 5 percent of the landings are fins and 95 percent of the landings are carcass weight, this is equivalent to $1,008,027 (Table 4.13). This is a reduction of about 74 percent compared to the current gross revenues under alternative suite 1 ($3,824,589; Table 4.9).

As with alternative suite 2, porbeagle sharks would be placed on the prohibited list. Overharvests of quota for each category would be removed from the next season's quota. Underhavests for species that are unknown, overfished, or experiencing overfishing would not be transferred to the next season's quota. Finally, this alternative suite would also require that shark fins remain on the shark. The economic impacts of these proposed regulatory components are the same as those described for alternative suite 2.

Directed permit holder impacts

As stated under alternative suite 2, on average, directed permit holders landed 1,571,851 lb dw of sandbar sharks and 1,210,643 of non-sandbar LCS from 2003 to 2005 in the Coastal Fisheries and HMS Logbooks. In 2006 ex-vessel prices, this is equivalent to gross revenues of $3,744,032 (assuming 5 percent of the landings are fins and 95 percent of the landings are carcass weight) (Table 4.9). However, under alternative 3, the available sandbar and non-sandbar LCS quota would be spread over directed and incidental permit holders. Based on past effort, it was assumed 1,108 trips could be made by directed permit holders (Table 4.14). This is 78 percent of the total expected fishing effort (Table 4.14). Therefore, given 105.9 mt dw (233,467 lb dw) of sandbar and 229.2 mt dw (505,294 lb dw) of non-sandbar LCS that could be landed under alternative suite 3, approximately 83 mt dw (183,073 lb dw) of sandbar quota and 180 mt dw (396,225 lb dw) of the non-sandbar LCS quota are anticipated to be landed by directed permit holders (Table 4.14). Based on 2006 ex-vessel prices, this is equivalent to $793,338 gross revenues for directed permit holders. This is a 79 percent overall reduction in gross revenues compared to 2003 to 2005 (gross revenues based on current directed permit holders' landings were $3,744,032; Table 4.9). Again, since the states of Florida, New Jersey, and North Carolina have the most directed permit holders; therefore, it is anticipated that these states would experience the largest negative socioeconomic impacts under alternative suite 3 (Table 3.32).

As stated in alternative 2, the status quo revenue was based on a 4,000 lb dw LCS trip limit for directed shark permit holders with average South Atlantic trips at $4,743/trip and average Gulf of Mexico trips at $5,853/trip (Table 4.11). Under alternative suite 3, the retention limits are 4 sandbars/trip and 10 non-sandbar LCS/trip. However, since the ratio of sandbars to non-sandbar LCS caught in the Gulf of Mexico is 1:4, only ~ 3 sandbar sharks would be caught in the Gulf of Mexico region when the 10 non-sandbar LCS retention limit/trip is filled (10 non-sandbar LCS / 4 = 2.5 sandbar sharks). Therefore, gross revenues on a trip basis are estimated to be $610 per trip in the South Atlantic and $670 per trip in the Gulf of Mexico (Table 4.15). From 2003 to 2005, there were 128 vessels that averaged more than 163 lb dw (or 4 sandbar sharks) of sandbar/trip (Figure A.3). Therefore, these vessels would be most negatively affected by retention limits under alternative suite 3.

Incidental permit holder impacts

On average, incidental permit holders landed 19,066 lb dw of sandbar sharks and 39,995 lb dw of non-sandbar LCS from 2003 to 2005 in the Coastal Fisheries and HMS Logbooks. In 2006 ex-vessel prices, this is equivalent to gross revenues of $80,558 (assuming 5 percent of the landings are fins and 95 percent of the landings are carcass weight) (Table 4.9). The available sandbar and non-sandbar LCS quotas were averaged over directed and incidental permit holders under alternative suite 3. Based on past effort, it was assumed 305 trips could be made by incidental permit holders (Table 4.14). This is 22 percent of the expected fishing effort (Table 4.14). Therefore, given the 105.9 mt dw (233,467 lb dw) of the sandbar quota and 229.2 mt dw (505,294 lb dw) of the non-sandbar LCS quota that could be landed under alternative suite 3, approximately 23 mt dw (50,395 lb dw) of sandbar quota and 50 mt dw (109,069 lb dw) of the non-sandbar LCS quota are anticipated to be landed by incidental permit holders (Table 4.14). Based on 2006 ex-vessel prices, this is equivalent to $218,383 gross revenues for incidental permit holders (Table 4.14). This would result in gross revenues that are 2.7 times higher compared to 2003 to 2005 (gross revenues based on current incidental permit holders' landings were $80,558; Table 4.9).

This increase in gross revenues is due to the increase in retention limits for incidental permit holders. Under the status quo, incidental permit holders can retain 5 sharks from the LCS complex. However, under alternative suite 3, incidental permit holders would be able to retain 4 sandbars and 10 non-sandbar LCS or 14 LCS total. This retention limit is almost 3 times higher than what is currently allowed under the status quo. On average, incidental permit holders have been landing 2 sandbar sharks and 3 non-sandbar LCS per trip. Based on 2006 ex-vessel prices, this is equivalent to $248/trip (Table 4.11). However, under alternative suite 3, incidental permit holders would make equivalent gross revenues per trip as directed permit holders: $610 per trip in the South Atlantic and $670 per trip in the Gulf of Mexico (Table 4.15). This would result in gross revenues for incidental permit holders that are 2 to 3 times higher than gross revenues in 2003 to 2005 depending on future fishing effort and catch composition. Therefore, there would positive economic impacts for incidental permit holders under alternative suite 3. Since approximately 66 vessels with incidental permit holders landed sandbar sharks or non-sandbar LCS in 2003 to 2005 in the Coastal Fisheries and HMS Logbooks, these 66 vessels would have the largest economic benefits under alternative suite 3. However, if sharks become profitable for incidental permit holders under alternative suite 3, then more vessels with incidental permits may actively land sandbars and non-sandbar LCS in the future. Finally, the states of Florida, Louisiana, New Jersey, and North Carolina had the most incidental shark permit holders in 2007 (Table 3.32). Therefore, these states would see the largest socioeconomic benefits under alternative suite 3.

Time/Area Closures

Under alternative suite 3, NMFS would maintain the mid-Atlantic shark closed area to BLL gear and the current BLL closures in the Caribbean that were implemented in February 2007, (72 FR 5633). Therefore, the economic impacts associated with these closures would be the same as described under alternative suite 1. In addition, under alternative suite 3 NMFS would implement the South Atlantic Fishery Management Council MPAs as described under alternative suite 2. Therefore, the economic impacts associated with the MPAs would be the same as described in alternative suite 2.

Reporting

This alternative suite could result in neutral economic impacts. Shark dealers would still be required to submit landings data twice a month, however, they would need to ensure that it is actually *received* by the Agency within 10 days of a bimonthly reporting period ending. Currently, shark dealers simply have to ensure that the landings reports submitted to NMFS are *post-marked* within 10 days of the end of a reporting period. Additional burden is not expected as a result of modifying the regulations to ensure that dealer reports are actually received. Furthermore, more timely reporting and receipt of information by the Agency may result in a decreased likelihood that quotas would be exceeded and overharvests removed from forthcoming shark seasons resulting in neutral or slightly positive economic impacts.

As described in alternative suite 2, this suite would change how sharks listed as unclassified on shark dealer reports are accounted for. Unclassified sharks would be counted as sandbar sharks, and not as LCS, which is the current procedure. Properly identifying sharks would result in negative economic impacts in the short-term because it takes more time. Submission of accurate shark dealer data may result in positive economic impacts in the long-term as it would improve quota monitoring, decrease the likelihood of extensive overharvests and subsequent closures, and improve the results from stock assessments by ensuring data is more accurate and includes species specific information.

Seasons

When coupled with the measures included under regions (Section 4.2.5), this alternative suite would likely have negative economic impacts on vessels and dealers in the North Atlantic. Opening seasons on January 1, in all regions, would provide an advantage to vessels participating in shark fisheries in the South Atlantic and Gulf of Mexico regions as these regions have a wider variety of LCS and SCS sharks present year-round. Participants in the North Atlantic region would suffer as they would not be able to fish for sharks starting January 1 (since sharks would not have migrated north at this time), unless they moved to fish in another region. This is not likely as a result of the reduced quotas and retention limits for sandbar and non-sandbar LCS sharks. Historically, these participants have only had significant landings of LCS and pelagic sharks. There is a possibility that the quota could be filled and the season closed for sandbar and non-sandbar LCS before participants in the North Atlantic have had the opportunity to land these sharks once they became available in this region. Furthermore, the fact that sandbar and non-sandbar LCS would both close regardless of which quota is filled to minimize bycatch and dead discards of sandbar sharks would exacerbate the negative economic impacts. Landings in the North Atlantic regions have averaged 62.3 mt dw/year for LCS (including sandbar sharks) between 2004-2006. The majority of

LCS are landed in the second trimester in the North Atlantic region. Assuming that the entire quota is filled, and seasons for sandbar and non-sandbar LCS are closed before these sharks arrive offshore of the states in the North Atlantic region this would result in losses in gross revenues of approximately $32,963 in 2005 ex-vessel prices (Table 3.42). There are 107 directed and incidental shark permit holders in the states that comprise the North Atlantic region; therefore, losses are anticipated to be around $308 in gross revenues per vessel ($32,963 total gross revenues / 107 vessels = $308 per vessel). However, depending on their past involvement in the shark fishery, economic impacts to individual vessel owners would vary.

Vessels and dealers in the South Atlantic and Gulf of Mexico regions would experience a comparative advantage over vessels in the North Atlantic, however, reduced quotas and retention limits for sandbar sharks and non-sandbar LCS sharks would result in negative economic impacts for vessels and dealers in all locales. Furthermore, closing both non-sandbar LCS and sandbar sharks to minimize bycatch and dead discards of sandbar sharks on BLL gear would also result in negative economic impacts as this may result in a portion of either quota being unutilized. There is a possibility that the reduced retention limits for sandbar and non-sandbar LCS sharks may result in minor positive economic impacts by keeping shark fishing seasons for LCS and sandbar sharks open for an extended portion of the year. In 2006, shark seasons for LCS were open a total of 4, 19, and 18 weeks in the North Atlantic, South Atlantic, and Gulf of Mexico, respectively. The first trimester was excluded from the North Atlantic calculation as landings for LCS are almost zero during these months (January – April). In 2007, shark seasons for LCS were 3, 4, and 5 weeks for the North Atlantic, South Atlantic, and Gulf of Mexico, respectively. Extensive over harvests in 2006 were responsible for short seasons in 2007. This alternative suite may result in longer shark seasons which may have some minor economic impacts as it may provide for a greater proportion of the year when vessels could land and sell shark products.

Regions

As stated in alternative suite 2 and similarly with alternative suite 3, eliminating regions may have negative economic impacts on regions that do not have sharks present year round. The North Atlantic region would be disadvantaged as a result of reverting back to one region, versus three, as they would not have a secure regional trimester quota which increased the likelihood that they would have a shark fishery in adjacent waters when sharks are present. Vessels could either move to southern areas to participate in the shark fishery in areas where sharks are present year-round or redistribute fishing effort to other fisheries. Dealers in the North Atlantic region would also be affected, possibly even more so than vessels, as the likelihood of having shark products consistently would be decreased.

Recreational Measures

As described under alternative suite 2, participants in recreational shark fisheries would experience negative economic impacts as a result of reducing the number of sharks that could be legally landed (Table 4.8). Charter/Headboat operators would be most affected as a result of these measures as they may see a reduction in the number of charters that customers are willing to hire. These impacts may be most pronounced in areas where blacktip sharks are frequency encountered, including the South Atlantic and Gulf of Mexico regions. Recreational landings data indicates that there are more landings of blacktip sharks than any other species that could no longer be possessed as a result of this alternative suite. It is presumed that blacktip sharks are kept more than any other LCS because of the higher quality of their flesh and the fact that they are more abundant than other LCS in coastal waters. Charter/Headboat operators specializing in sharks may see the number of charters decline because some fishermen insist on keeping a blacktip or sandbar sharks. Prohibiting the other species (finetooth, silky, bull, blacknose, and porbeagle) is not expected to have adverse impacts as these species are not as frequently encountered in recreational fisheries for sharks.

Tournaments offering prize categories for sharks may also experience negative economic impacts as a result of prohibiting six additional species of sharks for retention in recreational fisheries. The majority of tournaments specializing in sharks are in the North Atlantic region, specifically Rhode Island, New York, and Massachusetts. In 2005 and 2006, there were 60 tournaments/year with prize categories for pelagic sharks. Species most commonly targeted in these tournaments including common thresher, oceanic whitetip, blue, shortfin mako, and porbeagle. Of these, only porbeagle would be prohibited from retention as stocks are overfished. Tournaments are generally won by shortfin mako or common thresher, therefore, significant economic impacts as a result of prohibiting porbeagle retention in shark fishing tournaments are not anticipated.

6.4.4 Alternative Suite 4: Establish a Research Fishery for Sandbar Sharks; Shark Fishery for Directed, Incidental, HMS Angling, and HMS Charter/Headboat Permit Holders – Preferred Alternative

Species Complexes

Under alternative suite 4, NMFS would structure species complexes as they are outlined for alternative suites 2 and 3. Therefore, the economic impacts associated with species complexes would be the same as described in alternative suite 2. The associated economic impacts of the quota reductions for sandbar sharks and non-sandbar LCS and the division of those quotas among vessels inside and outside of a research fishery are described in the next section in combination with retention limits.

Quotas and Retention Limits

Alternative suite 4 would establish a shark research fishery for sandbar sharks (See Section 4.4 and "*Fishery level impacts*" in this section for additional information). Only incidental or directed permit holders that apply and are selected to participate in this program could land sandbar sharks. If the dealer infrastructure is impacted by business closures, participants in the research fishery may have difficulty marketing their catch. Vessels not participating in the research program would still be able to land non-sandbar LCS, SCS, and pelagic sharks subject to the retention limits described in Chapter 2 (Table 2.1). Based on the few number of vessels that would be in the shark research fishery, most current directed and incidental permit holders would not be allowed to land sandbar sharks, resulting in negative socioeconomic impacts for these permit holders. In addition, given the reduced non-sandbar LCS trip limit for vessels outside the research fishery and since directed permit holders presumably make a larger percentage of their gross revenues from shark landings, it is anticipated that there would be greater negative socioeconomic impacts on directed permit holders outside the research fishery compared to incidental permit holders. Since Florida, New Jersey, and North Carolina have the most directed and incidental shark incidental permit holders, it is anticipated that these states would have the largest negative socioeconomic impacts by the reduced non-sandbar LCS retention limits (Table 3.32). As with alternative suites 2 and 3, shark dealers could also experience negative impacts due to the reduction in the sandbar and other LCS quotas and retention limits, which would reduce the overall amount of sharks being landed. Furthermore, there may be some acute region impacts on dealers in areas not covered by the limited research fishery.

As with alternative suites 2 and 3, NMFS would also maintain the 60 mt ww (43.2 mt dw) shark display and research quota under alternative suite 4. Given an average 2 mt dw of sandbar sharks per year have been collected under the exempted research program from 2000 to 2006, there would not be an appreciable decrease in sandbar allocation compared to what was collected in past years. Thus, minimal negative economic impacts are anticipated. 94 dusky sharks have been collected under the exempted fishing program from 2000 to 2006 (or 13 dusky sharks per year). Due to the prohibition of dusky shark collection under alternative suite 4 for public display, this could have a negative economic impact on a few collectors, although the majority of dusky shark collections have been for shark research. Collectors and researchers would still have the majority of the shark display and research quota (41.2 mt dw or 57.2 mt ww) available for all non-sandbar LCS beside dusky sharks.

Fishery level impacts

Under alternative suite 4, the commercial quotas would be reduced to 116.6 mt dw for sandbar sharks and 541.2 mt dw for non-sandbar LCS, however, these quotas would be divided among vessels operating within a small research fishery and vessels operating outside the research fishery. All of the 116.6 mt dw (257,056 lb dw) quota for sandbar sharks would be allocated to the vessels operating in the research fishery. In addition, it is anticipated that 50 mt dw (110,230 lb dw) of the non-sandbar LCS quota would be caught while fishermen fulfilled the 116.6 mt dw of sandbar quota in the research fishery (see Appendix A, Table A.5). Therefore, in 2006 ex-vessel prices, it is estimated that vessels operating in the research fishery could make $490,411 in gross revenues of sandbar and non-sandbar LCS landings (Table 4.16). Vessels operating outside of the research fishery would have an estimated 491 mt dw (1,082,459 lb dw) of non-sandbar LCS quota available to them depending on non-sandbar LCS landings in the shark research fishery. In 2006 ex-vessel prices, this is equivalent to $1,502,994 in gross revenues (Table 4.16). In total, vessels operating within, and outside, of the research fishery are expected to have gross revenues of $1,993,435 in sandbar and non-sandbar LCS landings (Table 4.16). This is a 48 percent reduction in gross revenues from sandbar sharks and non-sandbar LCS under the status quo (gross revenues based on current directed and incidental permit holders' landings were $3,824,589; Table 4.9). The states of Florida, Louisiana, New Jersey, and North Carolina have the most incidental and direct shark permit holders (Table 3.32). It is anticipated that these states would have the largest negative socioeconomic impact by these reductions in quotas of different shark species.

As with alternative suite 2, porbeagle sharks would be placed on the prohibited list. Overharvests of quota for each category would be removed from the next season's quota. Underhavests for species that are unknown, overfished, or experiencing overfishing would not be transferred to the next season's quota. Finally, this alternative suite would also require that shark fins remain on the shark. The economic impacts of these proposed regulatory components are the same as those described for alternative suite 2.

Directed and Incidental permit holder impacts in the research fishery

Currently directed permit holders have a 4,000 lb dw LCS trip limit. Vessels operating within a shark research fishery may experience similar trip limits, depending on the research objectives of the fishery. However, the overall quota for sandbar sharks in the research fishery would be reduced to 116.6 mt dw. Assuming the catch composition is 70 percent sandbar sharks, and there is a 4,000 lb dw trip limit, 92 trips would fulfill the sandbar shark quota (see Section 4.4.2 and Appendix A, Table A.2). Given this catch composition, 30 percent of 4,000 lb dw trip would be non-sandbar LCS. If 92 trips were made with these trip limits and catch compositions, it is estimated that 50 mt dw of non-sandbar LCS would also be caught in the research fishery (see Section 4.4.2 and Appendix A, Table A.5). Based on these landings, the research fishery would have estimated overall gross revenues of $490,411 or $5,331 per trip in gross revenues (assuming these are BLL trips; Table 4.16). On average, directed permit holders reported 1,108 trips per year (using a combination of gear types) in the Coastal Fisheries and HMS logbooks that landed sandbar sharks and non-sandbar LCS from 2003 to 2005 (Table 4.11). While 92 trips represents a greater than 90 percent reduction in the average number of trips taken by directed permit holders from 2003 to 2005, these trips would be divided across a much smaller universe of vessels, therefore, minimizing the economic impacts for vessels that are selected to participate in the research fishery. Since Florida, New Jersey, and North Carolina have the most directed shark incidental permit holders, it is anticipated that these states would have the largest negative socioeconomic impacts given the limitation of only a few vessels inside the research fishery being able to maintain higher trip limits than those vessels operating outside the research fishery.

Incidental permit holders took, on average, 305 trips per year that landed sandbar sharks and 347 trips per year that landed other LCS in 2003 to 2005 (Table 4.11). On average, they landed 2 sandbars and 3 non-sandbar LCS per trip for total estimated gross revenues of $248 per trip (Table 4.11). However, under alternative suite 4, incidental fishermen would have the same retention limits as directed shark permit holders, and therefore, receive the same gross revenues from shark landings as directed shark permit holders. Given gross revenues for directed shark permit holders would be $5,331 per trip under alternative suite 4, the same gross revenues for incidental permit holders would be almost 21 times higher than gross revenues under the status quo ($5,331/$248 = 21.4 times higher). Therefore, positive economic impacts may be realized by the few incidental permit holders that may participate in the research fishery.

Directed and Incidental permit holders outside the research fishery

Directed and incidental permit holders operating outside the research fishery would still be able to retain 22 non-sandbar LCS/trip until the remaining 491 mt dw non-sandbar LCS quota is filled. Based on 2006 ex-vessel prices, this quota could result in gross revenues of $1,502,994 (Table 4.16). Given the 22 LCS trip limit (741.4 lb dw non-sandbar LCS/trip) and the 491 mt dw (1,082,459 lb dw) of non-sandbar LCS quota, approximately 1,460 trips (1,082,459 lb dw / 741.4 lb dw per trip) could be made by directed and incidental permit holders to fulfill the non-sandbar LCS quota. This is equivalent to approximately $1,365 per trip in non-sandbar LCS gross revenues (Table 4.16).

On average, directed permit holders made 1,108 trips that landed non-sandbar LCS from 2003 to 2005 resulting in gross revenues of $1,497 per trip in non-sandbar LCS landings (Table 4.11). Therefore, directed permit holders operating outside of the research fishery could take an 8 percent reduction in gross revenues per trip for non-sandbar LCS landings ($1,497 - $1,365 = $132; $132/$1,497 = 8 percent reduction). In addition, on a trip basis, directed permit holders made approximately $1,860 in gross revenues from sandbar sharks (Table 4.11). Therefore, directed permit holders could lose $1,993 in combined gross revenues earned from non-sandbar LCS and sandbar shark landings per trip ($1,497+$1,860 = $3,358; $3,358 - $1,365 = $1,993; Table 4.11), which is a 59 percent reduction in gross revenues per trip ($1,993/$3,358 = 59 reduction) for directed permit holders operating outside of the research fishery compared to the status quo. Since an average of 141 vessels with directed shark permits reported sandbar landings in the Coastal Fisheries and HMS Logbooks from 2003 to 2005 and most directed permit holders are located in Florida, New Jersey, and North Carolina (Table 3.32), it is anticipated that these 141 active vessels in these states would be most negatively impacted by alternative suite 4.

On average, incidental permit holders made 347 trips that landed non-sandbar LCS from 2003 to 2005 resulting in gross revenues of $141 per trip in non-sandbar LCS landings (Table 4.11). Therefore, under alternative suite 4, incidental permit holders operating outside of the research fishery could experience an increase in gross revenues from non-sandbar LCS of almost 10 times the trip average under the status quo ($1,365 per trip/$141 per trip= 9.6). However, incidental permit holders outside the research fishery would not be able to land sandbar sharks, equating to a $25,024 loss in gross revenues from sandbar landings for incidental permit holders (Table 4.9). Therefore, the lost revenues in sandbar landings could be offset by the 10 fold increase in gross revenues from non-sandbar LCS landings on a trip basis. For instance, if fishing effort by incidental permit holders stayed constant (*i.e.*, 347 trips), and the gross revenues of $1,365 per trip were realized by incidental permit holders, this would equate to $473,655 in gross revenues from non-sandbar LCS by incidental permit holders (347 trips x $1,365/trip = $473,655). A loss of $25,024 in gross revenues from sandbar landings makes the incidental fishery's net gross revenues equal to $448,631 ($473,655 - $25,024 = $448,631). Given the total gross revenues for sandbar and non-sandbar LCS landings was $80,558 under the status quo (Table 4.9), incidental permit holders operating outside of the research fishery could still increase their gross revenues by almost 6 times under alternative suite 4 compared to the status quo. Since most incidental shark permit holders are in the states of Florida, Louisiana, New Jersey, and North Carolina (Table 3.32), these states would benefit the most from this increase in gross revenues.

Time/Area Closures

Under alternative suite 4, NMFS would maintain the mid-Atlantic shark closed area to BLL gear and the current BLL closures in the Caribbean that were implemented in February 2007, (72 FR 5633). Therefore, the economic impacts associated with these closures would be the same as described under alternative suite 1. In addition, NMFS would also implement the South Atlantic Fishery Management Council MPAs as described under alternative suite 2. Therefore, the economic impacts associated with the MPAs would be the same as described in alternative suite 2.

Reporting

This alternative suite could result in neutral economic impacts. Shark dealers would be still be required to submit landings data twice a month, however, they would need to ensure that it is actually *received* by the Agency within 10 days of a bimonthly reporting period ending. Currently, shark dealers simply have to ensure that the landings reports submitted to NMFS are *post-marked* within 10 days of the end of a reporting period. Additional burden is not expected as a result of modifying the regulations to ensure that dealer reports are actually received. Furthermore, timelier reporting and receipt of information by the Agency may result in a decreased likelihood that quotas would be exceeded and overharvests removed from forthcoming shark seasons.

This alternative suite would increase the level of observer coverage for a limited number of vessels that would apply and be selected for participation in a shark research program. One-hundred percent observer coverage would be a requirement for consideration under this program. Vessels outside the shark research program would still be required to take an observer if selected. All vessels would still be required to complete and submit commercial logbooks in the same timeframe.

As described in alternative suites 2 and 3, this suite would change how sharks listed as unclassified on shark dealer reports are accounted for. Unclassified sharks would be counted as sandbar sharks, and not as LCS, which is the current procedure. Properly identifying sharks would result in negative economic impacts for dealers in the short-term because it takes more time for correct reporting. Submission of accurate shark dealer data may result in positive economic impacts in the long-term as it would improve quota monitoring, decrease the likelihood of extensive overharvests and subsequent closures, and improve the results from stock assessments by ensuring data is more accurate and includes species specific information.

Seasons

The same negative economic impacts for the North Atlantic region described in alternative suites 2 and 3 would exist for alternative suite 4. The primary difference between alternative suite 4 and the other alternatives is that there would be a limited number of vessels that would be selected to participate in a shark research program, and would be able to land sandbar, non-sandbar LCS, and other species/complex year-round if quota was available. As described in alternative suites 2 and 3, seasons for sandbar and non-sandbar LCS would both be closed with five days notice if either achieves 80 percent of their respective species/complex quota. This could result in negative economic impacts as it would limit the number of trips that may be scheduled for all vessels.

Regions

As stated in alternative suites 2 and 3, eliminating regions would likely have negative economic impacts on regions that do not have sharks present year round. The North Atlantic region would be disadvantaged as a result of reverting back to one region, versus three under the status quo, as they would not have a secure regional trimester quota which increased the likelihood that they would have a shark fishery when sharks are present in the summer months. However, this alternative suite would implement a shark research program that would allow a limited number of vessels to conduct fishing activities in all regions throughout the year. Vessels outside the research fishery could either move to southern areas to participate in the shark fishery in areas where sharks are present year-round or redistribute fishing effort to other fisheries. Dealers in the North Atlantic region would most likely be negatively affected, possibly even more so than vessels, as the likelihood of consistently having shark products would decrease.

Recreational Measures

As described under alternative suites 2 and 3, participants in recreational shark fisheries would experience negative economic impacts as a result of reducing the number of sharks that could be legally landed (Table 4.8). Charter/Headboat operators would be most affected as a result of these measures as they may see a reduction in the number of charters that customers are willing to hire. These impacts may be most pronounced in areas where blacktip sharks are frequency encountered, including the South Atlantic and Gulf of Mexico regions. Recreational landings data indicates that there are more landings of blacktip sharks than any other species that could no longer be possessed as a result of this alternative suite. It is presumed that blacktip sharks are kept more than any other LCS before of the higher quality of their flesh and the fact that they are more abundant than other LCS in coastal waters. Charter/Headboat operators specializing in sharks may see the number of charters decline because some fishermen insist on keeping a blacktip or sandbar sharks. Prohibiting the other species (finetooth, silky, bull, blacknose, and porbeagle) is not expected to have adverse impacts as these species are not as frequently encountered in recreational fisheries for sharks.

Tournaments offering prize categories for sharks may also experience negative economic impacts as a result of prohibiting six additional species of sharks for retention in recreational fisheries. The majority of tournaments specializing in sharks are in the North Atlantic and Gulf of Mexico regions, specifically Rhode Island, New York, Massachusetts, Louisiana, and Texas. In 2005 and 2006, there were 60 tournaments/year with prize categories for pelagic sharks. Species most commonly targeted in these tournaments including common thresher, oceanic whitetip, blue, shortfin mako, and porbeagle. Of these, only porbeagle would be prohibited from retention as stocks are overfished. Tournaments are generally won by shortfin mako or common thresher, therefore, significant economic impacts as a result of prohibiting porbeagle retention in shark fishing tournaments are not anticipated.

