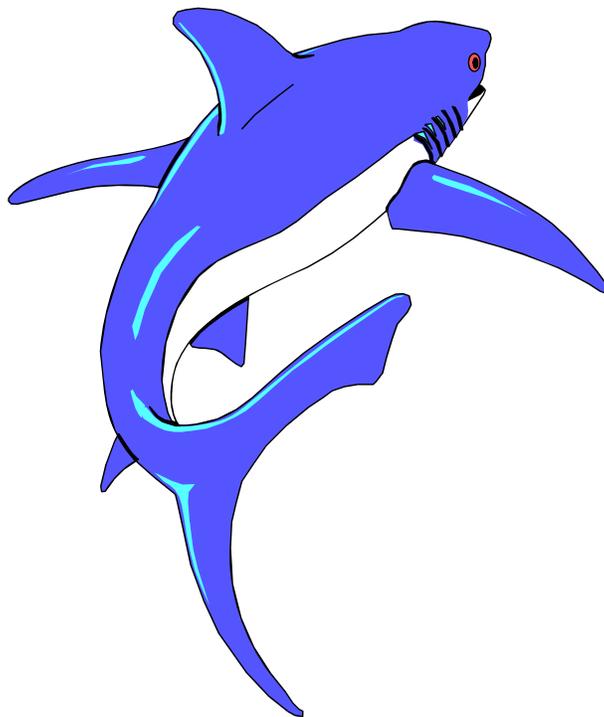


FISHERY MANAGEMENT PLAN
FOR SHARKS OF THE ATLANTIC OCEAN



Prepared by
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
U.S. Department of Commerce
February 25, 1993

PREFACE

This Final Fishery Management Plan for Sharks of the Atlantic Ocean, as issued in March 1993, has been revised since issued in preliminary form on December 11, 1992, and has been approved in final by the Assistant Administrator for Fisheries (Assistant Administrator). The Assistant Administrator preliminarily approved and issued the FMP on December 11, with final approval contingent upon completion of the 30-day cooling-off period for the Final Environmental Impact Statement (FEIS) as provided by the National Environmental Policy Act. The FEIS in support of the FMP and the final rule was filed with the Environmental Protection Agency on December 11, 1992; a notice of availability of the FEIS was published on December 18, 1992, and the cooling-off period ended on January 18, 1993. The Assistant Administrator approved the FMP in final on February 25, 1993. The FMP will be implemented by publishing final regulations as soon as the Department of Commerce and the Office of Management and Budget give the appropriate clearances.

After considering the public comments received during the cooling-off period, the Assistant Administrator directed certain limited changes in the final FMP and FEIS documents. These changes include the following: (1) editorial changes for purposes of clarity and correction of minor errors; (2) change in the permit conditions associated with accepting a Federal shark fishing permit; and (3) the composition of the Operations Team. All changes in the FMP as approved in final are reflected in the implementing final regulations.

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PROLOGUE

The National Marine Fisheries Service (NMFS) prepared the Fishery Management Plan for Sharks of the Atlantic Ocean (Shark FMP) for the Secretary of Commerce (Secretary) under authority of the Magnuson Fishery Conservation and Management Act (Magnuson Act). Section 304(c) of the Magnuson Act authorizes the Secretary to prepare and implement a fishery management plan (FMP) with respect to any fishery needing management and conservation under certain circumstances. Section 304(f) gives the Secretary management authority over Atlantic highly migratory species which are defined to include oceanic sharks.

The five Regional Fishery Management Councils (Councils) responsible for developing FMPs under the Magnuson Act in the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea recognized the need for the Shark FMP due to increasing catches attributed to the demand for shark fins and meat. The expected lengthy schedule for developing and implementing a five-Council FMP would further threaten overfished shark resources. On June 3, 1989, the five Councils recommended that the Secretary develop a shark FMP that would: (1) cap the growth of the commercial fishery at current levels, (2) establish a recreational bag limit, (3) eliminate finning, and (4) initiate a data collection program. Their concern was that the late maturity and low fecundity of sharks, coupled with increasing fishing mortality, could result in long-term damage to shark stocks. Conservation and wise management of this important resource therefore required timely action. In response to the Councils' request, NMFS began preparation of the FMP in 1989. The management strategy in the Shark FMP addresses these requests.

In 1978, the Secretary implemented two Preliminary Management Plans (PMPs), conforming with the Magnuson Act requirement to control foreign harvest in U.S. waters. The Shark FMP adopts all management measures that apply to sharks in the "Atlantic Billfishes and Sharks PMP" and amendments to that FMP, including the requirement that all foreign vessels carry a U.S. observer, and disallows the retention of sharks by foreign vessels. The second PMP, "Foreign Trawl Fisheries of the Northwest Atlantic," is not affected by the Shark FMP.

In response to the Councils' request, the National Marine Fisheries Service (NMFS) began preparation of the Secretarial FMP for Sharks of the Atlantic Ocean (FMP) in 1989 and adopted a management approach intended to address the Councils' specific concerns. Since 1989, three draft FMPs and a final FMP have been prepared.

The first draft, completed in October 1989, was presented at 22 coastwise public hearings. Based in part on the extensive comments received, NMFS determined that an updated stock assessment for Atlantic sharks would be beneficial.

In December 1990, the NMFS Southeast Fisheries Science Center completed a new shark stock assessment that required significant changes in the FMP. In November 1990, the Fishery Conservation Amendments of 1990 (Public Law No. 101-627) transferred from the Regional Fishery Management Councils (Councils) to the Secretary of Commerce (Secretary) full management authority for Atlantic highly migratory species, including "oceanic sharks." Public Law No. 101-627 directs the Secretary to prepare, amend, and implement fishery management plans and to pursue international fishery management measures for Atlantic highly migratory species. These statutory changes also required modifications to the FMP. The second draft FMP, completed in April 1991, was presented at eight additional coastwise public hearings.

The third draft FMP, referred to as the "proposed FMP," was prepared after considering the additional public comments. The proposed FMP, dated October 28, 1991, was released on

January 8, 1992, to the public for a 60-day review and comment period ending March 9, 1992. Proposed regulations to implement the FMP were published for public comment from June 8 through July 20, 1992. Comments were received from some 1,159 entities, including recreational and commercial fishermen, fish dealers or processors, charter vessels and headboat owners, organizations representing diverse fishery interests (such as recreational and commercial fishermen, environmental concerns, animal rights, and the charter industry), state and Federal agencies, and the Councils. Support for the FMP was strong and from a broad cross section of interests. Opposition to the FMP came primarily from those objecting to the short-term, adverse economic impacts associated with the restrictive quotas designed to rebuild overfished shark resources. Specific objections came from the State of North Carolina, certain North Carolina fishermen, several commercial pelagic fishermen's associations, and individual shark dealers and processors along the Atlantic and Gulf coasts.

Recent Magnuson Act amendments authorize the Secretary to manage oceanic sharks in the Atlantic. The Secretary has determined that all species of sharks listed in the management unit of the FMP are oceanic and subject to Secretarial authority and management.

An Operational Team (OT) will be established to monitor and adjust management measures, including sharks to be included in the management unit. The OT consists of representatives of the Councils (including Council members, staff, and advisory panel or scientific committee members), the International Convention for the Conservation of Atlantic Tuna (ICCAT) Advisory Committee, and NOAA scientists and management personnel.

Metric System Conversion Table

The Shark FMP uses the metric system. The following common conversions are provided:

1.0 centimeter (cm) = 0.394 inches
1.0 meter (m) = 3.281 feet
1.0 meter = 0.547 fathoms
1.0 kilometer (km) = 0.621 statute miles
1.0 kilometer = 0.540 nautical miles (nm)
1.0 square kilometer (sq km) = 0.386 square miles
1.0 kilogram (kg) = 2.205 pounds
1000.0 kilograms = 1 metric ton (mt)

Comments or requests for copies of the Shark FMP should be sent to:

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ACKNOWLEDGEMENTS

The following NMFS personnel were involved in the development of the FMP:

Headquarters - Davis A. Hays, Dr. Paul Hooker, and Aaron King

Northeast Regional Office - Pat Kurkul and Kevin Foster

Northeast Fisheries Science Center - Jack Casey.

Southeast Fisheries Science Center - Drs. José Castro and Mike Parrack.

Southeast Regional Office (SEO) - Michael E. Justen, Paul Leach, Eric Hawk (NOAA Corps), and Richard Raulerson.

Paul Leach was the Chairman of the team that prepared the first and the second draft FMPs.

Michael E. Justen was the Chairman of the team that prepared the third draft FMP, final FMP, Draft and Final Environmental Impact Statements, and implementing regulations. The other team members were Davis A. Hays and W. Perry Allen.

NMFS is grateful to many individuals within and outside the agency who provided data, information, advice, comments, and other forms of assistance. Among these individuals included: statisticians, managers, and scientists from NMFS' offices; members of the Intercouncil Shark Committee including the Chairman, Robert Martin; John Pedrick, NOAA Southeast Regional Counsel; Dr. Andrew J. Kemmerer, NMFS Southeast Regional Director; W. Perry Allen and Edward E. Burgess, NMFS SEO; Richard H. Schaefer, Director, NMFS Office of Fisheries Conservation and Management (F/CM), David S. Crestin, Joe P. Clem, Pat Blunt, and Lisa Smith, F/CM; and concerned citizens, fishermen and industry officials. NMFS thanks Dr. Thomas Hoff, Mid-Atlantic Fishery Management Council staff, who participated with the first FMP drafting team. From NMFS SEO, NMFS also acknowledged the help of Lorie Elder, Deanna Aaron, Laura Carter, Micki Thompson, Joyce Mochrie, Barbara Adams, and Sheral Conkright, who tended to word processing and graphics, arranged travel and meetings, and duplicated and distributed documents. Carolyn Dempsey, Pat Howell, and Joy Kocic, are recognized for assistance with desktop publishing, developing tables and figures, and editing.

0.0 SUMMARY

0.1 INTRODUCTION

Sharks are a diverse group of about 350 species ranging from whale sharks up to 12 meters (m) in length to the tiny pygmy shark that reaches only a few centimeters in length. Sharks grow very slowly, take many years to mature, have long reproductive cycles, and produce few young. Most are migratory and several are transoceanic. Migrations are tuned to temperature, photoperiod, and reproductive cycles. Adults usually congregate in specific areas to mate and females travel to specific nursery areas to pup. With few exceptions, sharks are armed with acute senses that allow them to be very effective predators. Since they have evolved as apex predators, they are not equipped to withstand predation themselves. Therefore, the appearance of man as a predator has confronted sharks with a mortality source they cannot withstand--intense exploitation.

Historically, there have been few shark fisheries in North America. While small, localized shark fisheries existed throughout the southeast for many years, sharks were underutilized until the late 1930s. Starting in 1938, intensive shark fisheries developed in several states, sparked by the high demand for the vitamin A-rich shark livers. These fisheries ceased to operate due to a combination of factors; i.e., synthesis and importation of vitamin A, low demand for other shark products, and overfishing. New shark fisheries developed in the 1980s, fueled by a domestic demand for shark meat and a foreign demand for shark fins that led to the controversial practice of "finning." Finning is removing the valuable fins from sharks and discarding the carcass. Although the extent of finning is unknown, this practice is perceived as wasteful and has brought considerable outcry from the public.

The Secretary has determined that corrective action is necessary to protect shark resources from overfishing. The Shark FMP addresses 73 species of sharks inhabiting U.S. Atlantic waters and includes 39 of these species in the management unit. Sharks are managed on the basis of the best and most recent scientific data available. The present state of knowledge precludes management on an individual species basis, although the Shark FMP segregates species for management and assessment purposes into species groups; i.e., large coastal, small coastal, and pelagic. Immediate restrictions will be placed on fishing activities on the managed shark species.

0.2 PREPARATION OF THE FMP

On June 3, 1989, the five Fishery Management Councils established by the Magnuson Fishery Conservation and Management Act (Magnuson

Act) to cover the east coast, the Gulf of Mexico, and the Caribbean Sea, requested that the Secretary develop a shark Fishery Management Plan (FMP) that would: (1) cap the growth of the commercial fishery; (2) establish a recreational bag limit; (3) eliminate finning; and (4) initiate a shark fishery data collection program. The Councils indicated that there was a critical need for an Atlantic shark FMP due to increasing commercial fishing pressures and the biological characteristics of sharks. The Councils were concerned that if they instead of the Secretary were to develop and implement a five-Council FMP, there would be unacceptable delays in establishing a management program to prevent overfishing, rebuild any overfished stocks, and prevent wasteful finning practices.

In response to the Councils' request, the National Marine Fisheries Service (NMFS) began preparation of the Secretarial FMP for Sharks of the Atlantic Ocean (FMP) in 1989 and adopted a management approach intended to address the Councils' specific concerns. Since 1989, three draft FMPs and a final FMP have been prepared.

The first draft, completed in October 1989, was presented at 22 coastwise public hearings. Based in part on the extensive comments received, NMFS determined that an updated stock assessment for Atlantic sharks would be beneficial.

In December 1990, the NMFS Southeast Fisheries Science Center completed a new shark stock assessment that required significant changes in the FMP. In November 1990, the Fishery Conservation Amendments of 1990 (Public Law No. 101-627) transferred from the Regional Fishery Management Councils (Councils) to the Secretary of Commerce (Secretary) full management authority for Atlantic highly migratory species, including "oceanic sharks." Public Law No. 101-627 directs the Secretary to prepare, amend, and implement fishery management plans and to pursue international fishery management measures for Atlantic highly migratory species. These statutory changes also required modifications to the FMP. The second draft FMP, completed in April 1991, was presented at eight additional coastwise public hearings.

The third draft FMP, referred to as the "proposed FMP," was prepared after considering the additional public comments. The proposed FMP, dated October 28, 1991, was released on January 8, 1992, to the public for a 60-day review and comment period ending March 9, 1992. Proposed regulations to implement the FMP were published for public comment from June 8 through July 20, 1992. Comments were received from some 1,159 entities, including recreational and commercial fishermen, fish dealers or processors, charter vessels and headboat owners, organizations representing diverse fishery interests (such as recreational and commercial fishermen, environmental concerns, animal rights, and the charter industry), state and Federal agencies, and the

Councils. Support for the FMP was strong and from a broad cross section of interests. Opposition to the FMP came primarily from those objecting to the short-term, adverse economic impacts associated with the restrictive quotas designed to rebuild overfished shark resources. Specific objections came from the State of North Carolina, certain North Carolina fishermen, several commercial pelagic fishermen's associations, and individual shark dealers and processors along the Atlantic and Gulf coasts.

During the public comment periods held on the proposed FMP and on the proposed rule, significant new information was received from fishermen, fish buyers, and state fishery management agencies. This information included: (1) fishery removals not previously recorded; (2) sizes of landed sharks; and (3) the numbers of commercial fishing vessels targeting sharks. The additional information significantly changed the analytic results of the last stock assessment done in 1990 (see Parrack, M.L., 1990, A Study of Shark Exploitation in U.S. Atlantic Coastal Waters during 1986-1989).

To ensure that all FMP management measures are based upon the best scientific information available, NMFS completed a revised assessment of the condition of the large coastal species group. The large coastal species group includes the principal species taken in the directed shark fishery: sandbar, blacktip, dusky, spinner, silky, bull, bignose, tiger, sand tiger, lemon, night, nurse, great hammerhead, and scalloped hammerhead sharks.

The revised assessment was reviewed by a scientific peer committee consisting of both outside scientific experts and NMFS scientists. The Review Committee issued its final report on November 23, 1992 (see Appendix II, Report of the Atlantic Coastal Shark Fishery Analysis Review, November 23, 1992). The Review Committee reported evidence of overfishing for the large coastal species group during 1986 through 1992 (except for 1987 and 1990). The Committee recommends that calendar year 1993 landings for the large coastal should be reduced below the calendar year 1991 landings level of 4,319 mt dressed weight

The current assessment of shark resources in the U.S. Atlantic EEZ indicates an MSY of 3,800 dressed weight mt for large coastal sharks, the only overfished group of species. The estimated MSY for the small coastal species group is 2,590 mt. The estimated MSY for the pelagic species group is 1,560 mt, the average of 1986-1991 landings, since data to carry out a quantitative assessment were unavailable. Current landings indicate significant exploitation of this group.

Under the FMP, a specific shark species group is considered overfished as follows: (1) if the stock size of the group is at a level that is determined, based on the best scientific

information available, to be sufficient to produce MSY on a continuing basis, overfishing is defined as a fishing mortality rate (F) that exceeds the fishing mortality rate that would produce MSY on a continuing basis (F_{MSY}); or, (2) if the stock size is below the level that is determined, based on the best scientific information available, to be sufficient to produce MSY on a continuing basis, overfishing is defined as a fishing mortality rate that exceeds the rate that is consistent with a rebuilding program established under this FMP.

The current assessment indicates that the large coastal species group is overfished since catches have exceeded resource production since 1987. Stock size estimates indicate that the small coastal and pelagic species groups appear to be fully utilized.

The FMP's management measures, which include a rebuilding program for the recovery of the large coastal species group, should stabilize fishing mortality at or just below the level that would produce MSY for each species group. The large coastal and pelagic species group each have semi-annual quotas that will become effective during periods from January 1 to June 30, and from July 1 to December 31. As the commercial quota for each species group is reached the commercial fishery for sharks within that group will be closed. The fishing year is from January 1 through December 31. Overages or under-used portions of the semi-annual quotas will be adjusted by the next semi-annual quotas. Total Allowable Catch (TAC) for each group will be reevaluated yearly by the Operations Team (OT).

To ensure that the large coastal group is rebuilt to the MSY level, NMFS has selected the Committee's recommended second option (Option 2--see Table 4 of the Committee Report) establishing 1993 total landings of 2,900 mt dressed weight (a 34% reduction from the 1991 landings; a 29% reduction from the 1986-91 annual average landings). Under this option, stock abundance will rebuild 5% each year back to the MSY level (estimated by NMFS to be 14,900 mt dressed weight) by 1995. The Review Committee's rebuilding schedule shows that annual fishery yields would increase about 5% each year but would not equal MSY until 1999. Option 3 of the Committee Report requires a 1993 landings limit of 2,311 mt (a 50% reduction from the 1991 level; a 44% reduction from the 1986-91 annual average). This option achieves a 10% annual increase in stock abundance until the MSY level is reached. NMFS determined that this option would cause unacceptable short-term costs in lost fishery revenues, and is not necessary to achieve stock rebuilding in a reasonable time period.

While NMFS adopted option 2 for stock rebuilding and will implement the recommended calendar year total landings (and derived calendar year commercial quotas) from 1993 to 1995, NMFS

believes that the large coastal species group will be rebuilt by 1995 and at that point the stock size should be sufficient to provide MSY. NMFS does not agree with the Committee Report's conclusion that MSY yields will not occur under its rebuilding schedule until 1999.

The commercial fishery for the pelagic species group will close when either of the semi-annual quotas of 290 mt for the 1993 fishing year is reached or projected to be reached. This process will continue for subsequent years. The pelagic species group includes species taken primarily as bycatch in the tuna and swordfish fisheries. These include: shortfin mako, longfin mako, thresher, bigeye thresher, oceanic whitetip, porbeagle, and blue sharks.

There are no commercial fishing restrictions planned for the small coastal species group at the present time. Current fishing mortality is below the MSY level of 2,590 mt. No significant commercial landings of species in the small coastal group have been reported. The small coastal group includes: Atlantic and Caribbean sharpnose, bonnethead, blacknose, smalltail, finetooth, and Atlantic angel sharks. These species, especially sharpnose, are taken primarily as bycatch in the shrimp trawl fishery, and a small portion is taken by the recreational fishery.

There is no recreational fishing season or "quota" per se; however, the recreational bag limit is expected to keep landings of large coastal species group below 464 mt and landings of the pelagic species group below 980 mt. Thus, combined recreational landings will total less than the 1,444 mt assigned to the recreational sector from the TAC for the large coastal and pelagic species groups. The bag limit is four sharks per boat per trip for the combined large coastal and pelagic species groups. The daily bag limit for the small coastal species group is five sharks per person. The latter bag limit has minimal conservation value, but does limit harvest and encourage conservation by the recreational angler, while providing sufficient meat for the dinner table. The five-shark bag limit is also consistent with Texas regulations. The Texas bag limit reflects that this state is the center for a headboat fishery for sharpnose sharks.

Sharks taken other than as part of a quota or bag limit must be released uninjured. There is a prohibition on the sale of recreationally caught sharks or shark products taken in the EEZ, except aboard permitted charter vessel or headboat.

Other management measures include a ban on finning, and a data collection and reporting system. All fishermen harvesting and selling meat or fins from the EEZ, must purchase an annual Federal permit and submit reports or other information requested by NMFS. Permits will be required within 60 days of

implementation of the Shark FMP. Vessel permit applicants must have derived 50 percent or more of their earned income from the sale of fish or fish products from commercial or charter vessel, or headboat operations, or more than \$20,000 in the sale of fish during one of three years before the application. The recipient of a Federal permit must agree that the vessel's fishing, catch, and gear will be subject to Federal shark fishing regulations regardless of where the fishing occurs (i.e., in state, Federal, or international waters) with the exception that if a permitted vessel fishes only in state waters on a given trip, the vessel's fishing, catch, or gear may be subject to the more restrictive state requirements for that trip. A maximum of 5% by weight of wet fins to dressed weight of shark carcass may be landed. Permitted fishermen may not store fins aboard their vessel after the first point of landing.

To assess impacts of the shark fishery on marine mammals and endangered species, and to obtain better information on discards, observers must be accommodated on permitted vessels when requested by NMFS. Besides mandatory logbooks, statistical data will be collected at the docks through interviews with selected commercial fishermen via the NMFS Trip Interview Program or by special surveys. Persons conducting recreational shark fishing tournaments must submit reports to NMFS, if requested.

A "framework regulatory adjustment procedure" will allow pre-season adjustment of these measures as better information and understanding are acquired. The framework procedure allows changes in: commercial quotas, trip limits, recreational bag limits, species size limits, permitting and reporting requirements, MSYs, management unit, species groups, and fishing year. The OT, composed of representatives of NMFS, the five Councils (including Council members, staff, and advisory panel or scientific committee members), and the International Commission for the Conservation of Atlantic Tuna (ICCAT) Advisory Committee, is the primary group that will monitor the effectiveness of the Shark FMP and guide future actions. Regulatory actions in other fisheries, such as the mandatory use of TEDS in the shrimp trawl fishery, will further reduce shark mortality, particularly in the small coastal species group. More stringent management measures will be imposed if new information suggests that overfishing is occurring in any of the species groups. Allowable landings will be increased if new information shows that a safe expansion of the fishery can occur. The OT will coordinate such action through the framework regulatory adjustment procedure.

0.3 FINAL MANAGEMENT MEASURES

The final FMP and implementing interim final and final regulations contain the following fishery management measures:

- (1) A fishery management unit containing 39 frequently caught species of Atlantic sharks. These species are separated into three groups for assessment and regulatory purposes: large coastal (22 species), small coastal (7 species), and pelagic species (10 species). Thirty-four additional species are included in the FMP for data collection purposes but are not part of the management unit--most of these species are small, deepwater sharks taken incidentally in directed swordfish and tuna longline fisheries. This group also includes dogfishes that are harvested in trawl fisheries in shallow water;
- (2) A fishing year of January 1 through December 31;
- (3) Annual commercial quotas based on a calendar year for the large coastal and pelagic species groups; each annual quota will be divided into equal semi-annual quotas that will apply to the fishing periods--January 1 through June 30 and July 1 through December 31. The 1993 annual quotas are 2,436 mt (dressed weight) for large coastal species group and 580 mt (dressed weight) for the pelagic species group;
- (4) Closure of the commercial fishery for a species group for the remainder of the half year fishing period when the commercial semi-annual quota for that species group is reached or is projected to be reached. All sharks in the FMP management unit landed and sold in the U.S. by U.S. fishermen will be counted against any applicable commercial quota established by the FMP. After a fishery closure, permitted charter vessels and headboats will be allowed to fish for sharks under the permit conditions and under the bag limits, but landed sharks cannot be sold;
- (5) Bag limits for the recreational fishery of four sharks per fishing vessel per trip for large coastal and pelagic species combined and five sharks per person per day for small coastal species;
- (6) A requirement for annual permits for commercial fishing vessels catching sharks in the EEZ. A condition of the permit is that the recipient must agree to abide by Federal regulations for all sharks caught despite where the fishing occurs (state, Federal (EEZ), or international waters), unless the permitted vessel fishes only in state waters on a given fishing trip, in which case a state may apply its more restrictive requirements for that trip. To qualify for the Federal commercial permit, the applicant must have derived, during any one of three preceding years, more than 50 percent of his or her earned income from commercial fishing (sale of catch) or from charter vessel or headboat operations, or have had at least \$20,000 in gross receipts from the sale of fish;

- (7) A limitation on the sale of sharks harvested in Federal waters to those sold by owners or operators of permitted vessels;
- (8) A requirement that permitted vessels land fins and carcasses in a weight ratio of 5 percent or less;
- (9) A requirement that sharks not retained and landed as part of the commercial quota or under the recreational bag limits be released in a manner ensuring maximum probability of survival;
- (10) A requirement that all owners or operators of permitted vessels submit to NMFS copies of weighout slips (trip tickets or weighout slips); requirement for submission of logbook reports from selected owners, operators, and persons conducting shark fishing tournaments;
- (11) A requirement that selected permitted vessels accommodate observers;
- (12) An authorization for the Assistant Administrator to implement or adjust certain management measures following an established framework regulatory adjustment procedure;
- (13) A reduction of the total allowable level of foreign fishing in U.S. waters for the managed species to zero; and
- (14) Establishment of an FMP Operations Team (OT) composed of representatives from the five Regional Fishery Management Councils (Councils), NOAA scientists and management personnel, and the ICCAT Advisory Committee to monitor the fishery and FMP, and to recommend regulatory adjustments for implementation by the Assistant Administrator.

0.4 OTHER MATTERS

State cooperation is essential to prevent overfishing. States are urged to adopt uniform and compatible regulations. Sixty-four percent of recreational fishing mortality (by number) occurs in state waters, and 14 percent of commercial harvests are within state waters. Coordinated international management is also necessary because many sharks migrate across international boundaries. Hopefully, the Shark FMP, the first Federal attempt to safeguard shark resources in the Western North Atlantic, will stimulate coordinated management.

Approximately 124 vessels operating in U.S. waters of the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea spend a portion of their time targeting shark. The directed shark fishery is pursued with longline gear, although approximately 5 vessels use net gear. About 6,140 mt (86 percent of commercial landings in

1989) were caught on longline gear. Of the remaining 981 mt of commercial landings, 621 mt were taken by gillnetters.

Longlines and net gear are known to kill marine mammals and sea turtles. Components of the shark fishery are known to interact or suspected of interacting with marine mammals. With respect to the drift gillnet fishery that targets schooling blacktip sharks, no data presently exist to suggest that significant numbers of marine mammals or endangered species are incidentally captured in this fishery.

The bottom longline fishery in the South Atlantic and Gulf of Mexico for snapper-grouper and other reef fish (including sharks) and the pelagic hook-and-line fishery in the Gulf of Maine, southern New England, and the Mid-Atlantic for tuna, shark, swordfish are listed as Category III fisheries (Federal Register, Vol. 56, No. 26, February 7, 1991). These fisheries are required to report any lethal takes to NMFS within 10 days of the interaction. Components of the shark fishery listed as Category II are the Florida east coast gillnet fishery and the Atlantic Ocean, Caribbean, and Gulf of Mexico tuna, shark, swordfish longline fishery. They are required to register their vessels in the Marine Mammal Exemption Program and to complete marine mammal logs that document the vessels' daily fishing effort and any marine mammal interactions. Observers are required on the Atlantic Ocean, Caribbean, and Gulf of Mexico swordfish, tuna, shark drift gillnet fishery. Registration and reporting requirements for Category I vessels are the same as for Category II.

On July 5, 1989, a Biological Opinion (BO) concerning the issuing of exemptions for commercial fishing operations under Section 114 (Marine Mammal Exemption Program) of the Marine Mammal Protection Act (MMPA) concluded that the issuance of exemptions was not likely to jeopardize the continued existence of any listed species. The requirement for an observer program to document incidental capture and mortality of endangered/threatened species was included in the incidental take statement.

On September 7, 1989, a Section 7 consultation under the Endangered Species Act (ESA) was conducted by the SEO on the potential impacts of the management action proposed in the initial draft of the Shark FMP. The consultation concluded that the proposed management measures would not jeopardize the continued existence of threatened or endangered species, but that the fishery may adversely affect listed species.

On April 2, 1991, a Biological Assessment (BA) discussing the effects of the fisheries and the Shark FMP on listed species was submitted by the SEO with a request for initiation of consultation pursuant to Section 7 of the ESA. The assessment concluded that neither the Shark FMP nor the fisheries would

jeopardize the recovery or existence of any endangered or threatened species or their habitat, but the shark fisheries may adversely affect listed species. On September 23, 1991, the resulting BO concurred with this conclusion.

In July 1992, the shark gillnet fishery came under suspicion of taking sea turtles when over 20 loggerhead turtles stranded on Cumberland Island, Georgia during a 10-day period. Three shark gillnet vessels were reportedly fishing off this island during this period. On October 13, 1992, (57 FR 46815) NMFS published a temporary observer requirement in the shark gillnet fishery. This rule was in effect from October 7 through November 5, 1992. Under this regulation, NMFS could place observers on these vessels to determine whether these vessels take turtles. The accompanying biological opinion analyzed the impact of this fishery on threatened and endangered sea turtles. That opinion reemphasized the need for an observers program to determine the impact of this fishery on sea turtles and established an incidental take statement that allowed the documented take of by injury or mortality of: one Kemp's ridley, or one green, or one hawksbill, or one leatherback turtle, or two loggerhead turtles.

Implementation of the Shark FMP through the Federal permit, quotas, recreational bag limits and anti-finning regulations will reduce fishing effort. A reduction in marine mammal and endangered species mortality should occur with a reduction of shark fishing effort. The presence of on board observers will help quantify the impact of shark fishing on these species.

A request for state concurrence with NMFS's determination of consistency of the proposed management measures with state coastal zone management programs under the Coastal Zone Management Act (CZMA) was submitted to each state for review during the initial draft Shark FMP development process. The states of New York, New Jersey, New Hampshire, Massachusetts, Connecticut, South Carolina, Pennsylvania, Maryland, Florida, and Delaware concurred with the Federal consistency determination. Georgia, Maine, and Texas do not participate in the Federal coastal zone management program. North Carolina commented it would review the final Shark FMP. Louisiana, Mississippi, and Puerto Rico submitted comments, but did not state concurrence or disagreement with the consistency determination. Alabama, Rhode Island, Virginia, and the Virgin Islands did not respond.

NMFS prepared a second set of consistency determinations for the proposed Shark FMP that were sent to each state and territory for concurrence. Ten states concluded that the proposed measures were consistent with their coastal zone management plans. These states were Connecticut, Delaware, Florida, Mississippi, New York, North Carolina, Pennsylvania, Puerto Rico, South Carolina, and Virginia. Since none of the other states commented on the

Shark FMP, dated October 28, 1991, consistency was assumed under the CZMA procedures.

New Jersey objected to the proposed mako shark minimum size measures as inconsistent with its Coastal Management Program prepared and implemented under the Coastal Zone Management Act. The State argued that the different manner in which the size measure was to be applied to the commercial and recreational fisheries was inconsistent with the conservation objections of the State's program. This issue was resolved fully when the mako shark minimum size measure was dropped from the FMP because of inadequate biological justification.

NMFS will make a new CZMA consistency determination for the final FMP and interim final rule and send to all the affected states at the time of publication of the rule. In preparing and implementing the subsequent final rule, NMFS will consider the views of the coastal states and the general public regarding those FMP measures implemented through the interim final rule.

A Final Environmental Impact Statement is incorporated in the Shark FMP. There is no indication that the proposed management actions will have any adverse impact on the physical environment, public health, or safety. The proposed actions will have some impact on the fishery resource, but they are designed to rebuild the overfished large coastal group and protect the large pelagic and small coastal species groups from overfishing and potential collapse. There will be a short-term negative impact on the human environment as fishing restrictions become effective. However, these restrictions will produce long-term benefits, allowing fishing to continue indefinitely under a program of sustained yield from the shark resources.

A Federalism Assessment (FA) was prepared for the final FMP and implementing regulations. The FA concluded that the implementation of regulations managing sharks in Federal waters is not only required by Federal law, but clearly in the Nation's best interest since sharks are a valuable resource in danger of a stock collapse from overfishing. The Shark FMP does not limit the policy-making discretion of the states or preempt state laws. The proposed management measures and the implementing regulations are therefore consistent with the principles, criteria, and requirements of Executive Order 12612. The concepts of Federalism support the approval of the management measures and issuance of the regulations.

After implementing the FMP, the Assistant Administrator will establish the OT and will request that the OT review the management measures and supporting scientific information and make recommendations for management changes as necessary and appropriate.

1.0 DEFINITIONS

Atlantic EEZ means the U.S. East Coast Exclusive Economic Zone, which includes Atlantic, Gulf of Mexico, and Caribbean waters.

Atlantic Ocean means the waters off the U.S. East Coast, the Gulf of Mexico, and the Caribbean Sea.

Charter Vessel means a vessel whose operator is licensed by the U.S. Coast Guard to carry six or fewer paying passengers and whose passengers fish for a fee.

Commercial Fisherman means a person who derives income by catching and selling fish or shellfish taken from inland or marine waters.

Dealer means the person who first receives fish from a commercial fisherman by way of purchase, trade, or barter.

Directed Fishery means the commercial and recreational fishery for which shark is the principal species targeted.

Director means the Director, Office of Fisheries Conservation and Management, National Marine Fisheries Service (NOAA), 1335 East-West Highway, Silver Spring, MD 20910. Telephone (301) 713-2334, or a designee.

Discard means fish that have been caught and then thrown back into the water either dead or impaired to the point where death is imminent.

EIS; EA; DEIS; FEIS; SEIS means an Environmental Impact Statement (EIS) required under the National Environmental Policy Act; EA is an Environmental Assessment; DEIS is a draft EIS; FEIS is a final EIS; SEIS is a supplemental EIS.

Exclusive Economic Zone (EEZ) means the area adjacent to the United States that, except where modified to accommodate international boundaries, encompasses all waters from the seaward boundary of each of the coastal states to a line on which each point is 200 nautical miles from the baseline from which the territorial sea of the United States is measured.

Finning means the practice of removing only the fins from sharks and discarding the remainder of the shark into the sea.

Fishing means any activity, other than scientific research conducted on a scientific research vessel, which involves:

- (a) The catching, taking, or harvesting of fish;

- (b) The attempted catching, taking, or harvesting of fish;
- (c) Any other activity which can reasonably be expected to result in the catching, taking, or harvesting of fish; or
- (d) Any operations at sea in support of, or in preparation for, any activity described in paragraphs (a), (b), or (c) of this definition.

Fishery Management Plan (FMP) means a plan prepared by a Regional Fishery Management Council (Councils) or by NMFS (if a Secretarial plan) to manage a particular fishery, as directed by the Magnuson Act.

Fishing Vessel means any vessel, boat, ship, or other craft, including aircraft, which is used or equipped to be used for, or of a type which is normally used for:

- (a) Fishing; or
- (b) Aiding or assisting one or more vessels at sea in the performance of any activity relating to fishing; including, but not limited to, preparation, supply, storage, refrigeration, spotting, transportation, or processing.

Fork Length means the straight-line measurement from the tip of the head (snout) to the center of the tail (caudal fin).

Headboat means a vessel whose operator is licensed by the U.S. Coast Guard to carry seven or more paying passengers and whose passengers fish for a fee.

Incidental Catch means catch of other than the target species; also called bycatch.

Inshore means ocean waters from shore to the inner boundary of the EEZ.

Longline means fishing line that has baited hooks in a series, and is anchored, floating, or attached to a vessel, or one or more buoys.

Magnuson Act means the Magnuson Fishery Conservation and Management Act of 1976, as Amended.

Management Unit refers to the 39 shark species found in the Western North Atlantic Ocean that are regulated by this management plan.

Maximum Sustainable Yield (MSY) is an estimate of the largest average annual catch or yield that can be taken over a significant period of time from each stock under prevailing

ecological and environmental conditions.

National Marine Fisheries Service (NMFS) is the component of the National Oceanic and Atmospheric Administration (NOAA), Department of Commerce, responsible for conservation and management of living marine resources.

Net means any net, including but not limited to purse seines, gillnets, paired trawls, and any other type of encircling or entanglement gear.

Nondirected or Indirect Fishery means any fishery that targets a species other than shark, but does land some sharks, or throws sharks back into the water dead or alive.

Offshore means ocean waters seaward of the inner boundary of the EEZ.

Optimum Yield (OY), as defined by the Magnuson Act, means the amount of fish that can be taken from a fishery that will provide the greatest overall benefit to the Nation with particular reference to food production and recreational opportunities, and which is prescribed as such on the basis of the MSY from each fishery, as modified by any relevant economic, social or ecological factor.

Recreational Fisherman means an angler who does not sell his/her catch.

Recruitment Overfishing means the harvesting of a stock to the point that reproduction by the remaining reproductive stock is inadequate to produce as many fish as the habitat can support.

Regulatory Impact Review (RIR) means an assessment of the ability of the proposed measures to achieve the overall objectives through analysis of the associated economic, social, biological, and ecological impacts.

Secretary means the Secretary of Commerce or a designee.

Shark Tournament means any fishing contest in which shark is a targeted species for which prizes are awarded, or its status as a gamefish is otherwise recognized.

State Waters means waters seaward of the baseline from which the territorial sea is measured to a distance of three nautical miles, except in the case of Texas, Puerto Rico, and the West Coast of Florida where it is nine nautical miles.

Total Allowable Level of Foreign Fishing (TALFF) means the portion of the Optimum Yield on an annual basis which will not be harvested by U.S. vessels.

Trip means fishing trip, regardless of number of days duration, which begins with departure from a dock, berth, beach, seawall, or ramp and which terminates with return to such structures.

U.S. Waters means all water shoreward of the outer boundary of the EEZ to the baseline from which the territorial sea is measured.

2.0 DESCRIPTION OF RESOURCE AND HABITAT

2.1 BIOLOGY

Sharks belong to the Class Chondrichthyes, cartilaginous fishes that also include the rays, the skates, and the deepwater chimaeras (ratfishes). Sharks are primitive fishes characterized by skeletons lacking true bones. About 350 species of sharks have been described throughout the world. Seventy-three species are known to inhabit the waters along the U.S. East Coast, including the Gulf of Mexico and the waters around Puerto Rico and the Virgin Islands.

The earliest known sharks appear as fossils in the rocks of the Devonian period, ca. 400 million years ago. Early sharks evolved as pelagic predators, although they were not the large predators of today. Early sharks were small creatures, about 60 to 100 cm long, that were preyed upon by much larger armored fishes that dominated the seas. Sharks have maintained the role of pelagic predators for nearly 400 million years, competing with other adapted predators, such as ichthyosaurs and toothed whales. Sharks have survived competition for eons, evolving into the large and aggressive predators that dominate the seas today.

Although the number of species of sharks is relatively small when compared to the number of species of bony fishes (over 20,000), sharks are a diverse group. They range in size from the gigantic 12-m whale shark, the largest fish in the oceans, to the tiny pygmy shark that is fully grown at only 20 to 25 cm. There are fast-moving streamlined species such as mako and thresher sharks, and sharks with flattened, ray-like bodies, such as the angel sharks. There are basking sharks and whale sharks that feed by filtering small organisms from the water. The tiger shark eats large turtles, and the tiny cookiecutter shark feeds by carving plugs of flesh out of large fishes and whales. There are sharks that reproduce by laying eggs, as well as sharks that nourish their embryos through a placenta. Despite the great diversity in size, feeding habits, habitat, behavior, etc., there are some adaptations common to nearly all sharks. These adaptations have contributed greatly to the evolutionary success of sharks. Most of these common adaptations involve their feeding habits and reproductive modes.

Sharks are aggressive predators at or near the top of the food chain, with three exceptions: whale sharks, basking sharks, and megamouth sharks, all of which are filter-feeders. Most, however, are flesh eaters that have evolved very sensitive receptors that allow them to track wounded or injured prey. They have extremely sensitive smell receptors, eyes that can adapt to very dim light, electroreceptors that can, in the absence of scent or visual clues, detect prey buried in the sand, and

lateral line receptors that sense movement in the water. As predators, sharks must balance the energy spent in chasing and capturing prey against the energy obtained from eating it. Consequently, sharks usually select weak, sick, injured, or dying prey because such prey is easier to overcome than healthy individuals. In addition to their fine senses, sharks are armed with a formidable set of teeth and jaws that can produce considerable force. The teeth are replaced often, so sharks always have a sharp set capable of inflicting a clean bite.

The reproductive adaptations of sharks have contributed to their evolutionary success. The most significant of these are internal fertilization and the production of small numbers of large young, which hatch or are born as fully developed young or "pups." All sharks have internal fertilization. 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. When development is complete, the young are born as active, miniature sharks. The young are large at birth. Large size reduces the number of potential predators and competitors, thus enhancing shark survival.

The number of young produced by most shark species in each brood is small, usually ranging from 2 to 25, although large females of some species can produce broods of 100 or more pups. The production of large-sized young requires great amounts of nutrients to nourish the developing embryo. Thus, sharks have evolved diverse means of nourishing their embryos, such as the production of eggs with very large yolks, the ingestion of egg yolks by the embryos, and the direct transfer of nutrients from mother to embryo through a yolk sac placenta. Traditionally, these adaptations have been grouped into three modes of reproduction: oviparity, ovoviviparity, and viviparity.

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

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

Viviparity, or placental viviparity, is the most advanced mode of reproduction. The embryos of viviparous sharks are initially dependent on stored yolk but are later nourished by the mother through a placental connection. In viviparous sharks, the yolk sac comes in contact with the mother's uterus, and it becomes modified into a yolk sac placenta. Here the tissues of embryo and mother come in intimate contact, and nutrients can be supplied to the embryo. Being connected to the blood supply of the mother, the embryo has an abundant and continuous supply of nutrients. The embryo can thus be nurtured to a relatively large size at birth. Most placental sharks produce broods of two to a dozen, with a few exceptional pelagic species producing 20 to 40 young. Viviparity is confined to some smooth dogfishes, requiem sharks, and hammerheads.

Most species of sharks have gestation periods and ovarian cycles that last about a year. These two cycles may or may not run concurrently. In most of the larger carcharhinid sharks, the cycles do not run concurrently, but follow each other. For example, females will ovulate and become fertilized in the early spring or summer. They gestate for about a year, and give birth the following spring or summer. After giving birth, females begin to develop the eggs that will be ovulated the spring of the second year. Thus, most of these species reproduce every two years. In other species, such as hammerheads and sharpnose sharks, the ovarian cycle and the gestation periods run concurrently. Females carry developing embryos and developing eggs at the same time. Shortly after giving birth, these females ovulate, and are fertilized again. Thus, these species reproduce yearly. Other species have even longer gestation periods. The spiny dogfish has a gestation period of about 24 months, the longest known of any living creature.

Females of most species of sharks travel to specific "nursery" areas to give birth to their young at certain times of the year. These nurseries are discrete geographic areas, usually in shallow waters, or at least shallower waters 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 are also free of large predators, thus the young sharks have enhanced chances of survival. In temperate zones, the young exit the nursery with the onset of winter; in tropical areas, the young may stay in the nursery for a few years.

Sharks are slow growing and slow maturing fishes. The most economically important sharks, the large coastal carcharhinids, have very slow growth rates. Several of the commercially important species, such as sandbar (Casey et al., 1985), lemon (Brown and Gruber, 1988) and bull (Branstetter and Stiles, 1987), do not reach maturity until 12 to 18 years of age. The life span of sharks in the wild is not known, but it is believed that many species may live 30 to 40 years or longer. The reproductive life span of these sharks is unknown.

In summary, sharks have a very low reproductive potential. Various factors determine this low reproductive rate: slow growth, sexual maturity not reached until 4 to 18 years, one- to two-year reproductive cycles, a small number of young per brood, and specific requirements for nursery areas. Therefore, sharks must be managed very conservatively.

2.2 ECOLOGICAL RELATIONSHIPS

As mentioned earlier, sharks are predators, except for basking sharks, whale sharks, and megamouth sharks. Whale sharks and basking sharks exceed 8 m in length, and are similar to some whales in feeding habits. Other sharks are at the apex of the food chain: white, mako, tiger, bull, and great hammerhead, all large species exceeding 3 m in length.

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

ocean basins. Examples of this category are most cat sharks and gulper sharks.

Tagging studies have shown that assignment of species to these categories must be somewhat arbitrary because several coastal-pelagic sharks have shown movements from the U.S. to the Bahamas, West Indies, and Mexico. For example, the sandbar shark has shown north-south movements along the U.S. east coast between Cape Cod and Texas. Sandbar sharks tagged off the northeast coast of the U.S. have traveled across the Florida Straits to Cuba and to Mexican waters as far south as the Yucatan. Some tagged sandbar sharks have traveled almost 5,000 km along the coast of North America and have been recaptured after 24 years. Other species (dusky, blacktip, night, silky, blue, shortfin mako, longfin mako, tiger, whitetip, spinner, and bignose) have also traveled between the U.S. east coast and the Gulf of Mexico. Detailed knowledge of the migrations of sharks between the U.S. EEZ and international waters will be required for the most effective management of these species, because they are available to several national and international fisheries.

The ecological relationships of sharks are poorly known. The effects of sharks on other fish stocks are not known, although some studies suggest that the removal of large sharks from an area results in the proliferation of the smaller shark species.

2.3 SPECIES IN THE MANAGEMENT UNIT

The shark management unit consists of 39 species in the Western North Atlantic Ocean. The management unit extends across state, Federal, and international jurisdictional boundaries. The species in the management unit were chosen for one or more of the following reasons: (1) they are frequently caught in commercial or recreational fisheries; (2) their low fertility and/or slow growth make them particularly vulnerable to overfishing; and (3) their habits make them vulnerable to indiscriminate killing. Sharks in the management unit were separated into three species groups for abundance assessments. The species in the management unit are listed in Table 2.1. The assessment groups are not ecological groups. They are groupings based on fisheries or where the species appear in the landings. Thus, one species could fit two assessment categories. However, for management purposes that species is listed only under one assessment group. For example, the silky shark and the bignose shark are found in both the pelagic environment and in deeper coastal waters, but for management purposes they are placed in the large coastal species group. Other species such as the Galapagos shark and the bigeye sand tiger shark are rare in U.S. waters, but they are similar to the commercially harvested dusky and sand tiger sharks, respectively. The former species are included in the management unit to prevent enforcement problems that would ensue from trying to discriminate among carcasses of similar species.

The smalltail shark has been reported in U.S. landings although there are questions about its presence in U.S. waters. It is included in the management unit to prevent enforcement problems like those explained above. The whale and basking sharks were included in the management unit, although they are not subject to organized fisheries at this time. They are included because their habits make them vulnerable to indiscriminate killing. The status of these species will be monitored by the OT, and appropriate actions may be recommended later through the framework regulatory adjustment procedure (Section 7.1.4) in the FMP. Additional species also may be incorporated into the management unit through the framework regulatory adjustment procedure.

2.4. SPECIES NOT IN THE MANAGEMENT UNIT BUT INCLUDED FOR DATA REPORTING

Most species included in the fishery for data reporting, but not in the management unit (Table 2.2), are small, deepwater sharks that are not target species, but are taken incidentally in directed shark fisheries, or in swordfish or tuna longlining operations. These species are not included in MSY estimates or included in any of the text tables or figures in any other sections of this FMP.

This group also includes two species known locally as "dogfish;" the spiny dogfish (*Squalus acanthias*) and the smooth dogfish (*Mustelus canis*). Unlike most species in Table 2.2, they are taken in considerable numbers in directed fisheries, and as bycatch in other fisheries, because they enter shallow water and are extremely abundant. These species are not overfished at this time nor confronted with such problems as finning, as are the species in the management unit, although finning of dogfish has been reported (Kurkul, 1990).

2.5 DESCRIPTION OF HABITAT

A detailed description of shark habitat has been prepared as a source document and is available upon request from the Regional Director.

2.5.1 CONDITION OF HABITAT AND IMPACTS ON SHARKS

Sharks are found in estuaries, nearshore areas, the continental shelf, continental slope, and open ocean. Many species are migratory and, like all other marine species, are affected by the condition of the habitat. Degraded habitat affects sharks by altering their ecological patterns and by reducing the availability of prey species.

Table 2.1

Sharks in the Management Unit, by Species Groups

Large Coastal Sharks

Sandbar	<u>Carcharhinus plumbeus</u>
Blacktip	<u>Carcharhinus limbatus</u>
Dusky	<u>Carcharhinus obscurus</u>
Spinner	<u>Carcharhinus brevipinna</u>
Silky	<u>Carcharhinus falciformis</u>
Bull	<u>Carcharhinus leucas</u>
Bignose	<u>Carcharhinus altimus</u>
Narrowtooth	<u>Carcharhinus brachyurus</u>
Galapagos	<u>Carcharhinus galapagensis</u>
Night	<u>Carcharhinus signatus</u>
Caribbean reef	<u>Carcharhinus perezi</u>
Tiger	<u>Galeocerdo cuvieri</u>
Lemon	<u>Negaprion brevirostris</u>
Sand tiger	<u>Odontaspis taurus</u>
Bigeye sand tiger	<u>Odontaspis noronhai</u>
Nurse	<u>Ginglymostoma cirratum</u>
Scalloped hammerhead	<u>Sphyrna lewini</u>
Great hammerhead	<u>Sphyrna mokarran</u>
Smooth hammerhead	<u>Sphyrna zygaena</u>
Whale	<u>Rhincodon typus</u>
Basking	<u>Cetorhinus maximus</u>
White	<u>Carcharodon carcharias</u>

Small Coastal Sharks

Atlantic sharpnose	<u>Rhizoprionodon terraenovae</u>
Caribbean sharpnose	<u>Rhizoprionodon porosus</u>
Finetooth	<u>Carcharhinus isodon</u>
Blacknose	<u>Carcharhinus acronotus</u>
Smalltail	<u>Carcharhinus porosus</u>
Bonnethead	<u>Sphyrna tiburo</u>
Atlantic angel	<u>Squatina dumerili</u>

Pelagic Sharks

Shortfin mako	<u>Isurus oxyrinchus</u>
Longfin mako	<u>Isurus paucus</u>
Porbeagle	<u>Lamna nasus</u>
Thresher	<u>Alopias vulpinus</u>
Bigeye thresher	<u>Alopias superciliosus</u>
Blue	<u>Prionace glauca</u>
Oceanic whitetip	<u>Carcharhinus longimanus</u>
Sevengill	<u>Heptranchias perlo</u>
Sixgill	<u>Hexanchus griseus</u>
Bigeye sixgill	<u>Hexanchus vitulus</u>

Table 2.2

Sharks Not in the Management Unit But Included For Data Reporting

Cat Sharks, Family Scyliorhinidae

Iceland cat shark	<u>Apristurus laurussoni</u>
Smallfin cat shark	<u>Apristurus parvipinnis</u>
Deepwater cat shark	<u>Apristurus profundorum</u>
Broadgill cat shark	<u>Apristurus riveri</u>
Marbled cat shark	<u>Galeus arae</u>
Blotched cat shark	<u>Scyliorhinus meadi</u>
Chain dogfish	<u>Scyliorhinus retifer</u>
Dwarf catshark	<u>Scyliorhinus torrei</u>

Dogfish Sharks, Family Squalidae

Japanese gulper shark	<u>Centrophorus acuus</u>
Gulper shark	<u>Centrophorus granulosus</u>
Little gulper shark	<u>Centrophorus uyato</u>
Kitefin shark	<u>Dalatias licha</u>
Flatnose gulper shark	<u>Deania profundorum</u>
Portuguese shark	<u>Cetoscymnus coelolepis</u>
Greenland shark	<u>Somniosus microcephalus</u>
Lined lanternshark	<u>Etmopterus bullisi</u>
Broadband dogfish	<u>Etmopterus gracilispinnis</u>
Caribbean lanternshark	<u>Etmopterus hillianus</u>
Great lanternshark	<u>Etmopterus princeps</u>
Smooth lanternshark	<u>Etmopterus pusillus</u>
Fringefin lanternshark	<u>Etmopterus schultzi</u>
Green lanternshark	<u>Etmopterus virens</u>
Cookiecutter shark	<u>Isistius brasiliensis</u>
Bigtooth cookiecutter	<u>Isistius plutodus</u>
Smallmouth velvet dogfish	<u>Scymnodon obscurus</u>
Pygmy shark	<u>Saualiolus laticaudus</u>
Roughskin spiny dogfish	<u>Squalus asper</u>
Blainville's dogfish	<u>Squalus blainvillei</u>
Spiny dogfish	<u>Squalus acanthias</u>
Cuban dogfish	<u>Squalus cubensis</u>
Bramble shark	<u>Echinorhinus brucus</u>

Sawsharks, Family Pristiophoridae

American sawshark	<u>Pristiophorus schroederi</u>
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Smoothhound Sharks, Family Triakiidae

Florida smoothhound	<u>Mustelus norrisi</u>
Smooth dogfish	<u>Mustelus canis</u>

Offshore areas used by adult sharks are the least affected by habitat alterations and water quality degradation. Currently, the primary habitat threats are oil and gas development and production, offshore dumping of dredged material, disposal of chemical wastes, and discharge of contaminants into river systems. However, no studies are known of adverse effects on sharks from these activities.

Nearshore areas generally appear to be acceptable shark habitat, but local problem areas exist. For example, water quality may be reduced in areas affected by the plumes of major rivers. Local disturbances also result from periodic beach nourishment, dredged material disposal, and the dredging itself.

Estuarine nursery is the habitat area of greatest concern relative to sharks. Natural and human-induced alterations of this fragile environment have modified freshwater inflow and removed much of the suitable habitat. The amount of remaining wetlands suitable for shark production has not been quantified; however, Alexander et al. (1986) estimated that for the last 25 years, coastal wetlands have been depleted at an average rate of 80 sq km per year. In some areas, this rate may be even higher. For example, Gagliano (1984) estimated that natural and human-induced forces in Louisiana contribute to a yearly land loss, including marsh, of more than 130 sq km. Major effects result from erosion, sea level rise, subsidence, and accretion.

The estuaries also have been the most impacted by water quality degradation. The major human activities that impact the estuarine zone are: construction and maintenance of navigation channels; construction of levees and marinas; discharges from wastewater plants and industries; dredge and fill for land use development; agricultural runoff; ditching, draining, or impounding wetlands; oil spills; thermal discharges; mining, particularly for phosphate and petroleum; entrainment and impingement from electric power plants; dams; alteration of freshwater inflows to estuaries; saltwater intrusion; and nonpoint-source discharges of contaminants.

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

2.5.2 HABITAT IN THE FUTURE

Coastal and marine habitat loss and degradation are major concerns to government agencies, conservation organizations, and private industry. The Presidential "no net loss" policy, habitat rehabilitation, the creation of new habitats, and broad-scale attacks on pollution are all important conservation efforts. There are more than 30 Federal agencies, as well as state and territorial governments, involved with coastal wetlands conservation, and thousands of laws aimed at their wise use, conservation, and management. Application of these laws by the appropriate agencies should modify these land-use demands and minimize the amount of coastal habitat loss.

3.0 DESCRIPTION OF THE FISHERY

3.1 HISTORY OF EXPLOITATION

Historically, sharks have been an underutilized resource in North America. Small, localized shark fisheries have existed along all U.S. coasts for many years, but organized intensive shark fisheries have been scarce and have lasted only a few years.

A shark longline fishery operated in Salerno, Florida nearly continuously from 1936 to 1950. The maximum number of these shark-fishing boats in use at any one time was five. The greatest number of shark-fishing boats known to have been operating off the Southeastern Coast of the U.S. concurrently was 16 (Springer, 1952). Sharks were fished primarily for their livers and hides. The liver oil was used in the production of vitamin A, and the hides were processed into leather. Production also included fresh and salted meat, fins, and fish meal.

From 1938 to 1946, all shark fishing was done with chain sets, except for one boat known to set nearshore gillnets in summer for nurse sharks. The weight of the chain line normally confined fishing to depths less than 46 m. When currents were not strong, however, sets were made at depths to 91 m. In the last years of the fishery (1947 to 1950), the catch per unit of effort increased. This was due both to expansion of the fishery and to a bonus arrangement that encouraged cooperation among the fishermen. This operation ended in 1950, because of the appearance of low-cost, synthetic vitamin A (Springer, 1950 and Wagner, 1966).

An intensive fishery for soupfin sharks and spiny dogfish existed for a few years off California during the late 1930s and early 1940s. Prior to 1937, shark fishing in California supplied limited demands for fresh shark fillets and fish meal. There was also a substantial ethnic market for dried fins of soupfin sharks. Annual production from 1930 to 1936 averaged 267 mt. In 1937, however, a new market for sharks developed when it was discovered that soupfin shark liver was the richest source of vitamin A available in commercial quantities. Supplies of vitamin A were scarce at the time because of the war in Europe (Butler, 1955). Nominal prices offered to fishermen for soupfin sharks increased dramatically, and the fishery became a bonanza. By 1942, the price of shark liver had risen to \$1,653 per metric ton from \$11 per metric ton in 1938. In 1939, about 600 boats were fishing for soupfin sharks along the California coast, with state shark landings reaching a maximum of 4,187 mt in 1939 (Ripley, 1946). In the following years, total landings decreased despite the increase in fishing effort encouraged by high prices. By 1946, shark landings had declined to 728 mt (Conner, 1947) due to overfishing, and by 1950, due to the availability of synthetic

vitamin A and imports from Japan (Butler, 1955), and decreased catches to a pre-1937 level of 322 mt.