6.4.5 Alternative Suite 5: Close Atlantic Shark Fisheries

Quotas, Species Complexes, and Retention limits

Alternative Suite 5 would have significant economic and social impacts on a variety of small entities, including: commercial shark permit holders, shark dealers, gear manufacturers, bait and ice suppliers, and other secondary industries dependant on the shark fishery. The level of economic impact would be directly proportional to the amount of revenues that each entity has realized from past participation in the shark fishery. Permit holders would be impacted differently depending on the quantity of sharks landed in the past. Vessels targeting sharks (directed permit holders) landed an annual average of 1,262 mt dw of LCS, 184.5 mt dw SCS, and 29.84 mt dw pelagic sharks per year between 2003-2005. The gross revenues based on 2006 ex-vessel prices of these landings is estimated at $3,877,003, $593,853, and $117,920 for LCS, SCS, and pelagic sharks, respectively, based on price information provided in Table 3.42. While it is assumed that very few directed shark permit holders subsist entirely on revenues attained from the shark fishery, however, impacts would still be severe for those participants that did depend on any income from participating in the directed shark fishery at certain times of the year. Because of the extensive economic impacts to shark directed permit holders as a result of this alternative suite, it is assumed that directed permit holders would likely pursue one of the following options as a result of closing the Atlantic shark fishery: (1) transfer fishing effort to other fisheries for which they are already permitted (snapper grouper, king and Spanish mackerel, tilefish, lobster, dolphin/wahoo, etc), (2) acquire the necessary permits to participate in other fisheries (both open access and/or limited access fisheries), or (3) relinquish all permits and leave the fishing industry. Table 3.32 displays the other permits held by directed shark permit holders as of May 2007.

Incidental permit holders would face negative economic and social impacts as a result of closing the Atlantic shark fishery, however, not as severe as directed permit holders. It is assumed that incidental permit holders receive the majority of their fishing income from participating in other fisheries depending on the region and the type of gear predominantly fished (i.e., swordfish, tunas, snapper grouper, tilefish, dolphin/wahoo, lobster, etc.). It is estimated that, between 2003-2005 on average, incidental permit holders landed 26.8 mt dw LCS, 15.3 mt dw SCS, and 8.11 mt dw pelagics per year. This equates in gross revenues based on 2006 ex-vessel prices for these landings of $82,333, $49,246, and $32,049 for the respective species complexes. Incidental permit holders would likely have to increase effort in these other fisheries to replace lost revenues from landing sharks. Furthermore, these vessels may seek other permits (open access or limited access transferred from another vessel) or leave the fishing industry entirely.

This alternative suite could also have negative economic and social impacts for shark dealers as they would no longer be authorized to purchase shark products from Federally permitted shark fishermen. Shark dealers also maintain permits to purchase other regionally caught fish products. Due to the brevity of the LCS shark fishing season, which is the shark fishery that accounts for the majority of the shark product revenue due to the fin value, many dealers also get revenue from purchasing fish products other than sharks. The majority of shark dealer permit holders hold permits to purchase other fish products, including swordfish, tunas, snapper grouper, tilefish, mackerel, lobster, and dolphin/wahoo among others. It is difficult to assume, on an individual dealer basis, the quantity of revenues received exclusively from shark products.

Shark fin dealers, specializing in the purchase of shark fins from Federal and state permitted dealers, would also experience negative social and economic impacts as a result of closing the shark fishery. These dealers receive virtually all of their income from purchasing shark fins and shipping them to exporters. Exporters then transport the fins to global and domestic markets. This alternative suite would likely force shark fin dealers to leave the industry or focus on purchasing other fishery products, resulting in significant economic impacts to the individuals involved in this trade.

It is difficult to estimate the indirect economic and social impacts that would be experienced by various small entities that support the shark fishery, e.g., purveyors of bait, ice, fishing gear, and fishing gear manufactures. However, these impacts would likely be negative. It is difficult to estimate these impacts as it is uncertain to what extent vessels that were fishing for sharks would redistribute their fishing effort to other fisheries, or simply cease fishing operations. If the majority of vessels affected by a shark fishery closure simply displace effort to other fisheries it is assumed that they would still be dependant on small entities for their bait, ice, and gear as these are products are essential for fishing excursions targeting any species. Redistributing effort to other fisheries would mitigate negative economic impacts. However, if a significant number of vessels simply cease fishing operations or scale back considerably, then severe economic consequences would be imparted on these support industries as a result.

Time/Area Closures

Seasonal time area closures for BLL gear would no longer be applicable as a result of this alternative. Measures that affect the shark gillnet fishermen during the right whale calving season (November 15 – March 31 every year) are administered by the Atlantic Large Whale Take Reduction Team and these measures would still apply to fishermen who possess a commercial shark permit and fish in the calving area between the months of November through April. These measures are specific to the mesh size of gillnets that are being deployed, therefore, these measures would continue to apply to shark permit holders regardless of which species they are pursuing during these months in this area. Negative economic and social impacts would likely occur as a result of maintaining these closures.

Reporting

This alternative suite would increase the proportion of fishermen completing the Coastal Fisheries Logbook who are selected to report information on fish that are discarded. Currently, 20 percent of the fishermen completing this logbook are selected. This percentage would be increased to facilitate improved data available for shark interactions with longline and gillnet gear. This information would be especially useful because sharks could no longer be landed and the existing Coastal Fisheries logbook only requires fishermen to provide data on landed fish. Increasing the number of fishermen who are selected to provide this data would result in negative economic and social impacts because it would require additional paperwork to be filled out. Increased reporting burden would be subject to authorization under the Paperwork Reduction Act. It is unlikely that fishermen would keep their shark permits under this alternative and there would no longer be required to take an observer. Shark dealers would no longer be required to submit federal dealer reports regarding sharks purchased – dealer reporting may still be required by individual states.

Seasons

Seasons for the commercial Atlantic shark fishery would no longer apply as this alternative suite would close the fishery.

Regions

Regions for the commercial Atlantic shark fishery would no longer apply as this alternative suite would close the fishery.

Recreational Measures

Closing the Atlantic recreational shark fishery would have negative economic and social impacts. These impacts would be most pronounced for Charter/Headboat operators whom specialize in landing sharks and operators of shark tournaments that have prize categories for landing sharks. It is difficult to estimate the number of Charter/Headboat operators that specialize in shark charters as the permit covers any participant targeting swordfish, sharks, tunas, and billfish. Many Charter/Headboat operators target a variety of species depending on client interests, weather, time of year, and oceanographic conditions. Charter/Headboat operators specializing in shark fishing charters would have to target other HMS or non HMS species to replace revenues lost as a result of customers not being able to land sharks. However, not all customers necessarily want to land sharks. Charter/Headboat operators would still be able to catch sharks, however, all sharks regardless of species would need to be released in a manner that maximizes their chances of survival. Catering business operations to clientele interested in catch and release fishing for sharks might mitigate some of the negative economic impacts.

Shark tournaments that reward prizes for landing sharks would be negatively impacted as a result of this alternative suite. There have been 79 tournaments/year that had a prize category for sharks from 2005-2006. The majority of these tournaments target pelagic sharks and are held in the North Atlantic and Gulf of Mexico regions. These tournaments would either modify their rules to only allow points/prizes for released sharks or these tournaments would cease to exist. Economic impacts on small entities such as restaurants, hotels, gear manufacturers, retail stores selling fishing supplies, and marinas in the vicinity of where these tournaments are held would also experience negative economic impacts.

HMS Angling permit holders would also experience negative impacts, despite the fact that they would still be able to catch and release sharks. Landings would not be permitted by any recreational anglers as a result of this alternative suite.

Closing the Atlantic shark fishery would have negative economic impacts on global shark fin markets. As a result of this alternative suite, U.S. flagged vessels would no longer be able to contribute to the global demand for shark fins. This would disadvantage U.S. shark fishermen as global markets would likely need to purchase their shark fins from other markets. However, the U.S. is not a significant producer of shark products globally. Based on data from the United Nations Food and Agriculture Organization (FAO), less than one percent of global shark landings occur in the U.S. Atlantic.

6.4.6 Alternative 6: Stock assessments for Sharks Every 2-3 Years (Status Quo)

Economic impacts of conducting stock assessments every 2-3 years could be neutral. The timing of the stock assessments does not generally have a direct economic impact, however, measures that are necessary to prevent overfishing and/or rebuild overfished stocks generally have a negative economic impact on small entities that depend on landings sharks for their livelihood. If conducting stock assessments more frequently would continue to result in the implementation of measures that require reductions in fishing mortality to maintain consistency with National Standard 1, then negative economic impacts could occur as a result. Alternatively, if results were positive for certain shark stocks, then assessing shark populations more frequently would have positive economic impacts. As additional data become available, it is difficult to predict the results of forthcoming stock assessments and the economic ramifications of the measures that need to be implemented as a result.

6.4.7 Alternative 7: Stock assessments for Sharks At Least Every 5 Years - Preferred Alternative

Economic impacts of conducting stock assessment could be variable depending on the results of the stock assessment and management measures necessary. Scheduling stock assessments so that there is more time between assessments allows participants in shark fisheries to adapt to management measures implemented in the past. This provides participants with the opportunity to decide if, and to what degree, they may continue to stay engaged in shark fisheries. More frequent stock assessments would have positive economic impacts if information attained from assessments indicated that quota levels and fishing mortality may be increased for certain species because fishermen would be able to harvest more sharks. Furthermore, participants may experience negative economic impacts if the results change dramatically and additional measures are needed to reduce fishing effort and mortality.

6.4.8 Alternative 8: SAFE Report Published in January or February of Every Year (Status Quo)

There are no negative social or economic impacts associated with NMFS publishing a safe report each year in either January or February as this deadline is mainly administration in nature. By publishing the SAFE report annually according to NS 2, framework actions and FMP amendments could base annual harvest levels from each stock, document significant trends or changes in the resource, the bycatch, and the fishery over time, and assess the relative success of existing state and Federal fishery management program. In doing so, management actions could appropriately address the fishery to minimize negative social and economic impacts to fishermen. However, the timing of the SAFE report within the calendar year would not affect any of these issues, therefore, maintaining the status quo would result in neutral social and economic impacts.

6.4.9 Alternative 9: SAFE Report Published in the Fall of Every Year

There are no negative social or economic impacts associated with publishing the SAFE report in the fall of every year. Publishing the SAFE report in the fall would give the Agency more discretionary time to develop a SAFE report each year according to the guidelines under NS 2. However, since a SAFE report would still be published on an annual basis, it would provide the needed information so management actions could appropriately address the fishery to minimize negative social and economic impacts to fishermen. Therefore, publishing a SAFE report each year in the fall would have neutral social and economic impacts.

References

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7.0 REGULATORY IMPACT REVIEW

The Regulatory Impact Review (RIR) is conducted to comply with Executive Order 12866 (E.O. 12866) and provides analyses of the economic benefits and costs of each alternative to the nation and the fishery as a whole. Certain elements required in an RIR are also required as part of an environmental impact statement (EIS). Thus, this section should be considered only part of the RIR; the rest of the RIR can be found throughout this document.

7.1 Description of the Management Objectives

Please see Chapter 1 for a description of the management objectives associated with these management actions.

7.2 Description of the Fishery

Please see Chapter 3 for a description of the fisheries that could be affected by these management actions.

7.3 Statement of the Problem

Please see Chapter 1 for a description of the problem and need for these management actions.

7.4 Description of Each Alternative

Please see Chapter 2 for a summary of each alternative and Chapter 4 for a complete description of each alternative and its expected ecological, social, and economic impacts. Chapters 6 and 8 provide additional information related to the economic impacts of the alternatives.

7.5 Economic Analysis of Expected Effects of Each Alternative Relative to the Baseline

Table 7.1 Net Economic Benefits and Costs of Alternatives

Alternatives	Net Economic Benefits	Net Economic Costs
Alternative Suite 1 No Action	Maintains current economic activity associated with shark landing levels in the short term.	In the long term, there would be economic costs associated with continued overfishing of sandbar sharks, including population decline and associated reduced revenue from landings. Current quota levels for the LCS complex would also result in costs associated with negative ecological impacts on dusky sharks. Continued fishing of porbeagle sharks could result in costs associated with potential ecological impacts on this species.

Alternatives	Net Economic Benefits	Net Economic Costs
Alternative Suite 2 Limited shark fishery for directed permit holders only.	There would be unquantified economic benefits to the public associated with reducing the landings and discards of overfished shark species including sandbar, dusky, and porbeagle sharks as well as ecological benefits to non-sandbar LCS complex. Potentially longer seasons might improve the efficiency of domestic shark markets. Improved quota tracking resulting from the increased dealer reporting frequency may help to avoid market disruptions associated with quota overharvests.	There would be an estimated reduction of $2,798,557 in gross revenues from sandbar and non-sandbar LCS resulting from the proposed quota reductions. Prohibiting the retention of sandbar sharks on pelagic longline gear would potentially reduce gross revenues by $106,802. Reducing the retention limit to 8 sandbar/trip and 21 LCS other/trip may reduce the profitability of each trip. In addition, prohibiting the retention of sandbar and non-sandbar LCS by incidental permit holders, could also reduce the profitability of their trips as a result of forgoing an estimated $80,558 in total annual gross revenues. There would also be an estimated gross revenue loss of $6,081 resulting from prohibiting porbeagle shark landings. The proposed MPAs could displace $1.06 million in BLL shark landings and result in redistributed fishing effort in less profitable areas. The costs of dealer reporting would increase as a result of increasing the reporting frequency. This includes increased costs associated with acquiring fax or computer equipment and increased labor required for the more frequent reporting. Negative economic costs resulting from the reduced number of sharks that can be legally landed by recreational anglers, particularly pronounced in areas where blacktip sharks are frequently encountered. Tournaments offering prize categories for sharks may also experience negative economic impacts as a result of prohibiting six additional species for retention in recreational fisheries.

Alternatives	Net Economic Benefits	Net Economic Costs
Alternative Suite 3 Limited shark fishery for directed and incidental permit holders (all gears).	There would be unquantified economic benefits to the public associated with reducing the landings and discards of overfished shark species including sandbar, dusky and porbeagle sharks as well as ecological benefits to non-sandbar LCS complex. Potentially longer seasons might improve the efficiency of domestic shark markets.	There would be an estimated reduction of $2,816,562 in gross revenues from sandbar and non-sandbar LCS resulting from the proposed quota reductions. There would also be an estimated gross revenue loss of $6,081 resulting from prohibiting porbeagle shark landings. The proposed MPAs could displace $1.06 million in BLL shark landings and result in redistributed fishing effort in less profitable areas. Negative economic costs resulting from the reduced number of sharks that can be legally landed by recreational anglers, particularly pronounced in areas where blacktip sharks are frequently encountered. Tournaments offering prize categories for sharks may also experience negative economic impacts as a result of allowing fewer species to be retained in recreational fisheries.

Alternatives	Net Economic Benefits	Net Economic Costs
Alternative Suite 4 Research set aside allowing small directed LCS fishery (Preferred Alternative).	There would be unquantified economic benefits to the public associated with reducing the landings and discards of overfished shark species including sandbar, dusky and porbeagle sharks as well as ecological benefits to non-sandbar LCS complex. Increased incidental retention limits could reduce the inefficiencies associated with discarding incidentally caught sandbar and non-sandbar LCS. Potentially longer seasons might improve the efficiency of domestic shark markets. Potential benefits associated with increased revenues from sandbar sharks for the limited number of vessels participating in the research fishery. In long term, the research fishery could generate benefits if the research helps stock assessments.	There would be an estimated reduction of $1,831,154 in gross revenues from sandbar and non-sandbar LCS resulting from the proposed quota reductions. There would also be an estimated gross revenue loss of $6,081 resulting from prohibiting porbeagle shark landings. The proposed MPAs could displace $1.06 million in BLL shark landings and result in redistributed fishing effort in less profitable areas. Negative economic costs resulting from the reduced number of sharks that can be legally landed by recreational anglers, particularly pronounced in areas where blacktip sharks are frequently encountered. Tournaments offering prize categories for sharks may also experience negative economic impacts as a result of not allowing six additional species to be retained in recreational fisheries. There could also be costs associated with the business disruptions and uncertainty associated with getting in the research fishery in one year and not another.

Alternatives	Net Economic Benefits	Net Economic Costs
Alternative Suite 5 Close Atlantic shark fisheries.	Significant unquantified economic benefits to the public would like be achieved for the LCS, SCS, and pelagic shark complexes. Reduced reporting burden on shark dealers. Potential improvements in shark catch and release recreational fishing.	There would be the loss of annual revenues from fishing for LCS, SCS, and pelagic sharks estimated to be $3,877,003, $593,853, and $117,920, respectively. Increased reporting burden on fishermen reporting discards in the Coastal Fisheries Logbook. Dealers that have handled significant quantities of shark in the past would experience domestic supply issues and likely economic losses. Shark fin dealers, specializing in the purchase of shark fins from Federal and state permitted dealers, would also experience negative social and economic impacts as a result of closing the shark fishery. Negative economic costs resulting from the reduced number of sharks that can be legally landed by recreational anglers, thus potentially decreasing willingness to pay for shark fishing. These impacts would be most pronounced for Charter/Headboat operators whom specialize in landing sharks and operators of shark tournaments that have prize categories for landing sharks. The 79 shark tournaments that have had reward prizes for landing sharks would be negatively impacted as a result of this alternative suite.

7.6 Conclusions

Under E.O. 12866, a regulation is a "significant regulatory action" if it is likely to: (1) have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or tribal governments or communities; (2) create a serious inconsistency or otherwise interfere with an action taken or planned by another agency; and (3) materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the legal mandates, the President's priorities, or the principles set forth in the Executive Order. The preferred alternatives described in this document do not meet the above criteria. The proposed measures would have an annual effect on the economy less than $100 million and would not adversely affect the aforementioned parameters. Proposed measures would also not create an inconsistency or interfere with an action taken by another agency. Furthermore, proposed measures would not materially alter the budgetary impact of entitlements, grants, user fees, the President's priorities, or the principles set forth in E.O. 12866. Therefore, under E.O. 12866, the preferred alternatives described in this document have been determined to be not significant for the purposes of E.O. 12866. A summary of the expected net economic benefits and costs of each alternative, which are based on supporting text in Chapters 4 and 6, can be found in Table 7.1.

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8.0 INITIAL REGULATORY FLEXIBILITY ANALYSIS

The Initial Regulatory Flexibility Analysis (IRFA) is conducted to comply with the Regulatory Flexibility Act (5 USC 601 et. seq.) and provides a description of the economic impacts of the various alternatives on small entities. Certain elements required in an IRFA are also required as part of an environmental impact statement (EIS). Therefore, the IRFA incorporates the economic impacts identified in the EIS.

8.1 Description of the Reasons Why Action is Being Considered

Please see Chapter 1 for a description of the need for action.

8.2 Statement of the Objectives of, and Legal Basis for, the Proposed Rule

Please see Chapter 1 for a description of the objective of the proposed rule.

8.3 Description and Estimate of the Number of Small Entities to Which the Proposed Rule Would Apply

NMFS considers all HMS permit holders to be small entities because they either had average annual receipts less than $4.0 million for fish-harvesting, average annual receipts less than $6.5 million for charter/party boats, 100 or fewer employees for wholesale dealers, or 500 or fewer employees for seafood processors. These are the Small Business Administration (SBA) size standards for defining a small versus large business entity in this industry.

The proposed rule would apply to the 529 commercial shark permit holders in the Atlantic shark fishery based on an analysis of permit holders on May 11, 2007. Of these permit holders, 231 have directed shark permits and 298 hold incidental shark permits. Not all permit holders are active in the fishery in any given year. NMFS estimates that there are 143 vessels with directed shark permits and 155 vessels with shark incidental permits that could be considered actively engaged in fishing, since they reported landing at least one shark in the Coastal Fisheries Logbook from 2003 to 2005. A further breakdown of these permit holders is provided in Table 3.32.

In addition, the reporting requirements in the proposed alternatives would also apply to Federal shark dealers. As of May 22, 2007, there were a total of 269 Atlantic shark dealer permit holders. Based on NMFS understanding of HMS dealers, the Agency assumes that each of these dealers would be considered a small business with 100 or fewer employees.

The proposed measures being considered may also impact the types of services HMS CHB permit holders may provide. As of April 25, 2007, there were 4,245 HMS CHB permit holders. It is unknown what portion of these permit holders actively participate in shark fishing or market shark fishing services for recreational anglers.

In addition, some businesses, such as marinas or specialized tournament organizers, that hold tournaments may be considered small entities. HMS tournaments are required to register with NMFS. As such, NMFS has estimates on the number of HMS tournaments. However, NMFS may not necessarily know the number of businesses behind the tournament name and contact. Tournaments offering prize categories for sharks may also experience negative economic impacts as a result of prohibiting six additional species of sharks for retention in recreational fisheries in alternatives suites 2 through 4, as well as alternative suite 5 which would allow no possession of any sharks and only allow for catch and release fishing. The majority of tournaments specializing in sharks are in the North Atlantic region, specifically Rhode Island, New York, and Massachusetts. In 2005 and 2006, there were 79 tournaments per year that had a prize category for sharks from 2005-2006. Sixty of these tournaments target pelagic sharks and were held in the North Atlantic and Gulf of Mexico regions.

More information regarding the description of the fisheries affected, and the categories and number of permit holders can be found in Chapter 3.

8.4 Description of the Projected Reporting, Record-keeping, and Other Compliance Requirements of the Proposed Rule, Including an Estimate of the Classes of Small Entities Which Would Be Subject to the Requirements of the Report or Record

The preferred alternative would require modifying existing reporting and record-keeping requirements. The research program component in this proposed rule would require modifications to the existing Exempted Fishing Permit (EFP) program and dealer reporting requirements.

The proposed rule would modify the reporting frequency for dealers. The current requirement for dealer reports to be post-marked within 10 days after each reporting period (1st through 15th and 16th through last day of month), would be modified to state that dealer reports must be received by NMFS not later than 10 days after each reporting period (i.e., 25th and 10th of each month). Shark, swordfish, and tuna dealers would have to submit these reports in advance of the 10th and 25th of each month to ensure adequate time for delivery, depending on the means employed for report submission. Requiring that all dealer reports are actually received by the Agency in a more timely fashion would provide more frequent reports of shark landings in order to better assess quantities of sharks landed and whether or not a closure or other management measures are warranted to prevent overfishing. Dealers would still be required to submit reports indicating that no sharks were purchased during inactive periods. Requirements for vessel logbooks and observer coverage would remain unchanged. Additional burden is not expected as a result of modifying the regulations to ensure that dealer reports are actually received within 10 days.

The proposed rule would also create a limited shark research program that would result in changes to existing reporting requirements. Entry into the proposed shark research program would require vessels to submit an application, which would add to the reporting burden for those vessels wishing to apply. Applicants selected to participate in the shark research program under this alternative would also be subject to 100 percent observer coverage as a requirement for eligibility to participate in the program. In addition, selected vessels would continue to report in their normal logbook in addition to the observer program. Vessels in the shark research program, however, would not need to report in a similar way as the other holders of EFPs even though they are being issued permits under the EFP program. For example, vessels in the research fishery would not be required to submit interim or annual reports describing their fishing activities. Rather, they would only be required to submit logbook per current regulations. Vessels outside the shark research program would still be required to carry an observer if selected and all vessels would still be required complete logbooks within 48 hours of fishing activity and then submit the logbooks to NMFS within seven days.

8.5 Identification of All Relevant Federal Rules Which May Duplicate, Overlap, or Conflict with the Proposed Rule

Fishermen, dealers, and managers in these fisheries must comply with a number of international agreements, domestic laws, and other FMPs. These include, but are not limited to, the Magnuson-Stevens Act, the Atlantic Tunas Convention Act, the High Seas Fishing Compliance Act, the Marine Mammal Protection Act, the Endangered Species Act, the National Environmental Policy Act, the Paperwork Reduction Act, and the Coastal Zone Management Act. NMFS does not believe that the new regulations proposed to be implemented would conflict with any relevant regulations, federal or otherwise.

8.6 Description of Any Significant Alternatives to the Proposed Rule That Accomplish the Stated Objectives of Applicable Statutes and That Minimize Any Significant Economic Impact of the Proposed Rule on Small Entities

One of the requirements of an IRFA is to describe any alternatives to the proposed rule which accomplish the stated objectives and which minimize any significant economic impacts. These impacts are discussed below and in Chapters 4 and 6 of this document. Additionally, the Regulatory Flexibility Act (5 U.S.C. § 603 (c) (1)-(4)) lists four general categories of "significant" alternatives that would assist an agency in the development of significant alternatives. These categories of alternatives are:

1. Establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities;
2. Clarification, consolidation, or simplification of compliance and reporting requirements under the rule for such small entities;
3. Use of performance rather than design standards; and,
4. Exemptions from coverage of the rule for small entities.

In order to meet the objectives of this proposed rule, consistent with Magnuson-Stevens Act and the Endangered Species Act (ESA), NMFS cannot exempt small entities or change the reporting requirements only for small entities because all the entities affected are considered small entities. Thus, there are no alternatives discussed that fall under the first and fourth categories described above. NMFS does not know of any performance or design standards that would satisfy the aforementioned objectives of this rulemaking while, concurrently, complying with the Magnuson-Stevens Act. Thus, there are no alternatives considered under the third category. As described below, NMFS analyzed seven different alternatives in this proposed rulemaking and provides justification for selection of the preferred alternative to achieve the desired objective.

The alternatives considered and analyzed have been grouped into five alternative suites. Alternative suite 1 would maintain the current Atlantic shark fishery (no action). Alternative suite 2 would allow only directed shark permit holders to land sharks. Alternative suite 3 would allow directed and incidental shark permit holders to land sandbar and non–sandbar LCS as well as SCS and pelagic sharks. Alternative suite 4 would establish a program where vessels with directed or incidental shark permits could participate in a research fishery for sandbar sharks. Only vessels participating in this program could land sandbar sharks. Vessels not participating in the research program could land non-sandbar LCS, SCS, and pelagic sharks. Finally, alternative suite 5 would shut down the commercial Atlantic shark fishery and only allow a catch and release recreational shark fishery. The preferred alternative is suite 4, which would establish a program where a limited number of vessels with directed or incidental shark permits could participate in a research fishery for sharks dependent on the research needs of NMFS.

8.6.1 Alternative Suite 1

Alternative suite 1, the status quo alternative, would not likely result in any significant new economic impacts to small businesses in the HMS Atlantic shark fishery if the current LCS quota of 1,017 mt dw, in conjunction with the 4,000 lb LCS directed shark permit trip limit, is maintained. Under this alternative, the current fishing effort would not likely change which could lead to economic benefits from reduced market uncertainty for fishermen and related businesses in the short term. If gross revenues for directed and incidental permit holders is averaged across the approximately 298 active directed and incidental shark permit holders, then the average annual gross revenues per shark fishing vessel is just over $14,000. However, long term, negative economic impacts could occur if current fishing mortality of sandbar sharks, an economically important species, is not decreased as recommended by the LCS stock assessment, and this species continues to be overfished.

The status quo alternative would maintain the existing closures and would not add any new closures. The three management regions would also remain unchanged. There would also be no additional reporting requirements. Alternative suite 1 would also maintain the trimester seasons, which provides fishermen and dealers with more open seasons. With an annual LCS quota of 1,017 mt dw, spreading the seasons out over the calendar year could potentially result in greater economic stability for fishermen and associated communities. However, if quotas are reduced to comply with the recommendations from the LCS stock assessment, trimester seasons could become less economically stable for fishermen and dealers because of the reduced amount of quota and fishing effort during the calendar year. Maintaining existing closures, reporting requirements, and management regions would likely have little to no economic impacts on effected small businesses.

Alternative suite 1 would also maintain the current bag limit for HMS Angling permit holders at one shark greater than 54 inches per vessel per trip as well as one sharpnose and one bonnethead shark(both of which are in the SCS complex) per person per trip. This would likely result in no new economic impacts for businesses operating recreational fishing charter trips targeting sharks and shark fishing tournaments in the short term.

Overall, alternative suite 1 would likely have the lowest economic impact on small businesses. However, this alternative would likely not meet the objectives of this action. Maintaining the LCS quota of 1,017 mt dw, would be inconsistent with the Magnuson-Stevens Act and the recent LCS stock assessment that recommended a TAC of 158.3 mt dw for sandbar sharks for this species to rebuild by 2070. Current fishing effort, under the status quo alternative, could lead to continued overfishing of sandbar, porbeagle and dusky sharks, which could potentially prevent these species from rebuilding in the recommended timeframe. As a result, this alternative was not selected.

8.6.2 Alternative Suite 2

Alternative suite 2 would allow only directed shark permit holders to land sharks. In addition, this alternative would remove sandbar sharks from the LCS complex and establish a separate category for sandbar sharks from the LCS complex. Incidental shark permit holders would be affected by alternative suite 2. As of 2007, there were 231 shark directed; 298 shark incidental; 336 shark dealers permit holders. One hundred forty-three vessels with directed shark permits and 155 vessels with shark incidental permits reported landing at least one shark in the Coastal Fisheries Logbook from 2003 to 2005 and could be considered active.

On average, directed permit holders landed 1,571,851 lb dw of sandbar sharks and 1,210,643 of non-sandbar LCS from 2003 to 2005 in the Coastal Fisheries and HMS Logbooks. In 2006 ex-vessel prices, this is equivalent to gross revenues of $3,744,032 (assuming 5 percent of the landings are fins and 95 percent of the landings are carcass weight) (Table 4.9). If gross revenues for directed permit holders are averaged across the approximately 143 active directed shark permit holders, then the average annual gross revenues per shark fishing vessel is just over $26,000 from shark revenues. Under alternative suite 2, gross revenues for directed permit holders would be estimated to be $1,026,032 (Table 4.10). This is a 73 percent overall reduction in gross revenues compared to 2003 to 2005 (Table 4.10). These reduced gross revenues averaged across the 143 active directed permit holders are just over $7,000 per directed shark fishing vessel. This estimated reduction in revenue from shark landings could affect the profitability and even viability of some marginal operations. Operations that have permits in other fisheries and can easily diversify are less likely to be as affected as those marginal operations. Nevertheless, the profitability of all directed shark fishing vessels would likely by reduced. Because the states of Florida, New Jersey, and North Carolina have the most directed shark permits (Table 3.32), these states would be most negatively impacted by alternative suite 2.

In addition, retention of sandbar sharks on pelagic longline (PLL) gear would be prohibited under alternative suite 2. On average, 80,825 lb dw of sandbar sharks were reported landed on PLL gear by directed shark permit holders from 2003 to 2005 (HMS Logbook). In 2006 ex-vessel prices, this is equivalent to $106,802 in gross revenues. Given an average of 16.7 vessels landed sandbar sharks with PLL gear from 2003 to 2005, prohibition of sandbar sharks on PLL gear could result in a loss of gross revenues of $6,395 per vessel.

Gross revenues under the status quo revenue were based on a 4,000 lb dw LCS trip limit for directed shark permit holders. The average number of sandbars and non-sandbar LCS landed per trip was 35 sandbars and 32 non-sandbar LCS for all gear types reported in the Coastal Fisheries and HMS Logbooks. Based on 2006 ex-vessel prices, this is equivalent to $3,358 per trip (Table 4.11). Revenue estimates on a regional trip basis were also based on species composition data attained from the BLL observer program data (Hale and Carlson, 2007). Observer data indicate that between 2005 and 2006, 69 sandbar sharks and 35 non-sandbar LCS were caught per trip in the South Atlantic region, and 30 sandbar sharks and 83 non-sandbar LCS were caught per trip in the Gulf of Mexico region (Hale and Carlson, 2007). Based on these numbers and 2006 ex-vessel prices, South Atlantic trips averaged $4,743/trip and Gulf of Mexico trips averaged $5,853/trip (Table 4.11).

Under alternative suite 2, the retention limits would be 8 sandbars/trip and 21 non-sandbar LCS/trip. Non-sandbar LCS retention limits are based on the average ratio of sandbars to non-sandbar LCS caught in the South Atlantic and Gulf of Mexico regions to limit sandbar shark discards by fishermen deploying non-selective gear (Hale and Carlson, 2007). In the Gulf of Mexico, the ratio of sandbars to other LCS caught is 1:4, which based on an 8 sandbar/trip retention limit, would equal 32 non-sandbar LCS/trip. However, such a high non-sandbar LCS retention limit would result in a sandbar discards in the South Atlantic (~65.3 mt dw). Therefore, a 21 non-sandbar LCS/trip retention limit was set to balance discards versus catch in the two regions (see Table A.4). This results in approximately 5 sandbar sharks being caught in the Gulf of Mexico region when the non-sandbar LCS retention limit/trip is filled (and therefore, only 86.1 mt dw of the sandbar quota would be filled). Therefore, gross revenues on a trip basis are estimated to be $1,262 of gross revenue per trip in the South Atlantic and $1,333 of gross revenue per trip in the Gulf of Mexico (Table 4.12). From 2003 to 2005, there were 124 vessels that averaged more than 324 lb dw (or 8 sandbar sharks) of sandbar/trip (Figure A.3). Therefore, these vessels would be most negatively affected by retention limits under alternative suite 2.

On average, 66 incidental permit holders landed 19,066 lb dw/year of sandbar sharks and 39,995 lb dw/year of non-sandbar LCS from 2003 to 2005 in the Coastal Fisheries and HMS Logbooks. Using 2006 ex-vessel prices, this is equivalent to gross revenues of $80,558 (assuming 5 percent of the landings are fins and 95 percent of the landings are carcass weight) (Table 4.9). Gross revenues averaged across the 66 vessels with incidental permits landing sharks were just over $1,221 per vessel. Since incidental permit holders would not be able to land any sharks under alternative suite 2, the 66 active vessels would be most negatively affected by this alternative suite. The states of Florida, Louisiana, New Jersey, and North Carolina had the most incidental shark permit holders as of 2007 (144, 37, 20, and 16, respectively; Table 3.32); therefore, these states would be most negatively impacted by alternative suite 2.

Alternative suite 2 also includes increasing dealer reporting to 24 hours of when shark products were purchased. There could be negative economic impacts to Atlantic shark dealers as a result of the increased reporting requirement associated with this alternative. Currently, shark dealer reports must be submitted bimonthly, regardless of whether or not the dealer actually purchased any shark products. Reporting frequency would be increased to 24 hours of when shark products were purchased. While the increased reporting burden would not impact shark dealer expenditures per se, it would result in more time spent submitting dealer reports, which represents an opportunity cost for dealers since that would be time they could not spend conducting other activities related to their business. Furthermore, in order to comply with the requirement that dealer reports must be *received* by the Agency within 24 hours, it is assumed that dealers would have to submit dealer reports electronically or via facsimile. Dealers that do not currently possess a computer or fax machine would have to purchase one of these items. The increased reporting burden implemented in this alternative suite would be subject to approval under the Paperwork Reduction Act. Reporting requirements for shark vessel permit holders, including the need to take an observer if selected and the need to submit vessel logbooks within seven days of completing a fishing trip would not be modified, resulting in neutral economic impacts.

The other provisions of alternative suite 2 are the same as in alternative suite 4, which is the preferred alternative for this proposed rule. These provisions include: maintaining the 60 mt shark display and research quota; placement of porbeagle sharks on the prohibited list; quota carryover limited to 50 percent of base quota for species not overfished; no carryover for overfished, overfishing or unknown species; sharks fins must remain on the shark; removal of regions and seasons; and limiting the shark species that can be landed recreationally.

This alternative suite was not selected for two primary reasons. First, this alternative does not address the impacts from continued incidentally caught sandbar sharks by vessels targeting other species. These vessels will likely continue to incidentally catch sandbar sharks, but then under this alternative those sharks would be required to be discarded. These discards would reduce potential revenues and possibly operating efficiency of vessels possessing incidental shark permits. Regulatory discards would likely lead to increases in mortality and slow efforts to end overfishing. Second, the 24 hour dealer reporting that would be required to effectively manage quotas would result in a significant increase in reporting burden for dealers. This alternative would therefore not minimize the economic cost to dealers in comparison to the preferred alternative.

8.6.3 Alternative Suite 3

Alternative suite 3 would allow directed and incidental shark permit holders to land sandbar and non –sandbar LCS as well as SCS and pelagic sharks. Therefore, the available sandbar and non-sandbar LCS quota would be spread over a larger universe of commercial permit holders. However, unlike the status quo or alternative suite 2, the retention limits for sandbar sharks and non-sandbar LCS would be the same for both directed and incidental permit holders. Since directed permit holders presumably make a greater percentage of their gross revenues from shark landings, they are expected to have larger negative socioeconomic impacts compared to incidental permit holders. Since the states of Florida, New Jersey, and North Carolina have the most directed permit holders, NMFS anticipates that these states would have the largest negative socioeconomic impacts under alternative suite 3 (Table 3.32). As with alternative suite 2, shark dealers could also experience negative impacts due to the reduction in the sandbar and other LCS quotas and retention limits, which would reduce the overall amount of sharks being landed.

As stated under alternative suite 2, on average, directed permit holders landed 1,571,851 lb dw of sandbar sharks and 1,210,643 of non-sandbar LCS from 2003 to 2005 in the Coastal Fisheries and HMS Logbooks. In 2006 ex-vessel prices, this is equivalent to gross revenues of $3,744,032 (assuming 5 percent of the landings are fins and 95 percent of the landings are carcass weight) (Table 4.9). However, under alternative 3, the available sandbar and non-sandbar LCS quota would be spread over directed and incidental permit holders. Based on past effort, it was assumed 1,108 trips could be made by directed permit holders (Table 4.14). This is 78 percent of the total expected fishing effort (Table 4.14). Therefore, given 105.9 mt dw (233,467 lb dw) of the sandbar quota and 229.2 mt dw (505,294 lb dw) of the non-sandbar LCS quota that could be landed under alternative suite 3, approximately 83 mt dw (183,073 lb dw) of sandbar quota and 180 mt dw (396,225 lb dw) of the non-sandbar LCS quota are anticipated to be landed by directed permit holders (Table 4.14). Based on 2006 ex-vessel prices, this is equivalent to $793,338 gross revenues for directed permit holders. These gross revenues indicate a 79 percent overall reduction compared to 2003 to 2005 (gross revenues based on current directed permit holders' landings were $3,744,032; Table 4.9). Again, since the states of Florida, New Jersey, and North Carolina have the most directed permit holders, NMFS anticipates that these states would experience the largest negative socioeconomic impacts under alternative suite 3 (Table 3.32).

As stated in alternative 2, the status quo revenue was based on a 4,000 lb dw LCS trip limit for directed shark permit holders with average South Atlantic trips at $4,743 per trip and average Gulf of Mexico trips at $5,853 per trip (Table 4.11). Under alternative suite 3, the retention limits would be 4 sandbars per trip and 10 non-sandbar LCS per trip. However, since the ratio of sandbars to non-sandbar LCS caught in the Gulf of Mexico is 1:4, NMFS estimates that approximately 3 sandbar sharks would be caught in the Gulf of Mexico region when the 10 non-sandbar LCS retention limit/trip is filled (10 non-sandbar LCS / 4 = 2.5 sandbar sharks). Therefore, gross revenues on a trip basis are estimated to be $610 per trip in the South Atlantic and $670 per trip in the Gulf of Mexico (Table 4.15). From 2003 to 2005, there were 128 vessels that averaged more than 163 lb dw (or

4 sandbar sharks) of sandbar/trip (Figure A.3). Therefore, these vessels would be most negatively affected by retention limits under alternative suite 3.

On average, incidental permit holders landed 19,066 lb dw of sandbar sharks and 39,995 lb dw of non-sandbar LCS from 2003 to 2005 in the Coastal Fisheries and HMS Logbooks. In 2006 ex-vessel prices, this is equivalent to gross revenues of $80,558 (assuming 5 percent of the landings are fins and 95 percent of the landings are carcass weight) (Table 4.9). The available sandbar and non-sandbar LCS quotas would be averaged over directed and incidental permit holders under alternative suite 3. Based on past effort, it was assumed 305 trips could be made by incidental permit holders (Table 4.14). This is 22 percent of the expected fishing effort (Table 4.14). Therefore, given the 105.9 mt dw (233,467 lb dw) of the sandbar quota and 229.2 mt dw (505,294 lb dw) of the non-sandbar LCS quota that could be landed under alternative suite 3, approximately 23 mt dw (50,395 lb dw) of sandbar quota and 50 mt dw (109,069 lb dw) of the non-sandbar LCS quota are anticipated to be landed by incidental permit holders (Table 4.14). Based on 2006 ex-vessel prices, this is equivalent to $218,383 gross revenues for incidental permit holders (Table 4.14). This would result in gross revenues that are 2.7 times higher compared to 2003 to 2005 (gross revenues based on current incidental permit holders' landings were $80,558; Table 4.9).

This increase in gross revenues is due to the increase in retention limits for incidental permit holders. Under the status quo, incidental permit holders can retain 5 sharks from the LCS complex. However, under alternative suite 3, incidental permit holders would be able to retain 4 sandbars and 10 non-sandbar LCS or 14 LCS total. This retention limit is almost 3 times higher than what is currently allowed under the status quo. On average, incidental permit holders have been landing 2 sandbar sharks and 3 non-sandbar LCS per trip. Based on 2006 ex-vessel prices, this is equivalent to $248/trip (Table 4.11). However, under alternative suite 3, incidental permit holders would make equivalent gross revenues per trip as directed permit holders: $610 per trip in the South Atlantic and $670 per trip in the Gulf of Mexico (Table 4.15). This would result in gross revenues for incidental permit holders that are 2 to 3 times higher than gross revenues in 2003 to 2005 depending on future fishing effort and catch composition. Therefore, there would be positive economic impacts for incidental permit holders under alternative suite 3. Since approximately 66 vessels with incidental permit holders landed sandbar sharks or non-sandbar LCS in 2003 to 2005 in the Coastal Fisheries and HMS Logbooks, these 66 vessels would have the largest economic benefits under alternative suite 3. However, if sharks become profitable for incidental permit holders under alternative suite 3, then more vessels with incidental permits may actively land sandbars and non-sandbar LCS in the future. Finally, the states of Florida, Louisiana, New Jersey, and North Carolina had the most incidental shark permit holders in 2007 (Table 3.32). Therefore, these states would see the largest socioeconomic benefits for incidental permit holders under alternative suite 3.

The other provisions of alternative suite 3 are the same as in alternative suite 4, which is the preferred alternative for this proposed rule. These provisions include maintaining the 60 mt shark display and research quote; placement of porbeagle sharks on the prohibited list; quota carryover limited to 50 percent of base quota for species not overfished; no carryover for overfished, overfishing or unknown species; sharks fins must remain on the shark; dealer reports received within 10 days of purchase; removal of regions and seasons; and limiting the shark species that can be landed recreationally.

This alternative suite was not selected as the preferred alternative primarily based on the economic impacts it would potentially result in and since it does not meet some of the ecological objectives of this rule. Despite the time/area closures, alternative suite 3 would have a smaller reduction in dead discards of dusky sharks compared to alternative suite 2 since sandbar sharks would be allowed to be retained on PLL gear under alternative suite 3.

Negative economic impacts under alternative suite 3 are expected for directed permit holders (79-percent reduction in gross revenues compared to the status quo) as a result of the four sandbar per vessel per trip retention limits. Given the retention limits for sandbar and non-sandbar LCS are significantly lower than the limit under the status quo (91 and 69-percent reduction in sandbar and non-sandbar LCS retention limits, respectively for directed permit holders), it is anticipated that there would be no directed shark fishery as a result of alternative suite 3. While an observer program would still operate under alternative suite 3, without a directed shark fishery, it is anticipated that the fishery dependent data collection would be limited, which could compromise data collection for future stock assessments. Alternative suite 4 would likely accomplish the necessary reductions in quota, retention limits, and fishing effort to prevent overfishing and allow stocks to rebuild while collecting valuable scientific data for the Agency. Therefore, due to concerns over dusky discards, quota monitoring, and data collection, NMFS is not preferring alternative suite 3 at this time.

8.6.4 Alternative Suite 4

Alternative suite 4, the preferred alternative, would establish a program where vessels with directed or incidental shark permits could participate in a small research fishery for sandbar sharks that would harvest the entire 116.6 mt dw sandbar quota. There would be 100 percent observer coverage on each research vessel, and only vessels participating in this program could land sandbar sharks. Vessels not participating in the research program could land non-sandbar LCS, SCS, and pelagic sharks.

Alternative suite 4 was selected as the preferred alternative because it meets the objectives of this proposed rule while minimizing some of the economic impacts. Those objectives include: implement rebuilding plans for sandbar, dusky, and porbeagle sharks; provide an opportunity for the sustainable harvest of blacktip sharks and other sharks, as appropriate; prevent overfishing of Atlantic sharks; analyze bottom longline time/area closures and take necessary action, as appropriate; and improve, to the extent practicable, data collections or data collection programs. As detailed in the economic analysis in chapters 4 and 6, it is estimated that vessel in the shark research fishery could make $490,411 in gross revenues of sandbar and non-sandbar LCS landings. Depending on the number of vessels selected for the shark research fishery it is estimated that these vessels will generate higher revenues from sharks than the average vessel under the other alternatives suites. If less than 18 vessels are selected for the shark research fishery, then average gross shark revenues per vessel per year could potentially be higher under the proposed than under the other alternatives. However, the vessels operating outside of the research fishery would have an estimated 491 mt dw (1,082,459 lb dw) of non-sandbar LCS quota available to them depending on non-sandbar LCS landings in the shark research fishery. In 2006 ex-vessel prices, this is equivalent to $1,502,994 in gross revenues. Divided by the remaining vessels (298 active directed and incidental shark permit holders - 18 = 280) it is estimated that the average gross revenues from shark per vessel would be just over $5,000.

In the no action alternative, it was estimated that if gross revenues for directed and incidental permit holders is averaged across the approximately 298 active directed and incidental shark permit holders, then the average annual gross revenues per shark fishing vessel is just over $14,000. Using the average landing for directed permit holder from 2003 to 2005, it is estimated that the 143 active directed permit holders generated average annual gross shark revenues of just over $26,000 from sharks. Under alternative 2, the reduced gross revenues averaged across the 143 active directed permit holders are estimated to be just over $7,000 per directed shark fishing vessel and just $1,221 per vessel per year for incidental permit holders that land sharks. Under alternative 3 this is reduced further to approximately $5,500 ($793,338 gross revenues/143 vessel) per directed shark fishing vessel per year.

Comparing these revenues to those in alternative 4 indicates that the preferred alternative maintains the annual gross revenues per vessel for the vessel operating in the small research fishery, while allowing other vessels outside of the research fishery to generate revenues at reduced levels. Alternative suite 4 has less economic impacts to shark fishermen than alternative 5, but has greater impacts in the short-run than the status quo alternative. By allowing a limited number of historical participants to continue to harvest sharks under the research fishery, the Agency ensures that data for stock assessments and life history samples would continue to be collected. Alternative suite 4 also involves less reporting burden for dealers than would be required under alternative suite 2. Alternative 4 is the alternative that best meets the objectives of this rule while minimizing the economic impacts to shark permit holders.

8.6.5 Alternative Suite 5

Alternative Suite 5 would have significant economic and social impacts on a variety of small entities, including: commercial shark permit holders, shark dealers, gear manufacturers, bait and ice suppliers, and other secondary industries dependent on the shark fishery. The level of economic impact would be directly proportional to the amount of revenues that each entity has realized from past participation in the shark fishery. Permit holders would be impacted differently depending on the quantity of sharks landed in the past. Vessels targeting sharks (directed permit holders) landed an annual average of 1,262 mt dw of LCS, 184.5 mt dw SCS, and 29.84 mt dw pelagic sharks per year between 2003-2005. The gross revenues based on 2006 ex-vessel prices of these landings is estimated at $3,877,003, $593,853, and $117,920 for LCS, SCS, and pelagic sharks, respectively, based on price information provided in Table 3.42. While it is assumed that few directed shark permit holders subsist entirely on revenues attained from the shark fishery, impacts would still be severe for those participants that depend on any income from participating in the directed shark fishery at certain times of the year. Because of the extensive economic impacts to shark directed permit holders as a result of this alternative suite, it is assumed that directed permit holders would likely pursue one of the following options as a result of closing the Atlantic shark fishery: (1) transfer fishing effort to other fisheries for which they are already permitted (snapper grouper, king and Spanish mackerel, tilefish, lobster, dolphin/wahoo, etc), (2) acquire the necessary permits to participate in other fisheries (both open access and/or limited access fisheries), or (3) relinquish all permits and leave the fishing industry. Table 3.32 displays the other permits held by directed shark permit holders as of May 2007.

Incidental permit holders would face negative economic and social impacts as a result of closing the Atlantic shark fishery; however, these impacts would not be as severe as those experienced by directed permit holders. It is assumed that incidental permit holders receive the majority of their fishing income from participating in other fisheries depending on the region and the type of gear predominantly fished (i.e., swordfish, tunas, snapper grouper, tilefish, dolphin/wahoo, lobster, etc.). It is estimated that, on average, between 2003-2005 incidental permit holders landed 26.8 mt dw LCS, 15.3 mt dw SCS, and 8.11 mt dw pelagics per year. This equates in gross revenues based on 2006 ex-vessel prices for these landings of $82,333, $49,246, and $32,049 for the respective species complexes. Incidental permit holders would likely have to increase effort in these other fisheries to replace lost revenues from landing sharks. Furthermore, these vessels may seek other permits (open access or limited access transferred from another vessel) or leave the fishing industry entirely.

This alternative suite could also have negative economic and social impacts for shark dealers as they would no longer be authorized to purchase shark products from Federally permitted shark fishermen. Shark dealers also maintain permits to purchase other regionally caught fish products. Due to the brevity of the LCS shark fishing season, which is the shark fishery that accounts for the majority of the shark product revenue due to the fin value, many dealers also get revenue from purchasing fish products other than sharks. The majority of shark dealer permit holders hold permits to purchase other fish products, including swordfish, tunas, snapper grouper, tilefish, mackerel, lobster, and dolphin/wahoo among others. It is difficult to assume, on an individual dealer basis, the quantity of revenues received exclusively from shark products.

Shark fin dealers, specializing in the purchase of shark fins from Federal and state permitted dealers, would also experience negative social and economic impacts as a result of closing the shark fishery. These dealers receive virtually all of their income from purchasing shark fins and shipping them to exporters. Exporters then transport the fins to global and domestic markets. This alternative suite would likely force shark fin dealers to leave the industry or focus on purchasing other fishery products, resulting in significant economic impacts to the individuals involved in this trade.

It is difficult to estimate the economic and social impacts that would be experienced by various small entities that support the shark fishery, e.g., purveyors of bait, ice, fishing gear, and fishing gear manufactures. However, these impacts would likely be negative. It is difficult to estimate these impacts as it is uncertain to what extent vessels that were fishing for sharks would redistribute their fishing effort to other fisheries, or simply cease fishing operations. If the majority of vessels affected by a shark fishery closure simply displace effort to other fisheries, it is assumed that they would still be dependant on small entities for their bait, ice, and gear as these are products essential for fishing excursions targeting any species. Redistributing effort to other fisheries would mitigate negative economic impacts. However, if a significant number of vessels simply cease fishing operations or scale back considerably, then severe economic consequences would be imparted on these support industries as a result.

This alternative suite would increase the proportion of fishermen completing the Coastal Fisheries Logbook who are then selected to report information on fish that are discarded. Currently, 20 percent of the fishermen completing this logbook are selected. This percentage would be increased to facilitate improved data available for shark interactions with longline and gillnet gear. This information would be especially useful because sharks could no longer be landed and the existing logbook only requires fishermen to provide data on landed fish. Increasing the number of fishermen who are selected to provide this data would result in negative economic and social impacts because it would require additional paperwork to be filled out. Increased reporting burden would be subject to approval under the Paperwork Reduction Act. Vessels would no longer be required to take an observer. Shark dealers would no longer be required to submit dealer reports regarding sharks purchased.

Seasons and regions for the commercial Atlantic shark fishery would no longer apply as this alternative suite would close the fishery.

Closing the Atlantic recreational shark fishery would have negative economic and social impacts. These impacts would be most pronounced for Charter/Headboat operators who specialize in landing sharks and operators of shark tournaments that have prize categories for landing sharks. It is difficult to estimate the number of Charter/Headboat operators that specialize in shark charters as the permit covers any participant targeting swordfish, sharks, tunas, and billfish. Many Charter/Headboat operators target a variety of species depending on client interests, weather, time of year, and oceanographic conditions. Charter/Headboat operators specializing in shark fishing charters would have to target other HMS or non HMS species to replace revenues lost as a result of customers not being able to land sharks. However, not all customers necessarily want to land sharks. Charter/Headboat operators would still be able to catch sharks, however, all sharks regardless of species would need to be released in a manner that maximizes their chances of survival. Catering business operations to clientele interested in catch and release fishing for sharks might mitigate some of the negative economic impacts. Shark tournaments that reward prizes for landing sharks would be negatively impacted as a result of this alternative suite. There have been 79 tournaments per year that had a prize category for sharks from 2005-2006. The majority of these tournaments target pelagic sharks and are held in the North Atlantic and Gulf of Mexico regions. These tournaments would either modify their rules to only allow points/prizes for released sharks or these tournaments would cease to exist. Economic impacts on small entities such as restaurants, hotels, gear manufacturers, retail stores selling fishing supplies, and marinas in the vicinity of where these tournaments are held would also experience negative economic impacts.

HMS Angling permit holders would also experience negative impacts, despite the fact that they would still be able to catch and release sharks. Landings would not be permitted by any recreational anglers as a result of this alternative suite.

Closing the Atlantic shark fishery would have negative economic impacts on global shark fin markets. As a result of this alternative suite, U.S. flagged vessels would no longer be able to contribute to the global demand for shark fins. This would disadvantage U.S. shark fishermen as global markets would likely need to purchase their shark fins from other markets. However, the United States is not a significant producer of shark products globally. Based on data from the United Nations Food and Agriculture Organization (FAO), less than one percent of global shark landings occur in the U.S. Atlantic.

While alternative suite 5 would meet the objectives of this rule, it would have the highest negative economic impacts of the alternatives considered. There would be significant reductions in revenues for shark dealers and fishing vessels involved with the shark fishery. Some small businesses dependent on commercial shark fishing may cease operating as a result of prohibiting the commercial harvest of shark species. Therefore, this alternative was not selected.

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9.0 COMMUNITY PROFILES

9.1 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))

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.

9.2 Methodology

9.2.1 Previous community profiles and assessments

The 2006 Consolidated HMS FMP used information from the 1998 Wilson et al. study for the 1999 FMP for Atlantic Tunas, Swordfish and Sharks that investigated the social and cultural characteristics of fishing communities in five states and one U.S. territory: Massachusetts, New Jersey, North Carolina, Florida, Louisiana, and Puerto Rico. These areas were selected because they each had important fishing communities that could be affected by the 1999 FMP and Atlantic Billfish Amendment, and because they are fairly evenly spread along the Atlantic and Gulf coasts and the Caribbean. In addition, the 2006 Consolidated HMS FMP used information gathered under the contract with the Virginia Institute of Marine Science (VIMS) at the College of William and Mary to re-evaluate several of the baseline communities (Kirkley, 2005). The VIMS study gathered a profile of basic sociological information for the principal states involved with the Atlantic shark fishery. From the 255 communities identified as involved in the 2001 commercial fishery, Amendment 1 to the 1999 FMP for Atlantic Tunas, Swordfish and Sharks focused on specific towns based on shark landings data, the size of the shark fishing fleet, the relationship between the geographic communities and the fishing fleets, and the existence of other community studies. While the recreational fishery is an important component in the shark fishery, participation and landings were not documented in a manner that allowed community identification. Wilson, *et al.*, selected only the recreational fisheries found within the commercial fishing communities for a profile due to the lack of community-based data for the sport fishery. A detailed description of additional information used in the community profiles analysis can be found in Section 9.2.2 of the Consolidated HMS FMP. Several other chapters in this document include information that addresses the requirements described in section 9.1. Please refer to the Description of the Affected Environment in Chapter 3, the Economic Evaluation in Chapter 6, the Regulatory Impact Review (RIR) in Chapter 7, and the Initial Regulatory Flexibility Analysis (IRFA) in Chapter 8. Furthermore, each of the management alternative suites in Chapter 4 includes an assessment of the potential social and economic impacts associated with the proposed alternatives. The preferred alternative suite was selected to minimize economic impacts and provide for the sustained participation of fishing communities, while taking the necessary actions to rebuild overfished fisheries as required by the Magnuson-Stevens Act.

9.3 Overview of the Shark Fishery

The shark fisheries of the Atlantic and Gulf of Mexico extend from Maine to Texas, and include Puerto Rico and the U.S. Virgin Islands. The geographic extent of the shark directed and incidental commercial permit holders is large, but is currently concentrated in the waters off four states; Florida (54 percent of shark permits), New Jersey (9 percent of shark permits), Louisiana (8 percent of shark permits) and North Carolina (6 percent of shark permits). The shark fishery is notable for the degree of flexibility of the commercial fishing fleet. Of the 529 vessels in the 2007 fleet, 231 vessels (44 percent) held directed shark fishery permits. The remaining 56 percent (298 vessels) hold incidental catch permits that target species other than sharks. Vessels which engage in the directed shark fishery do so on a seasonal basis, depending on area and the length of the fishing season, and fish for other species at other times of the year.

Shark directed and incidental permit holders also possess permits in other HMS and non-HMS fisheries (Table 9.1 and Table 9.2). Of the 529 directed and incidental shark permit holders, 81 percent also hold king or Spanish mackerel permits, 48 percent hold dolphin/wahoo permits, 34 percent hold directed swordfish permits, 22 percent hold snapper/grouper permits and 29 percent hold charter/head boat permits. Currently, there are 269 Federally permitted shark dealers, the majority of which are located in Florida (38 percent). Table 9.3 shows the number of shark dealers permitted in each state in 2007. Dealers that possess shark permits also hold dealer permits for other species such as swordfish, dolphin/wahoo, reef fish and snapper/grouper. The additional permits that the commercial shark fishermen and dealers possess may help mitigate economic and social impacts of the preferred management measures.