A soupfin shark fishery also operated in Oregon and Washington from about 1940 to 1949. The development of more efficient gear, and expansion of the fishery, caused a sharp rise in Oregon landings, peaking when 123 mt of livers were landed, but subsequently dropping to a low of 23 mt of livers in 1948. Expansion to new fishing grounds in the Hecate Straits, British Columbia, caused landings to increase slightly in 1949, but by 1950, the synthesis of vitamin A and decreased catches resulted in a total absence of boats fishing for sharks in Oregon (Westrheim, 1950).

Another small shark 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 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 fishery for thresher sharks is centered off southern California with the common thresher, Alopias vulpinus, as the principal species. This fishery began as a minor operation with only 15 vessels landing sharks caught as a bycatch in the directed fishery for swordfish, Xiphias gladius. Nominal ex-vessel prices for the common thresher increased from \$.29 in 1977 to \$1.60 per pound in 1986. By 1980, the number of vessels in the fleet reached 200 and entry became limited by California. By 1985, the number of licensed vessel reached 250. Landings increased from 59 mt in 1977, peaked at 1,099 mt in 1982, and declined ever since to 545 mt in 1986. Available information indicates that the local population is not large or capable of reproducing itself and immigration from adjacent waters is not sufficient to sustain a fishery under the current fishing pressure (Holts, 1988). Since 1986, landings have continued to decline and the resource is considered to be depleted in different areas within its range. In 1989, the directed harvest was prohibited as part of a management plan implemented by California, Oregon, and Washington (Holts, 1991).

The fishery for the Pacific angel shark, Squatina californica, started in 1978 near Santa Barbara, California. Prior to 1982, 6-8 vessels from California fished for this shark. After 1982, landings increased to about 144 mt in 1982, doubled by 1984, reached 590 mt in 1985, and declined to 499 mt in 1986 (Holts,

1988). Landings have continued to decline due to overfishing and an influx of lower-price imports from Mexico. (Holts, 1991)

3.1.1 SHARK MEAT AS FOOD FOR HUMANS

There was little consumption of shark meat in the U.S. prior to the 1970s. Since then, shark flesh has become a popular seafood; largely due to improved handling at sea, a Federally assisted marketing program that promoted shark consumption, and a market economy favoring the low-cost shark over more costly fish.

Shark meat is nutritious, boneless, and mild-flavored, and the texture has eye-appeal. Species valued for premium edibility are mako, white, thresher, soupfin, sandbar, and blacktip, but some species, such as blue sharks, are generally considered unpalatable. Shark meat is susceptible to spoilage because of its high urea content. The flavor and quality of the meat depend on effective, timely bleeding of the carcass, and on storage temperature.

3.1.2 SHARK FINS

Chinese use shark fins as the main ingredient of a highly regarded soup; consequently, there is a significant market for shark fins in Asia. Thus, the fins are the highest priced shark product. For the longest white shark fins and tails indicated, 40/up (40-cm and longer), nominal wholesale market prices declined from \$44/kg by 1982 to \$26-\$34/kg in 1984-87 and rose to the range of \$45-\$50/kg by 1988-91. The prices of 30/40 and 20/30 white shark fins and tails behaved similarly. Prices of the shorter ones, 10/20s and un/10s, increased more sharply since the mid-1980s.

Dried shark fins are processed primarily in Hong Kong and Singapore, soaked and dried repeatedly until the skin peels off and exposes the cartilage and fibers. Careful trimming yields the spaghetti-like fibers, ceratotrichia, used in shark fin soup. The preferred species are those that have large, very fibrous fins. The dorsal and caudal fins have the highest fiber content, although the two pectoral fins can also be used. Generally (in Asia), the larger the fibers, the more expensive the end product (Ross, 1989). Nominal prices in 1991 paid to fishermen in Florida range from \$3.30 per kilogram for wet fins, \$14.30 per kilogram for partly dry fins, and \$22.00 per kilogram for top grade dry fins (O'hop, 1991).

Prices for finished fins vary with degree of processing and other factors. According to the survey of San Francisco fin markets conducted in June 1989, mixed ceratotrichia and basal cartilages sold for a nominal price of \$100 per kilogram, while pure ceratotrichia commanded \$220 per kilogram or more for select fins

in "matched" sets, i.e., from the same shark, for the most prized species (Cook, 1989).

3.1.3 SHARK HIDES

Shark hides can be processed to produce high-quality leather. Processing only shark skin is not very profitable, however, and participants must combine this operation with additional utilization of the shark (such as fins) or with another fishery. Although there is some demand for skins, the market requires a high-quality product, making it necessary to exercise great care in processing the skin.

3.1.4 SHARK RESEARCH AND MEDICINE

Because of their position in vertebrate evolution, sharks have been studied as anatomical models of primitive vertebrates for many decades. Sharks are currently used in physiological, biochemical, and immunological research.

Sharks are utilized in biomedical research, both as model animals and as sources of medically important compounds. Sharks are being used in cancer research because they rarely develop any malignant tumors (Harshberger, 1968). Ten years of studies have shown that captive nurse sharks exposed to powerful carcinogens never develop the disease (Hueter, 1990a), demonstrating an immunity to tumors. Shark liver oil promotes the activity of white blood cells, potentially contributing to the sharks' natural resistance to cancer (Bliznakov, 1968). Sharks are also being used as a source of cartilage that contains a compound that may be useful in clinical control of tumors in humans (Lee and Langer, 1983; Luer, 1986). Shark cartilage has also been used as a component of artificial skin for burn victims (Maugh, 1982). Shark corneas were once used experimentally for human transplants because of their resistance to osmotic swelling (Payrau, 1969). Other compounds derived from sharks have anti-clotting agents more powerful than the commercially-available products (Ronsivalli, 1978).

Sharks have also been used in the manufacture of pharmaceutical drugs. Shark liver oil was used for many years as a source of vitamin A, until vitamin A was synthesized in the late 1940s. There is concern among some that the synthetic substitute may be inferior to fish liver oil because it lacks minerals, amino acids, and possibly other unidentified nutrients (Ronsivalli, 1978). Shark liver oil currently is used in hemorrhoid remedies and in food supplement capsules.

3.1.5 MISCELLANEOUS SHARK PRODUCTS

Shark jaws and teeth are sold extensively in seaside curio shops. Jewelry made from shark teeth is a popular item. Tiger shark

vertebrae are turned into a white face powder used by Japanese geisha girls.

3.1.6 SHARK ATTACKS

Approximately 20 to 25 shark "attacks" occur in U.S. waters every year (Burgess, 1990). These consist of human-shark interactions where a person may be hurt or, rarely, killed by sharks. The annual attack rate is relatively stable, although the number of people engaged in saltwater activities increases every year. The number of deaths attributed to shark attacks is small, compared to fatalities from bee stings or lightning strikes, but the news media focuses a great deal more attention on shark attacks.

Implementation of the plan is not expected to affect the number of shark attacks on humans, as these events are more dependent on human behavior than on shark abundance. For example, a speared fish in the water produces all the smells, sounds, and sights that attract sharks, with potentially unpleasant consequences to the spear-fisherman. Many other "attacks" stem from people carelessly handling sharks or provoking them. It is suspected that some victims of alleged attacks by tiger sharks, known scavengers as well as predators, actually may have died from unrelated causes. Public education and water safety can reduce the number of yearly shark attacks. Burgess (1989) puts shark attacks into a proper perspective: in Florida, over 100 million human-in-the-water hours annually produce about 15 to 20 attacks, resulting in an average of less than one death per year.

3.2 COMMERCIAL AND RECREATIONAL FISHING ACTIVITIES

3.2.1 PARTICIPATING USER GROUPS

Description of User Groups

Sharks, as both food and gamefish, increased in popularity in the 1970s. In recent years, economic changes in Asia broadened the sharkfin market. The increased demand for shark flesh and the high price of their fins encouraged entry into the shark fishery. Fishermen in other fisheries, such as tuna and swordfish, began to retain sharks for the fins, instead of releasing them alive as was done previously. Both directed and nondirected commercial fisheries, as well as recreational anglers, now exploit shark resources.

Users of shark resources may be divided into two broad categories: recreational and commercial. Recreational users are anglers who pursue sharks for sport; this has become popular in the last 15 years, as evidenced by the increased number of shark tournaments. Commercial fishermen, who derive some portion of their income by selling their shark catch, are grouped as those engaged in directed fisheries (targeting sharks), or those

involved in indirect fisheries (targeting other species with sharks as bycatch).

Recreational Use

In the past, sharks were often called "the poor man's marlin." Now, however, shark fishing is a popular sport at all socioeconomic 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. Makos, white sharks, and large oceanic sharks, on the other hand, are generally available only to those on ocean-going vessels.

Beach or surf fishing for sharks became popular in the early 1970s (Sand, 1982; Schneider, 1972). Pier fishing for sharks was also popular for many years (the largest tiger shark on record was caught from a pier in Cherry Grove, South Carolina in 1964), but has been prohibited by many tourist-dependent communities that did not want to publicize the presence of large sharks near swimming beaches.

Most recreational shark fishing takes place from small to medium-size boats. The increase in eastern Gulf Coast shark fishing tournaments since 1973 underscores the popularity of this activity. Previously, there were only about a half dozen such tournaments in the region, but by 1983, there were more than 40 shark tournaments, and there are currently about 65 each year (Casey, 1989).

Shark tournament fishing is usually conducted from boats that vary in size from small outboards to sportfishing yachts of 15 m or longer. The number of participants and boats varies: a two-day Long Island, New York shark tournament has drawn 300 boats and about 1500 anglers annually in recent years, but some tournaments limit boats to less than 150 because of limited shore facilities. "Exclusive" tournaments charge high entry fees on a "first-come, first-served basis." In the past 10 years, "big money" shark tournaments with a top prize of \$50,000 or more have become popular.

As many as 15 different species, depending upon tournament locale, are caught during these events. The most prized catches, with respect to fighting quality, size, or rarity are: mako, thresher, white, dusky, tiger, lemon, blacktip, hammerhead, and bull sharks.

In the 1960s and early 1970s, tournaments often awarded prizes for total weight or number of sharks caught. Unfortunately, the catch then was discarded, although some species, primarily mako, were sold or kept for food. Smaller or less desirable species were routinely killed rather than released; the prevailing

attitude was "the only good shark is a dead shark." Since then, however, attitudes have changed. Currently, most tournament rules include restrictions on minimum size, number of sharks per boat, and/or anglers. Many tournaments encourage tagging and releasing small sharks and discourage landing sharks that will be discarded. At least one shark tournament is strictly a tag-and-release contest, with observers assigned to each boat.

Charter vessel fishing for sharks is becoming increasingly popular, probably due to the decreased abundance of other large gamefish, but the cost of pursuing billfish may be a factor as well. In most U.S. waters, this type of fishing is confined to the warmer months, May to September. In some regions, certain species are heavily targeted: sharpnose and blacktip in the Carolinas, and mako and large white sharks at Montauk, New York. Headboats, on the other hand, may land the smaller shark species caught, but they usually do not target sharks specifically, except for a headboat fishery for sharpnose sharks based in Port Aransas, Texas.

Commercial Use

Directed Fisheries

Commercial fishermen in the directed shark fisheries use either longlines or gillnets. Longliners use modified swordfish lines in coastal waters during a long season, often following stocks as they move north or south along the Atlantic coast. The primary species caught by longline fishermen are sandbar, blacktip, bull, bignose, tiger, sand tiger, lemon, spinner, scalloped hammerhead, and great hammerhead sharks.

Gillnet fishing for sharks in the southeast has existed for many years. These fishermen operate small boats from May to November, when sharks are in shallow water. Some of these estuarine waters, 2 to 5 m deep, are nursery areas for many species of sharks. Gillnet fishermen catch sandbar, blacktip, finetooth, blacknose, bull, spinner, dusky, sharpnose, sand tiger, scalloped hammerhead, and others. Recent legislation in South Carolina essentially terminated the use of commercial gillnets in its waters. This action has forced fishermen into deeper, Federal waters where their gillnets are less effective.

Indirect Fisheries

Tuna and swordfish longline fisheries catch large numbers of sharks as bycatch. Dominant in the tuna fisheries are blue, porbeagle, hammerhead, and "unidentified" sharks; in the domestic swordfish fishery mako, thresher, and "unidentified" sharks are the major species. These unidentified species are probably bignose, dusky, silky, and night sharks. Other fisheries also take sharks as bycatch in the summer months. Shallow-water shrimp trawls catch large quantities of Atlantic sharpnose sharks and the juveniles of several species. Shrimping is common in

areas that serve as nurseries, and many newborn sharks are caught at this time (Castro, 1989). Gillnet vessels in the New England multispecies fishery catch and land sharks during the summer and early fall, with porbeagle and mako the dominant species.

The practice of "finning," i.e., removing the fins and discarding the remainder of the shark to the sea, probably arose in the indirect longline fisheries in order to save freezer space for the more valuable swordfish and tuna. Directed shark fisheries are unlikely to discard the carcasses, unless they are spoiled or unmarketable species. For example, hammerhead sharks are usually not marketed because their flesh is darker than that of other sharks and is commonly (but erroneously) considered spoiled; some processors also claim that it does not keep as well as other sharks.

Over the years, shark discards from both the commercial and recreational fisheries have been extensive. Although accurate information on amounts and species discarded cannot be derived without onboard observers, significant new fishery information was received from fishermen, fish dealers/processors, and several state fishery management agencies during the public comment periods held on the proposed FMP and on the proposed rule. This new information included: (1) data showing higher fishery removals in recent years than those used as a basis for determining MSY and stock conditions in the NMFS 1990 shark stock assessment; (2) records on the size and frequency of shark species caught in commercial fisheries; and (3) information on the commercial fishing fleet. NMFS reviewed this new information and determined that the amount of sharks finned was about the same as was harvested and landed during the years 1987 to 1991 (see Appendix II, Report of the Atlantic Coastal Shark Fishery Analysis Review, November 23, 1992).

3.2.2 LANDINGS AND VALUE INFORMATION

3.2.2.1 COMMERCIAL LANDINGS AND VALUE

Landings data are collected by port agents who routinely record the weight and average ex-vessel price of sharks purchased by seafood dealers. Some landings data may expose information about a single fisherman or dealer and must be treated confidentially, in accordance with the Privacy Act.

Landing statistics are maintained as round weight equivalents of the actual dressed weight or fin weight landed. Dressed carcass weights are converted to round weights before the data are archived. In cases where fins are sold without carcasses, the fin weights are used to estimate round weights.

Most sharks are not identified by species in the commercial landing statistics. There are many similar species, thus

identification of dressed sharks is difficult, and there is no difference in price except for mako sharks (Isurus spp.). Data for some species groups, however, are available through swordfish logbooks which list the weight of each carcass sold by species group: swordfish, tuna, mako, thresher, blacktip, "unidentified sharks," etc.

Commercial shark landings are seasonal. In the Gulf and South Atlantic, lowest landings from 1979 to 1987 occurred in January, with maximum Atlantic landings in March, and maximum Gulf landings in May. In the northeast (Maine through Virginia), commercial landings are lowest in February and March, increase significantly into June, peak and remain steady from July through September, and decrease into the winter months. Most commercial landings (86% for the period 1979 to 1988) come from the EEZ and beyond rather than state waters.

Commercial U.S. shark landings and ex-vessel values have increased significantly for all regions over the past decade (Table 3.1, Figures 3.1 and 3.2). From 1979 to 1986, shark landings from the Atlantic and Gulf of Mexico increased at an almost linear rate of about 130 mt per year. This trend represents a developmental phase in the evolution of the present industry: fins and flesh were supplied by incidental catches from longline, gillnet, and trawl fleets fishing for other species, but fishermen needed a dependable market to cover time and labor expended on the incidental catch. Likewise, wholesalers and retailers required consistent supplies of quality products. The fishery began to flourish as the regional marketing network developed.

U.S. shark landings increased sharply from 1,618 mt in 1986, peaked at 7,122 mt in 1989, and declining by 16% to 5,950 mt in 1990 (Snell, 1991). This growth was largely in the South Atlantic and Gulf of Mexico, attributable to the sharp increase in fin prices and development of directed shark fisheries. Landings data were not available from the Caribbean prior to 1987. Peak landings were 18 mt in 1990. Caribbean landings are included with Gulf of Mexico landings. Since 1985, several longline and gillnet fisheries began to target sharks in response to an established market, availability of the resource, and limited revenues in other fisheries.

Since 1983, the ex-vessel price for sharks has remained relatively stable in constant dollars (Table 3.2), after almost doubling from 1979 to 1983. The market has averaged about \$1.00 per kilogram, figured as ex-vessel value divided by round weight. (Note: The actual price paid for dressed carcasses would be higher.) Nonimal fin prices have risen significantly since 1987, however, in response to the demand from Asia. For the longest white shark fins and tails indicated, 40/up (40-cm and longer), the wholesale market prices declined from \$44/kg in 1982 to \$26-

\$34/kg in 1984-87 and rose to the range of \$45-\$50/kg by 1988-91. The prices of 30/40 and 20/30 white shark fins and tails behaved similarly. Nominal prices of the shorter ones, 10/20s and under/10s, increased more strongly since the mid-1980s. Prices paid to fishermen in Florida range from \$3.30 per kilogram for wet fins, \$14.30 per kilogram for partly dry fins, and \$22.00 per kilogram for top grade dry fins (O'hop, 1991). One effect of this increase has been to encourage finning of sharks that otherwise would be released alive.

3.2.2.2 RECREATIONAL CATCH

Recreational landings are estimated by the Marine Recreational Fishery Statistics Survey (MRFSS) carried out annually by NMFS. The survey consists of two activities: a telephone survey of households and an intercept survey of anglers at fishing sites. Several statistics are estimated: the number of fishing trips, the number of fish caught and/or landed (number and weight), and the number of persons fishing. In addition to the MRFSS, data from the NMFS headboat survey, shark tournaments, and Texas landings (which have been excluded from the MRFSS since 1985) were also used in assessing recreational catch and effort in the FMP. The MRFSS data are extremely variable among years and regions. The data, due to interview sparsity, variances in coding and reporting, and estimation methods and preciseness, have limitations. Sharks in the MRFSS are grouped into one multi-species category that includes some species that are not included in the FMP management unit. MRFSS grouping is not aligned to the three species groups used in the FMP (large coastal, small coastal and pelagic) which limits the usefulness of these data. The MRFSS estimate of total shark landings from 1979-1989 is reflected in Table 3.3. Shark landings by region are shown in Table 3.4. The Caribbean has not been sampled since 1981 under the MRFSS. The level of landings, however, is considered to be quite low.

The MRFSS data on fishing modes for 1979 to 1988 indicate that approximately 10% of the sharks were taken by headboats and charter boats. Analysis of Atlantic charter boat data on the effects of bag limits on shark catch (Isely, 1989) showed that sharks were caught on 5% of all charter boat trips surveyed, with an average of 2.8 sharks per boat per successful shark trip (defined as a trip on which at least one shark was caught). There were an estimated 3.33 anglers per boat for successful shark trips, but only one shark was caught on 37.4% of such trips. On a per angler basis, 76.6% of successful shark trips resulted in catches of one or less sharks per person. About 2% of all charter boat trips yielded one shark per trip, and 3% yielded more than one shark per trip. On a per angler basis, about 4% of charter boat trips caught one or less sharks per person, and about 1% caught more than one shark per person. Table 3.5 shows that the 838 charter boats operating in the Gulf

of Mexico during this period targeted sharks from 0.4 to 5.2% of their fishing time.

For purposes of this section only (because of the way the survey data were gathered), headboats are defined as vessels that carry 15 or more passengers, with the exception of 7 or more passengers in Louisiana. The number of headboats operating in the Gulf of Mexico has ranged from a high of around 100 in 1985 (Huntsman, 1989a) to 69 in 1988, increasing to 91 in 1990 (Cross, 1991). Approximately 110 more operated in the South Atlantic in 1990, from North Carolina to the Florida Keys.

While South Atlantic headboat shark catches are apparently increasing, from about 1 mt in 1986 and 3 mt in 1987 (Huntsman, 1989b and NOAA, 1989) to 24 mt in 1988 and 34 mt in 1989, total angler days (effort) are apparently decreasing: 415,472 in 1986; 446,404 in 1987; 420,663 in 1988; and 410,010 in 1989 (Cross, 1991). The most common shark caught by anglers fishing from headboats in the U.S. South Atlantic in 1989 was the blacktip, with 6 mt landed.

Total Gulf headboat shark catches were 61 mt in 1986, 113 mt in 1987, 135 mt in 1988, and 101 mt in 1989. About 50 to 75% of the Gulf headboat shark catch is landed between June and August (NOAA, 1989). In 1989, Texas headboats accounted for 87% by weight of total Gulf headboat shark landings. Gulf headboat shark catches are mostly attributed to a directed sharpnose shark fishery from Port Aransas, Texas. These headboats landed 26 mt in 1986, 92 mt in 1987, 113 mt in 1988, and 74 mt in 1989. Approximately half of Port Aransas-landed sharks were sharpnose.

Gulf of Mexico headboat effort (angler days) was 302,536 in 1986, 286,774 in 1987, 274,035 in 1988, and 274,581 in 1989. Thus, while it appears that Gulf of Mexico headboat effort (angler days) remained almost constant from 1988 to 1989, Gulf Headboat shark landings decreased 25%.

While Gulf headboats take large numbers of small sharks, especially sharpnose, sharks make up only 1 to 2% of all fish caught. Still, in summer months sharks can make up as much as 25% of total catch weight (NOAA, 1989a). No significant decrease has been noted in the average weight of sharks landed in Port Aransas (all sharks combined) over the last four years. Mean weights have remained fairly constant: 5.3 kg in 1986, 5.9 kg in 1987, 5.6 kg in 1988, and 5.9 kg in 1989.

The majority of sharks taken recreationally are caught in state waters (NOAA, 1979-1988). Combined recreational shark catches (by number) for the Mid-Atlantic, South Atlantic, and Gulf of Mexico inshore regions (from shore to three nautical miles) for 1984 to 1988 were 64% of the total for that period, with offshore (greater than three nautical miles from shore) catches accounting

Table 3.1

U.S. Commercial Shark Landings*

<u>Year</u>	<u>Landings</u> (mts)
1979	135
1980	458
1981	666
1982	590
1983	724
1984	846
1985	969
1986	1618
1987	3603
1988	5276
1989	7122
1990	5950

* All species in the management unit.

Source: National Marine Fisheries Service

Table 3.2

Average Nominal and Constant Dollar U.S. Commercial Shark Values by Region, 1979-1990

	New England		Mid-Atlantic		South Atlantic		Gulf of Mexico		All Areas	
	Nom. \$/kg	Const. \$/kg	Nom. \$/kg	Const. \$/kg	Nom. \$/kg	Const. \$/kg	Nom. \$/kg	Const. \$/kg	Nom. \$/kg	Const. \$/kg
1979	.56	.72	.45	.58	.50	.65	.33	.43	.44	.57
1980	.22	.25	.31	.35	.47	.53	.88	.99	.50	.56
1981	.23	.24	.25	.26	.95	.98	.84	.87	.64	.66
1982	.54	.54	1.15	1.15	.71	.71	.89	.89	.80	.80
1983	1.38	1.36	1.30	1.28	.84	.83	1.00	.99	.99	.98
1984	1.27	1.25	1.69	1.67	.85	.84	.88	.87	.94	.91
1985	1.66	1.60	1.77	1.71	1.09	1.05	.90	.87	1.10	1.06
1986	2.05	2.02	2.44	2.41	1.03	1.02	.95	.94	1.14	1.12
1987	2.17	2.09	2.58	2.49	1.08	1.04	1.03	.99	1.17	1.13
1988	2.08	1.96	2.88	2.43	1.05	.99	1.05	1.06	1.10	1.08
1989	1.94	1.83	1.85	1.74	1.04	.98	1.06	1.00	1.10	1.04
1990	1.65	1.40	1.97	1.67	1.04	.88	1.07	.91	1.10	.93

Source: Average nominal values calculated from Request to the Secretary to Collect Information on the Western North Atlantic Shark Fishery, p.11, January 10, 1988, Authority and Amendment to the Magnuson Act, Sec.303(e)(2). Constant dollar values derived deflating nominal values by the producer price index for finished consumer goods (1982=100).

for the remainder. For this period in the Mid-Atlantic, more sharks were caught offshore (58%) than inshore (42%). In the South Atlantic, significantly more sharks were caught inshore (84%) than offshore (16%). Similarly, in the Gulf of Mexico, 70% were taken inshore versus 30% offshore.

No information is available on recreational catches of sharks in the Caribbean. Data are not available to assign a monetary value directly to the recreational shark catch. A study of big-game fishing in New Jersey indicated that the value of catching an additional shark (marginal value) on a given fishing trip ranged from about \$40 each for a sandbar, dusky, or blue shark to almost \$120 for a mako shark (Brown, 1987). Marginal values assigned in big-game fisheries are not appropriate for more common fisheries. For smaller sharks, these values may be closer to those of similar-sized fishes, such as red drum or king mackerel.

3.2.3 VESSELS, GEAR AND EMPLOYMENT

3.2.3.1 COMMERCIAL FISHERY

Commercial shark fishing gear includes longlines, gillnets, trawls, and to an unknown extent, harpoons. Longlines commonly have a mainline up to 30 km long, along which buoy lines and baited gangions are attached, and are fished as either pelagic or bottom gear, depending on whether the mainline is suspended in the water column or resting on the sea floor. Most Atlantic and Gulf longlines are pelagic gear used by the swordfish and tuna fleets, and capture sharks incidentally. These fisheries often avoid areas of large shark concentrations, to conserve bait and time that might otherwise be spent on more valuable species.

In recent years a directed longline shark fishery has emerged, with many vessels converted from shrimp trawl or snapper-grouper bottom-longline fisheries. A typical shark vessel is 10 to 15 m long and deploys pelagic or bottom longlines baited with bluefish, bonito, mackerel, mullet, or squid. Lines usually have large (3/0 or 3.5/0) shark hooks, with 300 to 500 hooks on gangions of multistrand steel cable. A trip usually lasts one or two days with one to three sets per day (Lawlor, 1985). The number of full-time, year-round longline shark fishing vessels increased from 102 in 1988 to 124 in 1989 and is less now. It is not possible to classify vessels as fishing in the Atlantic versus the Gulf because many, if not most, fish both places. However, it is estimated that in 1988 over half of longline vessels that targeted shark for at least one trip were based in the Gulf (Massey, 1989b). Some longliners probably target sharks during part of the year as demand peaks or catches in alternative fisheries decline (e.g., tuna, swordfish, or reef fish).

The number of vessels with required Federal swordfish permits increased significantly from 1985 to 1989 and then decreased to

655 in 1990 (Table 3.6). This includes virtually all the pelagic longliners, many bottom longline vessels, and all harpoon and drift gillnet boats. An unknown number of harpoon vessels are from Massachusetts. These are all vessels that could potentially fish for sharks.

Drift and anchored gillnets are also used to harvest sharks in the nondirected and directed fisheries. In Florida, monofilament drift gillnets range in size from 18- to 64-cm stretch mesh (Lawlor, 1985). In South Carolina, anchored gillnets are more common, with mesh size from 20 to 33 cm; the state limits gillnet lengths within 5 km of the coastline to 31 m, but offshore the nets may be 246 m long. Virginia has an extensive inshore summer gillnet fishery with a significant shark bycatch, and gillnet vessels in New York and New Jersey that target weakfish, shad, and bluefish also catch sharks. In 1989, two of these vessels fished for shark during the winter months, but it is not known whether this small fishery has continued. An estimated 12 to 15 swordfish gillnet boats in Massachusetts and Rhode Island also have a shark bycatch. Gillnetters targeting groundfish in Maine also take shark, and the multispecies trawl fishery on Georges Bank takes a small shark bycatch.

From 1986-1989, there were 10 to 12 gillnet boats directing at sharks, and 3 to 4 boats using both gillnets and longlines. These boats work the Atlantic and the waters off Key West, Florida.

Some sharks are also landed by the Gulf and South Atlantic shrimp fleet. However, this catch will be reduced through mandatory use of TEDs in shrimp trawls to eliminate the capture and drowning of protected sea turtles. A turtle or large fish entering the trawl is shunted from the net through an escape opening in the TED, although some soft TEDs may not reduce mortality of small sharks because they get caught in the webbing (Seidel, 1990).

3.2.3.2 RECREATIONAL FISHERY

The number of recreational angler-trips that targeted sharks in North Carolina and areas south, including the Gulf of Mexico, averaged 214,682 from 1986-1989. During that same time period, recreational shark fishing trips from Virginia to New York averaged 1,116,000 (Parrack, 1990). The primary recreational gear is rod and reel, fished from boats or, to a lesser extent, from shore, piers, and bridges. In the northeast, there is also a significant handline fishery for sharks centered on Long Island, New York. Although it is considered a recreational fishery, the fish are frequently sold and, therefore, are recorded as commercial landings.

A survey of Atlantic charter boats (Isley, 1989) revealed that 5% of the trips resulted in shark catches. If this proportion

corresponds to targeted trips only, a small number of charter boat trips target sharks. The Gulf of Mexico charter boat data indicate that the 838 charter boats fished for sharks less than 5% of the time.

3.2.4 MARKETING AND DISTRIBUTION

There are five main shark products: fins, meat, skins, teeth/jaws, and oil. Shark fins account for most of the international shark trade. When the meat, skins or jaws are utilized, they are usually processed for sale in the domestic market.

3.2.4.1 DOMESTIC

Domestically, in the last two decades, there has been an increase in trade of shark meat. The new willingness to experiment with unfamiliar species, the high price and scarcity of some more traditional species, and the similarity with swordfish steaks has increased consumption of shark meat (Ross, 1989).

Shark "fillets" (loins or logs for cutting into meal-size steaks or fillets) became the leading shark product of U.S. seafood processing plants during the 1970s. Real prices (expressed in 1982 dollars) were on a downward trend from \$1.75/kg (f.o.b., plant) in 1975 to \$1.10/kg in 1982, but they increased to \$3.60 by 1990. From 62 mt in 1974, output rose to 1,000-1,500 mt in 1976-79, and to 2,000-4,000 mt in 1979-90. Adding smaller amounts of steaks and dressed fish, meat has dominated sales value for two decades. Production of dried shark fins, absent since 1969, was reported again in 1984, and their higher price made them a significant part of sales value by 1988. U.S. imports and exports of shark meat roughly balanced in 1990, and U.S. consumption could have been about 6,000 mt, perhaps twice what it was in 1980 (Vondruska, 1991).

Most shark-meat traders prefer sharks less than 45 kg, selecting especially those from 10 to 30 kg for easier handling and storage, and for a product similar in size to swordfish steaks. In addition, meat from larger sharks is tougher. Shark meat is generally distributed through retail seafood outlets.

3.2.4.2 INTERNATIONAL

International data on processed products and foreign trade specifically for sharks are limited, and the following description is based on available data. In 1989, the world harvest of all sharks was 371,100 mt (U.S., 13,600 mt). This

Table 3.3

U.S. Recreational Shark Landings 1979-1989

<u>Year</u>	<u>Landings</u> (mt)
1979	11512
1980	3210
1981	9431
1982	2599
1983	5527
1984	1975
1985	5305
1986	4243
1987	4175
1988	2728
1989	1666

Source: NMFS, Marine Recreational Fishery Statistics Survey, Atlantic and Gulf Coasts, 1979-1989.

Table 3.4

U.S. Recreational Shark Landings By Region
1979 - 1989

Year	North Atlantic	Mid- Atlantic	South Atlantic	Gulf of Mexico	All Regions
(In Metric Tons)					
1979	-	10925	218	369	11512
1980	-	240	1966	1005	3210
1981	275	420	1132	7604	9431
1982	-	1252	688	660	2599
1983	1415	1304	2574	234	5527
1984	-	1408	349	115	1975
1985	-	2165	1521	1618	5305
1986	-	2943	692	608	4243
1987	-	3563	451	156	4175
1988	-	1530	318	813	2728
1989	-	1000	231	228	1666
Totals:	1690	26750	10140	13410	52371
Percent of Totals:	.03	.51	.19	.26	1.00 ¹

¹Regional figures do not necessarily add with total figures.

Source: Marine Recreational Fishery Statistics Survey,
Atlantic and Gulf Coasts, Various Years.

Table 3.5

Number of Vessels with Federal Permits To Fish for Atlantic
Swordfish by State of the Owner's Residence 1985-1989

State	1985	1986	1987	1988	1989	1990
AL	2	7	24	19	14	6
CA	1	-	1	-	2	2
CT	14	12	10	6	5	5
DE	4	8	7	5	4	5
FL	166	185	210	211	231	220
GA	1	-	1	2	4	1
LA	-	7	45	104	110	89
MA	135	138	168	139	113	88
MD	4	6	6	6	6	8
ME	8	7	8	5	4	4
MS	-	2	2	5	10	8
NC	5	2	1	4	9	14
NH	-	2	3	4	3	3
NJ	35	41	38	49	55	51
NY	17	14	25	30	39	35
PA	-	-	1	-	-	1
PR	1	1	2	-	-	1
RI	32	34	38	30	38	32
SC	8	6	8	8	9	7
TX	13	11	15	68	89	66
VA	4	2	1	2	4	6
VI	1	2	2	2	3	5
Totals	451	487	616	699	752	655

Source: National Marine Fisheries Service

Table 3.6

Number of Charter Vessels Operating on the Gulf of Mexico
U.S. Coast and Mean Percent Time Targeted on Shark

Sharks State	Number of Charter Vessels	% Time Targeted
Alabama	35	0.6
Florida	628	5.2
Louisiana	45	1.1
Mississippi	18	3.3
Texas	112	0.4
Total	838	

Sources: Holland, S.M. and J.W. Milon (1989) and
Ditton, R.B. et al. (1989). Gulf of Mexico
Fishery Management Council, 1989.

includes 84,300 mt of dogfish shark (U.S., 5,800 mt), much of which is thought to enter international trade as shark meat (FAO, 1991). European imports of shark meat had an estimated value of \$75-\$127 million in 1988, and U.S. exports (mostly to Europe) had a value of \$6 million in 1990. In 1988, Far East imports of dried shark fins amounted to \$133 million, and U.S. exports were estimated at \$7 million (Vondruska, 1991).

Regarding dried shark fins, the combined imports for several Far East countries rose gradually from 3,703 mt in 1976 to 6,818 mt in 1988, including trade among these countries, and the value in 1988 was \$133 million. The real price (average unit value in 1982 dollars) for imports of Hong Kong, the leading buyer, was \$10/kg in 1976, \$14/kg in 1982 and \$24/kg in 1988. Hong Kong imported from the United States some 50-80 mt in 1974, 1979 and 1985-86, 261 mt in 1988, and 229 mt in 1989. Based on the average for all Hong Kong imports in 1988 (about \$26/kg), the U.S. shipment in 1988 would have had a value of \$6.7 million.

According to the annual NMFS survey of U.S. seafood processing plants, these plants had a small (confidential) output of dried shark fins in 1984-86, and it rose from 11 mt in 1987 to 118 mt in 1989. U.S. imports of dried shark fins rose from 63 mt in 1984 to 220 mt in 1989, falling to 192 mt in 1990. Higher-priced U.S. imports from Hong Kong and other Far East countries are probably for U.S. consumption or shipment to other consuming countries, whereas most U.S. imports from some countries, such as Latin American countries, and U.S. production are probably for export to the Far East. U.S. processors may purchase "wet" (fresh or frozen) shark fins from domestic fishermen, air-dry them, and ship them. Among east coast fisheries, the preferred sharks for sharkfin soup market are, in order of preference: sandbar, bull, hammerhead, blacktip, porbeagle, mako, thresher, and blue, although only the lower caudal lobe from mako and thresher sharks is considered satisfactory.

Regarding shark meat, combined imports by the 12 countries of the European Economic Community (EEC) totaled 35,400 mt in 1988 (FAO, 1991). Of this amount, 18,300 mt was from non-EEC sources and included 9,400 mt of dogfish meat, 7,200 mt of other shark meat, and 1,700 mt of fillets. Based on U.S. processor prices for fillets in 1988-90 (\$2.12-\$3.60/kg), the 1988 imports of the 12 EEC countries of 35,400 mt would have had a value of some \$75-\$127 million, and their imports from non-EEC sources of 18,300 mt would have had a value of about \$40-\$70 million.

U.S. exports of shark meat (mostly dogfish and mostly to Europe) from east coast ports declined from 2,066 mt in 1981 to 305 mt in 1986. For all ports, the exports rose from 517 mt in 1989 to 3,023 mt in 1990 because of a shortfall in Turkish fisheries (Ross, 1991). In 1990, U.S. imports were 2,753 mt with a value of about \$5.8 million.

The major market for the small volume of U.S.-exported shark meat has been Europe. Many Europeans, especially in the Mediterranean, traditionally consume shark products, and as local supplies dwindled, imports satisfied local demand. Spain has an extensive shark fishery and a strong demand for shark meat, with total imports averaging about 1,500 mt a year. Spain also exports small quantities of shark meat to other European countries. Italy also imports an average of 3,200 mt annually from other Mediterranean and African countries to supplement domestic landings.

Most U.S. exports of sharks (except spiny dogfish) go to the United Kingdom, France and West Germany. The British market utilizes sharks as fillets or pieces in the traditional fish-and-chips seafood takeout industry. French and German consumers prefer shark steaks, similar to U.S. consumers. U.S. exporters have shipped both fresh and frozen product, in whole, sectioned, and steak form. The preferred sharks in Northern Europe are porbeagle and mako species, historically fished and consumed in this region. Due to the growing U.S. domestic demand and the high cost of air shipment, fresh product has generally proven to be too expensive for the foreign market (Ross, 1989). There is a substantial market for salted shark meat in Central America.

Although Europe is the major shark market for U.S. east coast exporters, small quantities of mako and porbeagle meat have also been shipped to Asia. West Coast exporters of mako sharks have developed the Asian markets because of lower transportation costs and their generally greater trade with Japan.

Shark skin, when combined with fins and meat, offers more complete utilization of the sharks. However, such multiple uses may be incompatible: sharks intended for leather are not gutted or iced, but sharks for meat must be quickly gutted and iced. For a top quality hide, the sharks should be washed in saltwater, skinned, and salted within 24 hours of capture to prevent sour spots (decomposition) or burnt hide (exposure to the hot sun). Full curing of the hide can be tricky and some foreign buyers prefer to purchase frozen, uncured hides. In the U.S., the preferred shark hides are from tiger and sandbar sharks, which are light-skinned and average 1 to 3 m long. Other sharks that have suitable skins are nurse, lemon, and dusky. Less preferred species are blacktip and hammerhead, because of thin skins, and bull shark, whose skin is easily ruined by fresh water. There have also been reports of shark skins exported to Europe (Ross, 1989).

4.0 CAPACITY LIMITS

4.1 MAXIMUM SUSTAINABLE YIELD (MSY) IN U.S. ATLANTIC WATERS

The status of shark resources was assessed from statistics of the fisheries currently occurring within the U.S. Atlantic EEZ (Parrack, 1990) and as result comments from the public, commercial fishermen, fish dealers/processors, and several state agencies during the comment period held on the proposed FMP and on the proposed implementing rule. Significant new fishery information was received from fishermen, and several state fishery agencies. This new information included: (1) data showing fishery removals in recent years higher than those used as a basis for determining MSY and stock conditions in the Parrack 1990 stock assessment; (2) records on the size frequency of shark species caught in commercial fisheries; and (3) information on the commercial fishing fleet. Parrack (1992) reviewed this new information and incorporated these new data in the stock assessment for the large coastal resource. To ensure that all FMP management measures are based upon the best scientific information available, a revised assessment of the condition of the large coastal species group was completed. The revised assessment was reviewed by a scientific peer committee consisting of both outside scientific experts and NMFS scientists. The Review Committee issued its final report on November 23, 1992 (see Appendix II, Report of the Atlantic Coastal Shark Fishery Analysis Review, November 23, 1992). The conclusions concerning the small coastal and pelagic species groups remain unchanged.

Both assessments defined several gear-specific and area-specific fisheries and three species groups. Each gear-specific fishery exploits one of the three species groups. A directed shark longline/gillnet fishery and a southern area tournament fishery both target large coastal sharks. Small coastal sharks are targeted by rod-and-reel fishermen and are also a significant bycatch of the shrimp fishery in the Gulf of Mexico. Pelagic sharks are most often taken by longline vessels incidental to tuna and swordfish, although rod-and-reel fishermen and commercial fishing vessels in northern areas sometimes target these species.

The species compositions of commercial landings were not recorded, and only a general knowledge of the species most often encountered in each fishery exists. The species included in each group (Table 2.1) are thus sharks that are caught by particular gear-specific fisheries; they are not ecological groups.

The status of the small coastal sharks and pelagic sharks species groups were assessed separately using 1986-1989 fishery statistics. Due to the transoceanic nature of pelagic shark

catches and the international fleets that exploit them, the necessary fisheries information was not complete enough to assess that resource. Instead, reported U.S. landings from 1986-1989 for small coastal sharks and updated information through 1991 for the pelagic sharks were viewed as a gross indicator of current EEZ resource production levels.

Parrack (1992) incorporated new data on landings, catch, catch-per-unit-effort, and other information provided from fishermen and others during the public review process into the stock assessment for the large coastal resource. Data from fisheries exploiting the coastal sharks were complete enough to yield assessments of resource production and status.

The method used to assess the small coastal shark groups was based on the probability distribution of the average weights of caught fish observed in each fishery; corresponding yields and fishing efforts were auxiliary (independent) variables. The 1990 stock abundances (numbers of sharks), biological rates of population increase (in numbers), and fishing gear efficiency coefficients that maximize the probability of obtaining the average weights observed in each fishery [i.e., maximum likelihood estimates, (MLE)] were obtained. The method combines all gains and losses to the stock that are not observed (i.e., those other than the reported landings) into a single statistic: an intrinsic rate of unobserved change. These gains and losses are due to the entry of newly born sharks into the stock, emigration and immigration, death from predation and disease, unreported landings, and sharks caught and discarded.

These MLE's were then used to compute various statistics of interest including stock sizes during 1986-89, annual fishing mortalities, annual productions in numbers of fish, and catch-to-production ratios. Abundance estimates were multiplied by annual average weights to transform them to estimates of exploited biomass. This FMP uses the maximum of annual production estimates during the period of data (1986-1989) as a biological reference point by assuming that any annual production, including the maximum, is sustainable. Therefore, first approximations of maximum sustainable yields were taken as the maximum of the annual production estimates during the period 1986-1989.

This estimation method was used since species compositions of catches were not recorded. Estimates of mortality and production rates are therefore for species aggregations. Since some species within a species group are less abundant than others, some species within the aggregation will be more at risk than others because the group is managed as a whole.

The method estimates sustainable production in numbers of fish, not weight. These were converted to weight (after maximum likelihood estimation) to obtain MSY. The conversions were based

Table 4.1
Various Characteristics of the Three
Species Groups

	Large Coastal Sharks	Small Coastal Sharks	Pelagic Sharks
Migrations	Extensive	Limited	Extensive
Commercial Fishery	Directed	Limited	Bycatch
Recreational Fishery	Limited	Limited	Extensive
MSY Jan. 1 Abundance Level (Number of Fish)	1,361,485	3,737,000	na
MSY-Biomass (Dressed Weight [mt])	14,900	3,475	na
MSC (Maximum Sustained Catch Number of Fish)	346,691	2,454,500	na
Mean Dressed Weight (lbs)	24.14	2.05	na
MSY-Surplus Weight (mt)	3,800	2,590	1,560 ¹
Fishing Mortality Rate (F_{MSY}) ²	0.25	0.48	na
1986-1991 Mean F	0.26 ³	0.43	na
Current Status	Over- exploited	Fully utilized	Fully utilized
1993 Optimum Yield Dressed Weight (mt)	2,900	2,590	1,560

¹ 1,560 mt is the average annual U.S landings from 1986-1991. Better estimates can be derived when future catch statistics include the species and weight of individual fish.

² Fishing mortality rate that results in MSY.

³ Does not include discards and other unreported mortalities.

on observed average weights of landings. These average weights will probably change in the future, thus projections of future yields (weight caught) are difficult.

Despite the limitations and uncertainties of the data, the analyses provided statistics necessary for developing harvest limitations and management advice. The results of that advice are summarized in the following sections.

4.1.1 LARGE COASTAL SHARKS, STATUS, AND MSY

Large coastal sharks are those normally targeted by commercial shark longline and gillnet fisheries, and by the southern shark tournament fisheries (Table 4.1). Typical species in this group include sandbar, blacktip, dusky, bull, tiger, hammerhead, lemon, white, spinner, bignose, silky, and night sharks. Many of these make extensive migrations along the U.S. Atlantic coast.

During the public comment periods held on the proposed FMP and on the proposed rule, significant new information was received from fishermen, fish buyers, and state fishery management agencies. This information included: (1) fishery removals not previously recorded; (2) sizes of caught sharks; and (3) the numbers of commercial fishing vessels targeting sharks. The additional information significantly changed the analytic results of the last stock assessment done in 1990 (see Parrack, M.L., 1990, A Study of Shark Exploitation in U.S. Atlantic Coastal Waters during 1986-1989).

To ensure that all FMP management measures are based upon the best scientific information available, a revised assessment of the condition of the large coastal species group was completed. The revised assessment was reviewed by a scientific peer committee consisting of both outside scientific experts and NMFS scientists. The Review Committee issued its final report on November 23, 1992 (see Appendix II, Report of the Atlantic Coastal Shark Fishery Analysis Review, November 23, 1992).

The Review Committee reported evidence of overfishing for the large coastal group during 1986 through 1992 (except for 1987 and 1990, Table 4.2). The Committee recommended that calendar year 1993 landings for the large coastal should be reduced below the calendar year 1991 landings level of 4,319 mt dressed weight (see Appendix II).

Based on the Committee Report, NMFS estimates that the MSY for the large coastal species group is 3,800 mt dressed weight. The MSY stock biomass level is estimated to be about 14,900 mt dressed weight.

Table 4.2

Abundance, Production, Catch, and
Fishing Mortality for Large Coastal Sharks

Year	Avg. Wt (Pounds Dressed)	Jan. 1 Abundance	Production		Catch		Fishing Mortality Rate	Catch to ¹ Production
			Numbers	MT	Numbers	MT		
1986	21.06	1,578,368	194,916	1,862	215,338	2,057	0.18	1.10
1987	27.33	1,158,144	678,271	8,408	270,867	3,358	0.21	.40
1988	21.85	1,489,091	271,921	2,695	476,788	4,725	0.30	1.75
1989	25.42	1,302,961	377,078	4,348	488,301	5,629	0.31	1.29
1990	23.51	1,234,302	670,047	7,145	418,773	4,467	0.30	.62
1991	25.72	1,406,042	350,891	4,090	370,458	4,319	0.27	1.06

¹ Catch/Production ratio greater than one indicates overfishing.

Parrack 1992.

Table 4.3

Abundance, Production, Catch, and
Fishing Mortality for Small Coastal Sharks

Year	Avg. Wt. ¹ (Pounds Dressed)	Jan. 1 Abundance	Production Numbers	Catch ² Numbers	Mortality Production		Fishing Rate	Catch to Ratio
					MT	Numbers		
1986	2.66	3,072,877	2,018,181	3,385	1,631,734	2,736	0.38	0.81
1987	1.88	3,370,674	2,213,767	2,624	3,006,581	3,563	0.65	1.36
1988	1.32	3,373,061	2,215,334	1,844	3,419,214	2,845	0.73	1.54
1989	2.35	3,737,084	2,454,415	3,637	1,889,998	2,800	0.37	0.77
1990	2.05 ³	4,199,176	2,757,904	3,564	2,486,882 ⁴	3,214	0.48	0.90
1991	2.05 ³	4,573,275	3,003,500	3,882	3,003,580			

¹ Dressed wt. X 1.39 = whole weight.

² Whole weight.

³ 1986-1989 average dressed weight = 2.05 lbs.

⁴ 1986-1989 Mean Catch = 2,486,882

Table 4.4
MSY Estimates; Commercial Quotas and
Domestic Annual Harvest for 1993
(Dressed Weight - Metric Tons)

	<u>Large¹</u> <u>Coastal</u>	<u>Small</u> <u>Coastal</u>	<u>Pelagic</u>	<u>Domestic</u> <u>Annual Harvest</u>
Commercial	2,436	No quota ²	580	-
Recreational	464	No quota ³	980	-
Total	2,900	2,590	1,560	7,050
MSY Estimates	3,800	2,590 ⁴	1,560 ⁵	

¹ Landings are based on a rebuilding program.

² Past commercial landings are negligible (see footnote ⁴).

³ 1986-1989 average of recreational landings of small coastal species group was less than 200 mt.

⁴ 1986-1989 average of shrimp trawl discards is estimated to be 2,014 mt of the MSY (Parrack, 1990).

⁵ 1986-1991 average of pelagic shark landings.

4.1.2 SMALL COASTAL SHARKS, STATUS AND MSY

Small coastal sharks are typically caught in recreational fisheries (headboats and privately owned boats) and as discarded bycatch in the Gulf of Mexico penaeid shrimp trawl fishery (Table 4.1). The largest component of the catch, by far, is the shrimp trawl bycatch. The predominant species in this group are the sharpnose, with bonnethead, blacknose, finetooth, and smalltail.

Results of the analysis show a high degree of estimation uncertainty, even more than that for the large coastal species (Parrack, 1990). Estimates suggest that catches exceeded production in 1987 and 1988 and not in 1986 and 1989; hence, a reduction in abundance over the period 1986-1989 is not indicated. These statistics indicate that small coastal sharks appear to be fully utilized. The estimate of annual production potential for these sharks is high (Parrack, 1990), indicating that abundance would rapidly increase if present sources of fishing mortality were eliminated. These analyses suggest that 1990 production was greater than the 1989 catch, thus abundance was probably not reduced by fishing during 1990.

The maximum stock production during 1986-1989 was 2,617 mt (Table 4.3). The MSY for the small coastal sharks is estimated at 2,590 mt.

4.1.3 PELAGIC SHARKS, MSY

Pelagic sharks are a bycatch of the commercial tuna and swordfish longline fisheries and are directly exploited by recreational fisheries from Virginia to New York. Typical species in this group include makos, threshers, blues, oceanic whitetips, and porbeagles. Trans-Atlantic migrations of these sharks are common. Therefore, this species group is exploited by several nations, removals often occur outside of U.S. territorial waters, and discarding at sea is common, but not recorded. For the above reasons, data were not available to develop production estimates, as was done for the large and small coastal sharks. The average annual U.S. commercial landings of this species group during 1986-91 was about 580 mt (with an unknown amount of discards). The average recreational pelagic shark landings in the southern area is estimated to have been about 94 mt. Recreational shark landings in the northern area are estimated to have averaged about 885 mt. The sum of these (1,559 rounded to 1,560 mt) is the estimate of MSY for this species group (Table 4.1). Note, however, that it is based upon a short-term average.

4.2 OPTIMUM YIELD (OY) GOAL

The national goal is to maintain abundance in each of the three species groups in U.S. waters to produce MSY, and to manage shark resources throughout their range in cooperation with the major shark fishing nations.

Within U.S. jurisdiction, the OY goal is to maintain fishing mortality at the level that will produce MSY on a continuing basis (F_{MSY}). Therefore, OY is the total annual level of fishing mortality on sharks in the management unit under the management measures in this FMP. This level of harvest is estimated at 7,050 mt, the sum of the commercial and recreational harvests of 2,900 mt of large coastal sharks, 2,590 mt of small coastal sharks, and 1,560 mt of pelagic sharks.

As necessary and appropriate, NMFS will prepare new stock assessments that will provide an estimate of the MSYs for the different species groups based on the latest available scientific information. When each assessment is completed and available to the public, NMFS will consider appropriate additional management measures (i.e., commercial quotas and recreational bag limits) based on the condition of shark resources as documented by the revised stock assessment. These additional measures will be implemented expeditiously and will, along with the current management measures, ensure that the fishing mortality is held at or reduced to a level that will produce MSY on a continuing basis. To ensure maintenance of MSY and prevention of overfishing, the framework procedure (Section 7.1.4) will adjust the quotas, trip limits, bag limits, MSYs, management unit, species groups, fishing year, species size limits, and permitting and reporting requirements, based on the best available information.

4.3 OPTIMUM YIELD FOR U.S. ATLANTIC WATERS

Statistics of coastal shark fisheries (for both large and small sharks) were extensive enough to gain a general knowledge of biological production potential, and OY is based on that knowledge. Though limited, these data are the best available scientific information.

OY for coastal sharks is defined as the appropriate harvest level that will produce MSY, or that will allow rebuilding of the stock level to the level that will produce MSY. MSY is defined in 50 CFR 602.11(d)(1) as the largest average annual catch or yield that can be taken over a significant period of time. Therefore, OY is the total annual level of fishing mortality on sharks in the management unit under the management measures in this FMP.

4.4 DEFINITION OF OVERFISHING

Title 50 CFR 602.11(c)(1) requires that an objective and measurable definition of overfishing be prepared for each stock or stock complex managed under an FMP. Overfishing, as generically defined by the 602 guidelines, is a level or rate of fishing mortality that jeopardizes the long-term capacity of a stock or stock complex to produce MSY on a continuing basis. The definition is required to guide management in determinations of whether the capacity of a fish stock to maintain itself through

reproduction might be destroyed by fishing. The definition may be stated as a population level at which a stock will be in jeopardy, or as a rate of fishing that will precipitate such a population level, or both.

There is reason to be especially concerned about overfishing of large coastal sharks and the pelagic sharks. Reproductive capacities of these species are small (Section 2.0) and exploitation histories of shark stocks that have been quickly overfished are documented (Section 3.0).

Given these concerns, the following definition of overfishing will be applied in this FMP:

1. When a stock size is at a level that is determined, based on the best scientific information available, to be sufficient to produce MSY on a continuing basis, overfishing is defined as a fishing mortality rate (F) that exceeds the fishing mortality rate that would produce MSY on a continuing basis (F_{MSY}).
2. When the stock size is below the level that is determined, based on the best scientific information available, to be sufficient to produce MSY on a continuing basis, overfishing is defined as a fishing mortality rate that exceeds the rate that is consistent with a rebuilding program established under this FMP.

There are a number of points that should be noted in regard to the definition. First, the present data do not allow addressing the biological reproduction potential of individual species; only of species aggregates. Therefore, a high fishing mortality rate will increase the risk that an individual species within the aggregation will be adversely affected. Conversely, stocks with abundance levels at or slightly below that which would produce MSY are often not at great risk. However, the determination of MSYs for the three species groups of sharks for this FMP was based upon the supposition that maximum sustainable productions were observed during the 1986-1991 period for the large coastal and pelagic species groups, and during the 1986-1989 period for the small coastal species group. If the true MSY-level is higher than the production observed during the 1986-1991 or the 1986-1989 periods, then present estimates of MSY are low and the likelihood of a species stock being considered overfished (before it actually is) under the present definition is increased. The balance of the above factors supports the selection of the above definition as a reasonable approach to overfishing concerns.

In the event that the stock size is overfished as defined above, the OT will advise the Assistant Administrator for Fisheries and recommend a strategy designed to provide for the recovery of each stock or stock complex within a reasonable period. Section 7.1.4 contains the framework regulatory adjustment procedure designed

Table 4.5

Overfishing of Large Coastal Species
(Dressed Weight - Metric Tons)

<u>Year</u>	<u>Production</u>	<u>Landings</u>	<u>Difference</u>	Ratio <u>Landings</u> <u>Production</u>
1986	1,862	2,057	-195	1.10
1987	8,408	3,358	5,050	.40
1988	2,695	4,725	-2,030	1.75
1989	4,348	5,629	-1,281	1.29
1990	7,145	4,467	2,678	.62
1991	4,090	4,319	-229	1.06

Source: Parrack 1992

Table 4.6

Rebuilding Program for Large Coastal Species
(Dressed Weight - Metric Tons)

<u>Year</u>	<u>Total Allowable Catch</u>	<u>Commercial</u>	Allocation <u>Recreational</u>
1993	2,916	2,449	467
1994	3,062	2,572	490
1995	3,800*	3,192	608
1996	3,800	3,192	608
1997	3,800	3,192	608
1998	3,800	3,192	608
1999	3,800	3,192	608
2000	3,800	3,192	608
2001	3,800	3,192	608
2002	3,800	3,192	608

Source: Parrack 1992

* Estimated MSY level.

to make timely annual changes to the management measures in the regulations in response to new information about the fishery.

4.4.1. OVERFISHING, LARGE COASTAL SHARKS

The draft Shark FMP (October 28, 1991) concluded that the large coastal resource was overfished. NMFS selected an array of quotas and bag limits to rebuild this resource.

During the public comment periods held on the proposed FMP and on the proposed rule, significant new fishery information was received from fishermen, fish dealers/processors, and several state fishery management agencies. This new information included: (1) data showing higher fishery removals in recent years than those used as a basis for determining MSY and stock conditions in the NMFS 1990 shark stock assessment; (2) records on the size and frequency of shark species caught in commercial fisheries; and (3) information on the commercial fishing fleet. NMFS reviewed this new information and determined that it could result in significantly revised conclusions about the abundance, productivity, and condition of the managed shark species from those in the proposed FMP that were based on the NMFS 1990 stock assessment for Atlantic coast sharks (see Parrack, M.L., A Study of Shark Exploitation in U.S. Atlantic Coastal Waters during 1986-1989, 1990).