Table 9.1 **Distribution by state of shark directed and incidental permit and non-HMS fisheries permits that are possessed by commercial shark permits as of May 11, 2007.**

State	Shark Directed	Shark Incidental	Swordfish Directed	Swordfish Incidental	GOM Reef Fish	Dolphin/ Wahoo	*Mackerel: King and Spanish	Lobster	Snapper/ Grouper	**Charter Head Boat General	*** Other	# Vessels / # Permits
ME	3	3	3			2						6/11
NH		1										1/1
MA	2	11	8	2		5	5	2			1	13/36
RI		8	2	2		1					4	8/17
CT		2	1									2/3
NY	6	7	9	2		10	2		1	1	1	13/39
NJ	25	20	21	13		21	25	2	2	3	7	45/139
DE	4	1	5			5						5/15
MD	4	2	6			5	2			3		6/22
VA	1	4		3		3	3		2			5/16
NC	16	16	9	9		25	45		13	7	9	32/149
SC	5	11	1			12	12		13	6	1	15/61
GA	2	1				2	3	4	2	3		3/17
FL	141	144	70	30	128	156	296	47	81	131	20	284/1252
AL	2	1		1	1	1	2					3/8
MS	1	5			4		9				3	6/21
LA	5	37	30	8	10	4	14				3	42/111
TX	2	8	2	4	9	3	5				1	10/34
WV	1				1		2					1/4

State	Shark Directed	Shark Incidental	Swordfish Directed	Swordfish Incidental	GOM Reef Fish	Dolphin/ Wahoo	*Mackerel: King and Spanish	Lobster	Snapper/ Grouper	**Charter Head Boat General	*** Other	# Vessels / # Permits
PA		3		2		1	4					3/10
No Vessel ID	11	13	15	2							4	26/38
Totals 2007	**231**	**298**	**182**	**78**	**153**	**256**	**429**	**55**	**114**	**154**	**54**	**529 / 2,004**

* of shark directed permit holders, 107 have Spanish mackerel permits, and 87 have king mackerel permits and of shark incidental permit holders, 121 have Spanish mackerel permits, and 117 have king mackerel permits
** charter/head boat permits include Gulf of Mexico reef fish, migratory pelagics, Atlantic dolphin/wahoo, and Atlantic snapper/grouper
*** Other includes shrimp permits and swordfish handgear permits

Table 9.2 Distribution of HMS permits possessed by the directed and incidental shark permit holders as of June 2006.

Swordfish Directed	Swordfish Incidental	Charter/ Headboat	Tuna Longline	General Category Tuna Permit
182	78	9	140	28

Table 9.3 Number of HMS and non-HMS Dealer Permits by state as of May 22, 2007.

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

9.4 State and Community Profiles

The 2006 Consolidated HMS FMP provides a thorough analysis, by state, of HMS fisheries including the shark fishery for in the Atlantic and Gulf of Mexico states and will not be duplicated here.

9.5 HMS Community Profile Needs

For future social impact analyses, the HMS permit databases, landings information, and HMS APs should be consulted to determine the most appropriate community profiles for HMS-related fisheries. It was identified in the Consolidated HMS FMP that several new community profiles should be developed and some of the previously profiled communities may no longer be as significantly involved in the fishery as they were in the past (see Chapter 9, Section 9.5; NMFS, 2006). NMFS is currently reviewing existing HMS community profile materials and identifying gaps in existing profiles. NMFS will then identify which communities are dependent upon the HMS fisheries and should be profiled. Part of this review will entail developing guidelines and conducting any rapid assessment that may be needed as part of the identification process for new communities.

References

Kirkley, J.E. 2005. The communities of the Atlantic Highly Migratory Species (HMS) Fishery: An overview of change associated with the HMS Fishery Management Plan. Department of Coastal and Ocean Policy, School of Marine Science, Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, Virginia (NOAA-NMFS-HMS contract report).

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10.0 OTHER CONSIDERATIONS

10.1 National Standards

The analyses in this document are consistent with the National Standard (NS) guidelines set forth in the 50 CFR part 600 regulations. The following descriptions are a summary of how the preferred alternatives are consistent. More information can be found in earlier chapters.

NS 1 requires NMFS to prevent overfishing while achieving, on a continuing basis, the Optimum Yield (OY) from each fishery for the U.S. fishing industry. As summarized in other chapters, over the past several years, NMFS has undertaken numerous management actions, including the 1999 FMP, Amendment 1 to the 1999 FMP, and Amendment 1 to the Billfish FMP, to address overfishing and to rebuild HMS stocks. The preferred alternatives in this Draft EIS are consistent with ongoing management efforts to rebuild, manage, and conserve target species and with the NS 1 guidelines.

- The preferred alternatives is consistent with NS1 because it implements the recommended quotas and retention limits that will greatly reduce fishing effort to allow overfished shark stocks to rebuild and to stop overfishing, as well as provide the opportunity for the sustainable harvest of shark stocks that are healthy and not currently overfished.
- The time/area closure measures in the preferred alternatives maintain the current closures as well as add new closures to backstop measures being proposed by the South Atlantic Fishery Management Council. This is consistent with NS 1 because these time/area closures will support efforts aimed at achieving OY for sharks while helping to prevent overfishing of target and non-target species.
- In addition to maintaining the current reporting measures, the preferred alternatives include 100 percent observer coverage for those who participate in the shark research program. Maintaining the current dealer and logbook reporting as well as increasing observer coverage would greatly increase NMFS ability to monitor landings, bycatch and interactions with protected resources, thereby helping to prevent overfishing and maintain consistency with the Standardized Bycatch Reporting Methodology.
- Under the preferred alternatives, the seasons for sandbar sharks, and non-sandbar LCS would open on January 1 and would close within 5 days notice of either quota being 80 percent filled. This management measure is consistent with NS 1 because it assists NMFS in preventing further overfishing of overfished shark stocks.
- The preferred recreational management measures would only allow HMS recreational anglers to possess easily identifiable shark species that are less likely to be confused with dusky or sandbar sharks. This management measure is consistent with NS 1 because it helps to prevent overfishing of currently overfished shark stocks while still allowing possession of certain shark species in the recreational fishing sector.

NS 2 requires that conservation and management measures be based on the best scientific information available. The preferred alternatives in this Draft EIS are consistent with NS 2 guidelines.

- The preferred alternatives is consistent with NS 2 because the analyses of the management measures in the preferred alternatives are based on the 2005/2006 LCS stock assessment, and the 2006 dusky stock assessment, and the 2005 Canadian porbeagle stock assessment, up-to-date logbook and observer data which constitute the best available scientific information.
- One of the goals of the preferred alternatives and the development of the shark research fishery is to maximize scientific data acquisition by continuing a limited research fishery for sandbar sharks with 100 percent observer coverage which should ensure the best scientific information is maintained.
- Changing the stock assessment frequency from every 2-3 years to at least every five years would continue to ensure that stock assessments are conducted using the best scientific information available. Currently, the frequency of stock assessments makes it difficult to discern whether or not management measures that are implemented as a result of past stock assessments have been effective prior to subsequent assessments. This makes it difficult to ascertain the impacts that management measures may be having on the stock based on the prior assessment. Further, the Agency has adopted the Southeast Data and Review process for completing stock assessments, which requires three separate workshops, and generally requires more time to complete a stock assessment than how stock assessments were conducted in the past. For example, the most recent stock assessment for LCS was started in 2005 and completed in 2006, employing fisheries data through 2004. Management measures based on this assessment will be implemented in 2008 with the next assessment occurring in 2009 according to the existing stock assessment frequency guidelines. One year of management measures may not be representative of their effectiveness. Thus, results from a 2009 stock assessment may not reflect management measures made in the past, and while they may be representative of the most up-to-date stock data, they may not be representative of the best available science. Changing the stock assessment frequency to at least every five years would allow more time for current management measures to take effect and their results to be detected in the next stock assessment.

NS 3 requires that, to the extent practicable, an individual stock of fish be managed as a unit throughout its range, and interrelated stocks of fish be managed as a unit or in close coordination. The preferred alternatives in this Draft EIS are consistent with this NS.

- The preferred alternatives propose to remove sandbar sharks from the LCS complex. The 2005/2006 LCS assessment assessed sandbars separately and recommended a sandbar specific TAC of 158.3 mt dw. Based on this recommendation, NMFS has proposed to remove sandbar sharks from the LCS complex. This allows sandbars to be managed separately and gives NMFS the ability to track this separate quota more efficiently, which is critical given the overfished and overfishing status of sandbar sharks. The preferred alternative suite also proposes to have one region for management and would allow NMFS to manage shark species as a unit throughout their range. All fishermen will have the opportunity to apply to participate in the shark research fishery. The selection criteria will be made available each year in the Federal Register and when making selections NMFS will ensure that eligible participants are selected from each region consistent with past fishing effort and landings data.

- The 2005/2006 LCS assessment assessed blacktip sharks as an Atlantic and Gulf of Mexico stock based on tag and recapture data indicating a lack of mixing between these populations. The status of blacktip sharks in the Gulf of Mexico is healthy and is unknown in the Atlantic. The assessment recommended not increasing landings in the Gulf of Mexico and keeping landings the same in the Atlantic. The Agency is proposing removing the regions in this rulemaking, however, it is maintaining consistency with stock assessment recommendations by basing the quota for non-sandbar LCS (including blacktips) based on landings reported in Coastal Fisheries and HMS Logbook data from 2003-2005. As such, fishing effort and subsequent landings will not be increased in either region for blacktip sharks. Furthermore, the Agency is proposing managing blacktip sharks as a unit throughout their range which is consistent with NS 3.

NS 4 requires that conservation and management measures do not discriminate between residents of different states. Furthermore, if it becomes necessary to allocate or assign fishing privileges among various U.S. fishermen, such allocation should be fair and equitable to all fishermen; be reasonably calculated to promote conservation; and, should be carried out in such a manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges. The preferred alternatives in this Draft EIS are consistent with this NS.

- The preferred alternatives and the shark research fishery apply to residents of all states. This alternative would establish a program where vessels with directed or incidental shark permits could participate in a research fishery for sandbar sharks. Only vessels participating in this program could land sandbar sharks. Participation in this fishery would be subject to vessels meeting specific criteria designed to meet research objectives while allowing fishermen to earn revenue from selling sharks. These criteria may include, but are not limited to: possession of a directed shark permit, seasonal flexibility with regard to trips targeting sandbar sharks, willingness to take an observer on 100 percent of fishing trips and collect biological samples from landed and released shark, and ability to participate in the program for three years. Vessels not participating in the research program would still be able to land non-sandbar LCS, SCS, and pelagic sharks subject to the retention limits described below. The preferred alternatives are consistent with NS 4 because current permit holders will have the opportunity to apply to participate in the shark research fishery, and shark fishermen not participating in the shark research fishery could still land other shark species in the non-sandbar LCS, SCS and pelagic shark species groups subject to the same regulations. The selection criteria for the shark research fishery would be announced in the Federal Register each year and NMFS would ensure that there was no bias in the selection of vessels among different states when selecting participants.
- While maintaining the mid-Atlantic shark closed area may disadvantage shark fishermen living in adjacent areas because they would have to travel to an open area, it is not a direct allocation of fishing privileges nor does it discriminate between residents of different states. The closure is applicable to individuals from any state. Furthermore, maintaining this closure is justified under NS4 as a conservation measure to reduce bycatch of neonate and juvenile dusky and sandbar sharks in a known nursery area with no discriminatory

intent. Both of these species are overfished and experiencing overfishing so it would not be prudent to remove this closed area in light of recent stock assessments.

- Adding new time area closures consistent with the SAFMC's Amendment 14, is not expected to cause any NS 4 concerns and will ensure that regulations pertaining to participants fishing with bottom longline gear are consistent between the snapper/grouper and shark fisheries.
- Quotas and retention limits for non-sandbar LCS are based on landings reported in Coastal Fisheries and HMS Logbooks between 2003-2005. These landings include trips and landings made by vessels in all regions. Thus, past effort from all regions has been accounted for when NMFS established quotas and retention limits. Removing the regions is not expected to discriminate against participants in the North Atlantic region since fishermen from the North Atlantic region would still have the opportunity to travel to areas where there are more sharks present during the winter months, consistent with how the fishery is currently managed. In addition, fishermen in the North Atlantic would be able to land their sharks in any region, since all regions would open and close on the same time schedule. Reduced retention limits for all participants are expected to result in seasons stay open throughout the year, resulting in fishing opportunities for participants in the North Atlantic region in the summer months when sharks have north.

NS 5 requires that conservation and management measures should, where practicable, consider efficiency in the utilization of fishery resources with the exception that no such measure shall have economic allocation as its sole purpose. The preferred alternatives in this Draft EIS are consistent with this NS.

- The preferred alternatives would not impact the efficiency in the utilization of the fishery resource. The purpose of the shark research fishery in the preferred alternatives is to implement quotas and retention limits necessary to allow rebuilding and prevent overfishing of shark species while maximizing scientific data acquisition by continuing a limited research fishery for sandbar sharks. By allowing a limited number of historical participants to continue to land sandbar and other species of sharks in a manner resembling how the fishery has traditionally been executed, NMFS can ensure that data for stock assessments and life history samples continue to be collected while allowing a small pool of individuals to continue to collect revenue from sharks.
- NMFS considered shark catch efficiency when calculating retention limits for non-sandbar LCS in the preferred alternative suite by using catch ratios of sandbar to non-sandbar LCS in the Gulf of Mexico and South Atlantic regions.
- NMFS considered the efficiency of the rod and reel, recreational fishery because participants can practice catch and release of sharks therefore minimizing mortality of overfished species such as sandbar and dusky sharks.
- Implementing the Marine Protected Areas proposed by the South Atlantic Fishery Management Council (SAFMC) is not expected to affect efficiency in the utilization of fishery resources due to the low levels of shark fishing effort that has occurred in these small areas in the past. Furthermore, enforcement problems could result if fishermen, who use the same to gear, have different regulations apply depending on whether they were targeting sharks or participating in Council-managed fisheries.

NS 6 states that conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches. The preferred alternatives for this Draft EIS are consistent with this NS.

- The preferred alternative for the management of the shark fishing season allows NMFS to account for variations in the fishery and catches because NMFS would close the shark fishery within 5 days of either the sandbar, or non-sandbar LCS quota is 80 percent filled, which would help prevent overfishing.
- The preferred alternatives would allow vessels in the shark research program to fish under existing trip limits with 100 percent observer coverage, however NMFS will maintain some control over when these trips take place to ensure continuity of the program throughout the year and to encompass regional and seasonal variability among biological samples collected.
- NMFS also provides framework methods to have the ability to change quotas, based on over and under harvests, retention limits, and trip limits depending on how the fishery operates as a result of changes and by considering all the different variations between fisheries and regions.
- Modifying the assessment frequency from 2-3 years to at least every five years would still provide NMFS the flexibility of incorporating additional stock assessment methodologies or data while balancing the need to discern whether past management measures have been effective at achieving rebuilding targets thresholds and preventing overfishing.

NS 7 states that conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication. The preferred alternatives in this Draft EIS are consistent with this NS.

- The costs associated with the preferred alternatives are minimal as there would be no fee to participate in the shark research fishery. When analyzing the ecological and socioeconomic benefits in Chapter 4, NMFS determined that the preferred alternatives maximize scientific data acquisition while mitigating significant economic impacts that are necessary to reduce fishing mortality and effort as recommended by the recent stock assessments. The severity of the negative economic impacts are minimized in the preferred alternatives compared to alternative suites 2, 3, and 5 by allowing a small pool of individuals to continue to collect revenue from sharks. The preferred alternatives would also avoid unnecessary duplication because reporting requirements will not change significantly.

NS 8 states that conservation and management measures shall, consistent with the conservation requirements of the Magnuson-Stevens 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 provide for the sustained participation of such communities, and to the extent practicable, minimize adverse economic impacts on such communities. The preferred alternatives for this Draft EIS are consistent with this NS.

- NMFS is preferring alternative suite 4 because it implements quotas and retention limits necessary to allow rebuilding and prevent overfishing of shark species, maximizes scientific data acquisition by continuing a limited research fishery for sandbar shark to continue with 100 percent observer coverage, and mitigates some of the significant economic impacts that are necessary and included in all alternative suites to reduce fishing mortality and effort as prescribed by recent stock assessments. This alternative suite strikes an appropriate balance between positive ecological impacts that must be achieved to rebuild and prevent overfishing on depleted stocks while minimizing the severity of negative economic impacts that will occur as a result. By allowing a limited number of historical participants to continue to land sandbar and other species of sharks in a manner resembling how the fishery has traditionally been executed, the Agency ensures that data for stock assessments and life history samples continue to be collected while allowing a small pool of individuals to continue to collect revenues from sharks. Individuals not selected to participate in the shark research program could still land SCS, pelagic sharks and 22 non-sandbar LCS/vessel/trip which would limit the number of trips targeting non-sandbar LCS sharks, however, would still afford the opportunity to keep some sharks that are landed incidentally, preventing excessive discards.

- Communities may be negatively affected by the need to reduce quotas and retention limits consistent with NS1; however the proposed management measures in the preferred alternatives would ensure that certain communities would not be disproportionately affected.
- NMFS considered the importance of the recreational fishery to communities and has proposed measures that would allow the recreational shark fishery to continue but would restrict the species of sharks that can be landed to those that are easily identified and are not likely to be mistaken for sandbar or dusky sharks.

NS 9 states that conservation and management measures shall, to the extent practicable, minimize bycatch, and to the extent that bycatch cannot be avoided, minimize the mortality of such bycatch. The preferred alternatives for this Draft EIS are consistent with this NS.

- The preferred alternatives would minimize bycatch as it is expected to reduce overall fishing effort targeting sharks with gillnets and BLL gear while increasing the level of observer coverage on a limited number of vessels participating in the shark research program.
- The time/area closure measures in the preferred alternatives would maintain current closures as well as add new time/area closures consistent with SAFMC Amendment 14. The time/area closures that have been implemented in recent years have been effective in reducing the bycatch of prohibited, protected and non-target HMS species.
- In addition, the current gillnet gear restrictions that limits gillnet fishing in the Atlantic Ocean during certain times of the year to prevent endangered right whales from entanglement in gillnet gear in core right whale calving areas would not change as a result of this amendment.
- The requirement for the protected species safe handling, release, and identification workshops to educate longline and gillnet fishermen on the proper techniques for safe handling and release of entangled and/or hooked sea turtles, marine mammals and smalltooth sawfish to reduce the post release mortality of bycatch will not change as a result of this amendment.

- Limiting the species of shark that can be possessed by recreational anglers to those that are easy to identify is expected to reduce bycatch of prohibited shark species by reducing the number of prohibited sharks that are mis-identified or mistaken for species that can be legally landed. The Agency is especially concerned about reducing landings of dusky sharks. Thus, it is not allowing landings of silky and sandbar sharks, which look very similar to dusky sharks, in order to reduce bycatch due of mis-identification.

NS 10 states that conservation and management measures shall, to the extent practicable, promote the safety of human life at sea. The preferred alternatives in the draft EIS is consistent with this NS.

- No impact to safety of life at sea is anticipated to result from the preferred alternatives. The management measures in the preferred alternative would not require fishermen to travel greater distances, fish in bad weather, or otherwise fish in an unsafe manner.

10.2 Consideration of Magnuson-Stevens Section 304(g) Measures

Section 304(g) of the Magnuson-Stevens Act sets forth requirements specific to the preparation and implementation of an FMP or FMP amendment for HMS. See 16 U.S.C. 1854(g) for full text. The summary of the requirements of Section 304(g) and an explanation of how NMFS is consistent with these requirements are below. The impacts of the preferred alternatives and how it meets these requirements are described in more detail in Chapters 2 and 4 of the draft EIS. This section provides only a summary of how each of the requirements is met.

1. *Consult with and consider the views of affected Councils, Commissioners, and advisory groups*

NMFS published a Notice of Intent on November 7, 2006 (71 FR 65086) announcing the intent to initiate an amendment to the Consolidated HMS FMP. On January 3, 2007 (72 FR 123), NMFS published a Notice of Availability to inform the public of the issues and options presentation that was available on the HMS website. This Notice also announced NMFS intent to hold seven public scoping meetings to discuss and collect comments on issues described in the presentation. A Predraft of the amendment to the Consolidated HMS FMP was developed and released to consulting parties and HMS AP members in March 2007. NMFS presented the Predraft to the HMS AP members at the March 2007 AP meeting to discuss and receive comments. Written comments received on the issues and options presentation, during the scoping meetings, and at the HMS AP meeting were considered at all stages when preparing this draft EIS. NMFS will send the draft EIS to consulting parties including all five of the Atlantic Regional Fishery Management Councils, both the Atlantic and Gulf States Marine Fisheries Commissions, and the HMS AP. NMFS will also ask to present the draft EIS, during the public comment period, at the meetings of the Atlantic Regional Fishery Management Councils, and the Atlantic and Gulf States Marine Fisheries Commissions.

2. *Establish an advisory panel for each FMP*

As part of the Final Consolidated HMS FMP, NMFS combined the Atlantic Billfish and HMS APs into one panel. This combined HMS AP provides representation from the commercial and recreational fishing industry, academia, non-governmental organizations, state representatives as well as representatives from the Regional Fishery Management Councils and the Atlantic and Gulf States Marine Fisheries Commissions. This draft amendment will not change the HMS AP and they will be convening a meeting during the public comment period of the proposed rule to discuss and collect comments on the draft EIS and proposed shark management measures.

3. *Evaluate the likely effects, if any, of conservation and management measures on participants in the affected fisheries and minimize, to the extent practicable, any disadvantage to U. S. fishermen in relation to foreign competitors.*

Throughout this document, NMFS has described the effects of the management measures and any impacts on U. S. fishermen. The preferred alternatives in the Draft EIS are necessary to meet Magnuson-Stevens Act mandates to rebuild overfished stocks and prevent overfishing which in the long-term is not expected to disadvantage U.S. fishermen in relation to foreign competitors. NMFS acknowledges that LCS that are caught by U.S. fishermen are also caught by Mexican and Bahamian fishermen and incorporates this information into stock assessments. Canada has a porbeagle shark fishery and conducts stock assessments for this species. The U.S. has minimal landings of porbeagle sharks and provides the landings information to Canada so that they can incorporate this information into their stock assessments. NMFS also uses results from the Canadian stock assessments to manage porbeagle sharks in the U.S EEZ.

4. *With respect to HMS for which the United States is authorized to harvest an allocation, quota, of fishing mortality level under a relevant international fishery agreement, provide fishing vessels with a reasonable opportunity to harvest such allocation, quota, or at such fishing mortality level.*

There is currently no international agreement on shark quotas, allocations, or fishing mortality levels. Therefore this requirement is not applicable.

5. *Review on a continuing basis, and revise as appropriate, the conservation and management measures included in the FMP.*

NMFS continues to review the need for any revisions to the existing regulations for HMS. The Draft EIS for Amendment 2 to the Consolidated HMS FMP is the culmination of one of those reviews.

6. *Diligently pursue, through international entities, comparable international fishery management measures with respect to HMS.*

NMFS continues to work with ICCAT and other international entities such as CITES, to implement comparable international fishery management measures. To the extent that some of the management measures in this Amendment are exportable, NMFS works to provide foreign nations with the techniques and scientific knowledge to implement similar management measures.

7. *Ensure that conservation and management measures under this subsection:*

   a. *Promote international conservation of the affected fishery;*

   b. *Take into consideration traditional fishing patterns of fishing vessels of the United States and the operating requirements of the fisheries;*

   c. *Are fair and equitable in allocating fishing privileges among United States fishermen and do not have economic allocation as the sole purpose; and* *d. Promote, to the extent practicable, implementation of scientific research programs that include the tagging and release of Atlantic HMS.*

All of the objectives of the draft EIS indicate how NMFS promotes the international conservation of the affected fisheries in order to obtain optimum yield while maintaining traditional fisheries and fishing gear and minimizing economic impacts on U.S. fishermen. The management measures in the preferred alternatives in this draft EIS are expected to meet these goals.

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11.0 LIST OF PREPARERS

The development of this rulemaking involved input from many people within NMFS, NMFS contractors and input from constituent groups including the HMS Advisory Panel. Staff and contractors from the HMS Management Division, in alphabetical order, who worked on this document include:

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The development of this document also involved considerable input from other staff members and Offices throughout NOAA including, but not limited to:

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- The Northeast Fisheries Science Center (Nancy Kohler, Cami McCandless, Lisa Natanson);
- The Southeast Regional Office (David Bernhart, Julie Weeder, Steve Branstetter);
- The Office of Law Enforcement (Sara Block, Jeff Radonski, Paul Raymond)
- NOAA General Counsel (Meggan Engelke-Ros, Mark Hodor, Adam Issenberg, Caroline Park, Constance Sathre, Frank Sprtel); and
- NMFS NEPA coordinator (Tammy Adams, Steve Kokkinakas, Shelby Mendez).

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A. APPENDIX: SPECIES COMPLEXES, QUOTAS, AND RETENTION LIMIT CALCULATIONS

For alternative suites 2 through 4, NMFS calculated quotas and retention limits based on total allowable catches (TAC) recommended in the 2005 and 2006 stock assessments; fishing effort and landings reported from 2003 to 2005 in the HMS Logbook and Coastal Fisheries Logbook; and discards from the bottom longline (BLL) and gillnet 2005 to 2006 observer reports. In all cases, NMFS accounted for total mortality from all fishing sectors (*e.g.*, commercial and recreational), including landings and discards. By reducing the quota below this TAC, NMFS should reduce fishing mortality below the level that would cause overfishing. The quotas and retention limits in this rulemaking are specific to the 2005/2006 LCS stock assessment, the 2006 dusky assessment, and the 2005 porbeagle shark stock assessment, but NMFS anticipates changing these quotas and retention limits via framework actions in the future, as necessary. In subsequent rulemakings, NMFS would determine quotas and retention limits, based on the recommendations from the most recent stock assessments and/or estimates of landings, discards, and effort in fisheries that interact with sharks using the same process used in this rulemaking as outlined below.

A.1 Sandbar quota and retention limit

The 2005/2006 LCS assessment assessed sandbars separately and recommended a sandbar specific TAC of 158.3 mt dw (220 mt ww). The assessment stated that this TAC provides a 70-percent chance of rebuilding sandbar sharks by the year 2070. Based on this recommendation, NMFS is proposing to remove sandbar sharks from the LCS complex. This would allow sandbar sharks to be managed separately and gives NMFS the ability to track this separate quota more efficiently, which is critical given the overfished and overfishing status of sandbar sharks.

To determine the proportion of the 158.3 mt dw TAC for sandbar that would be available for the commercial fishery, NMFS accounted for mortality of sandbar sharks in all sectors of recreational and commercial fisheries. NMFS first determined the commercial TAC by subtracting the average annual number of recreational sandbar shark landings (27 mt dw) from the 158.3 mt dw TAC, resulting in a commercial TAC of 131.3 mt dw (Table A-1). NMFS then determined the available commercial quota by subtracting discards in the HMS pelagic longline (PLL) fishery and non-HMS fisheries (*e.g.*, the snapper/grouper and tilefish fisheries) as well as the set-aside for display and research quota (see below under discussion of alternative suite 2). NMFS also accounted for landings recorded in the Coastal Fisheries Logbook by fishermen who did not have valid or current HMS shark permits. NMFS subtracted dead discards/landings from non-permit holder and recreational fishermen because it is assumed that mortality will continue regardless of directed fishery management measures. The total landings and discards from each of these data sources can be found in Table A-1. By removing these landings and/or mortalities from the commercial TAC (131.3 mt dw; Table A-1), NMFS has determined that the available commercial sandbar quota is 116.6 mt dw (or 6,347 sandbar sharks, which is 116.6 mt dw / average commercial sandbar weight of 40.5 lb dw (Cortés and Neer, 2005)).

Table A-1 Calculation of sandbar quota.

	mt dw
Total sandbar shark TAC	158.3
Average Annual Recreational Landings	27
Resultant Commercial TAC (158.3 mt dw – 27 mt dw)	**131.3 (7,147.3* sandbar sharks)**
Average annual number of sandbars landed/discarded by non-HMS permit holders in Coastal Fisheries Logbook	6.1
Average annual number of sandbars discarded by incidental permit holders in Coastal Fisheries Logbook	2.3
Average annual number of dead discards on PLL gear in the HMS Logbook	4.3
Public display quota	1
Research quota	1
All gillnet discards	0.018
Extrapolated number of discards in snapper/grouper and tilefish BLL fishery based on BLL observer program	0
Total discards	*14.7*
Resultant sandbar shark quota (131.3 mt dw – 14.7 mt dw)	**116.6 (6,346.9* sandbar sharks)**

*assumes an average commercial sandbar shark weight of 40.5 lb dw (Cortés and Neer, 2005)

To determine sandbar retention limits for the different alternative suites, NMFS projected the number of trips that could be taken by directed and incidental permit holders based on past fishing effort. However, this level of effort may not be realized in the future given the reduced sandbar TAC; therefore, retention limits could be changed as necessary via proposed rule or framework actions based on quota monitoring and realized fishing effort.

The sandbar retention limit is dependent on which part of the commercial fishery (*i.e.*, directed and/or incidental permit holders) is allowed to retain sandbar sharks. For instance, alternative suite 2 would allow only directed shark permit holders to retain any shark species, and there would be no retention of sandbar sharks with PLL gear. Therefore, the 116.6 mt dw of sandbar quota was averaged over the average annual number of directed shark permit holder trips reported in the Coastal Fisheries Logbook from 2003 through 2005. This results in a sandbar trip limit of 8 sandbar sharks (Table A-2).

Table A-2 Calculation of sandbar retention limit for alternative suites 2 through 4.

Alternative Suite	Average annual trips taken by directed permit holder that landed sharks in the Coastal Fisheries Logbook	Average annual trips taken by incidental permit holder that landed sharks in the Coastal Fisheries Logbook	Average annual BLL, directed permit holder trips taken in the HMS Logbook landing sharks	Average annual PLL trips, directed permit holder trips in the HMS Logbook landing sharks	Average annual PLL, incidental permit holder trips in the HMS Logbook landing sharks	Total Trips	Retention Limit (6,346.9 sandbars / total trips)
2*	790	*	†	β	*	790	8 sharks/trip
3	790	49.7	80	237.7	255.3	1,413	4.5 sharks/trip
4						92#	0 outside research fishery

*only directed permit holders would be allowed to land sharks

βno retention of sandbar sharks on PLL gear

†since sandbar sharks cannot be retained on PLL gear, it is assumed that BLL sets will not be made on PLL vessels; fishermen primarily report PLL sets in HMS Logbook, but some BLL sets may also be reported in the HMS Logbook by PLL vessels.

#number of trips with 4,000 lb dw trip limit for sandbar sharks that would fulfill the 116.6 mt dw sandbar shark quota (assuming 2,800 lb dw sandbar sharks/trip)

To help estimate the appropriate number of fishing trips by directed permit holders, NMFS also investigated individual vessel's average annual sandbar landings and trips made that landed sandbar sharks from 2003 through 2005 in the Coastal Fisheries and HMS Logbooks (see Figure A-1 and Figure A-2). In doing so, NMFS investigated whether or not there was a portion of the commercial directed shark fishery that made a majority of the sandbar landings. If a small proportion of the fishermen possessing directed shark permits landed a majority of the sandbar sharks, then the predicted number of directed fishing trips could be based on the number of trips taken by those vessels in the past. This could lower the number of trips by directed shark permit holders and potentially increase the retention limit of sandbar sharks. However, after examining the average annual sandbar landings and average annual number of trips taken that landed sandbar sharks, there was no obvious portion of the directed shark fishery that made a majority of the sandbar landings. Rather, most of the directed shark fishermen had moderate sandbar landings (see Figure A-1) with only a few vessels landing more than 3,000 lb dw of sandbars on an average trip (Figure A-3). Therefore, NMFS averaged the available 116.6 mt dw of sandbar quota over the average annual number of all trips made by directed shark permit holders in the Coastal Fisheries Logbook (Table A-2).

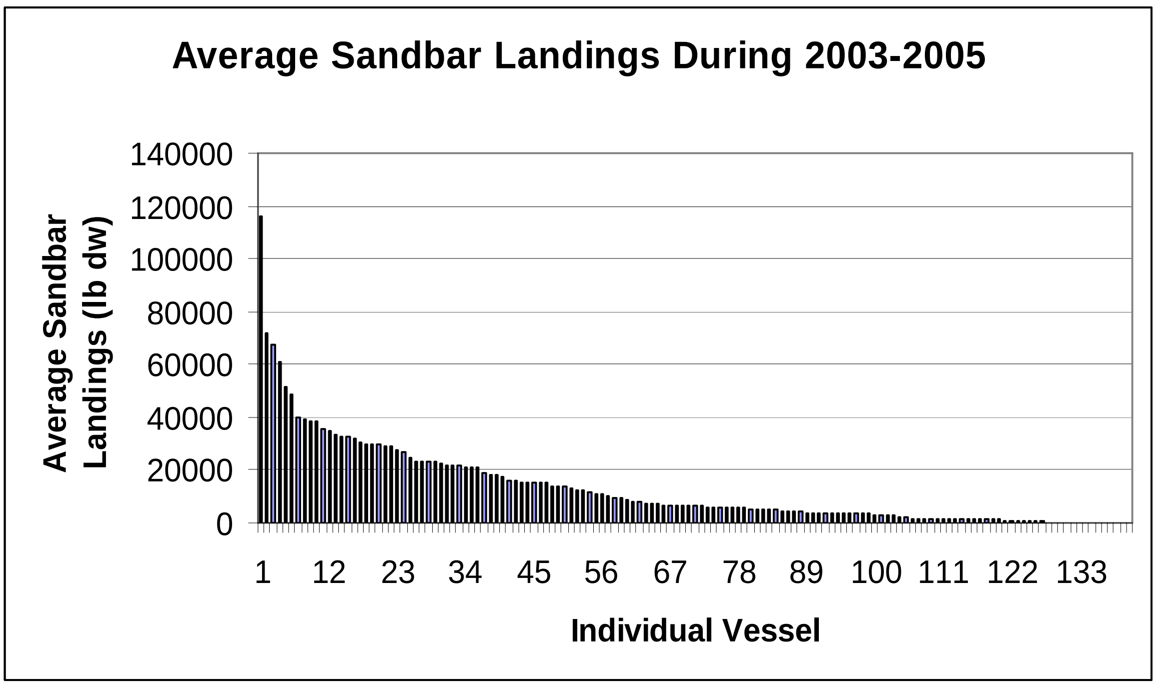

Figure A-1 **Average annual sandbar landings (lb dw) for individual vessels during 2003 to 2005. The average sandbar landings per vessel was 13,150 lb dw per year.** Source: Coastal Fisheries Logbook and HMS Logbook**.**

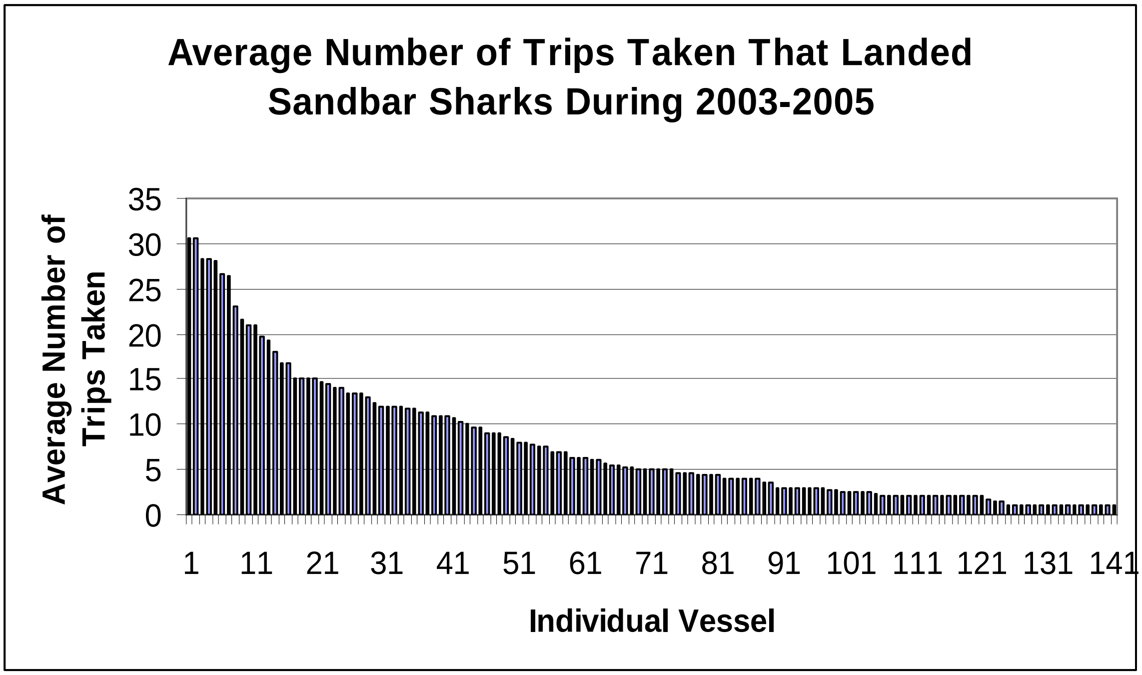

Figure A-2 **Average annual number of trips taken that landed sandbar sharks for individual vessels from 2003 to 2005**. Source: Coastal Fisheries Logbook and HMS Logbook**.**

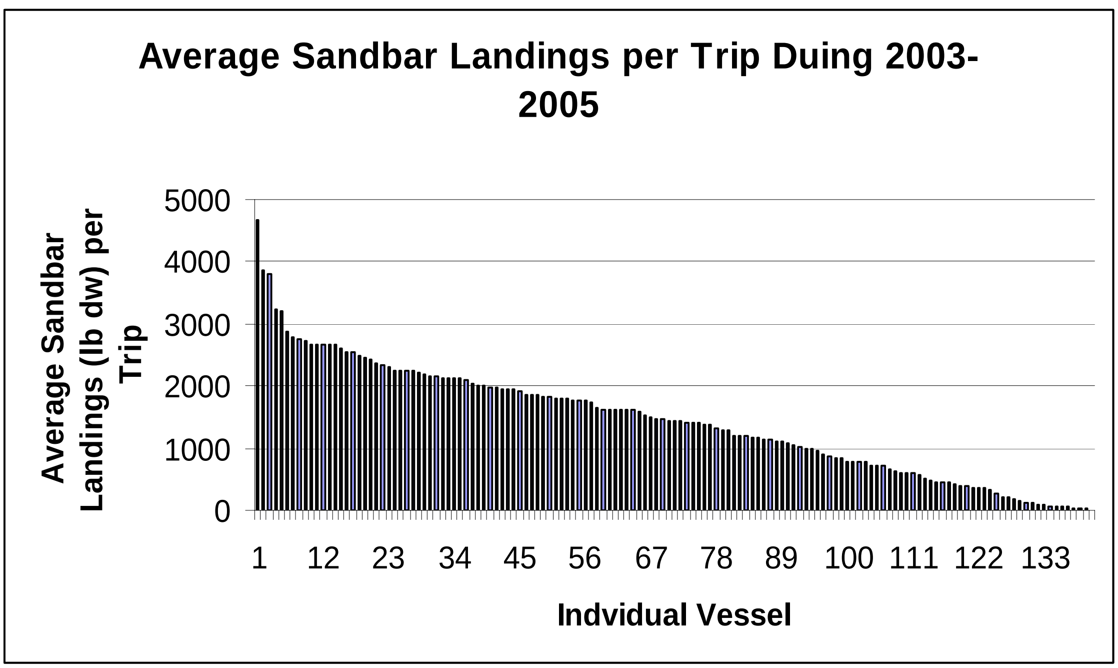

Figure A-3 **Average sandbar landings (lb dw) per trip taken for individual vessels from 2003 to 2005. The average sandbar landings was 1,417.5 lb dw per trip**. Source: Coastal Fisheries Logbook and HMS Logbook**.**

Similarly for alternative suite 3, which would allow sandbar landings by both directed and incidental shark permit holders, NMFS spread the 116.6 mt dw of sandbar quota over the average annual number of trips that made sandbar landings by directed and incidental permit holders recorded in both Coastal Fisheries logbook and the HMS logbook to determine a retention limit of 4 sandbar sharks/trip (Table A-2).

Finally, alternative suite 4 would establish a small research fishery that could harvest the 116.6 mt dw sandbar quota and retain other shark species and would be afforded higher trip limits for sandbar and non-sandbar LCS than vessels operating outside the research fishery. Vessels outside this research fishery would not be allowed to retain sandbar sharks. NMFS first determined the number of trips it would take to land the sandbar quota, assuming a 4,000 lb dw sandbar and non-sandbar LCS trip limit (however, this trip limit would be based on the research objectives for a given year). The number of trips was determined by looking at the catch composition of directed BLL trips reported in the BLL observer program (Hale and Carlson, 2007). The observer program data indicated that 70 percent of the catch on directed shark BLL trips in the South Atlantic region was comprised of sandbar sharks whereas 30 percent of the catch on directed shark BLL trips in the Gulf of Mexico region was comprised of sandbar sharks. By taking a precautionary approach and assuming that 70 percent of a 4,000 lb dw trip limit would be made up of sandbar sharks and that the average sandbar shark is 40.5 lb dw (Cortés and Neer, 2005), the 116.6 mt dw of sandbar quota could be caught in approximately 92 trips (see Table A-2). Therefore, for the purposes of analysis relative to other alternatives, a small universe of vessels in the research program would be able to make approximately 92 trips with a 4,000 lb dw sandbar and non-sandbar LCS trip limit, which would fulfill the sandbar quota. Specifics of the research program, including trip limits, would be determined to meet specific research objectives and may not be structured based on a 4,000 lb dw trip limit. For additional details on the research program, see Chapters 2 and 4.

A.2 Non-sandbar quota and retention limits

The 2005/2006 LCS assessment also assessed blacktip sharks separately and recommended that the catch of Atlantic and Gulf of Mexico blacktip populations not change or increase, respectively, given the unknown status for the Atlantic blacktip population and the relatively healthy status for the Gulf of Mexico population. Based on this LCS assessment, NMFS also determined that the status of the LCS complex is unknown. Given the unknown or healthy status of these species and the larger available quota relative to the sandbar quota, management for these species would be based on a new non-sandbar LCS complex in alternative suites 2 through 4, which has sandbar sharks removed from the complex (non-sandbar LCS complex = silky, tiger, blacktip, spinner, bull, lemon, nurse, scalloped hammerhead, great hammerhead, and smooth hammerhead sharks). The non-sandbar LCS quota is based on the average annual catch of these species from 2003 to 2005, as recommended by the most recent LCS stock assessment (Table A-3a). A TAC was established for non-sandbar LCS based on total catch and discards from all sectors of the LCS fishery (Table A-3b).

Table A-3 Calculation of non-sandbar LCS quota and TAC.

	mt dw
***a)** Non-sandbar LCS Quota*	
Average annual number of non-sandbar LCS landed by non-HMS permit holders in Coastal Fisheries Logbook	15.1
Average annual number of non-sandbar LCS landed by incidental permit holders in Coastal Fisheries Logbook	16.3
Average annual number of non-sandbar LCS landed by directed permit holders in Coastal Fisheries Logbook	503
Average annual number of non-sandbar LCS kept on PLL gear in the HMS Logbook	19.9
Average annual number of non-sandbar LCS kept on BLL gear in the HMS Logbook	28.1
total	*582.4*
Research and Public Display Quota	41.2
Resultant Quota (582.4 mt dw – 41.2 mt dw)	**541.2**
***b)** Non-sandbar LCS TAC*	
Average Annual Recreational Landings	309.8
Total gillnet discards (both shark and non-directed shark fisheries)	19.9
Extrapolated number of discards in snapper/grouper and tilefish BLL fishery based on BLL observer program	3.5
Extrapolated number of discards in directed shark BLL fishery based on BLL observer program	116.7
Average annual number of dead discards on PLL gear in the HMS Logbook	12.6
Average annual number of dead discards on BLL gear in the HMS Logbook	0.7
Total discards and recreational landings	*463.2*
Total TAC (582.4 mt dw of landings + 463.2 mt dw of discards & recreational landings)	**1,045.6**

Retention limits for non-sandbar LCS were calculated in different ways, depending on the alternative suite being considered. Since the overall quota for non-sandbar LCS is higher than the overall sandbar quota, retention limits are higher for non-sandbar LCS than they are for sandbar sharks. To reduce the number of sandbar sharks that would be discarded as fishermen fulfill their non-sandbar LCS retention limits in alternative suites 2 and 3, the non-sandbar LCS retention limits were based on the ratio of sandbar sharks to non-sandbar LCS caught in the BLL observer program (Hale and Carlson, 2007). However, the ratio of sandbar sharks to non-sandbar LCS caught varied between the Gulf of Mexico and South Atlantic regions. In the Gulf of Mexico region, there was a 1:4 ratio (1 sandbar for 4 non-sandbar LCS) whereas in the South Atlantic region there was a 1:1.4 ratio. In addition, the fishing effort varied among regions, with 2/3 of the BLL effort occurring in the Gulf of Mexico region and 1/3 of the BLL effort occurring in the South Atlantic region (Coastal Fisheries Logbook). Therefore, NMFS had to accommodate for differences in catch composition and fishing effort in the different regions when setting the non-sandbar LCS retention limit for alternative suites 2 and 3.

This balance was important to limit discards of sandbar sharks in the region with the lower sandbar to non-sandbar LCS ratio (*i.e.*, the South Atlantic). For instance, using the 1:4 sandbars to non-sandbar LCS ratio in the Gulf of Mexico to set the retention limit would result in a 32 non-sandbar LCS retention limit with an 8 sandbar shark retention limit per trip (8 sandbars x 4 = 32 non-sandbar LCS). However, given the 1:1.4 ratio in the South Atlantic, an 8 sandbar shark retention limit/trip would equal a 11 non-sandbar LCS retention limit in the South Atlantic (8 sandbar sharks x 1.4 = 11.2 non-sandbar LCS). Therefore, setting one retention limit based on the Gulf of Mexico's catch ratio would result in excessive sandbar sharks discards. To determine the number of sandbar discards that would occur in the South Atlantic with a Gulf of Mexico's 1:4 ratio, it must first be determined the number of sandbar shark discards that would occur on a South Atlantic trip with a retention limit based on the Gulf of Mexico's catch ratio. This is done by determining the difference in the retention limits for non-sandbar LCS based on the respective ratios in the two regions; setting a non-sandbar LCS retention limit using the South Atlantic ratio would result in no sandbar discards; any non-sandbar LCS retention limit above that threshold would result in sandbar discards, but the number of discards would depend on the difference between the two retention limits divided by sandbar to non-sandbar ratio in the South Atlantic:

- Gulf of Mexico non-sandbar LCS retention limit = 8 sandbars x 4 = 32 non-sandbar LCS
- South Atlantic non-sandbar LCS retention limit = 8 sandbar sharks x 1.4 = 11.2 non-sandbar LCS (or 11 non-sandbar LCS)
- 32 non-sandbar LCS retention limit based on Gulf of Mexico ratio - 11 non-sandbar LCS retention limit based on South Atlantic = 21 non-sandbar LCS;
- 21 non-sandbar LCS/1.4 = 15 sandbar sharks discarded per trip in South Atlantic;
- 15 sandbar sharks x 237 South Atlantic trips = 3,555 sandbar sharks discarded in the South Atlantic; and
- 3,555 sandbar sharks x 40.5 lb dw [average commercial sandbar weight] = 143,977.565.3 lb dw or 65.3 mt dw.

Setting a non-sandbar LCS retention limit in the South Atlantic based on the Gulf of Mexico's catch ratio would therefore result in approximately 65.3 mt dw of sandbar shark discards as fishermen meet their sandbar retention limit and continue to fish for non-sandbar LCS, and discard sandbar sharks, in the South Atlantic.

Therefore, the non-sandbar LCS retention limit was determined by using an average ratio (or 1:2.7) for the two regions. This resulted in a slightly lower non-sandbar LCS retention limit in the Gulf of Mexico compared to its regional ratio (*i.e.*, 21 non-sandbar LCS versus 32 non-sandbar LCS) and a slightly higher non-sandbar LCS retention limit in the South Atlantic compared to its regional ratio (*i.e.*, 21 non-sandbar LCS versus 11 non-sandbar LCS). However, this average ratio balanced the number of sandbar sharks that would be discarded in the South Atlantic with the amount of sandbar quota that would not be harvested in the Gulf of Mexico (Table A-4). Given the lowered non-sandbar LCS retention limit for the Gulf of Mexico region, not all of the 116.6 mt dw of sandbar quota would be harvested under alternative suites 2 and 3 (86.1 mt dw and 105.9 mt dw, respectively). This is to compensate for the discards in the South Atlantic (see Table A-4). In addition, because the non-sandbar LCS retention limit is based on a ratio approach to limit sandbar discards (*i.e.*, the entire non-sandbar LCS quota was not averaged over the total number of fishing vessels as was done for sandbar sharks), only a portion of the non-sandbar LCS quota would be harvested under alternative suites 2 and 3 (253.6 mt dw and 229.2 mt dw, respectively).

Table A-4 Calculation of non-sandbar LCS retention limits for alternative suites 2 and 3. Note: these limits assume 237 BLL trips in the South Atlantic (SA) region and 553 trips in the Gulf of Mexico (GOM) region for alternative suite 2, and 290 BLL trips in the SA region and 581 trips in the GOM region for alternative suite 3.

Alternative Suite	Sandbar Retention Limit	Regional Ratios of Sandbars to Non-Sandbar LCS Caught	Non-Sandbar LCS Retention Limit Based on Regional ratios	Average Sandbar to Non-Sandbar LCS Ratio[1]	Non-Sandbar LCS retention limit based on average ratio	Sandbar Discards in South Atlantic Region (mt dw)[2]	Sandbar quota not caught in the Gulf of Mexico Region (mt dw)[3]	Net Sandbar discards [4]	Resulting Sandbar Quota Harvested (mt dw)	Resulting Non-Sandbar Quota Harvested (mt dw)
2	8	1:4 (GOM)	32	2.7	21	30.5	30.5	0	86.1	253.6
		1:1.4 (SA)	11							
3	4	1:4 (GOM)	16	2.7	10	15.4	10.7	4.7	105.9	229.2
		1:1.4 (SA)	6							

[1]The Gulf of Mexico regional ratio of sandbars to non-sandbar LCS caught is 1:4. The South Atlantic regional ratio of sandbars to non-sandbar LCS caught is 1:1.4. The average ratio is (4 + 1.4)/2 = 2.7 or a combined 1:2.7 ratio.

[2]**Alternative suite 2**: A 21 other LCS trip limit would mean that 7 sandbar discards would occur per South Atlantic regional trip (21 other LCS-11 other LCS=9.8 other LCS/1.4 ratio = 7 sandbar sharks discarded). This equates to 30.5 mt dw of sandbar discards over 237 South Atlantic regional trips (7 sandbars x 237 trips = 1,659 sandbars discarded. 1,659 sandbars x 40.5 [average sandbar weight] = 30.5 mt dw).

Alternative suite 3: A 10 other LCS trip limit would mean 2.9 sandbar discards would occur per South Atlantic regional trip (10 other LCS – 6 other LCS = 4 other LCS/1.4 ratio = 2.9 sandbar discarded). This equates 15.4 mt dw of sandbar discards over 290 South Atlantic regional trips (2.9 sandbars x 290 trips = 841 sandbars discarded. 841 sandbars x 40.5 [average sandbar weight] = 15.4 mt dw).

[3]**Alternative suite 2:** With a 21 non-sandbar LCS trip limit, fishermen in the Gulf of Mexico region would potentially only catch ~5 sandbars per trip. With an 8 sandbar/trip retention limit, this would mean 3 sandbar sharks would not be caught per trip. This equates to approximately 30.5 mt dw of sandbar quota that would not be caught in the Gulf of Mexico region (8 sandbar limit - 5 sandbars caught = 3 sandbars not caught. 3 sandbars not caught x 553 trips = 1,659 total sandbars not caught x 40.5 [average sandbar weight] = 30.5 mt dw of sandbars not caught).

Alternative suite 3: With a 10 non-sandbar LCS retention limit, fishermen in the Gulf of Mexico region would potentially only catch ~3 sandbars per trip. With a 4 sandbar/trip retention limit, this would mean 1 sandbar shark would not be caught per trip. This equates to approximately 10.7 mt dw of sandbar quota that would not be caught in the Gulf of Mexico region (4 sandbar limit - 3 sandbars = 1 sandbar not caught. 1 sandbar not caught x 581 trips = 581 total sandbars not caught x 40.5 [average sandbar weight] = 10.7 mt dw of sandbars not caught)

[4]**Alternative suite 2:** 30.5 mt dw – 30.5 mt dw = 0 mt dw net discards of sandbar sharks

Alternative suite 3: 15.4 mt dw – 10.7 mt dw = 4.7 mt dw net discards of sandbar sharks

Alternative suite 4 would allow vessels outside of a small shark research fishery to retain non-sandbar LCS as well as SCS and pelagic sharks (Table 2.1). However, the available non-sandbar LCS quota and associated retention limit outside the research fishery was based on the amount of non-sandbar LCS quota that could be caught in the research fishery. Based catch composition in the BLL observer report, NMFS assumed that approximately 92 trips with a 4,000 lb dw trip limit could be taken by a small number of vessels in a shark research fishery to harvest the available sandbar quota of 116.6 mt dw (however, the actual trip limit would be based on the research objectives for a given year). This assumed that the catch composition was 70 percent sandbar sharks and 30 percent non-sandbar LCS (Hale and Carlson, 2007; Table A-2). Based on 92 trips with a catch composition of 30 percent non-sandbar LCS, it is estimated that 50 mt dw of non-sandbar LCS quota would be harvested by vessels within the research fishery (Table A-5). This would leave 491 mt dw of non-sandbar LCS quota available to vessels outside of the research fishery (541.2 mt dw non-sandbar LCS quota – 50 mt dw quota harvested within the research fishery = 491 mt dw quota available outside the research fishery). This quota was averaged over the average annual number of trips that landed non-sandbar LCS by directed and incidental permit holders reported in the Coastal Fisheries logbook and the HMS logbooks. This resulted in a 22 non-sandbar LCS retention limit per trip for vessels operating outside of the research fishery (Table A-5).

Table A-5 Non-sandbar LCS retention limits for alternative suite 4.

Alternative Suite	**Average annual trips taken by directed permit holder that landed sharks in the Coastal Fisheries Logbook**	**Average annual trips taken by incidental permit holder that landed sharks in the Coastal Fisheries Logbook**	**Average annual BLL, directed permit holder trips taken in the HMS Logbook landing sharks**	**Average annual PLL trips, directed permit holder trips in the HMS Logbook landing sharks**	**Average annual PLL, incidental permit holder trips in the HMS Logbook landing sharks**	**Total Trips**	**Non-sandbar LCS quota (mt dw) available outside research fishery** 1,200 lb dw non-sandbar LCS/trip x 92 trips = 50.0 mt dw non-sandbar LCS (541.2 mt dw – 50.0 mt dw = 491 mt dw	**Retention Limit (non-sandbar LCS quota / total trips)**
4	790	92	80	237.7	255.3	1,455	491	22 sharks/trip outside of research fishery

APPENDIX B TABLE OF CONTENTS

Report to Directed Shark Fisheries, Inc. on the 2006 SEDAR 11 Assessment for Sandbar Shark

Prepared by

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Directed Shark Fisheries, Inc.

Mark Maunder, PhD
Inter-American Tropical Tuna Commission

Abstract

The Review Panel for SEDAR 11 (Large Coastal Sharks) was held 5–9 June 2006 at Panama City, FL. The panel was conducted by the Center for Independent Experts (CIE) and concluded that:

"The population model and resulting population estimates were the best possible given the data available.

"Stock status was determined from the results of a range of model fits reflecting the Panel's uncertainty about life history parameters. All results indicate that the stock is overfished and that overfishing is occurring. The target year to rebuild the stock is estimated to be 2070."

At the request of Directed Shark Fisheries, Inc., we reviewed the data and modeling of SEDAR 11 upon which the CIE based their conclusions. After review, we concluded that:

- ***The assessment proceeded without using the largest data set available, the BLOP data, which inter alia shows that average age of the catch has not declined over time, as it should if the stock were being overfished.***
- ***The BLOP data also show that the selectivity curve used for the commercial catch is wrong and needs to be re-examined.***
- ***Catch-rates for recent years remain level indicating a population in equilibrium; overfishing is not occurring, whereas the model trajectory indicates a continuing decline in abundance.***
- ***The assessment used several catch-rate series (LPS and NMFS – NE) that were either inappropriate, or did not include the available (but withheld) size and sex data (VA LL).***
- ***The age-at-maturity ogive was derived from a study that is technically flawed.***
- ***The biological parameters used in the model were selected subjectively and there may be some evidence that different values are more appropriate.***

If NMFS relies on this technically flawed assessment to make the formal finding that the stock is overfished and overfishing is occurring a legal process will begin that will require a severe reduction in TAC equivalent to closing the fishery. There is time yet to revisit the assessment before that reduction is in place if NMFS is willing to devote the effort to address the concerns that the CIE raises in their Report and we have raised in ours. Redoing the maturity ogive study may not fit into this period, but the other corrective work could be done a matter of months.

Background.