To ensure that all final FMP management measures are based upon the best scientific information available, NMFS undertook and completed a revised assessment of the condition of the large coastal shark species group using the above new/corrected information provided by the states and fishermen. The revised assessment was subjected to a peer review by a Review Committee consisting of both outside scientific experts and other NMFS stock assessment biologists; the Committee issued its final report on November 23, 1992 (see Appendix II, Report of the Atlantic Coastal Shark Fishery Analysis Review, November 23, 1992).

The Committee Report concludes, among several things, that the large coastal group is overfished (overfishing occurred in all years from 1986 through 1992 except for 1987 and 1990) and that calendar year 1993 landings for the large coastal should be reduced below the calendar year 1991 landings level of 4,319 mt dressed weight (see Table 4.5 and Appendix II). The Committee Report establishes three options for the calendar year 1993 landings limit (recreational and commercial combined) for the large coastal group; each option provides a specific degree of conservation benefits.

To ensure that the large coastal group is rebuilt to the MSY level, NMFS has selected the Committee's recommended second option (see Table 4 of the Committee Report) establishing 1993 total landings of 2,900 mt dressed weight (a 34 percent reduction

from the 1991 landings; a 29 percent reduction from the 1986-1991 annual average landings). Under this option, stock abundance will rebuild 5 percent each year back to the MSY level by 1995. The rebuilding schedule shows that annual fishery yields would increase each year and would be equal to MSY by 1999. Under the Committee's first option for 1993 calendar year total landings (3,520 mt dressed weight), the stock would not rebuild to the MSY level (14,900 mt). Option 3 of the Committee Report requires a 1993 landings limit of 2,311 mt (a 50 percent reduction from the 1991 level; a 44 percent reduction from the 1986-1991 annual average). This option achieves a 10 percent annual increase in stock abundance until the MSY level is reached. NMFS determined that this option would involve unacceptable short term costs in lost fishery revenues, and is not necessary to achieve stock rebuilding in a reasonable time period.

Based on the Committee Report, NMFS estimates that the MSY for the large coastal species group is 3,800 mt dressed weight. The MSY stock biomass level is estimated to be about 14,900 mt dressed weight. See Table 4.4 for a summary of the MSY estimates, as well as commercial quotas and total expected landings for calendar year 1993 for the three species groups.

4.4.2 OVERFISHING, SMALL COASTAL SHARKS

The small coastal species group will be considered overfished when the stock abundance level will not produce MSY on a sustainable basis. For the small coastal species group, MSY equals the annual production during 1989. In that year, an initial abundance of 3,737,000 sharks (Tables 4.1 and 4.3) produced a surplus (production) of 2,454,500 sharks. Based on the 1989 average dressed weight of 2.05 pounds, the annual production (MSY) is established at 2,590 mt.

The 1986 catch of approximately 1,632,000 individuals was 20 percent less than the estimated production of approximately 2,018,000 individuals; thus, abundance increased from 1986 to 1987 (Table 4.3). Catch was 36 percent higher than production in 1987 and 54 percent higher in 1988, but 1989 catch was 23 percent less than 1989 production. An approximation of the 1990 catch level based on the 1986-1989 average is 2,487,000 fish, 10 percent less than production, thus, abundance probably increased since 1989. The resulting 1991 abundance level is projected to be at the MSY level; the resource should be able to sustain MSY-level removals (about 3,600 mt) with the equilibrium fishing mortality rate at MSY ($F=0.48$).

4.4.3 OVERFISHING, PELAGIC SHARKS

Maximum sustainable yield of pelagic sharks was specified as 1,560 mt dressed weight (average 1986-1991 landings, Section 4.1.3). No evidence is available to suggest that this level is being exceeded.

4.5 REMOVAL LIMITS (TACS), REBUILDING, AND MONITORING

4.5.1 REMOVAL LIMITS (TAC'S), REBUILDING, AND MONITORING: LARGE COASTAL SHARKS

During the public comment periods held on the proposed FMP and on the proposed rule, significant new information was received from fishermen, fish buyers, and state fishery management agencies. This information included: (1) fishery removals not previously recorded; (2) sizes of caught sharks; and (3) the numbers of commercial fishing vessels targeting sharks. The additional information significantly changed the analytic results of the last stock assessment done in 1990 (see Parrack, M.L., 1990, A Study of Shark Exploitation in U.S. Atlantic Coastal Waters during 1986-1989).

To ensure that all FMP management measures are based upon the best scientific information available, a revised assessment of the condition of the large coastal species group was completed. The revised assessment was reviewed by a scientific peer review committee consisting of both outside scientific experts and NMFS scientists. The Review Committee issued its final report on November 23, 1992 (see Appendix II, Report of the Atlantic Coastal Shark Fishery Analysis Review, November 23, 1992).

The Review Committee reported evidence of overfishing for the large coastal group during 1986 through 1992 (except for 1987 and 1990). The Committee recommended and that calendar year 1993 landings for the large coastal should be reduced below the calendar year 1991 landings level of 4,319 mt dressed weight (see Appendix II and Table 4.5). The Committee Report establishes three options for the calendar year 1993 landings limit (recreational and commercial combined) for the large coastal group; each option provides a specific degree of conservation benefits.

Under the Committee's first option for the 1993 calendar year total landings (3,520 mt dressed weight), the large coastal stock would not rebuild to the MSY level (14,900 mt). To ensure that the large coastal group is rebuilt to the MSY level, NMFS has selected the Committee's recommended second option (Option 2--see Table 4 of the Committee Report) establishing 1993 total landings of 2,900 mt dressed weight (a 34 percent reduction from the 1991 landings; a 29 percent reduction from the 1986-91 annual average landings). Under this option, stock abundance will rebuild 5 percent each year back to the MSY level (estimated by NMFS to be 14,900 mt dressed weight) by 1995. The Review Committee's rebuilding schedule shows that annual fishery yields would increase about 5 percent each year but would not equal MSY until 1999. Option 3 of the Committee Report requires a 1993 landings limit of 2,311 mt (a 50 percent reduction from the 1991 level; a 44 percent reduction from the 1986-91 annual average). This option achieves a 10 percent annual increase in stock abundance

until the MSY level is reached. NMFS determined that this option would cause unacceptable short-term costs in lost fishery revenues, and is not necessary to achieve stock rebuilding in a reasonable time period.

While NMFS adopted option 2 for stock rebuilding and will implement the recommended calendar year total landings (and derived calendar year commercial quotas) from 1993 to 1995, NMFS believes that the large coastal species group will be rebuilt by 1995 and at that point the stock size should be sufficient to provide MSY. NMFS does not agree with the Committee Report's conclusion that MSY yields will not occur under its rebuilding schedule until 1999.

The 1993 calendar year commercial quota for the large coastal group is determined based on the historical commercial average annual share (percent of average total annual landings) for the period 1986 through 1991; this average annual share is 84 percent (see Table 4.7). The same approach was used in the proposed FMP to determine commercial quotas. The recreational share of the total 1993 landings will also be based on the historical average annual percentage share from 1986 through 1991; this value is 16 percent (see Table 4.7). The bag limits for large coastal (and pelagic) species have been changed to four fish per trip to ensure that 1993 commercial and recreational landings are reduced by about the same percent (29 percent) over their respective recent annual averages.

4.5.2 REMOVAL LIMITS AND MONITORING: SMALL COASTAL SHARKS

The abundance of small coastal shark species is estimated to be at the MSY level. Removals will be limited to the MSY level (2,590 mt dressed weight), thus imposing the equilibrium fishing mortality rate ($F=0.48$). If an annual fishing mortality rate exceeds this level, overfishing will have occurred and a rebuilding program will be necessary.

There is evidence that the abundance of this resource has been somewhat constant in recent years, but since it is heavily impacted by bycatch of the shrimp fishery, careful monitoring is prudent. Such monitoring is being carried out in the Gulf of Mexico through the SEAMAP program. These research cruise fishery-independent data will be used to monitor the relative abundance of this resource.

4.5.3 REMOVAL LIMITS AND MONITORING: PELAGIC SHARKS

The production potential for pelagic sharks cannot be estimated. Until the data become available to make statistical estimates of resource production, an annual landing of 1,560 mt dressed weight (average 1986-1991 landings) will be used as the removal limit for pelagic sharks. The effect of that yield on resource abundance is not known.

4.6 ANNUAL TOTAL ALLOWABLE CATCH (TAC)

The proposed allocation of Total Allowable Catch (TAC) is designed to be fair to commercial and recreational fishermen while safeguarding the resource for future generations. The expansion of the commercial fishery will be halted and landings reduced. Recreational bag limits will be imposed. Based on the 1986-1991 average percentages of commercial versus recreational landings, the large coastal species group allocation is 84 percent commercial and 16 percent recreational (Table 4.7).

The total TAC includes commercial and recreational landings of all three species groups. For 1993, total TAC is set at 7,050 mt, which is 890 mt below total MSY (Table 4.4).

The 1993 commercial quotas are 3,016 mt (approximately 39 percent of total MSY): 2,436 mt of the large coastal species group, and 580 mt of the pelagic species group. As each species group quota is reached, the commercial fishery on those species will be closed. The quotas halt the previously unrestricted growth of the commercial shark fishery. Commercial landings peaked in 1989 with 5,124 mt and have declined since.

Recreational catches are estimated by the MRFSS which are generally available one or two years after the fishing year. Therefore, there is no way to know when the recreational TAC has been reached. A recreational fishing trip limit will be used instead. The rebuilding policy requires that the fishing mortality level (F) not exceed 0.16. Thirty-one percent of the catch is allocated to the recreational fishery so the F , due to recreational fishing, must exceed 31 percent of 0.16 or 0.05. A trip limit will not limit the amount of fishing (f) but it will decrease the "effectiveness" of fishing (q). Any percent decrease in catch caused by a trip limit will cause an equal percent decrease in fishing effectiveness (because $qf = C/N$ where N is abundance and C is catch). Table 4.6 shows trip interview data and the resulting percent catch reductions that these data imply will occur from several trip limit options. A four fish trip limit will reduce the catch, and thus fishing effectiveness is estimated to be 0.227×10^{-6} (Parrack, 1990), thus with a four fish trip limit, it will be reduced by 28 percent to 0.163×10^{-6} . Assuming that recreational effort is constant in the future at the 1986-89 average of 376,616 directed trips, since the fishing mortality level is equal to the product of effectiveness and the amount of fishing ($F = qf = 0.163 \times 10^{-6} \times 376,616 = 0.06$), the four fish trip limit will achieve the target fishing mortality level and, therefore, restrict the recreational catch to the TAC listed in Table 4.8.

A recreational bag limit more conservative than one-shark per person per day (proposed in the initial draft FMP) was the consensus of comments received at public hearings. A two-shark per boat-trip limit was adopted in the Shark FMP (October 28,

1991). Due to information received during the public review process, the final bag limit was raised to four shark per trip limit for combined large coastal species and pelagic species, coupled with other management measures (Section 7.0), is expected to result in landings of approximately 1,331 mt (Table 4.4).

There is no recreational or commercial quota for the small coastal species group. Current information (Parrack, 1990) does not suggest that these sharks are overexploited, yet they may be fully exploited. However, their small size limits their commercial value and the potential for significant directed exploitation.

The proposed 1993 allocation to the recreational sector catching large coastal sharks is 464 mt. Established catches by that sector in 1989 were 44,386 fish (Parrack, 1990), equivalent to 464 mt dressed weight. Data for 1990 indicate that commercial landings were 16 percent less than for the same period in 1989 (Snell, personal communication). If that percent reduction were exhibited by the recreational sector as well, then the projected 1990 recreational yield would be 395 mt. If the recreational landings were not reduced in 1990 and stayed the same as in 1989, then the projected 1990 catches would be 464 mt.

The recreational allocation of pelagic species is 867 mt, based on the average landings from 1986-1989. The four per boat per trip limit should keep landings within this allocation. It is interesting to note, however, that the one-shark bag limit per person proposed in the initial draft was regarded as overly generous by the majority of commenting recreational fishermen at the public hearings. It is concluded, therefore, that the bag limit should meet the needs of most fishermen with respect to shark meat for home consumption.

In summary, commercial large coastal shark landings will be reduced 29 percent from the average 1986-1991 level of 3,444 to 2,436 mt and commercial pelagic shark landings will remain at the historical level of 580 mt during the first full year under management. There are no constraints on the small coastal species group at present because landings are believed to be near MSY. The combined effect of the management actions on the commercial and recreational shark fisheries is an estimated reduction in landings to or below the projected total allowable catch (TAC) of 7,050 mt (Table 4.4).

4.7 DOMESTIC ANNUAL HARVEST (DAH) CAPACITY

Domestic recreational and commercial fishermen have the capacity to harvest more than the annual OY level of 7,050 mt based on historic landing levels (Section 4.3).

Table 4.7

Commercial and Recreational Landings for Large Coastal Species
(Dressed Weight - Metric Tons)

Year	Commercial	Recreational	Total
			Landings
1986	1,301	755	2,507
1987	2,451	907	3,358
1988	4,057	668	4,725
1989	5,013	616	5,629
1990	3,830	637	4,467
<u>1991</u>	<u>4,010</u>	<u>310</u>	<u>4,319</u>
Total	20,662	3,893	24,555
% of Total	84	16	100
Average	3,444	649	4,093

Source: Parrack, 1992.

Table 4.8

Impacts of Alternative Trip Limits

Sampled Recreational Fishing Trips			Catches with Five Different Trip Limits				
Sharks Per Trip	No. of Trips	Total Caught	1 Shark	2 Sharks	3 Sharks	4 Sharks	5 Sharks
1	71	71	71	71	71	71	71
2	17	34	17	34	34	34	34
3	9	27	9	18	27	27	27
4	3	12	3	6	9	12	12
5	1	5	1	2	3	4	5
6 or more	11	118	11	22	33	44	55
Total	112	267	112	153	177	192	204
% Reduction In Catch			58	43	34	28	24

Source: See Table 7.3.

4.8 DOMESTIC ANNUAL PROCESSING (DAP) CAPACITY

The domestic processing sector has the capacity to fully process shark resources harvested annually at OY levels, based on past performance.

4.9 TOTAL ALLOWABLE LEVEL OF FOREIGN FISHING (TALFF)

There is no surplus of shark stocks for foreign fishing because the demand and capacity of the domestic fleets surpass the available resources. The TALFF is zero in the U.S. EEZ.

4.10 STRATEGY TO ACHIEVE OPTIMUM YIELD GOAL

The strategy for achieving OY is specified in Section 7.

5.0 PROBLEMS IN THE FISHERY

5.1 OVERFISHING

Sharks are particularly vulnerable to overfishing, despite being the top predators in the oceans. Unlike most fish, which may produce millions of eggs, sharks have few young (generally 2 to 25 pups every second year). They have low reproductive capability, are slow to reach sexual maturity, and have long reproductive cycles. For example, sandbar sharks, which comprise about 80 percent of the landings of the large coastal species group, grow very slowly and reach maturity about 20 years old. Bull sharks, a species that is sometimes a significant component of landings, particularly in the Gulf of Mexico, have similar characteristics. Blacktip sharks, the second most important species in the large coastal species group, reach maturity at age seven. On average a female sandbar gives birth to nine pups biannually, while a female blacktip gives birth to four pups biannually. Thus, sharks are especially vulnerable to stock depletion. A collapse of the shark complex or individual species could result from continued overfishing.

Parrack (1990) conducted a stock assessment for three separate shark species groups: large coastal, small coastal, and pelagic and calculated MSYs for each group. His analysis indicated that the large coastal shark species group is overfished (catch exceeds production), and a stock rebuilding program is required to achieve MSY. The species group, comprised of small coastal sharks, is fully exploited. Parrack was unable to carry out a quantitative assessment of the pelagic species group due to data limitations and concluded that there was no evidence available to suggest that the MSY is being exceeded but the group likely was fully exploited. The proposed FMP incorporated this assessment and a management regime to rebuild the large coastal species group that appeared to be overfished and to maintain the small coastal and pelagic stocks at the current levels.

During the public comment periods held on the proposed FMP and on the proposed rule, significant new fishery information was received from fishermen, fish dealers/processors, and several state fishery management agencies. This new information included: (1) data showing higher fishery removals in recent years than those used as a basis for determining MSY and stock conditions in the NMFS 1990 shark stock assessment; (2) records on the size and frequency of shark species caught in commercial fisheries; and (3) information on the commercial fishing fleet. NMFS reviewed this new information and determined that it could result in significantly revised conclusions about the abundance, productivity, and condition of the managed shark species from those in the proposed FMP that were based on the NMFS 1990 stock assessment for Atlantic coast sharks (see Parrack, M.L., A Study

of Shark Exploitation in U.S. Atlantic Coastal Waters during 1986-1989, 1990).

To ensure that all final FMP management measures are based upon the best scientific information available, NMFS undertook and completed a revised assessment of the condition of the large coastal shark species group using the above new/corrected information provided by the states and fishermen. The revised assessment was subjected to a peer review by a Review Committee consisting of both outside scientific experts and other NMFS stock assessment biologists; the Committee issued its final report on November 23, 1992 (see Appendix II, Report of the Atlantic Coastal Shark Fishery Analysis Review, November 23, 1992).

The Committee Report concludes, among several things, that the large coastal group is overfished (overfishing occurred in all years from 1986 through 1992 except for 1987 and 1990) and that calendar year 1993 landings for the large coastal should be reduced below the calendar year 1991 landings level of 4,319 mt dressed weight (see Appendix II). The Committee Report sets forth three options for establishing calendar year 1993 fishery landings (recreational and commercial combined) for the large coastal group that are all below the 1991 landings level; each option provides varying degrees of conservation benefits (see Appendix II).

5.2 LACK OF MANAGEMENT

At present, sharks are not managed throughout their range by international agreements or conventions, nor within U.S. waters (Federal or state waters). Several states have implemented regulations that establish recreational bag limits or commercial trip quotas and finning prohibitions (North Carolina, Virginia and Texas.) Several other states have imposed regulations that indirectly impact shark fishing activities, such as gear restrictions and data collection. Given the migratory patterns of most sharks, i.e., between Federal and state waters, between states, and between Federal and international waters, it is critical that sharks be managed comprehensively. Ideally, sharks need to be addressed on a species-by-species basis or other logical shark complex basis. The Gulf of Mexico Fishery Management Council prepared a draft shark FMP in 1979. An advance review by NMFS concluded the management measures were unenforceable. In turn, the plan was never finalized or officially submitted for processing. In January 1989 the Mid-Atlantic Fishery Management Council, in cooperation with the five Councils, developed a shark data collection program under the provisions of the Magnuson Act. The proposal was denied because of the exhaustive nature of needs that were not necessarily required to begin the management plan process, and the extent of funding requested to undertake the program. In June 1989 the

five east coast councils, concerned that the increased landings of sharks attributed to the growing foreign demand for shark fins and domestic demand for shark meat, requested the Secretary to develop the Shark FMP.

5.3 FINNING

There is growing demand in Asia for shark fins, the main ingredient of shark fin soup. The demand has increased due to recent easing of import restrictions into China. This market has spurred the practice of finning (removing only the fins and discarding the remainder of the shark to the sea). Dried fins currently bring U.S. fishermen as much as \$22 per kilogram in Florida. The U.S. public has decried this practice, perceiving it as wasteful and cruel. The extent of finning is unknown.

5.4 BYCATCH MORTALITY AND WASTE

Shark mortality of adults and juveniles occurs in both recreational and commercial fisheries, especially as incidental catch in the commercial swordfish, tuna, and shrimp fisheries. Over the period 1979-1988, U.S. shark landings averaged over 6,000 mt annually, while total yearly discards averaged almost 16,000 mt (NOAA, 1989b). Much more can be done to conserve shark resources, despite a considerable amount of bycatch. The required TEDs in the shrimp trawl fishery, and restrictions in other nondirected fisheries, will help.

5.5 INADEQUATE INFORMATION BASE

The Mid-Atlantic Fishery Management Council convened two workshops for shark experts (1986 and 1988) to identify management information needs. The five Councils, NMFS, and academia participated and concluded that the shark information base was inadequate to develop a species-specific FMP; i.e., separate management measures for each species. Data on landings, catch and effort, discard rates, and mortality were lacking. Cited were needs for management information on stock structure, stock recruitment relationships, and yield per recruit; biological information on pupping and nursery grounds, age and growth, and reproductive capabilities; and socioeconomic information on the users of sharks.

5.6 LIMITED PUBLIC EDUCATION

Sharks are generally feared. The impression exists that "the only good shark is a dead shark." Popular movies have exploited and increased the negative image of sharks. The public needs to learn that sharks are a valuable natural resource, play an important role in the ecosystem, and must be conserved.

5.7 HABITAT LOSS AND DEGRADATION

Habitat loss and degradation continue in the U.S. despite efforts to reverse this trend. Unsuitable habitat conditions, especially in nursery areas, undoubtedly affect sharks, but quantitative relationships between habitat and shark production have not been determined. It is certain, however, that the continuing degradation of habitat will adversely affect shark resources.

5.8 MERCURY ADVISORY

On May 13, 1991 the Department of Health and Rehabilitative Services (HRS) State of Florida, issued a health advisory urging limited consumption of sharks. Samples of sharks revealed average mercury concentrations in excess of current U.S. Food and Drug Administration and state standards. Because the samples were taken at the retail level, it is not known whether the high mercury content is limited to certain types or sizes of sharks or specific waters. Methyl-mercury from food is readily absorbed by the human digestive system and chronic consumption of excessive amounts produces toxicity of the central nervous system. Additional testing of samples will be made at Federal and state laboratories before regulatory action, if any, is taken. Thus, until additional information is acquired, the situation is not considered to be within the scope of this FMP.

6.0 OBJECTIVES

The following are objectives of this FMP.

Objective 1: Prevent overfishing of shark resources.

Objective 2: Encourage management of shark stocks throughout their ranges.

Objective 3: Establish a shark resource data collection, research, and monitoring program.

Objective 4: Increase the benefits from shark resources to the U.S. while reducing waste, consistent with the other objectives.

The five Councils requested that the FMP:

- Halt the expansion of the commercial fishery.
- Establish a bag limit in the recreational fishery.
- Eliminate the finning problem.
- Start a shark resource data collection program.

These goals are contained in the objectives of the FMP and are addressed in the management measures (Section 7).

7.0 MANAGEMENT PROGRAM

7.1 MANAGEMENT MEASURES

7.1.1 ALLOWABLE HARVEST LEVELS

7.1.1.1 FISHING YEAR AND THE INITIAL YEAR OF REGULATIONS

The fishing year is January 1 through December 31. Except for the mako minimum size limit, all management measures will be implemented on the effective date of the final rule. Comments on the revised bag limits and commercial quotas will be accepted for the time period in the interim final rule. Following implementation, a 60-day period will be allowed for fishermen to obtain a Federal permit.

7.1.1.2 COMMERCIAL QUOTA

During the public comment periods held on the proposed FMP and on the proposed rule, significant new fishery information was received from fishermen, fish dealers/processors, and several state fishery management agencies. This new information included: (1) data showing higher fishery removals in recent years than those used as a basis for determining MSY and stock conditions in the NMFS 1990 shark stock assessment; (2) records on the size and frequency of shark species caught in commercial fisheries; and (3) information on the commercial fishing fleet. NMFS reviewed this new information and determined that it could result in significantly revised conclusions about the abundance, productivity, and condition of the managed shark species from those in the proposed FMP that were based on NMFS' 1990 stock assessment for Atlantic coast sharks (see Parrack, M.L., A Study of Shark Exploitation in U.S. Atlantic Coastal Waters during 1986-1989, 1990).

To ensure that all final FMP management measures are based upon the best scientific information available, NMFS undertook and completed a revised assessment of the condition of the large coastal species group using the above new/corrected information provided by the states and fishermen. The revised assessment was subjected to a peer review by a Review Committee consisting of both outside scientific experts and other NMFS stock assessment biologists; the Committee issued its final report on November 23, 1992 (see Appendix II, Report of the Atlantic Coastal Shark Fishery Analysis Review, November 23, 1992).

The Committee Report concludes, among several things, that the large coastal species group is overfished (overfishing occurred in all years from 1986 through 1992 except for 1987 and 1990) and that calendar year 1993 landings for the large coastal species group should be reduced below the calendar year 1991 landings level of 4,319 mt dressed weight (see Appendix II). The

Committee Report sets forth three options for establishing calendar year 1993 fishery landings (recreational and commercial combined) for the large coastal species group that are all below the 1991 landings level; each option provides varying degrees of conservation and economic benefits (see Appendix II).

7.1.1.2.1 DETERMINATION OF COMMERCIAL QUOTAS AND RECREATIONAL LANDINGS

Based on the Committee Report, NMFS estimates that the MSY for the large coastal species group is 3,787 mt dressed weight (rounded to 3,800 mt); this represents the average stock production during the period 1986 through 1991 (see Section 4.1 for a discussion of MSY determination and Table 4.1). The average stock size (biomass) during the same 1986-1991 period was about 14,900 mt dressed weight.

Under the Committee's first option for the 1993 calendar year, total landings (3,520 mt dressed weight) for the large coastal stock would not rebuild to the MSY level (14,900 mt). To ensure that the large coastal group is rebuilt to the MSY level, NMFS has selected the Committee's recommended second option (Option 2--see Table 4 of the Committee Report) establishing 1993 total landings of 2,900 mt dressed weight (a 34 percent reduction from the 1991 landings; a 29 percent reduction from the 1986-91 annual average landings). Under this option, stock abundance will rebuild 5 percent each year back to the MSY level (estimated by NMFS to be 14,900 mt dressed weight) by 1995. The Review Committee's rebuilding schedule shows that annual fishery yields would increase about 5 percent each year, but would not equal MSY until 1999. Option 3 of the Committee Report requires a 1993 landings limit of 2,311 mt (a 50 percent reduction from the 1991 level; a 44 percent reduction from the 1986-91 annual average). This option achieves a 10 percent annual increase in stock abundance until the MSY level is reached. NMFS determined that this option would cause unacceptable short-term costs in lost fishery revenues, and is not necessary to achieve stock rebuilding in a reasonable time period. While NMFS adopted option 2 for stock rebuilding and will implement the recommended calendar year total landings (and derived calendar year commercial quotas) from 1993 to 1995, NMFS determined that the large coastal species group will be rebuilt by 1995 and at that point the stock size should be sufficient to provide MSY. NMFS does not agree with the Committee Report's conclusion that MSY yields will not occur under its rebuilding schedule until 1999.

The commercial quota for calendar year 1993 for the large coastal species group is determined based on the historical commercial average annual share (percent of average total annual landings) for the period 1986 through 1991 (see Table 4.7); this same approach was used in the proposed FMP. The recreational share of the total 1993 landings will also be based on the historical

average annual percentage share from 1986 through 1991 (see Table 4.7). The bag limits for large coastal species and pelagic species groups have been changed to ensure that 1993 commercial and recreational landings are each reduced by about the same percentage over their recent annual averages (each reduced about 29 percent).

The commercial quota for the pelagic species group is changed from the quota in the proposed FMP based on revised landings statistics and on several years' additional data; the 1993 calendar year commercial fishery quota is established at 580 mt dressed weight. Combining this commercial quota with the estimated recreational fishery share (under the bag limits) of 980 mt dressed weight, the total 1993 landings for the pelagic species group should be about 1,560 mt dressed weight.

7.1.1.2.2 COMMERCIAL QUOTA -- FIRST TWO YEARS OF IMPLEMENTATION

The Southeast Fisheries Science Center (SEC) has advised that retention of the proposed fishing year of July 1 through June 30 (with associated fishing year commercial quotas) could: (1) encourage rapid expansion of a new shark fishery in the previously unfished area off the northeastern states and, as such, be potentially destructive to already overfished shark resources--a growing new fishery on an overexploited resource in a previously unfished area, and (2) damage the historic fishery off the southern states by allowing the new northern fishery to take an unfair share of the annual quota. Also, it is noted that the Review Committee's stock rebuilding schedule and NMFS' collection of fishery statistics are both based on a calendar year. Implementing calendar year quotas while retaining a July 1 through June 30 fishing season poses several problems that are difficult to resolve.

For these reasons, NMFS decided to establish calendar year commercial quotas divided into two equal halves that would apply respectively to two fishing periods (January 1 through June 30; July 1 through December 31). This approach to applying the commercial quotas should spread the commercial fisheries in both southern and northern areas reasonably equally throughout the year, as well as addressing the SEC's specific concerns. Also, this approach should not eliminate the historic peak months of the established southern fisheries while ensuring an open season and a new, unfished quota for the peak fishing months of a new, expanding fishery in the northeast.

Specific commercial quotas for 1993 and 1994 are derived from the Review Committee's rebuilding schedule which provides total annual landings (recreational and commercial combined) for these years. The annual commercial quota is divided into two equal parts assigned respectively to the fishing periods January 1 through June 30 and July 1 through December 31.