The Review Panel for SEDAR 11 (**S**outh **E**ast **D**ata and **A**ssessment **R**eview) of Large Coastal Sharks was held 5–9 June 2006 at Panama City, FL. The panel was conducted by the Center for Independent Experts (CIE) and concluded that:

- *The population model and resulting population estimates were the best possible given the data available.*
- *The change in stock status in the 2006 assessment from the more optimistic status in 2002 appears to be mainly attributable to revisions to the life history parameters in the current assessment. The population is assessed to be less productive than was assumed in 2002.*
- *In 2006, the 3-part SEDAR process of data workshop, assessment workshop, and review workshop was adopted for large coastal sharks. This process resulted in a more thorough review at all stages of the process, which was not possible with the previous stock assessments. For this reason and those concerning the life history parameters given above, the Panel is confident that the 2006 assessment gives a more reliable estimate of stock status than obtained from the 2002 and earlier assessments.*
- *Stock status was determined from the results of a range of model fits reflecting the Panel's uncertainty about life history parameters. All results indicate that the stock is overfished and that overfishing is occurring. The target year to rebuild the stock is estimated to be 2070.*

Directed Shark Fisheries, Inc. (DSF) represents several entities involved with the commercial fishery for Atlantic large coastal sharks. The group disagrees with these conclusions, which are at variance with their observations of the fishery. There is no indication of a continuous decline in either catch rate or fish size (average carcass weight) predicted by the modeling. Of particular concern to the fishermen is the determination that the fishery for sandbar shark needs to be closed for a 65-year rebuilding period. Directed Shark Fisheries, Inc. has asked us to review the data and modeling of SEDAR 11 upon which the CIE based their conclusions to attempt to reconcile the two different perceptions of the status of the sandbar stock, report our findings and make such recommendations as may be appropriate.

The Problem

The CIE in reaching their conclusions stopped short of taking the vital but simple step of comparing the model results with actual information from the fishery. A cursory examination would show that the commercial landings and catch rates have remained stable for over a decade, and catch-rate (abundance) indices are mostly flat or trend upward over this period. These observations are inconsistent with the model output, which indicates a steady decline in biomass over the same period. The problem this created is that the CIE and SEDAR are pronounced by NMFS to have provided a peer review approval of this assessment, "…the best possible given the data available." The fishery now likely faces a major reduction in TAC under current law.

The CIE accepted both the data and analyses provided by SEDAR 11 and the conclusion that the stock is overfished and that overfishing is occurring with some caveats, and raised a number of issues for future examination. The issues raised by the CIE are important; so important in fact; that we wonder why the CIE did not express greater concern about the confidence that can be put on the SEDAR 11 assessment and recommend that some issues be addressed before the assessment was accepted.

These concerns might have been more strongly phrased had the CIE been advised that some of the data they highlighted for future work were actually available but not presented at SEDAR 11. We will now make use of additional data to explain some of the inconsistencies between the perception created by the model results and the perception held by the commercial sector.

The Data

The Review Panel qualified their conclusions by stating:

Research recommendations are included in the reports from the Data and Assessment Workshops (and in 2.3 below), so what follows is not intended to replace them but rather to emphasize specific needs for sandbar shark.

Two recommendations in particular are extremely important. These are:

Issue: A number of catch-rate indices were used, and it was not obvious which components of the sandbar population they were monitoring.
• Using information on the size composition of catches from these indices, if available, would be helpful
• Maps of where (and when) the catch-rate series are located, along with the location of the fisheries, would aid in interpreting these series

Issue: The assessment used an age-structured model, but no age information was used.
• The predicted age compositions for the population and the catch in the model may provide useful diagnostics for the performance of the model. Research should be directed into developing these diagnostics, including verification with any available data on age composition. One example of a diagnostic indicator is the mean size/age in the catch and population, and from any catch-rate index that may collect size composition data…

Size, sex, location and other information are contained in two data sets used at SEDAR 11 and this additional information was available to SEDAR 11 and the CIE, but was not presented. One set is the Bottom Longline Observer Program (BLOP)[1], the other the VIMS longline survey (VA LL). The BLOP comprises observed sets during the period from 1994 through 2004 from N. Carolina south and into the eastern Gulf of Mexico and covers all seasons and most of the range of the commercial fishery using a gear (bottom longline) that accounts for nearly 90% of the commercial landings. The latter, the VA LL, comprises sets from an intermittent summer longline survey from 1974 through 2004 confined to a small area off Virginia.

The BLOP data for 1248 observed sets were used to develop a catch-rate index at SEDAR 11, but the size and sex composition of the catch was not made available at SEDAR 11. The VA LL data were presented to SEDAR 11 in summarized form with no detailed information. NMFS standardized the series after the Data Workshop ended using the limited data provided that did not include age, size or sex. Through the cooperation of NMFS and University of Florida, we were provided with extracted BLOP data that includes length and sex and reproductive state information, general location (we were not given precise locations for the sets because of confidentiality concerns) and some environmental information. For the VA LL series, we do not have the data set available to SEDAR 11. The Principal Investigator for the VA LL survey declined to provide age, size or sex information until he has analyzed and published his 30-years of data.

The BLOP data set is useful for several reasons:
1. It is arguably representative of about 90% of the commercial catch of sandbar (but see bullet 3).
2. It provides length and sex information on all sandbar taken including discards (which were few) and should be a reasonably unbiased sample of the commercial catch.
3. It covers the South Atlantic Region and the eastern Gulf of Mexico Region (where most of the sandbar catch occurs). This is most of the range of the fishery. It does not include the North Atlantic Region.
4. It covers all months when fishing is allowed.

The VA LL data set includes information from 637 bottom longline sets beginning in 1973 and running through 2004. No sets were made in some years. The number of sets in any year varied from 3 to 47. There were 371 sets made between 1995 (none in 1994) and 2004, the same period covered by the BLOP data; however, the two areas do not overlap.
The standardized index used in the assessment was done after the Data Workshop and the procedure omitted the years prior to 1981. The index is not size or age specific, but assumes that the selectivity curve used for the commercial fishery should apply.

In addition to the above data sets, we received a copy of the State-Space Age-Structured Production Model (SPASM) from Dr. Liz Brooks, NMFS, and we will refer to several SEDAR 11 documents.

Analyses and Results

1. **BLOP Data**

[1] A.k.a. PLLOP and Commercial Shark Fishery Observer Program (CSFOP).

Length frequency samples.

The BLOP data set contains length measurements on 21,031 individual sandbar sharks. The distribution of the sample lengths by sex is shown below (Fig.1).

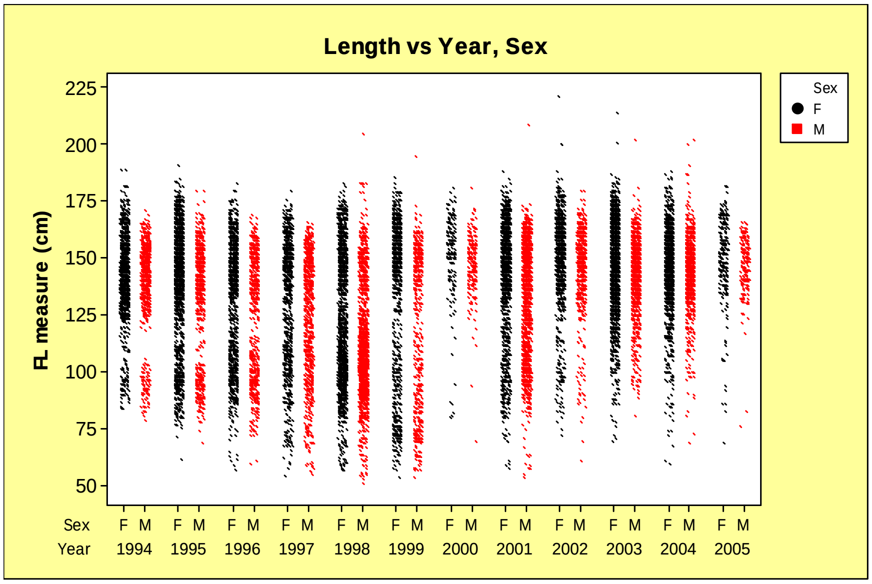


Figure 1. Lengths of individual sandbar sharks taken during Bottom Longline Observer Program trips

These 21,031 length frequency samples are important for two reasons. The allowed us to look for changes in the size (age) composition of the population over 12-years of exploitation, and they provide an indication of the pattern of selectivity of the bottom longline gear.

Change in age composition.

The average age (size) in a population of fish under exploitation is expected to decrease. This is particularly true for populations of long lived fish like sandbar.

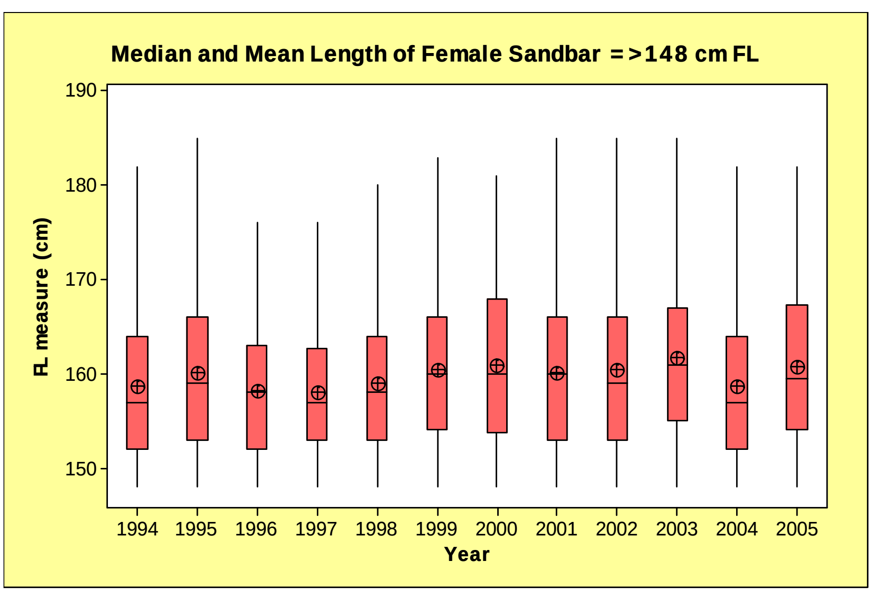


Figure 2. Median length mature females; means are indicated by circled cross symbol

The SPASM Model predicts a 45-percent decline in spawning biomass over these years, which should be reflected by a decrease in the average age of spawners (taken as >148 cm Fork Length). The BLOP data on the other hand indicate a stable size or slight increase in average size (Fig. 2) over the period. How this should be interpreted is arguable, but if size at age is constant as the model assumes the observed data are at variance with the model prediction.

Selectivity.

Converting lengths to ages using a von Bertalanffy equation (Sminkey and Musick, 1995) gives the distribution for the BLOP catches shown in Figure 3.

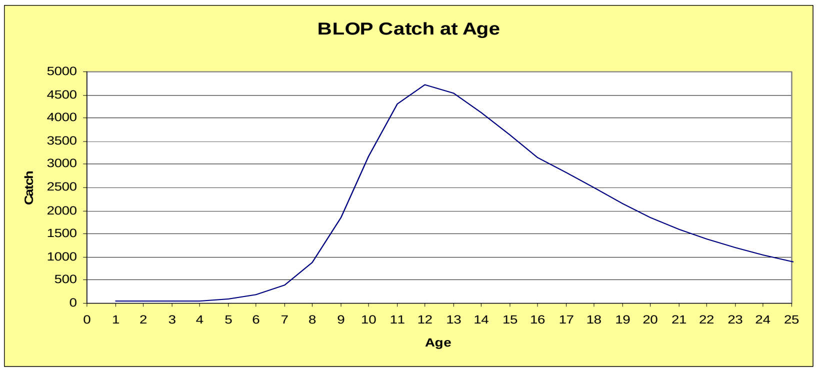


Figure 3. Sandbar catch at age from the observed "commercial" catch.

SEDAR 11 developed a series of curves believed representative of the selectivities in various sectors (fleets) of the fishery. These are reproduced in Figure 4a below. A revised selectivity curve is shown in Figure 4b.

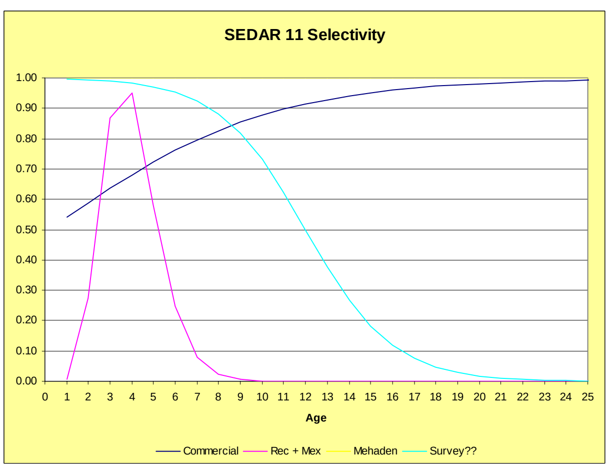


Figure 4a. The four selectivity curves used for the 2006 assessment.

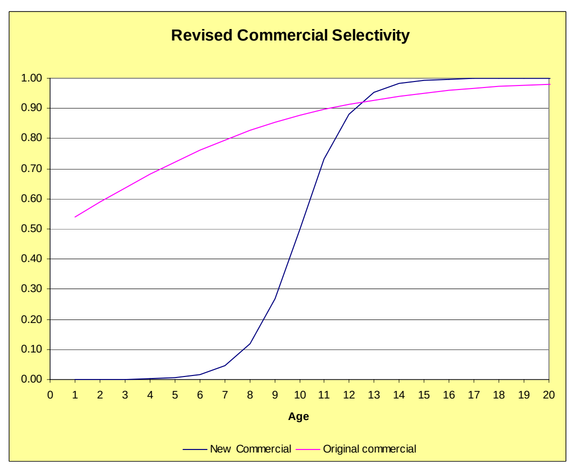


Figure 4b. The SEDAR 11 commercial selectivity curve and the BLOP based commercial curve

The plot indicates that juvenile sandbar sharks are less vulnerable to the commercial gear than was assumed by the SEDAR 11workshop.

Time and area differences.

The catch-at-age and selectivity patterns estimated in Figures 3 and 4b were derived using all BLOP observations combined. For the BLOP program, fishing takes place in three Regions (not the same as the three Regions used by the HMS management plan). The BLOP Mid-Atlantic Bight Region does not extend north into Virginia and there were few sets made north of 37° N. The HMS North Atlantic Region begins off

Virginia, so that the HMS South Atlantic Region comprises both the BLOP Mid-Atlantic Bight Region and the BLOP South Atlantic Region.

The BLOP data set include information by region and date. There are significant differences in average size among regions and seasons. These are shown in Figure 5, suggesting that a single selectivity may not be appropriate for all regions and seasons. In particular, season one in the mid Atlantic bight catches smaller individuals. This region is closest to the area used for the VA LL survey and indicates that the selectivity for the VA LL survey may also be different from the commercial selectivity used in the model.

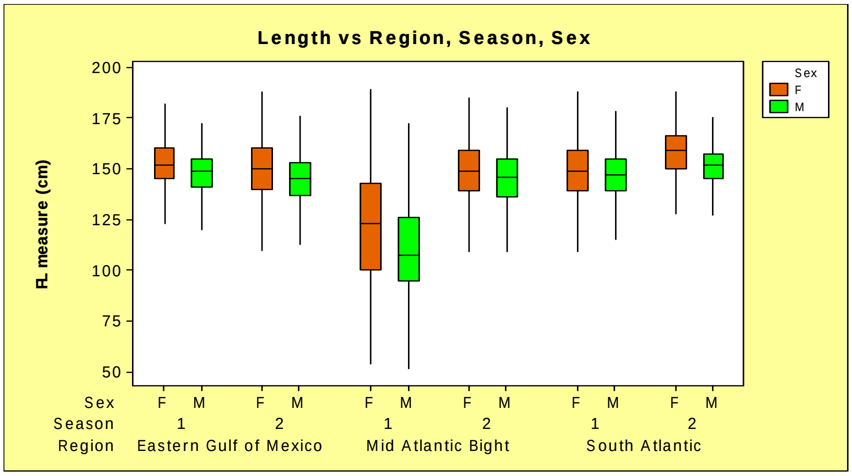


Figure 5. Median size by BLOP Region, Season 1 = Jan-Jun, 2 = July-Dec, and sex

<u>Sex ratio differences.</u>

Figure 6 indicates that bottom longline gear is selective of females. The overall ratio from the BLOP is 1:1.31 male to female. Whether this reflects a true sex ratio difference in the population or a targeting and/or segregation by sex deserves further investigation.

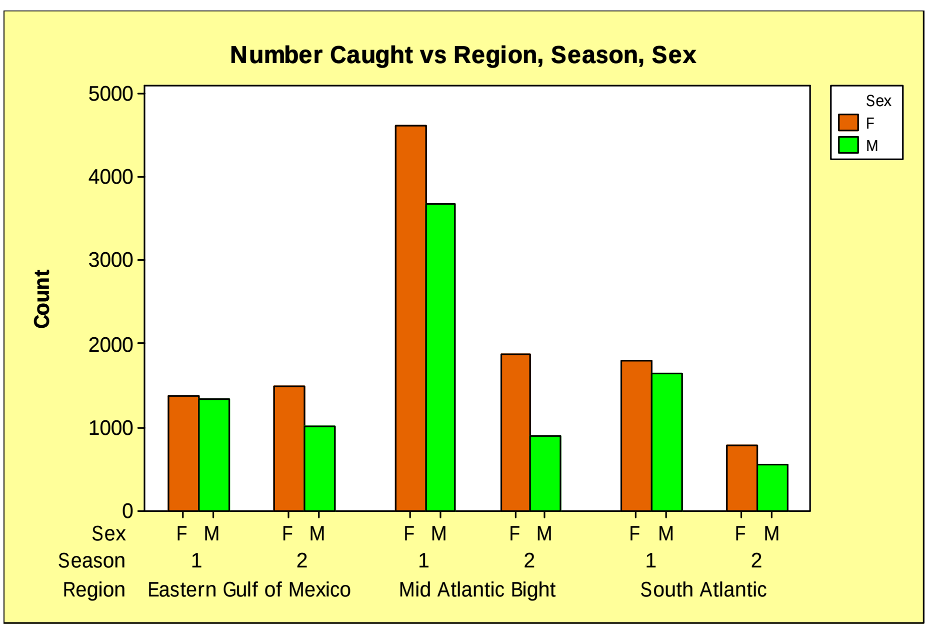


Figure 6. BLOP catches showing a preponderance of females, especially in the Mid-Atlantic Bight

2. SPASM Model

In this section, we will look at the modeling and consider how some changes in the inputs effect the perception of the status of the sandbar stock, as well as look briefly at the model itself. The model of interest for the sandbar assessment is Shark_SPASM.

"This model is [with some modification] the model used in the 2002 Large Coastal Shark was a state space, age structured production model (SSASPM, Porch 2002). Unlike a production model, the SSASPM can incorporate age-specific differences in model parameters such as growth, fecundity, and gear vulnerability (selectivity). In the case of long-lived, late-maturing fish or when there are multiple fisheries that exploit different age classes, having the flexibility to incorporate age-specific information could lead to a better fit to observed data. Age specific vectors for fecundity, maturity, and selectivity are specified by the user, and length and weight at age are calculated within the model based on user-specified growth functions. Natural mortality at age and a stock recruitment function are additional model parameters. The stock recruit function is parameterized in terms of virgin recruitment (R0) and pup survival. To derive the initial age structure for the first year that data is available, the model estimates a level of historic fishing (Fhist) and calculates the corresponding equilibrium population age structure. A historic selectivity vector is specified by the user, which is multiplied by Fhist to arrive at the historic age-specific fishing mortality rate. A historic selectivity vector of 1 for all ages was assumed.

"Continuity Model Inputs

"*Data*

"Data inputted to the model included maturity at age, fecundity at age (pups per mature female), spawning season, catches, indices, and selectivity functions …. Catches were made by the commercial sector, the recreational sector, and the Mexican fishery. In addition, unreported commercial catches were estimated, as were menhaden discards. Because of similar selectivity functions, the commercial and unreported catches were combined, and recreational catches were combined with Mexican catches, yielding a model with 3 distinct "fleets". A total of 13 indices were made available after the data workshop. The "DEL age 0" index was not used, as this model began with age class 1, which means that the stock recruitment relationship governed the number of one year olds to survive from the initial number of pups produced in a given year. Catch data begin in 1981, while the earliest data for the indices is 1975 (VA-LL). The missing catch for years 1975-1980 was treated several ways: the model estimated the missing catch; the missing catch was filled in with either the series-specific average, or series-specific assumptions were made….

"*Parameters*

"Estimated model parameters were pup survival, natural mortality (ages 1+), virgin recruitment (R0), catchabilities associated with catches and indices, and fleet-specific effort. In some models, a level of historic fishing (F_{hist}) was estimated, while other models fixed this parameter at 0 (assumes virgin conditions in 1975)."

(Quoted from SEDAR11-AW-03)

We investigated the sensitivity of the stock assessment model's results to assumptions about 1) the catch data, 2) the indexes, and 3) the mechanics of the model with the assumed biological parameter such as natural mortality (M) and fecundity,. The catches are of two sorts, the level of historical fishing and the estimated catches for which there are data. However, it quickly became apparent that this would be too large a task for this type of report, and instead will highlight a few examples that will indicate where there appear to be problems that need to be addressed.

i. Catch data As set forth in Liz's explanation of Shark_SPASM, the catch data comes in two parts, the historic catch that the model estimates, and the recorded catches starting in 1981. The catch before 1981 was assumed while from 1981 on it was based on estimates (recreational surveys of catch) or from recorded landings (commercial). The historic catch is estimated from the model. The recorded catches are for several sectors: commercial, recreational, scientific, Mexico, menhaden by catch, and discards. Most are estimated from sample data and dealers' reports.

The commercial catches are probably as good as can be had, but the recent discovery that there was major problem with the recording of the dealers' landing reports may result in some modifications of the estimates for the past few years.

There is no reason at this time to expect that adjustments can be made to catches for the other five sectors. The recreational catches are known to be highly uncertain, and should be subjected to more extensive sensitivity runs than has been the case. The other catch estimates are relatively minor in numbers and any changes unlikely to have any significant effect on the assessment.

Although recorded catches are assumed to begin in 1981, the model base case result (Fig. 7) assumes the stock biomass was virgin in 1975 because the first year for which there was an indexing value (the Virginia Longline or VA LL) was said to be 1975. However, when the VA LL index was standardized for SEDAR 11 to use in the model it was found that the earlier years lacked the information needed for the standardization. This complicated the modeling, as the first year having a standardized index now was 1981and, since F_{hist} was assumed to end with 1975, some way had to be found to bridge the gap to 1981.

For modeling the stock from 1975 to 1981, catch information was used from 1975 to 1981. This was estimated assuming that the recreational catches were zero in 1975 and increased linearly from 0 in 1975 to the estimated number in 1981and that the commercial catches were as in 1981. The slow decline in SSB/B0 between 1975 and 1981 shown in Figure 7 results from the recreational catches, which are the only appreciable catches assumed. Catch is the only thing that makes this model decline as there is no annual random variation in recruitment (and no catch-at-age data to estimate it). Recreational catch is believed to target young sharks and therefore some time must elapse before the effect of taking young fish shows up in the biomass of older fish. The commercial fishery, which targets larger fish, begins in the mid-1980's and, combined with the effect of the removals of the younger fish earlier on, is followed by an immediate and more rapid decline in SSB/B0 reaching a depletion level of 0.31 in 2004.

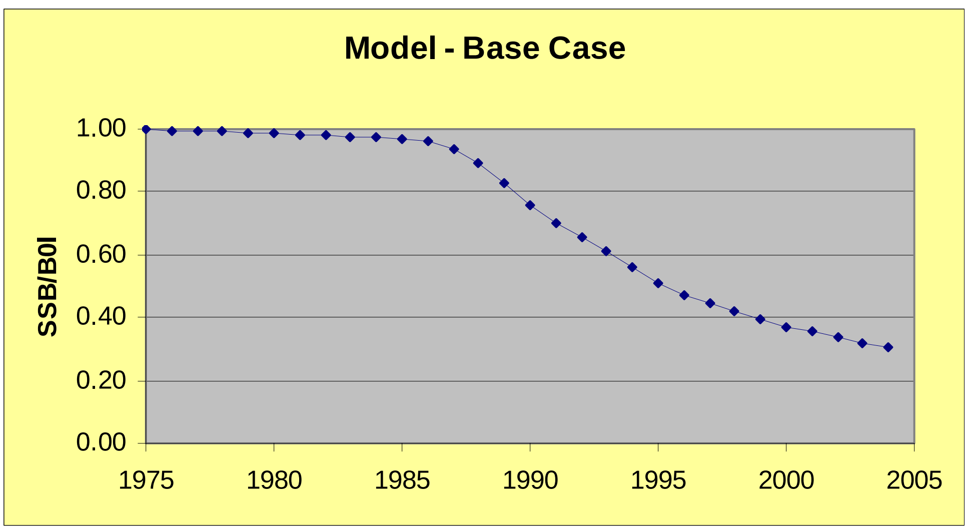


Figure 7. Trajectory for Model Base Case.

<u>ii. Indices</u> The eight indices used in the model are plotted in Figure 8 along with trajectory for the ratio of the Spawning Stock Biomass each year to Virgin Spawning Stock Biomass in 1975 (SSB/B0). The VA LL index, with some years missing, begins with 1981. The second longest time-series index is the Large Pelagic Survey index for recreational catch, which starts in 1985. The other indices start in 1993 when regulations for LCS first were implemented, and include indices from the commercial fishery.

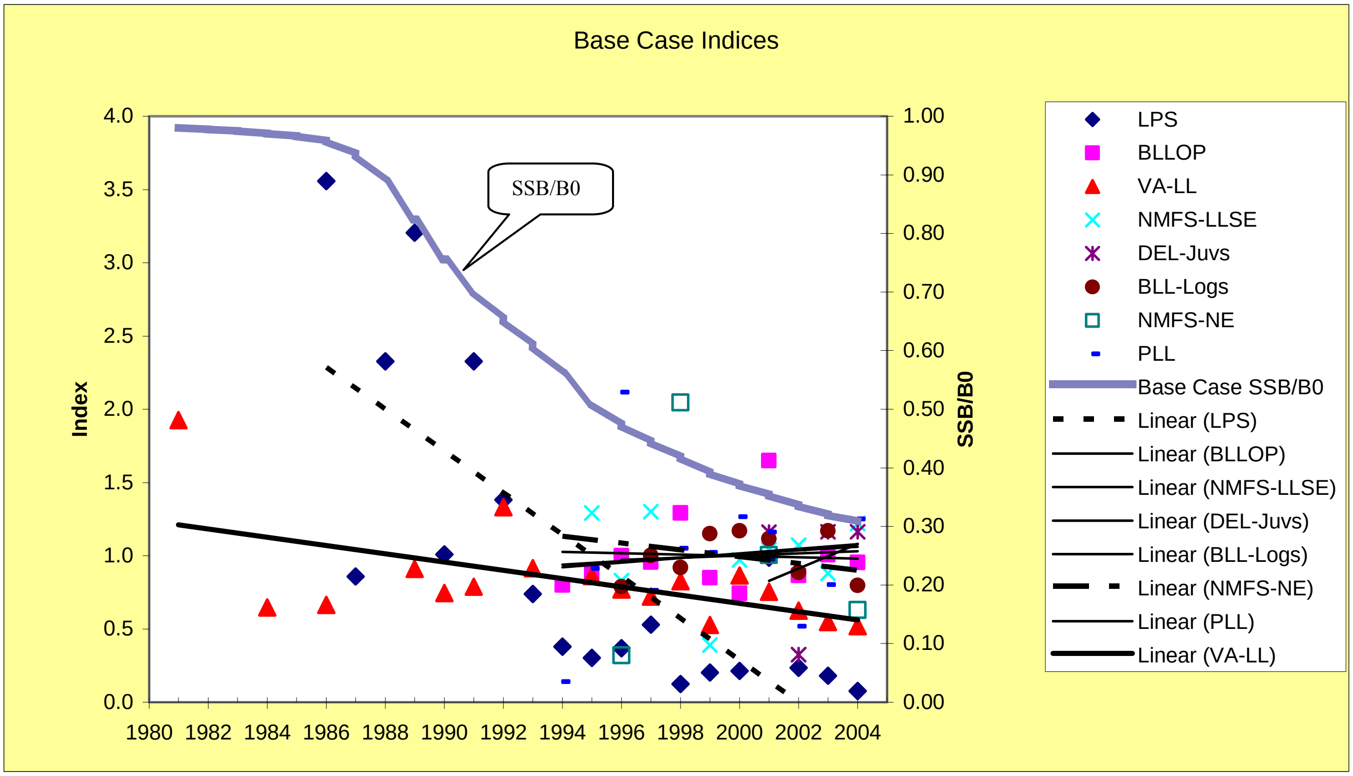
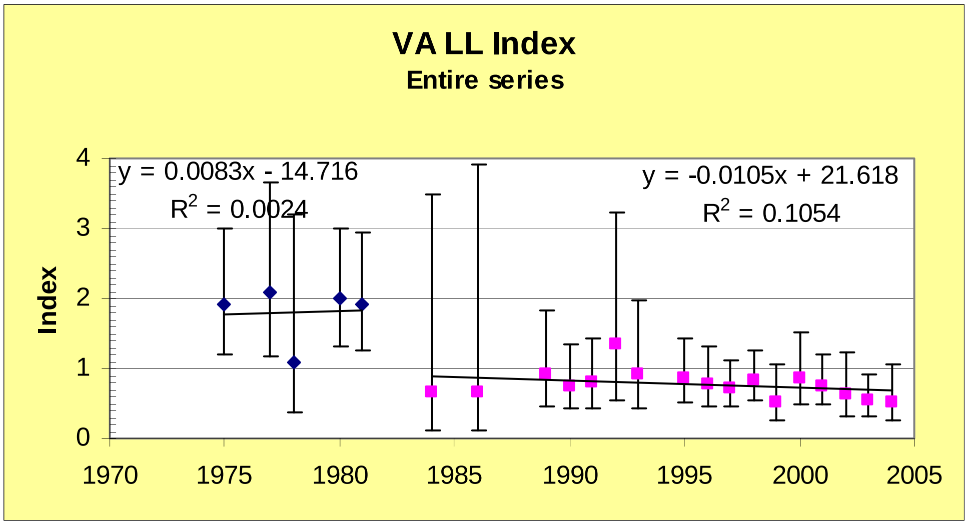


Figure 8. The eight base case indices plotted and showing their liner trends with the trajectory of the ratio of the spawning stock biomass to the virgin spawning stock biomass (SSB/B0) shown for comparison.