Large Coastal Group

The Review Committee's report recommended total landings of 2,900 mt, dressed weight, under the second option for stock conservation. Based on the historical shares of recreational and commercial landings during the period 1986-1991, the commercial quota for the large coastal group is 84 percent of 2,900 mt or 2,436 mt. For the period from January 1, 1993, through June 30, 1993, the commercial quota for the large coastal group is established at 50 percent of this amount or 1,218 mt dressed weight. When this amount is taken or projected to be taken prior to June 30, 1993, the large coastal fishery will be closed until the beginning of the next fishing period on July 1, 1993. A possible late spring closure would serve to protect female sharks during the spawning season. The commercial quota for the second fishing year period beginning July 1, 1993, and ending December 31, 1993, will consist of 1,218 mt adjusted for any quota overages or underages during the first half of 1993.

The Review Committee's recommended total landings for calendar year 1994 are 3,062 mt dressed weight. The commercial quota is 84 percent of this or 2,572 mt dressed weight. Therefore, each of the quotas for the two half-year fishing periods is 1,286 mt. Again, the second half year quota will be adjusted to reflect any quota overruns or underages during the first half of the year. Such adjustments will be implemented through in-season notice action.

The above method of establishing fishing season quotas will continue for subsequent years, unless modified by the Assistant Administrator under the framework regulatory adjustment procedure, and will closely follow the Review Committee Report. The Operations Team will review this method and the Committee's recommended rebuilding program and make appropriate recommendations for changes.

Pelagic Group

The same approach used for implementing the large coastal quota will be used for implementing the quotas for the pelagic group during 1993 and 1994. The Review Committee Report did not contain any recommendations for this species group since this resource is not considered to be overfished.

The table below illustrates the implementation of 1993 and 1994 quotas.

Table 7.1

Calendar Year 1993 and 1994 Commercial Quotas
Six Month Fishing Period Quotas¹
Large Coastal and Pelagic Species Groups
(Metric Tons Dressed Weight)

<u>Calendar Year</u> <u>Fishing Period</u>	<u>Large Coastal</u>	<u>Pelagic</u>
1/1/93--6/30/93	1,218	290
7/1/93--12/31/93	<u>1,218</u>	<u>290</u>
1993 Total	2,436	580
1/1/94--6/30/94	1,285	290
7/1/94--12/31/94	<u>1,285</u>	<u>290</u>
1994 Total	2,570	580

¹ Overruns or unused portions of the quota for any given 6 month fishing period will be compensated for adjustments to the quota for the following 6 month period.

7.1.1.3 RECREATIONAL BAG LIMIT

The EEZ recreational bag limit for the combined large coastal and pelagic species groups is four sharks per boat per trip. There is a daily five-shark per person bag limit for sharks in the small coastal species group.

7.1.2 HARVEST RESTRICTIONS

7.1.2.1 FINNING

The practice of finning is prohibited. Fins may be sold, traded, or bartered, but only in proper proportion to carcasses sold, traded, or bartered, with a maximum of 5 percent fins per dressed carcass weight. This percentage is based on the ratio of wet fin weight to dressed carcass weight for the sandbar shark (see Table 7.2). Fins may not be stored aboard the vessel after associated carcasses are sold, traded, or bartered. All fins and carcasses must be weighed and sold at the point of first landing.

7.1.2.2 RELEASE CONDITION

Sharks that are caught, unless retained as part of the commercial quota or as part of the recreational bag limit, must be released uninjured by cutting the line near the hook, with the shark in the water, or, for net-caught sharks, by returning the shark to the water quickly in a manner that minimizes injury.

7.1.2.3 MAKO MINIMUM SIZE

The mako minimum size was dropped from the final FMP and reserved because of inadequate supporting biological information. There is no clear evidence that significant conservation benefits would accrue and NMFS's proposed application of the measure differently to the recreational and commercial fisheries raised many public objections that could not overcome with demonstrable (tangible) stock conservation benefits. NMFS will ask the Operations Team to review this measure, as well as possible minimum sizes for other species, and provide NMFS with its recommendations regarding the implementation of and benefits from shark minimum sizes.

7.1.2.4 NO SALE OF RECREATIONAL CATCH

Fishermen may not sell shark or shark products taken from the EEZ without a Federal permit.

7.1.2.5 CHARTER VESSEL AND HEADBOAT SALE OF CATCH

The owner or operator of a charter vessel or headboat may sell sharks, including fins, if: (a) the vessel has a Federal shark

fishing permit; and (b) the commercial fishery is open; i.e., the applicable quota has not been reached. The operator or owner of a vessel under charter, or operating as a headboat, may sell sharks, not to exceed the cumulative bag limits.

7.1.3 ADMINISTRATIVE REQUIREMENTS

7.1.3.1 COMMERCIAL PERMITS

The owner or operator of a vessel that sells sharks caught in the EEZ must have an annual Federal permit. The permit application form is available from the SEO. A fee (approximately \$53) will be charged to cover administrative costs of processing the application. To be eligible for a Federal commercial permit, 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 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 year for which the permit is requested. The recipient of a Federal permit must agree that the vessel's fishing, catch, and gear will be subject to Federal shark fishing regulations regardless of where the fishing occurs (i.e., in state, Federal, or international waters) with the exception that if a permitted vessel fishes only in state waters on a given trip, the vessel's fishing, catch, or gear may be subject to the more restrictive state requirements for that trip. A permit remains valid and binding for the period for which it is issued and may not be surrendered during that period. Permits are not assignable or transferable to another person, entity, or vessel.

Effective management of the shark fishery requires the receipt of timely catch and effort data from participants in the fishery. NMFS considers these reports to be of such importance to management that the renewal of a permit will be conditioned on the applicant's submission of all required reports that provide catch and effort data on sharks. Such reports include those specified in Section 7.1.3.2, below, and will include reports in other fisheries when a standard logbook form is implemented. An applicant for renewal of a permit who is deficient in a required report will so be informed and given an opportunity to correct the deficiency. NMFS believes that a person who refuses to provide the required information should not be allowed to continue to participate in the fishery.

Table 7.2

Percentages of Fin Weight¹ to Whole (Round) Weight and Dressed (Carcass) Weight for Atlantic Sharks

<u>Species</u>	<u>N</u>	<u>TFW²/DW³</u>	<u>N</u>	<u>TFW/WW⁴</u>	<u>N</u>	<u>DFW⁵/DW</u>	<u>N</u>	<u>DFW/WW</u>
Sandbar	12	5.07	36	2.46	9	2.28	15	1.09
Blue	8	3.74	52	2.06	8	1.07	28	0.60
Dusky	1	4.58	1	2.08	1	2.08	1	0.95
Blacktip	4	2.86	5	1.59	4	1.40	5	0.75
Spinner	11	3.32	11	1.73	0	N/A	0	N/A
Silky	0	N/A	1	1.62	0	N/A	1	0.78
Shortfin Mako	5	4.22	28	1.68	4	1.01	17	0.70
Portbeagle	0	N/A	1	2.19	0	N/A	0	N/A
Sand Tiger	0	N/A	1	1.34	0	N/A	0	N/A
Bonnethead	2	4.69	2	2.56	0	N/A	0	N/A
Hammerhead								
Great	0	N/A	1	2.03	0	N/A	1	0.87
Scalloped	9	2.39	24	1.58	8	1.08	21	0.66
Smooth	0	N/A	1	1.49	0	N/A	1	0.74
Atlantic Sharpnose	0	N/A	1	1.47	0	N/A	0	N/A
Blacknose	6	3.40	6	1.55	0	N/A	0	N/A
Tiger	3	2.90	17	1.27	1	1.22	11	0.61
Lemon	0	N/A	1	2.30	0	N/A	1	1.09
Common Thresher	0	N/A	5	2.06	0	N/A	0	N/A
Night	2	2.64	2	1.30	2	1.15	2	0.57
Bignose	1	4.16	5	1.79	1	1.18	5	0.64
<u>Caribbean Reef</u>	<u>0</u>	<u>N/A</u>	<u>2</u>	<u>1.37</u>	<u>0</u>	<u>N/A</u>	<u>2</u>	<u>0.67</u>
<u>Weighted Average</u>	<u>64</u>	<u>3.65</u>	<u>203</u>	<u>1.69</u>	<u>38</u>	<u>1.42</u>	<u>111</u>	<u>0.71</u>

¹ Fin weight consists of first dorsal, pectorals, and lower caudal fins.

² TFW means total wet fin weight.

³ DW means dressed (carcass) weight.

⁴ WW means whole (round) weight.

⁵ DFW means Total dry fin weight.

Source: Jack Casey, NMFS, Northeast Fisheries Science Center, Narragansett Laboratory, 1992

7.1.3.2 COMMERCIAL VESSEL OWNER AND OPERATOR REPORTING REQUIREMENTS

Owners or operators of vessels in the shark fishery, if selected by the Science Director, must maintain and submit required information to NMFS on logbook forms provided by NMFS Southeast Fisheries Science Center (SEC). Information to be provided includes: kind and amount of gear used; time fished; number of each species caught, landed, and discarded; and location fished. A copy of the sales weigh-out sheet (i.e., any settlement sheet showing individual carcass species, weight, and exvessel value) received from the dealer for each trip must accompany the corresponding logbook submissions to NMFS. Any owner or operator of a Federally permitted commercial fishing vessel must make catches available for examination by designated officials.

Foreign data reporting requirements are contained in Section 7.10. The amount of allowable foreign fishing is limited in Section 7.10.2.

7.1.3.3 TOURNAMENT REPORTING REQUIREMENTS

If selected by NMFS (SEC), any person conducting a shark tournament must maintain and submit a fishing record on forms available from the SEC (Section 9.4.1).

7.1.3.4 OBSERVERS ON VESSELS

If selected by NMFS (SEC), operators of Federally permitted vessels must accommodate an observer.

7.1.4 FRAMEWORK REGULATORY ADJUSTMENT PROCEDURE

The framework regulatory adjustment procedure provides for timely annual changes to the management measures in the regulations in response to new information about the fishery.

7.1.4.1 OPERATIONS TEAM AND FMP MONITORING

The Assistant Administrator will be responsible for implementing, monitoring, and amending the FMP and regulations. The Assistant Administrator will establish an Operations Team (OT) and headed by his designee, to monitor the shark fishery and effectiveness of the FMP, and to recommend necessary adjustments to the management measures through the framework regulatory adjustment procedure. The OT will include representatives from the NMFS Northeast and Southeast Regional Offices, and the Washington Office; a staff person and/or member from each of the five Councils; and, if appropriate, scientists from NMFS Southeast and Northeast Fisheries Centers.

7.1.4.2 PROCEDURE FOR ADJUSTING THE MANAGEMENT MEASURES

The OT will meet as determined by the Assistant Administrator to evaluate the management measures relative to the objectives of the Shark FMP. In addition, NMFS will prepare an annual shark Stock Assessment and Fishery Evaluation (SAFE) report by March 15 that includes, to the extent possible: (a) landings and discard information; (b) present stock condition; (c) MSY; (d) information to base OY, and TAC; (e) social and economic issues; and (f) other pertinent data and statistics. Copies of the SAFE report may be obtained from the NMFS Washington Office. The OT may consider other sources of documented information, besides the SAFE report, to decide if adjustments are warranted. Such sources include Food and Agricultural Organization (FAO), foreign countries, states, Councils, fishermen, and academia. The OT will summarize its findings in a written report to the Assistant Administrator.

The goal for implementing regulatory changes is the start of the new fishing year. If the OT determines that adjusting the management measures is necessary, it will include in the written report to the Assistant Administrator specified ranges (acceptable biological catch) of the TAC for individual species, species groups, or all species as appropriate. Recommendations may include changes in: (a) commercial quotas; (b) commercial trip limits; (c) recreational bag limits; (d) MSYs; (e) species size limits; (f) management unit; (g) permitting and reporting requirements; (h) composition of the species groups; and (i) fishing year or season. The biological, environmental, social, and economic impacts of each recommendation will be included in the report. In formulating its recommendations, the OT will consult with the Assistant Administrator, Regional Directors, Northeast and Southeast Regions (NEO and SEO), NMFS, and the Councils, and may hold public hearings as appropriate.

If the Assistant Administrator concurs with the OT's recommendations, he/she will prepare the regulatory package and file within 30 days a proposed rule and a request for public comment with the Office of the Federal Register. The regulatory package will include a discussion of the need for action; the proposed adjustments to the management measures; analyses as required by applicable law of the social, economic, environmental, and biological impacts of the proposed measures; and the proposed rule. From 15 to 30 days will be provided for public comment, consistent with the magnitude of the action.

After reviewing public comments and additional information or data that may be available, the Assistant Administrator will, after consultation with the OT, if appropriate, make final determinations regarding consistency of the proposed conservation and management measures with the objectives of the FMP, the national standards, and other applicable law. Within 30 days of

the close of the public comment period on the proposed rule, the Assistant Administrator will publish a final rule in the Federal Register.

The Assistant Administrator may take action independent of the recommendations of the OT, if he/she finds that based on the best available scientific information on the biological condition of the shark resources or economic conditions of the fishery, that adjustments in the management measures are required. In this situation, the Assistant Administrator would follow the same procedure that the OT would follow in preparing recommendations for regulatory changes. The Assistant Administrator would consult with the OT, as appropriate.

7.2 IMPACTS OF ADOPTED MEASURES

7.2.1 ECOLOGICAL IMPACT

The proposed measures will not have any significant negative ecological impact. They are designed to prevent overfishing and promote conservation. The management measures will not affect habitats necessary to maintain the stocks.

7.2.2 FISHING YEAR

The fishing year of January 1-December 31 is not expected to have an adverse impact on the different user groups. This alternative represents an attempt to allow equal access to all user groups. See Section 9.3.5.1 for more information.

7.2.3 COMMERCIAL FISHERY IMPACT, QUOTAS, AND REBUILDING PROGRAM OPTIONS

During the public comment periods held on the proposed FMP and on the proposed rule, significant new fishery information was received from fishermen, fish dealers/processors, and several state fishery management agencies. This new information included (1) data showing higher fishery removals in recent years than those used as a basis for determining MSY and stock conditions in the NMFS 1990 shark stock assessment, (2) records on the size and frequency of shark species caught in commercial fisheries, and (3) information on the commercial fishing fleet. NMFS reviewed this new information and determined that it could result in significantly revised conclusions about the abundance, productivity, and condition of the managed shark species from those in the proposed FMP that were based on the NMFS 1990 stock assessment for Atlantic coast sharks (see Parrack, M.L., A Study of Shark Exploitation in U.S. Atlantic Coastal Waters during 1986-1989, 1990).

To ensure that all final FMP management measures are based upon the best scientific information available, NMFS undertook and

completed a revised assessment of the condition of the large coastal shark species group using the above new/corrected information provided by the states and fishermen. The revised assessment was subjected to a peer review by a Review Committee consisting of both outside scientific experts and other NMFS stock assessment biologists; the Committee issued its final report on November 23, 1992 (see Appendix II, Report of the Atlantic Coastal Shark Fishery Analysis Review, November 23, 1992).

The Committee Report concludes, among several things, that the large coastal species group is overfished (overfishing occurred in all years from 1986 through 1992 except for 1987 and 1990) and that calendar year 1993 landings for the large coastal species should be reduced below the calendar year 1991 landings level of 4,319 mt dressed weight (see Appendix II). The Committee Report sets forth three options for establishing calendar year 1993 fishery landings (recreational and commercial combined) for the large coastal species group that are all below the 1991 landings level; each option provides varying degrees of conservation benefits (see Appendix II).

Based on the Committee Report, NMFS estimates that the MSY for the large coastal species group is 3,787 mt dressed weight (rounded to 3,800 mt); this represents the average stock production during the period 1986 through 1991 (see section 4.1 for a discussion of MSY determination). The average stock size (biomass) during the same 1986-1991 period was about 14,900 mt dressed weight.

Under the Committee's first option for 1993 calendar year total landings (3,520 mt dressed weight), the stock would not rebuild to a level capable of producing MSY. In order to ensure that the biomass of the large coastal species group is rebuilt to the MSY producing level, NMFS has selected the Committee's recommended second option which would establish 1993 total landings of 2,916 mt dressed weight (rounded to 2,900 mt). Under this second option, the 2,900 mt would represent a 34 percent reduction from the 1991 landings level or a 29 percent reduction from the 1986-1991 average annual landings. If the Committee Report's recommended rebuilding schedule under the second option is followed (see Table 4 of Committee Report), the stock abundance level will rebuild approximately 5 percent each year back to the MSY producing level by 1995. The rebuilding schedule shows that annual fishery yields would increase each year and would return to the MSY level by 1999. Option 3 of the Committee Report recommends total 1993 landings of 2,311 mt (50 percent reduction from the 1991 level or a 44 percent reduction from the 1986-1991 average annual landings) that, along with a 10 percent annual increase in stock abundance under a specified rebuilding program, would achieve a significantly higher stock abundance level by 1999. NMFS determined that this option would involve

unacceptable short term costs in lost fishery revenues, and is not necessary to achieve stock rebuilding in a reasonable time period.

The commercial quota for calendar year 1993 for the large coastal species group is determined based on the historical commercial average annual share (percent of average total annual landings) for the period 1986 through 1991 (see Table 4.7); this same approach was used in the proposed FMP. The recreational share of the total 1993 landings will also be based on the historical average annual percentage share from 1986 through 1991 (see Table 4.7). The bag limits for large coastal species and species group have been changed to ensure that 1993 commercial and recreational landings are each reduced by about the same percentage over their recent annual averages (each reduced about 29 percent).

The commercial quota for the pelagic species group is changed from the quota in the proposed FMP based on revised landings statistics and on several years' additional data; the 1993 calendar year commercial fishery quota is established at 580 mt dressed weight. Combining this commercial quota with the estimated recreational fishery share (under the bag limits) of 980 mt dressed weight, the total 1993 landings for the pelagic species group should be about 1,560 mt dressed weight.

7.2.4 COMMERCIAL PERMITS

The earned income for commercial permit requirement is designed to prevent recreational and part-time commercial fishermen from selling their catch. Consequently, these groups would be adversely impacted by this measure to the extent that they sell their catch.

7.2.5 COMMERCIAL REPORTING

This measure consists of two parts. First, all permitted fishermen are required to supply a copy of the weigh sheet. This requirement is not expected to have a significant impact on these full-time fishermen. Second, if selected, the permit holder would supply the catch-and-effort information via logbook report to the Director, SEC. This requirement is not expected to have a significant impact on these fishermen since NMFS pays for the mailing and most of the other costs. All fishermen should benefit from the knowledge gained through better and more effective management measures. Failure of the permittee to provide this information could lead to fines (i.e., up to the statutory limit of \$100,000 per violation), loss of permit, and other sanctions identified in the Magnuson Act.

7.2.6 IMPACT OF COMMERCIAL MANAGEMENT MEASURES ON MORTALITY

The cumulative effect of the management measures cannot be accurately forecast, but mortality levels should decrease substantially. Between the mandatory release provision, commercial quotas, the finning prohibition, and the requirement to land the fins and carcasses at the point of first landing (i.e., 5 percent fins per dressed carcass weight), the directed shark fisheries should land the carcasses and fins. Addition of the carcasses should fill the holds and terminate the trip sooner. The required use of TEDs in the shrimp fishery should significantly reduce discard mortality of small coastal species sharks and juvenile large coastal species. Some estimates as high as 80 percent reduction have been suggested. However, reduction estimates are uncertain because TEDs are not used at all times in all areas. Juveniles of small coastal species may continue to be taken even while pulling TEDs; they may not be expelled from the net by the TED deflector bars due to their small size. Mortality reduction in the species group species group is uncertain, but could be significant. Between the mandatory release provision, the finning prohibition, and the requirement to land the fins and carcasses at the point of first landing (i.e., 5 percent fins per dressed carcass weight), the swordfish and tuna fisheries may choose not to land their shark bycatch. However, it is hoped that sharks retrieved dead from longlines will be brought to market rather than wasted.

7.2.7 RECREATIONAL BAG LIMITS, MUST-RELEASE, AND NO-SALE PROVISIONS

The EEZ recreational bag limit for the combined large coastal and pelagic species groups is four sharks per boat per trip. There is a daily five-shark per person bag limit for sharks in the small coastal species group. These bag limits should meet the needs of most recreational fishermen for home meat consumption. Some fishermen may resent the bag limit and the requirement to release uninjured all sharks caught over the bag limit. This may be tempered by the fact that they can catch and release as many sharks as they want, and the knowledge that the recreational fishery will ultimately benefit from the enforcement of conservation measures.

The available data on the distribution of shark catches among anglers are very limited and is summarized in Table 7.3. The first data set is MRFSS data of catch by angler-trip for those angler-trips in which large sharks are caught, pooled over all years and fishing modes of the data set. The category "large sharks" may include some pelagic sharks, as well. A four-fish per boat trip limit should not affect 89 percent of the trips, but is projected to reduce catch approximately 28 percent from unrestricted trips. The Table 7.3 data set includes charter boat trips, but it is dominated by private/rental boats.

Table 7.3

**MRFSS Boat-Trip Limit Analysis
for Large Coastal and Pelagic sharks**

Alternative Limit Per Boat-Trip Limit	# Boat-Trips Per Sample Size	% Reduction Landings Per Boat-Trip Limit	% Trips Unaffected By Boat-Trip
1	71	58	63
2	17	43	79
3	9	34	87
4	3	28	89
5	1	24	90
6	4	19	93
7	3	17	94
8	1	15	96
12	1	11	97
23	1	3	98
30	1	--	100

Source: NMFS, Marine Recreational Fishery Statistics Survey, Atlantic and Gulf Coasts, 1979-1989.

As noted in Section 4.6, it is likely that the recreational bag limit will have a significant impact on actual landings with respect to large coastal species. Based on recent trends, even without bag limits, landings are expected to be below the 464-mt allocation to the recreational sector.

The daily bag limit of five coastal species sharks per person will provide fishermen with sufficient meat for the table and should not diminish enjoyment of the sport. There is no biological basis for a bag limit since these species are not over exploited at present. The bag limit does promote a conservation ethic, thus is a benefit to society.

The must-release and prohibition on the sale of shark or shark products by recreational fishermen are not expected to have any significant economic impact. Presently, approximately 10 percent of recreational-caught sharks are sold (Parrack, 1990). Reductions in shark mortality are expected in shark fishing tournaments as sponsors of such events move toward catch-and-release tournaments and impose other restrictions and bag limits.

7.2.8 TOURNAMENT REPORTING

This measure is not expected to have any significant impact. Tournament holders are expected to benefit from the knowledge gained from the overall reporting.

7.2.9 FINNING

It is believed that the prohibition of finning, especially the requirement to land carcasses, will reduce mortality because those fishermen interested only in fins will prefer to save their freezer space for more valuable carcasses, such as swordfish and tuna. The regulation to land no more than 5 percent fins per dressed carcass weight may cause these fishermen and others who fish only for fins to drop out of the fishery entirely, thus further reducing commercial fishing mortality. The 5 percent weight of fin to dressed carcass weight provision and the prohibition on storing fins aboard a vessel beyond the first point of landing will inconvenience commercial fishermen who mainly target sharks. However, they will ultimately benefit by the withdrawal from the fishery of those fishermen interested only in landing fins.

7.2.10 RELEASE CONDITION

The requirement to release uninjured those sharks not harvested as part of the commercial and recreational fishery, and the prohibitions on finning and landing fins separately, are expected to reduce mortality by approximately 50 percent from the 1979-1988 average bycatch. Data on the EEZ Japanese longline fishery from 1978 to 1981 indicate that 80 percent of sharks hooked were

alive when cut off. Two NMFS tagging cruises off the U.S. East Coast, involving inshore and southern species, yielded tagging rates (i.e., live sharks expected to survive) in excess of 60 percent on one trip and 80 percent on the other (Casey, 1990). However, these cruises involved short longline sets and thus higher survival rates than could be expected from commercial longline operations. Survival rates for sharks released from longlines may be higher than 50 percent, but the more conservative figure is used until additional data become available.

7.2.11 MAKO SIZE LIMIT

The mako minimum size limit was reserved from the final FMP because of inadequate supporting biological information. No clear evidence was developed that significant conservation benefits would accrue. NMFS's proposed application of the measure differently to the recreational and commercial fisheries raised too many public objections that NMFS could not overcome with demonstrable (tangible) stock conservation benefits. NMFS will ask the Operations Team to review this measure, as well as possible minimum sizes for other species, and provide NMFS with its recommendations regarding the implementation of, and benefits from, shark minimum sizes.

7.2.12 PUBLIC EDUCATION

The public perception of sharks is changing as sharks become better known. The Shark FMP will contribute substantially to development of a sound conservation ethic through documented, advertised public hearings, and comments associated with the NMFS management process. Also, NOAA is expected to actively emphasize, at all levels of public education, conservation goals for this and other living marine resources. These factors should contribute to reducing shark mortality.

7.2.13 TURTLE EXCLUDER DEVICES

Use of TEDs in the shrimp trawl fishery is now mandatory. Currently, there are seven types of Federally-approved TEDs and all will reduce shark bycatch in shrimp trawls (Oravetz, 1991).

Most TEDs release sharks longer than 60 cm (some may release smaller sharks), thereby decreasing by an estimated 80 percent, or 2,240 mt, the shark mortality attributed to shrimp trawls. However, soft TEDs may not reduce the mortality of small sharks due to gilling in the separator net (Seidel, 1990).

7.3 MANAGEMENT MEASURES CONSIDERED AND REJECTED

7.3.1 NO-ACTION ALTERNATIVE

The option of taking no conservation and management action was considered and rejected. Some shark resources may become overfished soon. The rapid increase in commercial shark landings in U.S. waters, the perceived waste from finning, and the unique biology of sharks (low number of births and slow sexual maturation) dictate a need for management. The five Councils responsible for developing FMPs in the Atlantic Ocean recognized the potential danger of overfishing sharks and requested the Secretary (through NMFS) to develop a Shark FMP as soon as possible. Without management, there is a distinct potential for long-term damage, or worse, collapse of the shark stock complex or targeted species.

7.3.2 ADDRESS THE FINNING PROBLEM UNDER EMERGENCY ACTION

The practice of finning was, in part, a driving force for bringing sharks under management. A considerable and vocal U.S. public sector is strongly against this practice and is calling for action to prohibit it. The Secretary has the authority to take emergency action under the Magnuson Act; however, the law limits such action to 90 days, with a possible extension of another 90 days. The emergency action alternative was rejected because the finning issue is just one of the problems facing the fishery, and a 180-day period of protection was perceived as merely a stop-gap measure that would expire before any long-term measures could be implemented. Long-term resolution of this problem is required.

7.3.3 HARVESTING MALE SHARKS ONLY

This option was considered because it offers some potential for reducing mortality of females and enhancing reproduction potential. Male sharks have claspers that can be identified during fishing operations. Thus, male sharks could be kept and females released. This option was rejected for two major reasons. First, fishing gear, whether gillnets or longlines, is not selective and discard mortality of females may be unacceptably high. Second, enforcement would be difficult as gender of the shark can be identified only if claspers are left intact.

7.3.4 ALLOCATION OF COMMERCIAL QUOTAS

Consideration was given to allocating the available commercial shark quota by geographical region; i.e., Gulf of Mexico, Caribbean, South Atlantic, Mid-Atlantic, and North Atlantic. This option was rejected for the present, but may become a necessary management measure in the future. Among the reasons for rejection is a lack of data on migratory patterns of the important shark species. Equitable allocation among regions (so that one region does not take the entire quota), while ensuring that vulnerable shark species are not adversely impacted,

requires an understanding of distribution and movement patterns. A geographic and/or species-specific allocation scheme based on average catches over several years is being considered for future application (Section 7.4.1).

7.3.5 CLOSURE OF THE COMMERCIAL FISHERY FOR LARGE COASTAL SHARKS UPON PLAN IMPLEMENTATION UNTIL THE START OF THE NEW FISHING YEAR

Consideration was given to closing the commercial fishery for large coastal sharks upon implementation of the FMP until the start of the new fishing year, July 1, 1993. NMFS rejected this measure as unnecessary. The large coastal species resource was not as overfished as previously believed. During the public comment periods held on the proposed FMP and on the proposed rule, significant new fishery information was received from fishermen, fish dealers/processors, and several state fishery management agencies. This new information included (1) data showing higher fishery removals in recent years than those used as a basis for determining MSY and stock conditions in the NMFS 1990 shark stock assessment, (2) records on the size and frequency of shark species caught in commercial fisheries, and (3) information on the commercial fishing fleet. NMFS reviewed this new information and determined that it could result in significantly revised conclusions about the abundance, productivity, and condition of the managed shark species from those in the proposed FMP that were based on NMFS's 1990 stock assessment for Atlantic coast sharks (see Parrack, M.L., A Study of Shark Exploitation in U.S. Atlantic Coastal Waters during 1986-1989, 1990).

To ensure that all final FMP management measures are based upon the best scientific information available, NMFS undertook and completed a revised assessment of the condition of the large coastal species group using the above new/corrected information provided by the states and fishermen. The revised assessment was subjected to a peer review by a Review Committee consisting of both outside scientific experts and other NMFS stock assessment biologists; the Review Committee issued its final report on November 23, 1992 (see Appendix II, Report of the Atlantic Coastal Shark Fishery Analysis Review, November 23, 1992).