For the Base case, all indices are given equal weight in the analysis. This means that any index in which the points may have a trend, even though the variability (CV's or standard deviations) are very large, and the trend or slope is statistically not different from zero, will be seen by the model to be as good as an index that may have a statistically significant slope. The result is that a "bad" index (large CV) such as the LPS or NMFS NE is given equal weight to a "good" index such as the BLL-Logs.

Another problem with some indices is that they are not consistent throughout their lives. The assumption is that an index is proportional to stock abundance over time and that other factors such as fishing methods, area fished, environment, regulations, etc., remain constant or can be controlled in the course of standardizing the index. This may not be true, yet the index may be used even when some factor other than abundance is known to have changed over the course of time, as is the case with the LPS and, perhaps the VA LL.

The nominal trends for the VA LL, the LPS and the NMFS NE indices all are negative and roughly, in agreement with the biomass trajectory, which is not surprising since the trajectory is, in part, determined by the indices. Beginning with the VA LL, figures 9a and 9b show that the series consists of two parts that are essentially without a trend, an early period from 1975 through 1981, and a recent period from 1984 to present. The Index value for the early period 1975-1981 is roughly twice that for the recent period 1984-2004. The index used for SEDAR 11 omits all the years of the early part and begins with the final year 1981. Combining 1981 with the recent years causes the index o develop a negative slope that, though not statistically different from zero (flat), is perceived in the model to indicate a decline in abundance over the entire period 1981 to 2004. Why there is a difference in index level between two periods is unclear. We lack the data on size (age) and sex of the fish that might answer the question.



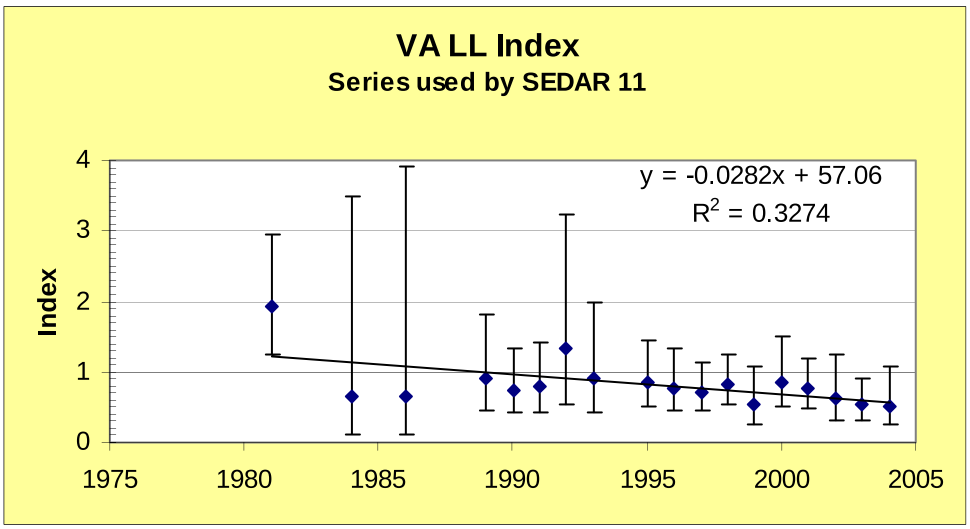


Figure 9a (top) and 9b (below). The Virginia Longline Index with trend line(s) and 95% C.I. None of the trend lines shown has a slope that differs from zero. Note that the full series beginning in 1975 appears to have an early part and a late part. The trend for each part is statistically flat. SEDAR 11, by beginning the series with 1981, produces a combined series with the 1981 point giving a larger (though still not significant) negative slope to the linear trend for the index.

The LPS index (Figure 10) has the same difficulty as the VA LL index in that it consists of two periods with high values in the early period and lower values in the recent period and addition problem that it has a very high degree of uncertainty associated with the second (recent) period. However, in the case of the LPS index we know a bit more about why the early period differs from the recent period. The LPS Index is for recreational catches off the NE Atlantic coast. The selectivity for this index was assumed the same as for the commercial catch, but no age or size information was available to confirm this supposition. This index has been used in previous assessments, but each time it was split into two indices: 1986-92 and 1993 to most recent year available. This was in recognition of the fact that the sportfishing regulations (size and bag limit) that went into effect in 1993 changed the way this fishery operated. One of us argued during SEDAR 11 DW that this should continue to be the case, or the index should not be included in the base case. That argument was dismissed out of hand. **We emphasize here that it is important to note that the LPS index is clearly two essentially flat indexes (slopes do not differ from zero), and to use the entire series to establish a trend that receives equal weighting in the assessment is not scientifically defensible.**

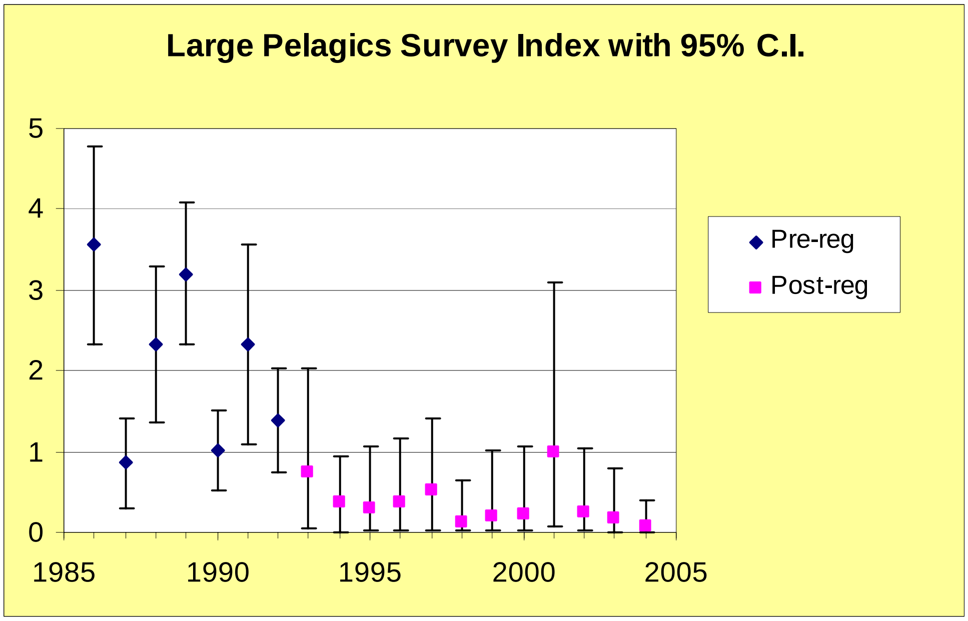


Figure 10. LPS index divided into to periods: Pre- and Post implementation of angling bag limit for Large Coastal Sharks that began in 1993. A reduced bag limit and size restrictions were added in 1999. The trend for the entire combined series is negative and significant, whereas the trends for the two separate periods are not different from zero.

The third index the NMFS-NE is a different matter (Figure 11). It is a puzzle why this index was selected as a Base Case index other than it has a negative slope when given equal weight. It has such enormous coefficients of variation that it is takes a leap of faith to accept that it contains any reliable or useful information about stock abundance. We believe that there is no valid reason to include it even as a sensitivity index.

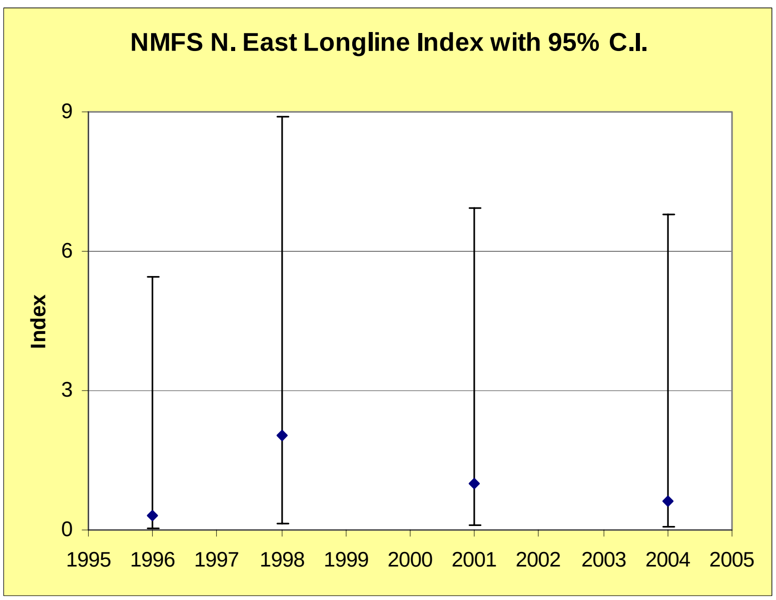


Figure 11. NMFS-NE longline index. The question is why an index with only four points and such an extreme range of uncertainty was included in the Base Case analysis. The index has no statistical trend other than zero, but when given equal weight in the assessment has considerable influence on the outcome. NMFS-NE index should not have been included as a base case index. Aside from the fact that there are only four observations, the enormous CV's should have precluded its use even as a sensitivity index.

The VA LL index may or may not be usable when and if it is properly standardized. As with the LPS and NMFS NE it samples only a fraction of the sandbar stock during the summertime when some fish have moved north to the Atlantic pupping grounds; however, large summer catches occur in waters south of Cape Hatteras and in the Gulf of Mexico at this time, thus these indices sample only a fraction of the population. None of these indices sample the areas where the majority of the fish are located and how representative these samples are of the population needs to be determined. Second, the VA LL index has in the course of sampling collected size and sex information. So far, the author has refused to make this information available. Thus, it impossible to know what size or sex selectivity to apply to the series – what segment of the population it is monitoring – a flaw with the LPS data as well. Until that information is provided, the use of this index should be restricted to a sensitivity run.

The remaining five indices are plotted in Figure 12. Three are from the commercial fishery, sample the entire range of the fishery, and begin when mandated by LCS Fishery Management Plan in 1994. What is of interest is the fact that all five indices are stable or have a positive trend over the ten-year period, whereas the model predicts the spawning stock has declined over 40-percent. **The inconsistency between the model prediction and the stable or increasing trend in abundance indicated by the five indices taken together with the failure for the average age of the catch to decline should have been a red flag to the CIE that the model has a problem that has to be corrected.**

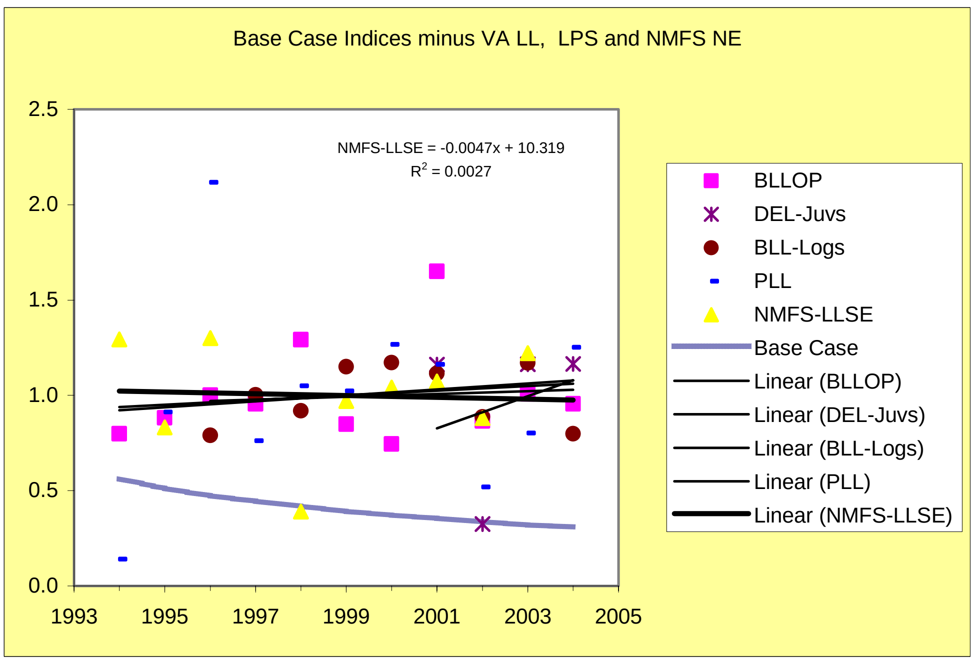


Figure 12. The five base case indices plotted and showing their liner trends with the trajectory of the ratio of the spawning stock biomass to the virgin spawning stock biomass (SSB/B0) shown for comparison. Note that one, NMFS-SE, has a very slight and non-significant negative slope.

ii (a) Testing the indices. In an assessment model, the indices establish a trend in abundance, which together with the catches and the workings in the model estimate the present condition of the stock. How much influence the indices have depends in part on the model. We tried several combinations of the indices to see how the output of the model changed depending on the combinations we selected. The different trajectories for SSB/B0 are shown in Figure 13.

ii (a) (1) Base Case and ii (a) (2) No VA LL The first trajectory to locate is the base case trajectory. If Figure 10 is not in color, the easiest way to identify the different trajectories will be to look at about the year 1995 and move up vertically. The base case is marked only by open square symbols and these are the second set of symbols from the bottom. What makes them difficult is that when we plotted the trajectory with The VA LL index heavily down weighted (the line labeled No VA LL) the trajectories are nearly identical with the base case, and the square symbols appear to be part the No VA LL curve. The final output levels for both trajectories is 31-pecent of the virgin spawning biomass This result was surprising as in past assessments the VA LL index alone had a major impact on the perception of the status of the stock. However, the re-standardization of the index done this year combined with omitting the years prior to 1981 resulted in a less steep decline than in the past. With this assessment, down weighting this index alone has essentially no effect on the model outcome.

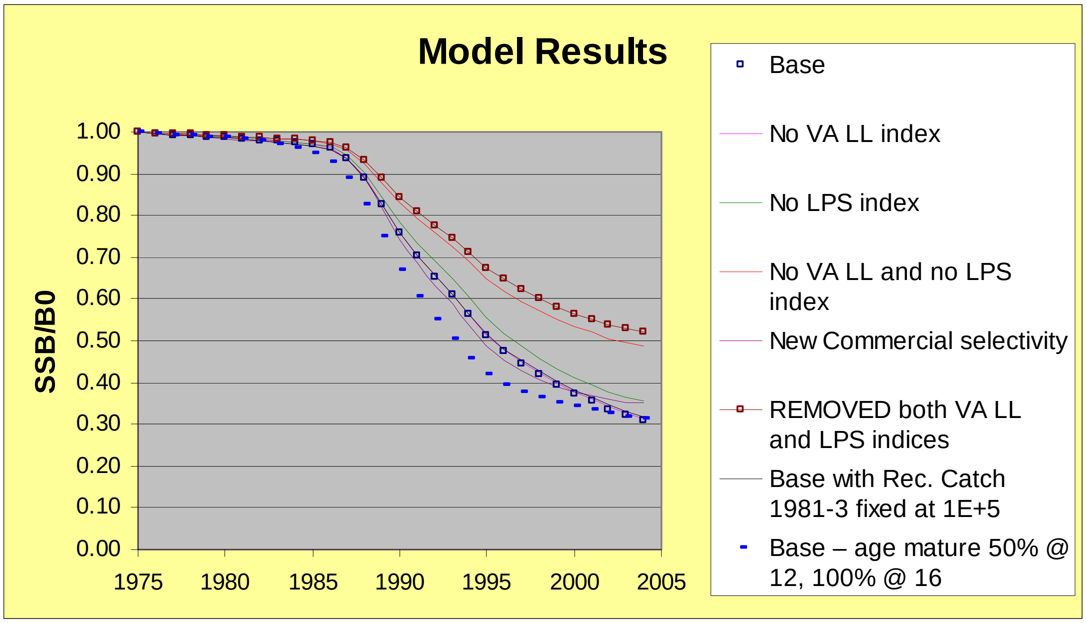


Figure 13. Experiments with the indices. See text for explanation of trajectories.

ii (a) (3) No LPS Our next experiment was to heavily down weight the LPS index. This is about equivalent to using inverse variance weighting for this index. The resulting trajectory appears as the fourth curve up from 1995 as the Base Case and No VA LL appear together as a single line. Down weighting the LPS index results in a more optimistic outcome.

ii (a) (4) No VA LL and No LPS In this experiment, both the VA LL and the LPS indices were heavily down weighted. The resulting curve is the next to the top. The result is much more optimistic, with SSB/B0 near the 50-percnet level although the stock continues to decline. Since the remaining indices are nearly flat in trend, the failure to flatten is likely driven by the biological parameters assumed in the model.

ii (a)(5) remove VA LL and LPS We then re-ran the experiment this time removing these two indices from the data file rather than merely down weighting them. The trajectory is the top curve with the closed square symbols. The final ratio is a bit above the 50-percent level and fishing mortality is less than F_{MSY} – the stock is not overfished and overfishing is not occurring. From a technical standpoint, the difference between this run and run 4 is interesting because it demonstrates that down weighting an index, which is easier to do than removing it form the data input file, is not exactly equivalent to removing it. This is mainly when the index stands alone for the first part of the time series. In the case of the VA LL and LPS they start about a decade before the other indices, therefore the small signal that remains after down weighting the index still affect the model.

ii(a)(6) Base Case using a different selectivity curve The next experiment we tried was to modify the commercial selectivity curve to be closer to what was observed in the BLOP data base. The trajectory is the second curve from the bottom. Using this selectivity curve results in a slightly more optimistic outlook, and more interesting is that here the trajectory flattens out in the recent years instead of continuing to decline as with the other runs so far. Why this happens is worth further investigation.

ii(a)(7) Base with Rec. Catch 1981-3 fixed at 1E+5 Here we chopped the early recreational catches down to a low level to see how sensitive the model is to what is a very uncertain estimate of catches. The trajectory is essentially the same as with runs 1 and 2 and overlies these two runs. This and the next run were done also by SEDAR 11.

ii(a)(8) Base case with age mature 50% @ 12, 100% @ 16 The last run in this series of experiments looks for the effect of using a young age at maturity ogive. A similar run was done by SEDAR 11and in both cases the final depletion level is the same as with the Base Case. However, we need to point out that the trajectory, which was not plotted by SEDAR 11 (this is the bottom line in the figure) shows a steeper decline than the Base Case followed by a leveling off in the last years. As the leveling off implies, fishing mortally is lower (by about half) in the terminal year than in the Base Case.

The resulting reference points for these runs are given in Table 2 along with runs 9 through 12 that are not plotted in Figure 13.

Case	SSB_{2004}/SSB_{virgin}	SSB_{2004}	F_{2004}/F_{MSY}	Pup survival	Steepness
1. Base Case – files received from Liz Brooks	0.31	428,000	3.72	0.62	0.32
2. Base down wt. VA LL	0.31	435,000	3.69	0.62	0.32
3. Base down wt. LPS	0.36	570,000	1.41	0.98	0.42
4. Base down wt. VA LL and LPS	0.49	936,000	0.98	0.97	0.42
5. Base remove both VA LL and LPS	0.52	1,080,000	0.87	0.95	0.42
6. Base with modified commercial selectivity	0.35	796,000	2.46	0.68	0.34
7. Base with Rec. Catch 1981-3 fixed at 1E+5	0.32	424,000	3.52	0.65	0.33
8. Base – age mature 50% @ 12, 100% @ 16	0.31	678,000	1.76	0.57	0.41
9. Base down wt. LPS, NMFS-NE, and VALL	0.67	1,011,000	0.92	0.97	0.42
10. As in 9 with the modified maturity	0.51	1,525,000	0.55	0.93	0.53
11. Base (1) with modified maturity and commercial selectivity	0.45	1,616,000	0.94	0.69	0.46
12. As 10 with modified commercial selectivity	0.58	2,751,000	0.48	0.85	0.51

Table 1. Reference points from experimental runs for Shark_SPASM

Runs 1 through 5 explore the effect the two long time series indices VA LL and LPS have on the model outcome. As noted above, down weighting the VA LL (2) has slight effect on the outcome whereas down weighting LPS (3) results in a more optimistic outcome with the F ratio and SSB being improved considerably, but accompanied by an estimate of pup survival that is quite high, and an increase in the estimate for steepness. Runs 4 and 5 reduce or remove the effect of both VA LL and LPS from the model and, as previously noted, provide a much more optimistic outcome, but again with a very high estimated pup survival and increased steepness.

To conclude our exploration of the negative indices, we made Run 9 that down weighted NMFS-NE as well as VA LL and LPS. As expected, there is further improvement over the optimistic outcome seem for Run 4. Again, pup survival is estimated to be quite high and steepness increases. We did not try actually removing all three indices, but we anticipate that the result would be an improvement over Run 5 with a lower F ratio and slightly lower estimated pup survival. This run has leaves the model with information mainly from indices that cover the period from 1993 through 2004 and are all essentially flat. (The down weighted indices still have a slight effect.) Thus, the outcome is the result of the catch information, the biological assumptions and the selectivity curves combined with indices that indicate stock abundance has been stable in recent years.

Run 6 investigates the Base Case using a modified commercial selectivity that is based on observational data in the BLOP data set. The outcome is similar to what we got by down weighting the LPS index: the F ratio is improved as is stock size, but with the estimate for pup survival much lower and perhaps more realistic than when LPS was down weighted.

Run 7 investigates the Base Case using a modified recreational catch that reduces the large catches in the early years to a perhaps more believable level. The outcome is slightly more optimistic, but because recreational catches are so poorly accounted, any changes to the data base are speculative. Further exploration and sensitivity runs should be done after examining the origin of the estimated catches, but that was not something we could do at this time.

Run 8 investigates the Base Case using a modified maturity ogive that is based on observational data other than the Merson study used by SEDAR 11. As noted by SEDAR 11 when it made this sensitivity run, the outcome is unchanged with respect to the final biomass ratio. However, the spawning biomass is considerably great – as might be expected since the number of mature animals would be increased by the addition of younger fish – and the F ration is much more optimistic. Pup survival and steepness are acceptable.

We then used the modified maturity ogive in Run 10 that also down weighted the negative indices. The result is very optimistic but pup survival is estimated to be high.

For Run 11 we returned to the Base Case inputs but used both the modified maturity ogive and the modified commercial selectivity. The result is optimistic with F_{2004}/F_{MSY} ratio less than 1.0 and pup survival (0.69) believable.

Run 12, the last we did, down weights the negative indices and uses the modified maturity ogive and commercial selectivity. The result is optimistic and pup survival is arguably acceptable. In this run and five other runs the stock is not overfished and/or overfishing is not occurring. In ten of the twelve cases examined, the model estimates that steepness lies outside the bounds (0.2 to 0.4) set by SEDAR 11 but there are no quantitative data to support this range. Density dependence response is presumed to exist for SB, perhaps mediated through a change in age at maturity and a lowering of natural mortality for both adults and pups, and the biological basis for fixing the upper bound for steepness at 0.4 needs to be examined.

iii. The Model

The CIE has this to say about the model: "Ultimately, the methods used for estimating stock status were found to have been much more sensitive to assumptions about life history parameters than the catch and catch-rate data used in the model.

"Size and maturity stage information was reported as being collected from the VIMS longline and some of the other series, but those data were not supplied to the stock assessment scientists. Given that the VIMS survey was a designed fishery-independent survey, it would have been helpful to have the size information to see if the component of the population that it was monitoring had been changing over time.

"An age-structured population model with state-space dynamics for some of the components and prior distributions assigned to some of the parameters was fitted to the data. No age data were used in the model, and the age structure was used mainly to incorporate different natural mortalities- and selectivities-at-age for the different fisheries (i.e. commercial, recreational, bycatch in menhaden fishery). Catch-rate indices were assumed proportional to population size, albeit with series-specific catchabilities and selection curves dependent upon whether they were commercial- or recreational-fishery-dependent, or fishery-independent series.

"The model adequately incorporated the information from the available catch-rate indices and was the best available for the data provided. However, while catch-rate indices can inform on trends, they do not necessarily help generate understanding of the life history patterns that underpin stock status estimation. Pup survival was the only life history parameter to be estimated in the model, and other parameters such as natural mortality-at-age and the prior mode for pup survival had to be adjusted so that the steepness parameter remained within a reasonable range for the species."

We have covered some of these comments above. The CIE comment about the failure to use age data in the model deserves additional comment in that the model in its present form cannot incorporated size data except indirectly[2], and then it got it wrong in the case of the selectivity curve. There are other stock assessment models

[2] Size has to be converted to age, which was done using a von Bertalanffy equation.

available that are able to use size data directly, and it would be useful to employ one or more along with the corrections to the indices and compare results.

The CIE also notes: "Ultimately, the methods used for estimating stock status were found to have been much more sensitive to assumptions about life history parameters than the catch and catch-rate data used in the model." This is a very serious defect. The use of biological parameters in the modeling would be quite useful if these parameters were estimated from data. In practice, only the average number of pups and age at maturity were based on sample data. The former comes from several studies and is consistent with the BLOP data. The age at maturity study, however, is seriously flawed. The animals were not aged, rather length was estimated using a von Bertalanffy equation that may not be correct, and in any event introduces a second source of error that was not accounted for. There is evidence that age at maturity has decreased in recent years. Unfortunately, the study material was discarded, and there is no way to redo the work except collect new specimens.

The other biological parameters used by the model are natural mortality M, pup survival and steepness. Pup survival is estimated by the model, which is a circular process, or fixed by the modeler, which in subjective. The values for M that were decided by SEDAR 11 BW were changed for the final assessment. Steepness was likewise manipulated in order to achieve a credible model output. The fact that these parameters were derived subjectively is disturbing as these are the assumptions the CIE point to as being more influential on the estimate of the status of the stock than are catch and catch-rate data.

3. **Projections**

We did not explore the projections. The future status of the stock is dependent upon the biological parameters, particularly the maturity ogive. Further work needs to be done to include the additional size/age at maturity information and to resolve the inconsistencies in the model results before projections may make sense. In particular, the biological parameters have to be carefully re-examined as they alone control the modeling for the future condition of the stock. Projections need to consider density dependent effects on age (size) at maturity, fecundity and natural mortality. Projections that do not recognize the variability of environmental conditions on growth rate and species interactions such as predation on pups will be misleading over the long term.

4. Conclusions and recommendations

To sum up our conclusions:

- ***The assessment proceeded without using the largest data set available, the BLOP data, which inter alia shows that average age of the catch has not declined over time, as it should if the stock were being overfished.***

- ***The BLOP data also show that the selectivity curve used for the commercial catch is wrong and needs to be re-examined.***

- ***Catch-rates for recent years remain level indicating a population in equilibrium; overfishing is not occurring, whereas the model trajectory indicates a continuing decline in abundance.***

- ***The assessment used several catch-rate series (LPS and NMFS – NE) that were either inappropriate, or did not include the available (but withheld) size and sex data (VA LL).***

- ***The age-at-maturity ogive was derived from a study that is technically flawed.***

- ***The biological parameters used in the model were selected subjectively and there may be some evidence that different values are more appropriate.***

The problem now is that NMFS has used this technically flawed assessment to make the formal finding that the stock is overfished and overfishing is occurring. This starts a legal process that may require a severe reduction in TAC. There is time yet to revisit the assessment before that reduction is in place if NMFS is willing to devote the effort and address most of the concerns the CIE and we have raised. Redoing the maturity ogive study may not fit into this period, but the other work could be done a matter of months.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
1315 East-West Highway
Silver Spring, Maryland 20910

THE DIRECTOR

Mr. Russell Hudson
Directed Shark Fisheries, Inc.
P.O. Box 11604
Daytona Beach, Florida 32120-1604

JUL 13 2007

Dear Mr. Hudson:

Thank you for your report entitled "Report to Directed Shark Fisheries, Inc. on the 2006 SEDAR 11 Assessment for Sandbar Shark." This document was received by NOAA's National Marine Fisheries Service (NMFS) during the scoping period for an Amendment to the Consolidated Highly Migratory Species (HMS) Fishery Management Plan (FMP). This amendment will implement shark management measures consistent with recent stock assessments.