The Committee Report concludes, among several things, that the large coastal species group is overfished (overfishing occurred in all years from 1986 through 1992 except for 1987 and 1990) and that calendar year 1993 landings for the large coastal species should be reduced below the calendar year 1991 landings level of 4,319 mt dressed weight (see Appendix II). The Committee Report sets forth three options for establishing calendar year 1993 fishery landings (recreational and commercial combined) for the large coastal species group that are all below the 1991 landings

level; each option provides varying degrees of conservation and economic benefits (see Appendix II).

Based on the Committee Report, NMFS estimates that the MSY for the large coastal species group is 3,787 mt dressed weight (rounded to 3,800 mt); this represents the average stock production during the period 1986 through 1991 (see Section 4.1 for a discussion of MSY determination). The average stock size (biomass) during the same 1986-1991 period was about 14,900 mt dressed weight.

Under the Committee's first option for the 1993 calendar year total landings (3,520 mt dressed weight), the large coastal stock would not rebuild to the MSY level (14,900 mt). To ensure that the large coastal group is rebuilt to the MSY level, NMFS has selected the Committee's recommended second option (Option 2--see Table 4 of the Committee Report) establishing 1993 total landings of 2,900 mt dressed weight (a 34 percent reduction from the 1991 landings; a 29 percent reduction from the 1986-91 annual average landings). Under this option, stock abundance will rebuild 5 percent each year back to the MSY level (estimated by NMFS to be 14,900 mt dressed weight) by 1995. The Review Committee's rebuilding schedule shows that annual fishery yields would increase about 5 percent each year but would not equal MSY until 1999. Option 3 of the Committee Report requires a 1993 landings limit of 2,311 mt (a 50 percent reduction from the 1991 level; a 44 percent reduction from the 1986-91 annual average). This option achieves a 10 percent annual increase in stock abundance until the MSY level is reached. NMFS determined that this option would cause unacceptable short-term costs in lost fishery revenues, and is not necessary to achieve stock rebuilding in a reasonable time period.

While NMFS adopted option 2 for stock rebuilding and will implement the recommended calendar year total landings (and derived calendar year commercial quotas) from 1993 to 1995, NMFS believes that the large coastal species group will be rebuilt by 1995 and at that point the stock size should be sufficient to provide MSY. NMFS does not agree with the Committee Report's conclusion that MSY yields will not occur under its rebuilding schedule until 1999.

The commercial quota for calendar year 1993 for the large coastal species group is determined based on the historical commercial average annual share (percent of average total annual landings) for the period 1986 through 1991 (see Table 4.7); this same approach was used in the proposed FMP. The recreational share of the total 1993 landings will also be based on the historical average annual percentage share from 1986 through 1991 (see Table 4.7). The bag limits for large coastal species and species group have been changed to ensure that 1993 commercial and recreational

landings are each reduced by about the same percentage over their recent annual averages (each reduced about 29 percent).

7.3.6 CLOSURE OF THE DIRECTED COMMERCIAL FISHERIES FOR SHARKS

Consideration was given to closing the directed commercial fisheries for sharks until the large coastal species resource recovered from overfishing. NMFS rejected this alternative in the FMP (dated October 28, 1991) since alternative strategies would have achieved the same goals over a longer period of time without the draconian impacts on the user groups.

7.3.7 CLOSING NURSERY AREAS TO FISHING

Closing shark nursery areas to fishing would reduce mortality. This option was rejected because of insufficient knowledge of specific nursery areas and the adverse effect closures would have on other fisheries, such as the shrimp trawl fishery. Further, this action would preempt state authority where nursery areas are in state waters.

7.3.8 ALTERNATIVE RECREATIONAL BAG LIMITS

The EEZ recreational bag limit for the combined large coastal and pelagic species groups of two sharks per boat per trip was rejected since this measure would reduce recreational landings by 43 percent. The proposed bag limits for large coastal and species group of four sharks per trip ensure that 1993 commercial and recreational landings are each reduced by about the same percentage over their recent annual averages (each reduced about 29 percent).

A recreational bag limit of one-shark per person per day in the EEZ was considered and rejected. Results of public comment indicate that a one-shark per person per day bag limit would not be restrictive enough to have sufficient conservation effect. A one-shark per person per day limit was considered too restrictive for Atlantic and Caribbean sharpnose sharks because of the abundance and size of these species.

7.3.9 ALTERNATIVE WAYS TO CONTROL FINNING

Six alternative ways of controlling finning were considered and rejected. Two management measures would have allowed the owner or operator of permitted vessels to land up to four or five fins per carcass. One measure would have required the owner or operator of permitted vessels to land all sharks with the fins attached to the carcasses. These measures were criticized by the commercial fishing sector as too restrictive; they suggested that all fins of a shark were valuable and fishermen should be allowed to harvest and sell all of them (up to eight). Also, this would allow fishermen to salvage the fins off dead sharks whose meat

had spoiled. It must be noted that the smaller secondary fins are of such low value that few fishermen bother with them.

Commercial fishermen wanted to control finning through either a 6 percent or 10 percent ratio of wet fins per dressed carcass weight. These alternatives were rejected since they would allow fishermen too much latitude in retaining fins and discarding undesirable carcasses.

A final option considered and rejected was requiring that fins be landed attached to the carcass except for the caudal fin. This drew criticism from commercial fishermen because of the extra hold space required, lowered product quality, and on shore disposal problems of the flaps between the carcass and fins that are of limited value.

7.3.10 CLOSURE OF RECREATIONAL FISHERIES

Consideration was given to closing recreational fisheries for sharks. This measure was rejected since this sector has experiencing a declining share of the harvest. Also, the commercial permit requirement, the live-release, and other related measures should further reduce the catch to acceptable levels without the need for a closure.

7.3.11 SIZE LIMITS FOR SHARKS OTHER THAN MAKOS

Imposing size limits for species other than makos would reduce mortality in those species. However, this option was rejected because available data are insufficient to estimate the expected short-term reduction in commercial and recreational landings, or the possible long-term increase in landings.

7.3.12 CLOSING FISHERIES THAT KILL SHARKS AS BYCATCH

Pelagic sharks are taken on longlines as bycatch in the swordfish and tuna fisheries. When sharks come up dead on the longline, it is presumed that fins of valuable species are retained for sale and that carcasses are discarded at sea. It is unknown how many sharks are released alive and how many are finned. Generally, hold space is reserved for the valuable targeted species. Consideration was given to evaluating the feasibility of closing the swordfish and/or tuna fishery to protect sharks, but was rejected because of the importance of these fisheries and the fact that some management measures will reduce shark discards; i.e., the quota on the pelagic species group, the prohibition of finning, and the "must release" provision. The level of mortality reduction will not be known until the proposed reporting system is operational and possibly not until onboard observers are used to document fishery activities.

The shrimp trawl fishery results in shark discards estimated at 2,800 mt yearly, consisting mostly of sharpnose sharks in the Gulf of Mexico. Consideration was given to closing or restricting the shrimp fishery, but was rejected because of the importance of the fishery, and the fact that the mandatory use of TEDs will greatly reduce shark mortality. Also, it is expected that, beginning in 1994, fish excluder devices and/or other measures may be required to protect red snapper stocks. Such action may further reduce shark mortality.

7.3.13 PROHIBITING SHARK GILLNETS TO PROTECT MARINE MAMMALS AND SPECIES LISTED AS THREATENED OR ENDANGERED

Approximately 15 of the 100+ vessels that seasonally target sharks use drift gillnets near shore, primarily for blacktip sharks, in the late summer and early autumn. Some of these boats are less than 30 feet in length. The degree of turtle or dolphin loss is unknown. Florida, whose state waters yield the majority of blacktip landings, has passed emergency legislation to reduce the number of listed species taken by limiting the lengths and numbers of gillnets that can be used in commercial fishing operations on the east coast, and requires that nets be tended. The State is presently considering limitations on gillnet mesh size. If adopted, it is expected that losses of listed species will be reduced. Consideration was given to imposing a prohibition on the use of gillnets in Federal waters, but was rejected because of inadequate information on their impact on listed species. A provision in the Shark FMP is for the OT to assess gear restrictions, including the use of observers to verify impacts of gillnet gear. Gillnets are an efficient gear for harvesting schooling blacktip sharks and insufficient evidence presently exists to warrant prohibiting their use.

7.3.14 REQUIRE ANNUAL DEALER PERMITS

The option of requiring annual dealer permits was considered as a means of identifying the dealers that purchased shark products from commercial fishermen. Statisticians planned on using this information to design efficient data collection systems. Agents planned on using this information to design efficient enforcement activities.

Requiring annual dealer permits was rejected since the scientists could obtain the necessary catch and information directly from fishermen via logbooks and weigh-out slips and other existing collection systems. Law enforcement agents could use other sources of information such as informants on specific cases to design efficient enforcement activities. This issue, as well as mandatory dealer reporting, may be revisited by the OT if problems develop in the data collection effort.

7.3.15 MANDATORY DEALER REPORTING

The option of requiring mandatory dealer reporting was considered as a means of obtaining necessary information such as the individual size, species, and other information from recalcitrant dealers that purchased shark products from commercial fishermen. Mandatory dealer reporting was rejected since the scientists could obtain the necessary catch and information directly from fishermen via logbooks and weigh-out slips and other existing collection systems.

7.4 FUTURE MANAGEMENT CONSIDERATIONS

7.4.1 POSSIBLE FUTURE MANAGEMENT MEASURES SUITABLE FOR FRAMEWORKING

Several management measures were identified during development of this Shark FMP that may be suitable for the framework regulatory adjustment procedure. These were not included in this Shark FMP because of insufficient data. However, information collected under the Shark FMP will be reviewed by the OT and, if determined appropriate, these measures may be added by an amendment to the Shark FMP later to the list of approved measures that may be taken modified under the framework regulatory adjustment procedure. These measures include: (a) commercial quota allocation by geographical area; (b) allocations between directed and incidental fisheries; (c) gear restrictions; (d) area closures (e.g., nursery areas); and (e) commercial trip limits.

7.4.2 FUTURE MANAGEMENT ACTIONS

Besides possible framework regulatory adjustment actions, the FMP Development Team and the Intercouncil Shark Committee identified other potential management measures that are not suitable for this procedure, either because of the expected extent of their regulatory impact, or because they are not appropriate for periodic management adjustments. These measures include: (a) limiting harvest to bycatch only; (b) restricting imports of shark meat; (c) fisheries closures (i.e., spawning season closures) except when the quota is reached; (d) establishing bycatch limits; and (e) limiting entry into the fishery including establishment of a control date for possible use in determining historical participation in the shark fishery. Such measures also would require one or more amendments to the Shark FMP.

7.5 DATA COLLECTION AND RESEARCH REQUIREMENTS

The Development Team considers that, based on the management measures set forth in Section 7.1, the following data collection activities and the Mid-Atlantic Fishery Management Council's data collection plan are necessary to generate the information needed to regulate shark exploitation:

7.5.1 DATA COLLECTION

1. A trip-ticket system that records the numbers of each species landed on all trips.
2. A port sampling system to obtain size samples of landed sharks by species on most (50 percent or more) shark directed trips.
3. Logbooks from all vessel trips directing at sharks that record the numbers of each species caught, those discarded, the amount of gear set and length of time the gear was fished, and location fished on each longline or gillnet set.
4. Shark tournament logs reporting similar data for selected tournaments.
5. At-sea observers should be used to verify logbook information and gather pertinent data on shark discards and interactions with protected marine mammals and turtles.

7.5.2 MID-ATLANTIC FISHERY MANAGEMENT COUNCIL DATA COLLECTION PLAN

During January 1989, the Mid-Atlantic Fishery Management Council had submitted a request under § 303(e)(2) of the Magnuson Act to the Secretary to collect information on the Western North Atlantic shark fishery. The data were to be used in the preparation of a shark FMP. This request was denied because of the high annual cost, and the belief that not all requested information was necessary to manage shark resources.

The data collection request contained the following additional information needs:

Biological

1. Mapping the inshore pupping and nursery grounds to define recruitment relationships.
2. Determining age and growth information on each species through a variety of analytical methods: seasonal growth ring formation on vertebrae or spines; size frequency; aquarium observations; oxytetracycline marking; and tag-and-recapture experiments.
3. Delineating age-related and sex-related distribution and migrations of such species as the sandbar, which has nurseries in the Mid-Atlantic, but large concentrations of males off Mexico.
4. Determining the reproductive potential for each species.

5. Separating genetically distinct stocks of some species; for example, blacktip sharks in Florida and the Carolinas may belong to a different stock than those from the Caribbean, whereas others, such as dusky sharks, may have only one population throughout the Western North Atlantic.

Fisheries

A statistically-valid sample to describe the catch by species is critical. Managers must know how many sharks of each species are killed annually (landed or discarded), and where their entire range, where appropriate, must be represented. The total catch from both commercial and recreational fishermen, and fishing effort (catch per unit effort, or CPUE), must be determined for each nation fishing the resource. As well, fishery sampling data (length, weight, sex, age, and maturity) must be obtained for reliable stock assessments.

Tagging studies are also important to provide information on stock identity, migrations, growth, and fishing mortality of key species. However, training is needed for port samplers and scientific personnel involved in such studies, as well as in dockside sampling, to avoid misidentification that affects statistical reliability. Tagging efforts must be coordinated, and data centralized, to provide maximum data availability to researchers.

Assessment/Management

Fishery-independent indices of population abundance over time are another critical information need. Longline and trawl survey data from NMFS, foreign longline fisheries, and other sources should be examined for long-term trends in abundance and distribution. Such surveys are also valuable sources of information on size and sex composition, ecological relationships, and habitat requirements.

Social and Economic

An organized effort to collect social and economic information on the recreational and commercial fisheries is needed. The number of persons fishing, fishing sites, income spent on fishing, number of processors and their employees, and information on the economic dependence of the user groups on the fisheries (e.g., amount of income derived from shark fishing or processing) are important to managers, both on a national and foreign scale, also at the community level.

7.6 SPECIAL RECOMMENDATIONS TO STATES

7.6.1 COMPATIBLE REGULATIONS

It is a basic premise and goal of the Shark FMP that management of shark resources be carried out throughout their range. Since determinations of MSY, OY, the commercial quotas, and overfishing are based on estimates of the total biomass of sharks in all U.S. waters (EEZ and state waters), it is recommended that coastal states, Puerto Rico, and the Virgin Islands adopt regulations

consistent with this FMP. From 1979-1988, 14 percent (by weight) of commercial shark landings, and 64 percent (by number) of recreational shark catch, occurred in state waters. State cooperation is therefore essential for effective management. Specifically, it is recommended that states:

1. Apply bag limits to recreational fishermen regardless of where sharks are caught.
2. Adopt the specified Federal quotas.
3. Prohibit finning and adopt other measures that govern how and when fins may be landed.
4. Prohibit the sale of recreational caught sharks and shark products.
5. Cooperate with NMFS to ensure consistent and integrated permitting and data collection systems.

7.6.2 HABITAT CONSIDERATIONS

The shark fishery contributes to the food supply, economy, recreation, and health of the Nation, through recreational and commercial fishing opportunities. The fishery is dependent upon the health of the shark resource, which in turn depends upon wise management of all aspects of the fishery, including habitat. Accordingly, activities that adversely affect habitat must be regulated by government actions. Maintaining the productivity of stocks is impossible without habitat protection, effective implementation of existing conservation regulations, and aggressive pursuit of the Nation's "no net habitat loss" policy. Federal and state regulatory agencies should act to:

1. Maintain the current quantity and productive capacity of habitats supporting important commercial and recreational fisheries, including their food base. This objective may be met through a policy that curbs wetlands loss and reef pollution and alteration ("no net loss").
2. Restore the productive capacity of currently degraded habitats.
3. Create and oversee the development of new habitats where increased fishery productivity will benefit society.

The five Councils are expected to use existing authorities to support state and Federal environmental agencies' habitat conservation and mitigation efforts. The five Councils will work directly with regulatory agencies on actions that may significantly affect habitat. This may include commenting on specific actions, policies, or regulations that affect the

habitat of sharks being managed. Public hearings and the building of administrative records also may be conducted to ensure adequate disclosure of facts, and public participation, in proposed actions that adversely affect habitat.

The OT will encourage state and territorial governments along the Atlantic Ocean, Gulf of Mexico, and Caribbean to intensify efforts to protect and enhance habitats used by sharks. The OT, with NMFS, must develop research to identify shark nursery areas and to recommend management measures involving area closures. As knowledge about shark habitats, nursery areas, and pupping seasons is obtained, public attention can be focused and interest created in the conservation of habitat and the protection of juveniles.

7.6.3 STATE RESEARCH

It is recommended that states actively participate in acquiring pertinent information and data as specified in Section 7.5. Effective, coordinated management will require the combined efforts of the states and the Federal Government, and will benefit from the expertise and facilities of the broad scientific community, including universities and private research.

7.7 PUBLIC EDUCATION AND AWARENESS

Sharks have been viewed by many people as inferior or undesirable species in the ocean. For years they have been generally perceived as vicious man-eaters that should be destroyed, and their flesh was thought to be unpalatable. Attitudes are changing, however, about their food value and many species are pursued by sport fishermen. The growing environmental conscience has focused public awareness on the important role of sharks in maintaining ecological balance. It is proper, therefore, for government entities, industry, consumer groups, and the environmental community to promote wise use and conservation of shark resources.

Several actions should be undertaken by NMFS and/or the five Councils to heighten public awareness for shark conservation. Distributing a suitable brochure(s) describing the life, biology, and ecological importance of sharks; the need for shark management and how regulatory measures benefit the resource; and ways of ensuring the survival of released sharks, would help conserve the resource. Sending the brochure to all tournament directors, conservation organizations, sport fishing clubs, and commercial shark fishermen in both directed and non-directed fisheries, with a letter requesting their cooperation and assistance, will promote shark conservation. State, Federal, and university shark experts should coordinate development of public education efforts. Useful activities might include a portable

shark exhibit to be deployed at major conservation or environmental events.

7.8 TOURNAMENT CONSERVATION SUGGESTIONS

Shark fishing tournaments are popular despite the fact that numbers and weights of sharks landed is declining. These well-attended events offer additional opportunities for promoting conservation awareness and research. Agencies and organizations are encouraged to develop materials that promote effective conservation: using degradable metal hooks (non-stainless steel); setting the hook before it is swallowed; avoiding double hooks; not "overfighting" the fish; and leaving the shark in the water when release is intended, including treating the fish gently, cutting the leader, and not removing the hook. Tagging tournaments also should be considered as an aid to resource conservation. Finally, tournament directors should consider establishing limits that would promote conservation of sharks and reduce waste. Suggested measures are weight and size minima of species caught at the tournament and limits of one shark per boat.

7.9 INTERNATIONAL CONSIDERATIONS

Many species of sharks migrate beyond U.S. waters and are harvested by foreign nations. It is therefore necessary that the management regime consider transboundary distribution. For example, in 1988, Cuba landed about 3,500 mt of sharks, Mexico harvested 12,000 mt of sharks in the Gulf of Mexico, and the total U.S. commercial catch was 5,276 mt. Tagging results show that at least some commercially important sandbar sharks move south from the U.S. into Mexican waters and are pursued by fishermen of both nations. To effectively manage sharks throughout their range, cooperation, particularly with Mexico, should be sought through existing conventions and agreements, such as MEXUS-Gulf, International Convention for the Conservation of Atlantic Tunas, and others.

Since 1977, the U.S. and Mexico have conducted research cooperatively under the MEXUS-Gulf program. Shark research is expected to become more important in the program, with emphasis on defining harvest levels, migratory routes, and size/sex distribution of transboundary species.

7.10 SHARK CONSERVATION AND MANAGEMENT MEASURES APPLICABLE TO FOREIGN FISHERIES IN THE ATLANTIC EEZ

The conservation and management measures applicable to the foreign fisheries that operate within the Atlantic EEZ and impact shark resources are described below.

7.10.1 FOREIGN FISHERY REPORTING REQUIREMENTS

Each foreign vessel fishing in the EEZ is required to maintain a daily fishing log that records: name and identification number of vessel; date; midday fishing location (within 0.1 degree latitude and longitude); number of hooks per set; number of each species of shark caught and thrown back dead; and number of each species of shark released alive. This log, which must be submitted to NMFS quarterly, will provide information on bycatch mortality by foreign fishermen for use in estimating MSY and optimum yield. As well, each foreign nation that catches shark incidentally must submit to NMFS a weekly report listing receipts of U.S. harvested fish (JVP) and any incidental catch or receipt of marine mammals.

These reports provide timely submission of catch and effort data needed to monitor stocks and manage foreign fishing effort. Such information has been required since the Preliminary Management Plan for Atlantic Billfishes and Sharks was implemented in 1978.

The PMP regulations governing the presence of U.S. observers on foreign fishing vessels remain unchanged in the FMP.

7.10.2 TALFF, DAH, AND OY

Since the Domestic Annual Harvest (DAH) capacity (7,060 mt dressed weight) equals OY (7,060 mt dressed weight), the directed or incidental taking of sharks by foreign fishing vessels is prohibited throughout the year in the Atlantic EEZ. The Total Allowable Level of Foreign Fishing (TALFF) for the species of shark managed under this FMP, equal to 1,150 mt in the PMP, is reduced to zero under the present FMP. For the sharks that are included in the FMP for data collection purposes, the TALFF is covered under the Preliminary Fishery Management Plan for the Foreign Trawl Fisheries of the Northwest Atlantic.

Sharks captured as bycatch must be released in such a manner that will ensure maximum probability of survival. For hooked sharks, the line must be as close to the hook as possible, without removing the animal from the water. For net-caught sharks, the animal must be released as quickly and gently as possible.

8.0 RELATED MANAGEMENT JURISDICTIONS, LAWS, AND POLICIES

Until recently, shark resources were of little concern to states or the Federal Government, although warnings were sounded from time to time. A commercial market was almost nonexistent and the demand for sharks by recreational fishermen did not overtax the available resources.

Even with the passage of the Magnuson Act, which gives exclusive jurisdiction for fishery management to 200 nautical miles offshore, Federal action was considered unwarranted, except for a foreign fishing PMP. The Magnuson Act does not alter the states' jurisdiction that extends three nautical miles offshore (except off Texas, the West Coast of Florida, and Puerto Rico, where it extends nine nautical miles). Yet, as the shark fishery intensified and the resource became vulnerable to overfishing, management became necessary under the Magnuson Act and other Federal laws.

8.1 FEDERAL LAWS, POLICIES, AND REGULATIONS

The following Federal laws, policies, and regulations may directly or indirectly influence the management of sharks. However, there are no known laws or policies that will constrain any of the measures in the FMP.

MAGNUSON FISHERY CONSERVATION AND MANAGEMENT ACT OF 1976 AS AMENDED: 16 U.S.C. 1801-1882

The Magnuson Act mandates the preparation of fishery management plans for important fishery resources within the EEZ. All FMPs and their respective management measures must be based on seven national standards as prescribed in the Magnuson Act. In 1990, an amendment mandated the authority to the Secretary over highly migratory species, including sharks, Atlantic billfishes and swordfish, and tunas and tuna-like species. NMFS has concluded preliminarily that all sharks are highly migratory and accordingly will be under Secretarial jurisdiction.

ATLANTIC TUNAS CONVENTION ACT (ATCA) AS AMENDED: 16 U.S.C. 971 et seq.

The ATCA provides for the conservation and management of tuna and tuna-like species for U.S. citizens under the authority of the International Convention for the Conservation of Atlantic Tunas (ICCAT).

MARINE PROTECTION, RESEARCH, AND SANCTUARIES ACT OF 1972 (MPRSA), TITLE III AS AMENDED: 16 U.S.C. 1431-1445

This Act provides for establishment of marine sanctuaries and may

include regulation of the fishery resource within them. As of November 30, 1992, the following sanctuaries in the Atlantic Ocean or gulf of Mexico were established: (1) Gray's Reef National Marine Sanctuary; (2) Flower Garden Bank National Marine Sanctuary; (3) Florida Keys National Marine Sanctuary; and (4) Monitor National Marine Sanctuary. The Looe Key and Key Largo Marine Sanctuaries were recently combined with the Florida Keys National Marine Sanctuary.

CLEAN WATER ACT (CWA) AS AMENDED: 33 U.S.C. 1251 et seq.

The CWA requires that a National Pollutant Discharge Elimination System (NPDES) permit be obtained before any pollutant is discharged from a point source into waters of the United States, including waters of the contiguous zone of the adjoining ocean. The disposal of drilling effluent and other drilling platform wastes is among the activities that require an EPA NPDES permit. Issuance of a permit is based primarily on the effluent guidelines found in 40 CFR Part 435. However, additional conditions can be imposed on permit issuance on a case basis to protect valuable resources in the discharge area.

MARINE PROTECTION, RESEARCH, AND SANCTUARIES ACT (MPRSA), TITLE 1 AS AMENDED: 33 U.S.C.1401-1421; 1441-1445

The transportation of materials for ocean dumping requires a permit. EPA issues the permits, except for transportation of dredged materials that is issued by the Corps of Engineers. Criteria for issuing such permits include consideration of effects of dumping on the marine environment, ecological systems, and fisheries resources.

COASTAL ZONE MANAGEMENT ACT OF 1972, AS AMENDED (CZMA): 16 U.S.C. 1451-1464

Under the CZMA states are encouraged, with Federal funding, to develop coastal zone management programs that establish unified policies, criteria, and standards for dealing with land and water use in their coastal zone. Coastal states also can control activities in estuarine areas to protect particularly sensitive resources.

ENDANGERED SPECIES ACT OF 1973, AS AMENDED: 16 U.S.C. 1531-1543

The Endangered Species Act provides for the listing of threatened or endangered plant and animal species. Once listed as a threatened or endangered species, taking (including harassment) is prohibited. The process ensures that projects authorized, funded, or carried out by Federal agencies do not jeopardize the species existence or result in habitat destruction or modification critical to species existence.

NATIONAL ENVIRONMENTAL POLICY ACT (NEPA), AS AMENDED: 42 U.S.C. 4321-4370a

NEPA requires that all Federal agencies recognize and give appropriate consideration to environmental amenities and values in their decision-making. NEPA requires that Federal agencies prepare an Environmental Impact Statement (EIS) before undertaking major actions that might significantly affect the quality of the human environment. Alternatives to the proposed action must be carefully assessed.

FISH AND WILDLIFE COORDINATION ACT, AS AMENDED: 16 U.S.C. 661-666c

Under the Fish and Wildlife Coordination Act, the FWS and the NMFS review and comment on aspects of proposals for work and activities sanctioned, permitted, assisted, or conducted by Federal agencies that take place in or affect navigable waters. The review focuses on potential damage to fish and wildlife and their habitat, particularly in near shore waters, and may, therefore, serve to provide protection to fishery resources from Federal activities. Federal agencies must consider the recommendations of the two agencies.

FISH RESTORATION AND MANAGEMENT PROJECTS ACT, AS AMENDED: 16 U.S.C. 777-7771

Under this Act, the Department of Interior apportions funds to state fish and game agencies for fish restoration and management projects. Funds for protection of threatened fish communities located within state waters, including marine areas, could be made available under the Act.

NATIONAL PARK SERVICE ORGANIC ACT, AS AMENDED: 16 U.S.C. 1-4,22,43

The National Park Service under the Department of Interior may regulate fishing activities within park boundaries. There are many parks, monuments, and seashores along the Atlantic Ocean.

LACEY ACT, AS AMENDED: 16 U.S.C. 1540, 3371-3378

The Act prohibits import, export, and interstate transport of illegally taken fish or wildlife. This Act strengthens and improves enforcement of Federal fish and wildlife laws and provides Federal assistance in enforcement of state and foreign laws.

MARINE MAMMAL PROTECTION ACT OF 1972, AS AMENDED 16 U.S.C. 1361-1407

This Act makes it unlawful (except to some native Americans) to

kill, capture, or harass any marine mammal or attempt to do so; prohibits the importation of pregnant, nursing, or illegally taken marine mammals; and prohibits whaling within U.S. jurisdiction.

8.2 MANAGEMENT INSTITUTIONS

8.2.1 FEDERAL MANAGEMENT INSTITUTIONS

REGIONAL FISHERY MANAGEMENT COUNCILS

Management in the EEZ is based on FMPs developed by eight Regional Fishery Management Councils. Each Council prepares and amends plans for the fisheries in need of management within its geographical area. Plans are submitted to the Secretary of Commerce through NMFS and NOAA for approval and implementation through Federal regulations.

The Councils' guidelines are standards that require, to the extent practicable, a fish stock be managed as a unit throughout its range and a stock be protected from overfishing while continuing to achieve Optimum Yield. As of October 23, 1992, there were 24 FMPs and PMPs in effect in the Atlantic Ocean, Gulf of Mexico and Caribbean Sea (Table 8.1). While some involve a single species, others involve many species, such as the Snapper-Grouper FMP (33 species) and the Caribbean Shallow Water Reef Fish FMP (64 species). The Shark FMP will probably impact all or most of the FMPs, either directly or indirectly, through the predator-prey relationship. As apex predators, sharks probably prey on most species involved in these plans. However, the most direct effect will be from directed fisheries using longlines and drift nets, such as the swordfish and tuna fisheries, and the shrimp trawl fishery that take sharks as bycatch. A possible reduction in swordfish landings, and the mandatory use of TEDs in the shrimp fishery will reduce shark bycatch. Besides mortality inflicted by the trawl fishery, juvenile sharks are eaten by larger species.