Based on the February 12, 2003, request of the industry, environmentalists, and academics to improve shark stock assessments, NMFS conducted the 2005/2006 Large Coastal Sharks stock assessment under the Southeast Data, Assessment, and Review (SEDAR) process. This is the same process used by the South Atlantic, Gulf of Mexico, and Caribbean Fishery Management Councils. At all stages, industry, environmentalists, and other interested parties were invited to participate in the process. NMFS believes that the latest stock assessment for sandbar sharks constitutes the best available science.

During the review workshop held June 5-9, 2006, the panel selected by the Center for Independent Experts found that the data and the models employed during the data and assessment workshops, respectively, were the best currently available for evaluating the stock status of sandbar sharks. Your specific concerns regarding which data sets were used in the assessment, selectivity curves employed, appropriateness of catch series included, the age-at-maturity ogive for sandbar sharks, and the selection of biological parameters are addressed in greater detail in the enclosure.

The stock assessment continues to represent the best available science as indicated by independent stock assessment specialists. NMFS is developing proposed management measures consistent with the results of the assessment. There will be additional opportunity for public comments when the proposed rule and draft Environmental Impact Statement for Amendment 2 to the Consolidated HMS FMP are released.

I appreciate your continued involvement in shark management.

Sincerely,

William T. Hogarth, Ph.D.

Enclosure

cc: Dr. Frank Hester
Dr. Mark Maunder

THE ASSISTANT ADMINISTRATOR
FOR FISHERIES

SCIENTIFIC REVIEW OF HESTER AND MAUNDER'S "REPORT TO DIRECTED SHARK FISHERIES, INC. ON THE SEDAR 11 ASSESSMENT FOR SANDBAR SHARK" (2007)

In this section, the Agency addresses each of the bulleted points listed in the report by Hester and Maunder entitled "Report to Directed Shark Fisheries, Inc. on the 2006 SEDAR 11 Assessment for Sandbar Shark" (2007).

- ***1. The assessment proceeded without using the largest data set available, the BLLOP data, which inter alia shows that average age of the catch has not declined over time, as it should if the stock were being overfished.***

This is incorrect. The Bottom Longline Observer Program (BLLOP) data was used in several places during the assessment:

1) Annual average weights from the BLLOP were used to transform commercial landed weights into numbers;
2) An index of relative abundance for the period 1994-2004 was produced; and,
3) Along with other datasets, the BLLOP was used to develop the commercial gear selectivity.

Note that only lengths, not ages, are available from the BLLOP. In the Hester and Maunder (2007) report, length is converted to age using a growth curve from Sminkey and Musick (1995). A lack of declining trend in size through time may be attributed to the fact that the directed bottom-longline shark fishery targets large individuals. While the BLLOP samples the directed bottom-longline shark fishery, one must keep in mind several caveats: the program covers approximately five percent of fishing trips, it was voluntary until 2002, and it is not a fishery-independent index. Fishery independent data is more effective at sampling a larger range of size classes and, therefore discerning trends in size, because any animal that is available to the gear has an equal likelihood of being sampled. Fishery dependent data represents fishermen targeting larger specimens for their greater fin value. Furthermore, fishery-independent data samples random or semi-random locations, whereas, fishermen generally only deploy gear where they have a higher likelihood of catching sharks.

The statement that the average age of a population is expected to decrease under exploitation is true only with qualifiers. For instance, if all ages are fully selected, then exploitation removes the same fraction from each age class over time, so that they are still in relatively the same proportion to each other. In the 2006 assessment, the average age in 1975 is 10.91 yr, and it drops to 9.63 yr in 2004. Over the years presented in their size analysis (1994-2005), the assessment results show that the average age decreased from 9.92 to 9.63 yr. As the age change is not appreciable, it is not surprising that Hester and Maunder (2007) do not find a decreasing trend in their analysis of length trends over years.

Hester and Maunder (2007) further state that the reviewers stopped short of "comparing the model results with actual information from the fishery." Fishery information is included in the assessment in a variety of forms (observer program information, landings, catch), and as such, the model results include fishery information.

Hester and Maunder (2007) indicate that size and sex composition from the BLLOP was not made available at SEDAR 11. This is not entirely correct. The size composition (length-frequency distributions by year and area as well as average length and weight by year) of the catch in the BLLOP was presented in document LCS05/06-DW-16 (Cortes and Neer 2005). Sex information was not presented as the models are not sex-specific. The assessment model assumes males and females are selected by the fishery with equal probability. If there were a sex ratio difference in targeting (biased towards females), this would lead to a greater depletion of mature females than is currently estimated by the model.

Figure 1 in the Hester and Maunder (2007) report, is summarized over all areas, and presumably is intended to support the fact that there was no change in the size composition of the population over the period spanning 1994-2005. However, it is clear from Figures 5 and 6 in the Hester and Maunder report that the size distribution and catch distribution vary by geographic area. Specifically, almost twice as many samples are available from the Mid Atlantic Bight than from the Eastern Gulf of Mexico or the South Atlantic, and the median size and range of sizes is much smaller in the Mid Atlantic Bight. This seems to indicate that the area with the most fishing (Mid Atlantic Bight) has a smaller size composition than areas with less fishing (Eastern Gulf of Mexico, South Atlantic), and likely reflects the impact of fishing on the population.

- ***2. The BLLOP data also show that the selectivity curve used for the commercial catch is wrong and needs to be re-examined.***

As mentioned above, the authors used a growth curve to convert the BLLOP length data to age, and then generated a "catch-at-age" curve for those data. While the BLLOP curve developed differs in shape from what was used in the assessment, the selectivity curve used for the BLLOP was termed "commercial+unreported" catch in the Hester and Maunder (2007) report. It was applied to various gears, not only bottom longline, and was used for a variety of indices (LPS, BLLOP, BLL-logbook, VA LL, PC Gillnet, NMFS LL NE, NMFS LL SE, and Pelagic Logbook). The Catch Working Group at the Data Workshop (in which industry members were represented) decided to reflect the fact that younger age classes can also be retained by (and are available to) various gears. No concerns were raised at that time.

It is interesting to note that, according to Figure 4b in the Hester and Maunder (2007) report, the age of full selectivity developed is actually 5-7 years *earlier* than that of the selectivity used in the 2006 assessment (Figure 4a in the Hester and Maunder report), indicating that more, smaller fish would be available and fully selected by the gear than the current model suggests.

- ***3. Catch-rates for recent years remain level indicating a population in equilibrium; overfishing is not occurring, whereas the model trajectory indicates a continuing decline in abundance.***

The Hester and Maunder (2007) report states that commercial landings and catch rates have remained stable for over a decade, and suggest that this is evidence that the stock assessment results do not reflect reality. It is important to remember that catch rate time series in isolation do not tell the whole story. Most catch rate series show stable or unclear trends in recent years (since the mid-1990s), but the large declines occurred in the late 1970s and 1980s (see VA LL, LPS, and MRFSS). In fact, there has been a commercial quota imposed on the fishery since 1993 (for over a decade); stable landings in the last decade most likely reflect the effect of a commercial quota, not of a stable population. Furthermore, commercial catch declined from 162,000 individuals in 1989 to 72,600 individuals in 1993, prior to implementation of the commercial quota.

Hester and Maunder (2007) also state that the 45% decline in spawning biomass "should be reflected by a decrease in the average age of spawners." However, as clearly pointed out in the Assessment Workshop report (p.86, text following eq. 2), spawning biomass is actually pup production, i.e. $SSB = \sum_a N_a mat_a pup_a$, where mat_a is maturity at age and pup_a is pups produced at age. Thus, the 45% decline in spawning biomass reflects a 45% decline in pups produced, not in weight of spawners. Since all mature sandbar sharks are assumed to produce the same number of pups, the age of the shark is irrelevant in this analysis other than determining whether or not an individual is mature. The 45% decline therefore reflects a decline in abundance (numbers) of mature sharks. The corresponding decline in total abundance for the same period (all ages considered) is 32% (N_{2005}/N_{1994}).

Hester and Maunder (2007) suggest that more extensive sensitivity runs should be made for the recreational catches; however, this point is irrelevant as a catch-free model was also applied to the sandbar shark data (see page 3 in SEDAR11-AW-03) and the same conclusions about stock status were reached.

There is bold text on page 11 of the Hester and Maunder report that discusses the inconsistency between the model predicted decline in SSB (spawning biomass), the lack of decline in average age, and the stable or increasing trend in abundance indices from 1994. As previously pointed out, the model results do not predict a substantial decline in average age, and therefore there is no inconsistency with Hester and Maunder's estimates from the BLLOP data. Eliminating the longer time series disregards critical historical information to help inform the model over the entire history of the fishery. In many cases, trends in relative abundance of sandbar and other sharks have remained relatively stable since the introduction of management in 1993.

- ***4. The assessment used several catch-rate series (LPS and NMFS – NE) that were either inappropriate, or did not include the available (but withheld) size and sex data (VA LL).***

Large Pelagics Survey (LPS)

The Agency does not agree that the inclusion of the LPS data was inappropriate. All decisions to keep or eliminate catch rate series were discussed in detail by the Indices Working Group (in which Dr. Hester participated) during the stock assessment data workshop and a consensus decision was reached. The arguments that the authors make regarding the LPS series (that it has been split in the past due to regulation changes, and that regulations would affect catch) are incorrect. The index was not split in 2002 and the index includes estimates of discards, so the imposition of size and bag limits is not expected to impact the assessment, as there is no indication that fishers would make significant changes to targeting methodology. Finally, contrary to what is stated: "The LPS index is clearly two essentially flat indexes" is not true, as the 1985-1992 period shows a declining trend.

The text on page 9 of the Hester and Maunder report (2007) referring to the LPS index is inconsistent with earlier statements on page 7. Specifically, on page 7, Hester and Maunder (2007) summarize the model trajectory: "The slow decline in SSB/B0 [sic] between 1975 and 1981 shown in Figure 7 results from the recreational catches, which are the only appreciable catches assumed. Catch is the only thing that makes this model decline as there is no annual random variation in recruitment (and no catch-at-age data to estimate it). Recreational catch is believed to target young sharks and therefore some time must elapse before the effect of taking young fish shows up in the biomass of older fish. The commercial fishery, which targets larger fish, begins in the mid 1980's and, combined with the effect of the removals of the younger fish earlier on, is followed by an immediate and more rapid decline in SSB/B0 [sic] reaching a depletion level of 0.31 in 2004." This is a reasonable summary of the model behavior, yet on page 9, Hester and Maunder (2007) write that "The LPS index (Figure 10 in the Hester and Maunder report) has the same difficulty as the VA LL index in that it consists of two periods with high values in the early period and lower values in the recent period." The Agency questions why this is characterized as a *difficulty* when it is completely consistent with the earlier text describing the catch history and the impact on SSB. Hester and Maunder (2007) state that the index should be split as it had been in the past to reflect the change in regulation (size and bag limit). Two points need to be clarified here: 1) the LPS index was not split in 2002 and 2) the LPS index includes estimates of discards, so the imposition of size and bag limits is not expected to impact the assessment as there is no indication that fishers would make significant changes to targeting methodology.

<u>Virginia Institute of Marine Science Longline Survey (VA LL)</u>

Hester and Maunder (2007) state that the lack of shark age information from the Virginia Institute of Marine Science's longline (VA LL) survey led the Agency to inappropriate size selectivities. While length information from the Virginia Institute of Marine Science's longline (VA LL) survey was not incorporated in the current assessment (only one series containing all sizes was developed), it may not have provided any additional useful catch rate series had it been available. The data would have to have been converted from length to age, and then further separated into the various life stages (neonate, juvenile, adult). Since the entire data set is relatively small, the model may not have been able to standardize the series because of the limited number of samples. Breaking larger data sets into smaller pieces may have resulted in there not being enough information to conduct the analyses required. The various age/stage series used in the 2002 assessment were nominal. It is likely that the assessment participants might not have been able to develop standardized indices by stage because as one partitions a small data set into even smaller parts, one may end up with insufficient observations for all years to conduct the statistical standardization.

Hester and Maunder (2007) also state that the VA LL index omitted data prior to 1981, which is incorrect. The data included years from 1975 to 2004. Furthermore, we note that this index was used without contest in the 2002 assessment. Additionally, Hester and Maunder (2007) state that age data contained within the VA LL data set was not made available. As stated previously, there is no age data for the majority of the time series, just length information; the exception being when directed ageing studies were being undertaken, but these constitute only a very small portion of the total sample.

Hester and Maunder make the statement on page 11 that "The VA LL index may or may not be usable when and if it is properly standardized." The Agency is not sure to what the authors are referring. This index was initially standardized using a general additive model (GAM). Following recommendations of the Indices Working Group, the index was re-standardized for consistency with other indices following the Lo et al. (1992) methodology. Therefore, it was properly standardized, using well established and accepted statistical techniques.

The authors also state that, with regards to the VA LL index, "it is impossible to know what size or sex selectivity to apply to the series" since size or sex data were not provided for review during SEDAR 11. The 2002 assessment used several nominal forms of this index, split by stage/size class. At that time, all sizes/stages were represented, thus a selectivity representing all stages is appropriate for use in the current assessment as all stages/ages would still be represented in the data. Additionally, sex-specific selectivities are not utilized for any index.

<u>National Marine Fisheries Service Northeast Index (NMFS NE)</u>

The text on page 10, in particular in the legend for Figure 11, suggests that the high uncertainty for the NMFS NE index, and the fact that it has only 4 points should have precluded it from being used in the assessment. Giving all indices equal weight or weighting all indices by their CVs resulted in the same conclusion. The statement by Hester and Maunder (2007) that the NMFS NE index "has no statistical trend other than zero, but when given equal weight in the assessment has considerable influence on the outcome" is false. It contributes very little to the objective function (Assessment Workshop Report. page 122, Fig. 4.12).

- ***5. The age-at-maturity ogive was derived from a study that is technically flawed.***

The Agency does not believe this to be the case. Hester and Maunder (2007) state that the study is "technically flawed" since the animals used in the reproductive study were not directly aged, but rather length was converted to age using a von Bertalanffy growth equation. The Agency would like to make several points in this regard:

1) This is commonly the case with reproductive studies, especially when an age and growth study already exists for the species;
2) The impetus for using an existing age and growth study for conversion from length to age is especially strong in this case because the specimens used in the age and growth study (Sminkey and Musick 1995) were collected within approximately 5 years of the reproductive samples, and were collected from the same region; and,

3) Hester and Maunder (2007) used this very same growth curve (Sminkey and Musick 1995) to convert the length information from the BLLOP to age for use in deriving a selectivity curve for those data.

Hester and Maunder (2007) criticize the maturity study as being flawed. "The animals were not aged, rather length was estimated using a von Bertalanffy equation that may not be correct, and in any event introduces a second source of error that was not accounted for" (page 15 of the report). Despite making this comment, Hester and Maunder (2007) begin this subsection by saying "Converting lengths to ages using a von Bertalanffy equation (Sminkey and Musick, 1995) gives the distribution for the BLLOP catches shown in Figure 3" (page 4 of their report). It would seem that Hester and Maunder (2007) are arguing both *for* and *against* using the von Bertalanffy growth equation which is logically inconsistent. By using the same von Bertalanffy equation that Hester and Maunder (2007) criticize, they are also introducing the same "sources of error" that they advise against introducing.

Furthermore, the Sminkey and Musick (1995) growth curve was constructed based on animals caught off the coast of Virginia. Specimens for the maturity ogive (Merson 1998) were also collected from this area within five years of when the specimens for Sminkey and Musick (1995) were collected. Hester and Maunder (2007) state that the BLLOP dataset is "representative of about 90% of the commercial catch of sandbar" but "does not include the North Atlantic Region (which includes Virginia)" (page 2 of their report). Given the difference in geographic coverage between the BLLOP samples compared to the Sminkey and Musick (1995) growth curve they use to convert lengths to age, it would seem that the Merson (1998) and Sminkey and Musick (1995) studies employed in the stock assessment would be more compatible since they both employ animals caught from the same region.

• ***6. The biological parameters used in the model were selected subjectively and there may be some evidence that different values are more appropriate.***

This is incorrect. The values of life history parameters agreed to at the data workshop produced steepness values below the theoretical minimum level. A document produced at the assessment workshop, SEDAR11-AW-10 (Brooks and Cortes, 2006), reflected the range of life history parameters that could be adjusted to raise steepness, and the biological argument that could be made for each change. After much discussion at the Assessment Workshop, the group decided that adjusting the values of M (natural mortality) was the most justifiable action. The Agency has emphasized that steepness was not "manipulated to achieve a credible model output" as Hester and Maunder state. Rather, steepness is a function of all life history parameters (natural mortality, maturity, and fecundity—see SEDAR11-AW-10). None of these parameters were derived subjectively; rather, they were estimated based on ecological principles consistently applied to a variety of species. We are unaware of the "evidence that different parameter values are more appropriate." If this "evidence" exists, it was not provided during SEDAR 11 for discussion. The same logic for modifying the biological parameters was applied to blacktip sharks; however, in that case, the logic was deemed acceptable by Hester and Maunder (2007).

In the 2002 assessment, a similar problem was encountered with steepness estimates falling below the minimum bound. As indicated in the 2002 assessment report, the parameter for pup production was inflated, yet this approach was not contested during the 2002 assessment. Adjusting pup production was presented as an option this time, but it was rejected by the group in favor of adjusting natural mortality levels.

Hester and Maunder (2007) also mention in the Reviewers comment that "No age data were used in the model." This was due to the fact that catch-at-age data are not available for sandbar sharks. One cannot simply convert length to age based on an age and growth study for use in the model, but must derive catch-at-age data from ageing samples collected from the fishery. This type of data does not currently exist for this or any other species of shark exploited in U.S. waters.

While the authors state that "there is evidence that age at maturity has decreased in recent years", this "evidence" was not presented during SEDAR 11. A chapter in a Ph.D. dissertation by Rebeka Rand Merson (1998) investigates reproduction of sandbar sharks and was reviewed by the Life History Working Group at the Data Workshop and determined to be the best available data. This chapter was included in SEDAR 11-DW-47. Concerns stated by Dr. Hester during the SEDAR data workshop were addressed by Merson in SEDAR 11-AW-09 during the assessment workshop. The Merson study is the only study available which provides a maturity ogive for sandbar sharks in the region of interest.

Hester and Maunder (2007) had further issues with the biological parameters used in the model. They state that "Pup survival is estimated by the model, which is a circular process." The Agency does not believe this to be true. While pup survival is given a prior probability distribution, it is estimated by the model - there is no "circular" process involved.

RESPONSES TO OTHER CONCERNS RAISED IN THE REPORT

This section provides additional detail and discussion of other issues presented in the Hester and Maunder (2007) report.

Indices Employed in the Stock Assessment

The issue of consistency of indices over time was discussed to some extent by the Indices Working Group at the Assessment Workshop. Standardization is used to account for changes in factors, such as introduction of regulations. While regulation changes could affect an index, this is not the case for the VA LL index, which is fishery-independent, and the LPS, where total catch (*i.e.,* not just landings) is recorded. The change from voluntary to mandatory observer coverage in the BLLOP is more of an issue and could have affected the standardization of that index more than the two indices mentioned by Hester and Maunder.

Furthermore, Hester and Maunder (2007) refer to "good" and "bad" indices that were employed, which is a very subjective characterization. Fisheries-independent indices typically have small sample size, which often results in a higher CV than fisheries-dependent indices that are derived from thousands of observations. The base case treated all indices as having equal weight, but a sensitivity model using the CVs for each index was also run, and arrived at the same conclusion that the stock is overfished with overfishing occurring. Hester and Maunder correctly point out that all factors in a standardized index are assumed to have been constant over time, and that if this is not true, then the resulting index could be biased. This point is equally true for fisheries-dependent indices for instances where catchability has changed over time either through increased skill at finding fish, learning, or gear and technology improvements, etc.

Hester and Maunder (2007) present "trend analyses" for several of the input indices. These fits conducted by the Hester and Maunder report appear to have been done in the EXCEL software. However, their analysis is misleading and misapplied. First, the indices fit within the assessment model assume a lognormal error structure, which was assumed to be the most appropriate error structure to use, while EXCEL fits trendlines assuming normally distributed errors, which could contribute to the differences seen in Figure 1 in this document. A comparison of the model fits versus "trendlines" to the three indices that Hester and Maunder single out (VA LL, LPS, and NMFS NE) is shown in Figure 1. For the VA LL and LPS indices, the trendlines of Hester and Maunder are far more negative than those predicted in the assessment model; the NMFS NE assessment predicted index is fairly similar to the trendline fit. The model fits to the observed index values are shown in the assessment final report, pages 112 - 114, Figure 4.7. From those plots, and from the likelihood contributions of each index (Assessment Workshop report p.122, Fig. 4.12), it is clear that the LPS is poorly fit and that it is not driving model results.

Sensitivity Analyses

From pages 11 to 15 in the Hester and Maunder report, various sensitivity model runs are discussed. Despite earlier comments by Hester and Maunder about "bad indices" and "negative slopes," excluding or down weighting those same indices did not alter model results substantially. In Table 1 of the Hester and Maunder (2007) report, they summarize model results for SSB_{2004}/SSB_0 rather than SSB_{2004}/SSB_{MSY}. Fishery management in the United States has determined the overfished criterion based on MSY reference points and not on relative depletion (we note that they correctly summarize the overfishing statistic as F_{2004}/F_{MSY}). This misunderstanding of reference point seems to be carried even further, as Hester and Maunder appear to believe that 50% of SSB_0 is the benchmark determining whether a stock is overfished or not. This is not the case. The correct benchmark is SSB_{MSY}.

Run 2 (No VA LL): Again, the years prior to 1981 in the VA LL index were not omitted, and the indices used in 2002 were nominal only. In all these sensitivity analyses, it is stated that the index of interest was "heavily down weighted", but there is no explanation of how exactly it was done, other than saying that "this is about equivalent to using variance weighting" (stated under Run 3 (No LPS)). The naming convention used is confusing: "No VA LL index" or "No LPS" implies the index was removed from the run, but that is not the case according to the text provided.

Run 5 (Removing VA LL and LPS): By selectively removing the 2 indices that start earlier in time (1975 and 1986, respectively), the model essentially has no CPUE information prior to 1993, thus showing a much reduced level of depletion since there are no points of comparison prior to 1993.

Run 7 appears to be in agreement with the base case assessment results, although the authors suggest that further sensitivity runs should be made to explore the poorly estimated recreational catches. Again, we note that the catch free model (which does not use any catch) arrived at the same results. The catch free model is discussed in SEDAR11-AW-03 (Brooks 2006).

The Hester and Maunder sensitivity analyses, in most cases, support the original stock status determined by the assessment. The main points that the industry had taken issue with (*i.e.*, the VIMS LL series, the LPS series, the commercial selectivity, and the median age at maturity) made essentially no difference, as demonstrated by Hester and Maunder's (2007) own sensitivity runs. The only difference was obtained when completely removing or down-weighting the 2 long-term CPUE indices (or other extreme scenarios), thus removing critical historical information from the modeling. Also note that for all scenarios (except run #12 where pup survival = 0.85) in which no overfishing ($F_{2004}/F_{MSY}<1$) was found, pup survival was unrealistically high (0.93-0.97).

CONCLUSIONS

While raising important concerns, the Hester and Maunder (2007) report contains numerous factual errors and unsupported statements. For the reasons stated below, none of the 6 initial conclusions (bullets in the abstract) stated in the Hester and Maunder (2007) report are valid:

1) The BLLOP index was used at different steps in the assessment process;
2) The new selectivity created by Hester and Maunder using only BLLOP data ultimately did not have any effect on results;
3) There has been a commercial quota imposed on the fishery since 1993 (for over a decade) and stable landings in recent years most likely reflect the effect of quotas, not of a stable population;
4) The CPUE indices used in the model were appropriate and selected by a group of experts and endorsed by a peer-review panel. Selective use of CPUE series will eventually produce the desired results, however, this could bias the outcome;
5) There is no evidence to suggest that the maturity/reproductive study is technically flawed; on the contrary, it is the best available science, to date; and,
6) The biological parameters used in the model were sensible and biologically defensible, unlike those in the optimistic outcomes produced by the Hester and Maunder (2007) report. There is no evidence to suggest that other more appropriate values are available or should have been used in the assessment.

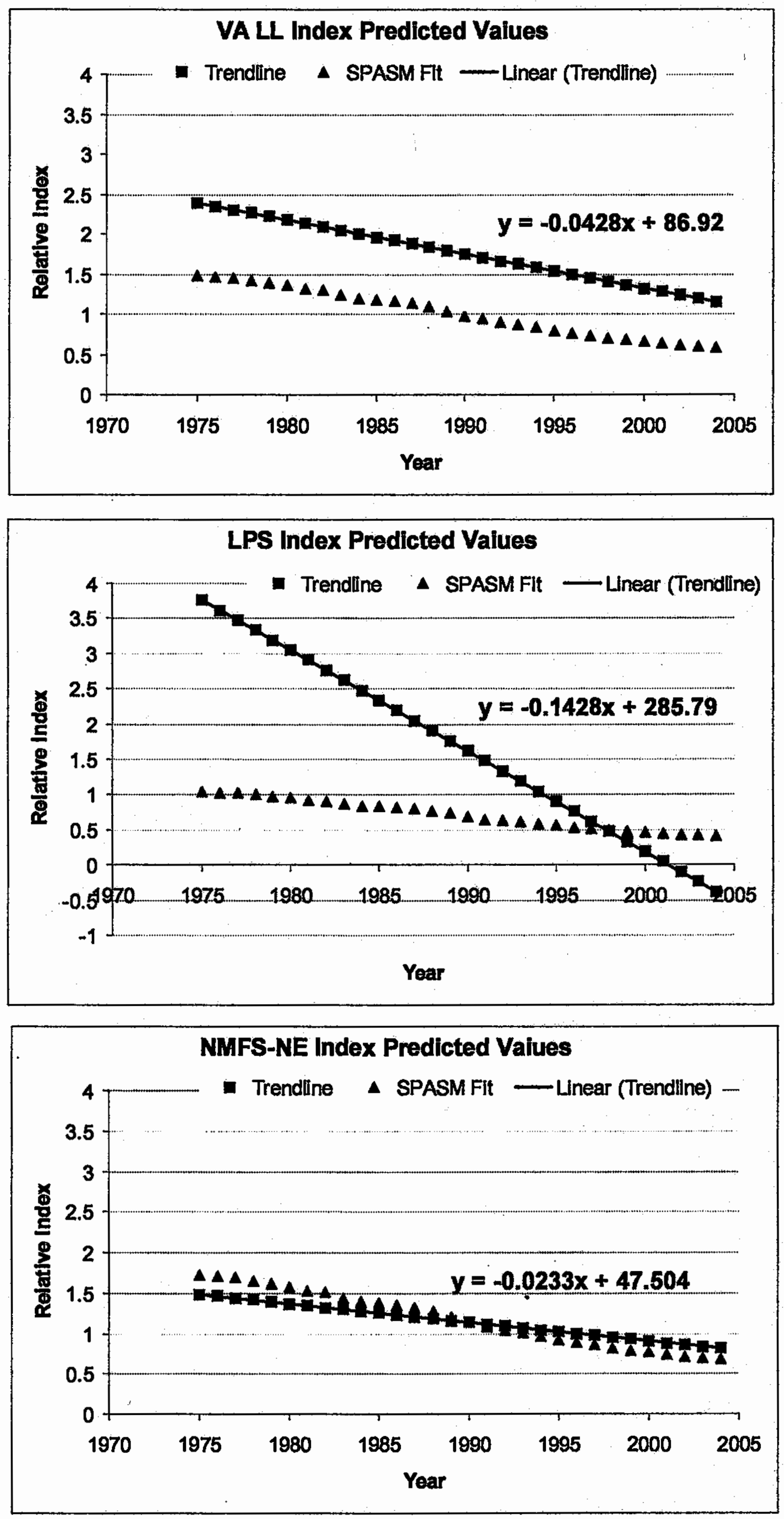


Figure 1. Comparison of model-predicted indices (solid triangles) to the trend lines of Hester and Maunder (solid line with solid square symbols).