NATIONAL MARINE FISHERIES SERVICE (NMFS), NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)

The Secretary, acting through NMFS, has the authority to approve or disapprove all FMPs prepared by the Councils pursuant to the Magnuson Act. The NMFS has issued regulations and guidelines for the development of FMPs and the operation of the Councils. Where a Council fails to develop a plan, or correct an unacceptable plan, the Secretary may do so. The five Councils originally having jurisdiction over shark resources requested the Secretary to develop the FMP because of apparent overfishing and finning. Another consideration was the amount of time it would take the combined Councils to develop a FMP.

In 1990, Congress transferred authority to manage highly migratory species of sharks, tunas and tuna-like species, Atlantic billfishes and swordfish to NMFS. NMFS will manage highly migratory sharks under ATCA and Magnuson Acts.

If an FMP does not exist, Section 204(b) of the Magnuson Act authorizes the Secretary to prepare PMPs for any fishery for which a foreign nation has applied to fish. The Secretary has prepared two PMPs (Table 8.1) in the Atlantic Ocean.

The NMFS also collects data and statistics on fisheries and develops stock assessments necessary to manage fisheries. The NMFS enforces regulations promulgated under an FMP, and NOAA processes civil penalties for violations.

OFFICE OF COASTAL RESOURCE MANAGEMENT (OCRM), NOAA

The OCRM asserts authority over fisheries through National Marine Sanctuaries, pursuant to Title III of the Marine Protection, Research, and Sanctuaries Act (MPRSA). By setting standards for approving and funding state coastal zone management programs, OCRM may further influence fishery management.

NATIONAL PARK SERVICE (NPS), DEPARTMENT OF INTERIOR

The NPS manages fish through the establishment of coastal and near shore national parks and national monuments. Everglades National Park is an example of an area managed by the NPS.

FISH AND WILDLIFE SERVICE (FWS), DEPARTMENT OF INTERIOR

The ability of the FWS to affect fish management is based primarily on the Endangered Species Act and the Fish and Wildlife Coordination Act. Under the Fish and Wildlife Coordination Act, the FWS reviews and comments on proposals for work and activities in or affecting navigable waters that are sanctioned, permitted, assisted, or conducted by Federal agencies. The review focuses mainly on potential damage to fish and wildlife, and to their habitats.

ENVIRONMENTAL PROTECTION AGENCY (EPA)

The EPA provides protection to fish communities by granting National Pollutant Discharge Elimination System (NPDES) permits, or approving state programs to issue such permits, for pollutant discharges into ocean waters, and the conditioning of those permits to protect valuable resources. The EPA also has review and approval authority over the Corps of Engineers' Section 404 permits.

Table 8.1

Fishery Management Plans

<u>Name of FMP/PMP</u>	<u>Lead Council or Office</u>
1. Atlantic Sea Scallops FMP	New England Council
2. American Lobster FMP	New England Council
3. Northeast Multispecies FMP	New England Council
4. Atlantic Salmon FMP	New England Council
5. Atlantic Mackerel, Squid and Butterfish FMP	Mid-Atlantic Council
6. Atlantic Surf Clam and Ocean Quahog Fisheries FMP	Mid-Atlantic Council
7. Summer Flounder FMP	Mid-Atlantic Council
8. Atlantic Bluefish	Mid-Atlantic Council
9. Hake Fisheries of the NW Atlantic PMP	Secretary of Commerce
10. Foreign Trawl Fisheries of the NW Atlantic PMP	Secretary of Commerce
11. Atlantic Billfishes FMP ¹	Secretary of Commerce
12. Gulf of Mexico Spiny Lobster Fishery FMP	Gulf of Mexico & South Atlantic Councils
13. Gulf of Mexico Shrimp FMP	Gulf of Mexico Council
14. Gulf of Mexico Stone Crab FMP	Gulf of Mexico Council
15. Snapper-Grouper FMP	South Atlantic Council
16. Gulf & South Atlantic Corals FMP	Gulf of Mexico & South Atlantic Councils
17. Reef Fish FMP	Gulf of Mexico Council
18. Coastal Migratory Pelagic Resources FMP	Gulf of Mexico & South Atlantic Councils
19. Atlantic Swordfish FMP	Secretary of Commerce
20. Red Drum FMP	Gulf of Mexico Council
21. Caribbean Shallow Water Reef Fish FMP	Caribbean Council
22. Caribbean Spiny Lobster FMP	Caribbean Council
23. Red Drum FMP	South Atlantic Council
24. Atlantic Bluefin Tuna ²	Secretary of Commerce

¹ This FMP was originally the Atlantic Billfishes and Shark PMP. The Billfishes FMP replaced the billfish aspects of the PMP. The Shark FMP adopts the shark-related measures of the PMP.

² This fishery is managed under the Atlantic Tuna Conventions Act and the Magnuson Act.

CORPS OF ENGINEERS (COE), DEPARTMENT OF THE ARMY

The COE jurisdiction over the disposal of dredged material, pursuant to both the Clean Water Act and the MPRSA, is to be exercised in a manner protective of fishery resources. Under the Rivers and Harbor Act, proposals to dispose of materials during the construction of artificial reefs are assessed to assure that materials do not physically alter the environment in a manner that endangers navigation.

U. S. COAST GUARD (USCG), DEPARTMENT OF TRANSPORTATION

The USCG shares responsibility for enforcement of the NOAA - administered Acts with NMFS. The USCG provides most of the air and sea patrols for enforcement of regulations.

8.2.2 STATE MANAGEMENT INSTITUTIONS

There are 18 states bordering the Atlantic Ocean and Gulf of Mexico. In addition, the Commonwealth of Puerto Rico and the Territory of the U.S. Virgin Islands border the Caribbean Sea. Each of these entities has management authority over marine resources in state waters -- including shark resources.

Except for Florida, North Carolina, Texas, and Virginia, there are no specific regulations on sharks in the state waters. The first state, Florida, established bag and possession limits, catch limitations, permit requirements, commercial seasons, and protected species status for basking and whale sharks. The purpose of these regulations are to protect and conserve Florida's shark resources and to assure the continuing health and abundance of these species. The further intent is to provide special protection to basking and whale sharks since these species are deemed particularly vulnerable to overfishing. Specific regulations: (1) established daily bag limit of one shark per person and a maximum possession limit of two sharks harvested of two sharks harvested from state waters aboard a vessel for both recreational and commercial vessels; (2) required that commercial fishermen have a federal permit to fish in state waters; (3) establishes a harvest season for sharks as July 1- June 30 each year; (4) prohibit the commercial harvest in state waters whenever federal waters close to the harvest of large coastal sharks. The sale of shark fins and carcasses harvested from state waters is prohibited beginning 31 days after state waters closure; (5) prohibit the finning of sharks but allow the removal of fins at sea provided the number of fins does not exceed 5 per carcass landed; (6) require the sharks not kept be released in a manner that will ensure maximum probability of survival; (7) prohibit sharks caught by recreational fishermen from being transferred at sea or sold; and (8) prohibits all harvest, landing, and sale of basking and whale sharks and declares them as "protected species."

The second state, North Carolina, established catch limitations on the taking, landing, and dealer reporting of sharks. These regulations are designed to restrict the practice of finning sharks. Specific regulations included prohibitions against: (1) the possession of fins or dried fins on board a vessel or the landing of fins without the carcasses or dried fins; (2) the possession of fins constituting more than 7 percent by weight of any catch of shark; and (3) a licensed dealer to fail to keep and available to the state records of all sharks landed at their facility.

The third state, Texas established a daily five-sharks per person bag and possession limit.

The fourth state, Virginia, established gear restrictions, a bag limit, and catch limitations on the taking and landing of sharks. These regulations are designed to ensure the conservation of shark resources by preventing overfishing by commercial and recreational fisheries and to control the practice of finning. Specific regulations included: (1) a daily catch and possession limit of one shark per person for recreational fishermen; (2) a 7,500-pound per day commercial trip limit; (3) a prohibition on the landing of fins alone or possession and landing of dried fins; (4) a prohibition on the possess or land shark fins that are more than 10 percent by weight of any catch of shark.

Some states have regulations in effect that impact sharks. For example, Florida prohibits taking food fish within state waters with a purse seine, purse gillnet, pound net, or other type of net using a purse drawn through the lead line. For brevity, a description of other laws, regulations, and policies that might impact shark resources is not included in this FMP. No known state law, regulation, or policy, other than in waters managed by Florida, North Carolina, Texas, and Virginia, is expected to be impacted by the shark FMP management measures. However, states are encouraged to adopt regulations conforming to the management measures contained in this FMP.

8.3 INTERNATIONAL TREATIES AND AGREEMENTS

Foreign fishing is prohibited within the EEZ and for anadromous species or continental shelf fishery resources beyond the EEZ unless: (1) it is authorized by an international fishery agreement that existed before passage of the Magnuson Act and is still in force and effect, or (2) it is authorized by a Governing International Fishery Agreement (GIFA) issued according to the Magnuson Act.

GIFAs resulting from the Magnuson Act are bilateral agreements in which participants agree to abide by the fishing laws and regulations of the other nation when fishing their waters. A GIFA is required before a nation can apply for fishing privileges

in a particular fishery. While several nations presently have GIFAs with the United States, none involve sharks. The original PMP on sharks was prepared to accommodate a foreign harvest up to 1,150 mt in the Atlantic; however, only a small catch of sharks occurred. Presently, the only foreign fisheries in U.S. Atlantic waters are a Japanese tuna fishery and a fishery for Atlantic mackerel in the Northwest Atlantic. Sharks, however, are prohibited species and cannot be retained by foreign vessels. Foreign fishing is not expected to expand in U.S. Atlantic waters in the future.

Mexico, Bahamas, Canada, and Cuba, like the United States, have economic or conservation zones and exclude foreign fishermen from fishing local stocks.

9.0 OTHER APPLICABLE LAWS AND REQUIREMENTS

9.1 FINAL ENVIRONMENTAL IMPACT STATEMENT (FEIS)

A Final Environmental Impact Statement (FEIS) was prepared and is included in the Shark FMP (Appendix I). Section 9 provides additional insights on environmental impacts, particularly on the human environment, and is important to understanding the effects of the selected actions.

9.2 VESSEL SAFETY

Under provisions of Public Law 99-659, the Magnuson Act was amended to require that vessel safety considerations be evaluated in the prosecution of fishing as provided for in a FMP. After consultation with the Coast Guard, NMFS concluded that, with respect to the shark fishery, no vessel will be forced into fishing during weather conditions that are deemed unsafe. Accordingly, no adjustments for access to the fishery are provided. Since no adjustment is necessary, there will be no adverse effects on the conservation of other fisheries or discrimination among participants in the shark fishery.

9.3 REGULATORY IMPACT REVIEW

9.3.1 INTRODUCTION

Executive Order 12291, "Federal Regulation," requires a Regulatory Impact Review (RIR) for all regulatory actions that are of public interest. The RIR: (1) provides a comprehensive review of the level and incidence of impacts associated with a proposed or final regulatory action; (2) provides a review of the problems and policy objectives prompting the regulatory proposals and an evaluation of the major alternatives that could be used to solve the problem; and (3) ensures that the regulatory agency systematically and comprehensively considers all available alternatives so that the public welfare can be enhanced in the most efficient and cost-effective way.

The RIR also serves as the basis for determining whether any proposed regulations are major, under criteria provided in E.O. 12291, and whether the proposed regulations will have a significant economic impact on a substantial number of small entities, in compliance with the Regulatory Flexibility Act of 1980 (RFA). The primary purpose of the RFA is to relieve small businesses, small organizations, and small governmental jurisdictions (collectively termed "small entities") of burdensome regulatory and record-keeping requirements. The RFA requires that if regulatory and record-keeping requirements significantly affect a substantial number of small entities, then the head of the regulatory agency proposing those regulations

must prepare a Regulatory Flexibility Analysis that is published with the regulations and reviewed by the Small Business Administration.

9.3.2 SUMMARY OF PROBLEMS IN THE FISHERY

Problems in the fishery are discussed in detail in Section 5 and are summarized as follows:

1. Overfishing of the shark populations in the Western North Atlantic, including U.S. waters.
2. Lack of management for shark fisheries in the Western North Atlantic.
3. "Finning" practice; i.e., harvesting sharks for fins alone, with discard and physical waste of carcasses.
4. Significant bycatch mortality and physical waste.
5. Inadequate information base.
6. Limited public awareness and education.
7. Habitat loss and degradation.

9.3.3 SUMMARY OF MANAGEMENT OBJECTIVES

Management objectives are discussed in Section 6.0 and summarized as follows:

1. Prevent overfishing of shark resources.
2. Encourage management of shark stocks throughout their ranges.
3. Establish a shark resource data collection, research and monitoring program.
4. Increase the benefits derived from shark resources to the U.S. while reducing waste, consistent with the other objectives.

9.3.4 SUMMARY OF MANAGEMENT MEASURES

9.3.4.1 ACCEPTED MEASURES

1. Establish a fishing year from January 1 through December 31.
2. Establish calendar year commercial quotas (based on the Review Committee Report) for the large coastal and pelagic

species groups; each annual quota will be divided into two equal half-year quotas that will apply to the following two fishing periods--January 1 through June 30 and July 1 through December 31; and a recreational trip limit of four sharks per vessel for large coastal or pelagic species groups and a daily bag limit of five sharks per person for sharks in the small coastal species group. The quotas are 2,436 mt (dressed weight) for large coastal species group and 580 mt (dressed weight) for the pelagic species group. The quota for large coastal species group is expected to increase yearly as part of a stock rebuilding program until it reaches 3,184 mt (projected to occur in the year 1995) when the MSY of 3,800 mt is projected to be attained.

3. NMFS intends to implement commercial quotas for the large coastal and pelagic groups during the first several years of FMP implementation (1993 and 1994) in a manner somewhat different from that presented in the proposed FMP. First, the calendar year commercial quotas are divided into two equal halves that would apply respectively to two fishing periods (January 1 through June 30; July 1 through December 31). Second, specific commercial quotas for 1993 and 1994 are derived from the Review Committee's rebuilding schedule which provides total annual landings (recreational and commercial combined) for these years.
4. Release uninjured all sharks not taken as part of the commercial or recreational fishery.
5. Establish a framework procedure for adjusting commercial quotas, recreational bag limits, species size limits, management unit, fishing year, species groups, MSY's, and permitting and reporting requirements.
6. Prohibit finning by requiring that the ratio between wet fins/dressed carcass weight not exceed 5 percent.
7. Prohibit the sale by recreational fishermen of sharks or shark products caught in the EEZ.
8. Require annual commercial permits for fishermen who harvest and sell shark meat and fins.
9. Establish 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 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.

10. Require trip reports by permitted fishermen, and persons conducting shark tournaments; and require fishermen to provide information to NMFS under the Trip Interview Program.
11. Require NMFS observers on selected shark fishing vessels to document mortality of marine mammals and endangered species.

9.3.4.2 RESERVED MEASURES

1. Mako minimum size limit.

9.3.4.3 REJECTED MEASURES

1. No action.
2. Alternative management strategies for large coastal and pelagic species groups.
3. Prohibit finning, by emergency Secretarial action.
4. Allow harvest of male sharks only.
5. Allocate commercial quotas by geographic region.
6. Close shark nursery areas to fishing.
7. Establish size limits for sharks other than mako.
8. Alternative recreational bag limits.
9. Close fisheries that kill shark as bycatch.
10. Prohibit shark gillnets to protect marine mammals and endangered species.
11. Require annual permits for dealers; i.e., persons who purchase shark meat and fins from fishermen who fish in the EEZ.
12. Establish different earned income alternatives for holders of the annual commercial permits.

9.3.5 IMPACTS OF ACCEPTED MANAGEMENT MEASURES

9.3.5.1 CALENDAR YEAR COMMERCIAL FISHING QUOTAS

A 12-month fishing year should result in a fishing season of less than 12 months for sharks in the large coastal and pelagic species groups (assuming that the preferred quota options are

adopted). The shortened season will unavoidably increase fishing activity during the early part of the season, raise costs, and alter the historical supply and price situation. The short-term results will be lower profits for commercial fishermen and lower consumer surplus resulting from less product and less availability of fresh product during the closed season. While these effects will be fully expected, the magnitude of the effects, including a prediction on the length of the season, cannot be estimated in the absence of information about predicted landings if a quota was not in effect.

NMFS established calendar year commercial quotas for the large coastal and pelagic species groups and divided the quotas into two equal halves that would apply respectively to two fishing periods (January 1 through June 30; July 1 through December 31). This approach to applying the commercial quotas should spread the commercial fisheries in both southern and northern areas reasonably equally throughout the year, as well as addressing the Center's specific concerns. Also, this approach should not eliminate the historic peak months of the established southern fisheries (Table 9.1) while ensuring an open season and a new, unfished quota for the peak fishing months of a new, expanding fishery in the northeast.

By splitting the commercial quotas into two parts and opening the fisheries on January 1 to June 30 and on July 1 through December 31, historical allocations by region can be approached and the necessity to make and enforce regional allocations may be avoided.

A positive biological effect of this approach is that the semi-annual quota during January - June, is likely to be filled and the fishery closed before the start of shark pupping season, which runs from April to June. Sharks in inshore nursery grounds are thought to be particularly vulnerable to commercial and recreational fishing effort.

Although landings data were not available from the Caribbean prior to 1987, the fishery is rather small. Peak landings in 1990 were 18 mt. Since this fishery occurs throughout the year, the proposed fishing year should not affect the landings.

The conclusions reached about regional access to the fishery before the season closes depend on an assumption that total fishing effort remains fixed or declines and that the distribution of effort does not change. It is possible that effort may be increased in the Gulf of Mexico via more effort by Gulf vessels or by other vessels moving to the Gulf to ensure that they receive their "share" of the semi-annual quotas. If this occurs, then total fishing costs will increase and the historical distribution of catches will be altered in favor of

the Gulf of Mexico fishery. However, the benefits from avoiding the pupping season should still occur.

In summary, the calendar year semi-annual quotas fishing year are expected to have a small net benefit relative to the July 1-June 30 or a calendar year-single year quota if the amount and distribution of effort does not change.

9.3.5.2 COMMERCIAL QUOTAS - SMALL COASTAL, LARGE COASTAL AND PELAGIC SPECIES GROUPS AND RECREATIONAL BAG LIMITS

The FMP contains provisions to set commercial quotas for sharks in the large coastal and pelagic species groups. The quota for the large coastal species group is expected to have a major effect of reducing catches in the short run, while the quota for the pelagic species group may not result in a reduction in catches of that group of sharks.

The first objective of the FMP is to prevent overfishing of the shark resource. Table 9.2 (derived from Parrack, 1992) shows the expected commercial and recreational take of sharks for the period 1992-2002. In the absence of management, landings are projected to decline due to the overfished status of the shark resources. Table 9.2 also shows that the RIR analysis flows from a stock assessment and management strategy based on numbers of sharks being added and/or removed from the fishery.

The choice of a commercial quota for the large coastal species of sharks is based on two parts. First, the Committee points out the following:

- "1) 1991 landings are estimated to have been 0.370 million fish (4319 mt, Table 3), considerably less than the peak of 0.448 million in 1989 (5629 mt) and much more than the 1986 landing of 0.215 million fish (2057 mt). Commercial boats directing at sharks decreased from the peak in 1989 to 1991. The 1992 kill probably exceeded that of 1991. During 1992 there was a significant increase in fin prices, anticipation of a fishery closure, a displacement of boats from closed fisheries into the shark fleet, a higher than usual availability of fish during the spring, and an increase in dressed meat prices in the fall."
- ...
- "8) The effect of 1993 removals cannot be projected without 1992 landings. [The] 1992 landings will not be compiled until mid 1993 or latter, so for the reasons in 1) above, 1992 landings were assumed to be 10 percent more than that of 1991. Projecting the average of 1986-91 replacement rates, the 1993 stock size is 6 percent less than that of 1992. Projection of that stock size (Table 4) indicates a 1993 landed removal of 3520 mt at the $F(\text{rep}) = .2546$ fishing level."

Table 9.1

Percent of U.S. Shark Landings by Month by Area, 1984-1988

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
New England	0.04	0.02	0.01	0.02	0.08	0.33	0.56	0.60	0.58	0.41	0.23	0.12	3.01
Mid-Atlantic	0.18	0.18	0.12	0.19	0.32	0.46	0.59	0.52	0.54	0.48	0.31	0.35	4.26
So Atlantic	2.54	3.73	5.04	4.60	3.48	2.63	2.62	2.39	2.85	2.60	2.60	1.97	37.07
Gulf of Mex	3.53	3.22	5.10	5.10	6.39	5.46	5.77	5.19	4.12	4.87	3.37	3.57	55.67
Total U.S.	6.29	7.16	10.27	9.91	10.27	8.89	9.53	8.70	8.09	8.36	6.51	6.02	100.00

Source: New England & Mid-Atlantic - R. Schween, NMFS, Washington, D.C.
South Atlantic & Gulf of Mexico - G. Davenport, NMFS, SEC, Miami, Fla.

Second, NMFS set the commercial and recreational shares at the historical landings based on the annual average between 1986-1991 (Table 4.7) and on the bag limit analysis (table 4.8). Therefore, the commercial quota is equal to 84 percent of the total allowable catch.

The rebuilding process of the management regime is based on the recommendation of the Committee that calendar year 1993 landings for the large coastal species group should be reduced below the calendar year 1991 landings level of 4,319 mt dressed weight to a total allowable catch (TAC) level that allows rebuilding of the resource to begin.

The Committee Report establishes three options for the calendar year 1993 landings limit (recreational and commercial combined) for the large coastal species group that will allow rebuilding of the resource to begin. Each option provides different levels of economic and conservation benefits while shark population is rebuilding. Accordingly the commercial quota is adjusted upward each year until the MSY is reached.

In the FMP, the initial TAC is described as 2,900 mt but the tables accompanying this analysis show the initial TAC as 2,916 mt. The reason for the slight difference is that the projected quota for each year is rounded in the FMP, but the RIR analysis uses unrounded quotas derived from the stock assessment to avoid problems in making the calculations. The small differences do not affect the outcome because the rounding differences sum to approximately zero over the period of analysis used in the RIR. (A more thorough explanation of the concepts used in the stock assessment is in Parrack, 1992.)

The economic impact of the commercial quota is represented by a proxy variable, the cumulative present value (CPV) of the landing stream under the preferred management measures. Since value of landings is a gross value indicator, the actual net value will be less. Nonetheless, it is reasonable to say that large changes in value of landings will be accompanied by changes in net value which, although surely smaller, will be in the same direction.

While concepts such as profits (producer surplus), consumer surplus and economic rents are more realistic measures of economic value, lack of data precluded the calculation of any of these measures. Missing data included cost and returns information and any measure of how price reacts to the supply of sharks. Although the latter information could potentially be derived, there were major supply and demand shifts occurring throughout the 1980's and these shifts make it difficult to identify the demand curve (or the price response relationship).

Table 9.2

**Large Coastal Species Landings Without
Management Regulations in Place**
(Dressed Weight Metric Tons)

<u>Year</u>	<u>Total landings</u>	<u>Commercial*</u>	<u>Recreational*</u>
1993	4,205	3,532	673
1994	3,965	3,331	634
1995	3,739	3,141	598
1996	3,526	2,962	564
1997	3,325	2,793	532
1998	3,135	2,633	502
1999	3,002	2,522	480
2000	2,874	2,414	460
2001	2,752	2,312	440
2002	2,636	2,214	422

* Based on the current shares of 84 percent commercial landings and 16 percent recreational landings.

Source: Derived from Parrack 1992.

In addition, there are few, if any species data for the earlier years and since price varies by species, the situation is even more confused. The problem can be visualized by examining the price and quantity time-series shown in Table 9.3 and noting the apparent lack of any relationship (a simple regression of price on quantity revealed no significant relationship and indicated that at minimum a simultaneous equation approach would be necessary to determine the relationships involved).

In lieu of a price dictated by supply or other factors, the price of large coastal species group was calculated to be \$.57 per pound on a whole weight basis and was assumed to be constant in real terms throughout the period used in the present value (PV) analysis. This constant price is not the average price for all Atlantic sharks since that average price includes the pelagic species group that have a higher value than the large coastal species group.

Since price by species is not available, this estimate of the price for large coastal species group was derived using recent information on the price of sharks landed in the northern areas, knowledge that northern landings are almost entirely pelagic species group, the average price received for all sharks combined in the southern area, the catch by gear in the southern area, and knowledge that almost all the pelagic species group sharks are caught by pelagic species group longline. The other data needed to estimate ex-vessel value is the expected landings stream (derived from Parrack, 1992) over the period of analysis and is shown as a part of Tables 9.4, 9.5, 9.6, 9.7, and 9.8. The PV analysis uses a discount rate of 5.6 percent based on the actual market yield for 1-10 year U.S. Treasury Notes ending on November 30, 1992. During the previous 52 weeks, this interest rate ranged from 4.6 to 6.6 percent. The 10 percent rate as dictated by the E.O. 12291 guidelines is not appropriate (Weir, 1992).

9.3.5.2.1 COMMERCIAL QUOTAS - LARGE SPECIES GROUP - NO-ACTION

The current trends are projected to continue from 1993 to 2002. Under this alternative, total landings are projected to decline from 4,205 mt in 1993 to 2,636 mt in 2002 due to overfishing of the resource. Accordingly, annual value would decline from \$4.4 million in 1993 to \$2.6 million in 2002. Life history information predicts that continue overfishing would lead to reduced landings since the shark resource is unable to sustain the current population.

9.3.5.2.2 COMMERCIAL QUOTAS - LARGE SPECIES GROUP - OPTION 2 (F(5%))

There will be a short-term negative impact on the commercial fishery and consumers from the initial quota of 2,436 mt for

Table 9.3

Landings and Nominal Prices of All Atlantic Sharks, 1979-1990

<u>YEAR</u>	<u>LANDINGS</u> (mt)	<u>PRICE</u> (\$/kg)	<u>VALUE</u> (\$ million)
1979	135	0.57	0.08
1980	458	0.56	0.26
1981	666	0.66	0.44
1982	590	0.80	0.47
1983	724	0.98	0.71
1984	846	0.91	0.77
1985	969	1.06	1.03
1986	1,618	1.12	1.81
1987	3,603	1.13	4.07
1988	5,276	1.08	5.70
1989	7,122	1.04	7.41
1990	5,950	0.93	5.53
1991	N/A	1.25	N/A

Source: Converted from NMFS statistics files.

Table 9.4

**Large Coastal Species Landings, Commercial Share
Annual Value (Nominal Prices), and Cumulative Present Value
(CPV) Without Fishery Management Plan In Place
(Dressed Weight Metric Tons, \$ Millions)**

<u>Year</u>	<u>Landings</u> (mt)	<u>Com*</u> <u>Share</u> (mt)	<u>Annual</u> <u>Value</u>	<u>CPV</u>
1993	4,205	3,532	4.4	4.2
1994	3,965	3,331	4.2	7.9
1995	3,739	3,141	3.9	11.3
1996	3,526	2,962	3.7	14.3
1997	3,325	2,793	3.5	17.9
1998	3,136	2,634	3.3	19.4
1999	2,957	2,484	3.1	21.5
2000	2,789	2,343	2.9	23.4
2001	2,630	2,209	2.8	25.1
2002	2,480	2,083	2.6	26.6

* Based on the current shares of 84 percent commercial landings and 16 percent recreational landings.

Source: Derived from Parrack 1992.

large species for the 1993 fishing year. The 1993 quota represents a reduction of about 29 percent of the annual average of 3,444 during the period 1986-1991 (Table 4.7). This reduction in landings will result in a large, but unavoidable, negative impact on the commercial fishing industry and accompanying losses in consumer surplus in the short run while the resource is rebuilding. For example, the loss in ex-vessel revenue would be about \$1,267,000 in 1993.

Despite these expected losses, the quota should help to rebuild the large stocks to MSY by the year 1995 (Table 9.5). The commercial quota will increase by 5 percent as the rebuilding process continues to 1995 and thereby reaching the MSY level of landings 3,192 mt (84 percent of the MSY level of 3,800 mt). A comparison between Tables 9.4 and 9.5 shows that by 2000 the annual catches without rebuilding are projected to be lower than the catches under management. At the end of 2002 the cumulative discounted value of the landings under regulation is projected to exceed the value without regulation by \$2 million.

9.3.5.2.3 COMMERCIAL QUOTAS - LARGE SPECIES GROUP - OPTION 3- (F(10%))

There will be a short-term negative impact on the commercial fishery and consumers from the initial quota of 1,941 mt for large species for the 1993 fishing year. The 1993 quota represents a reduction of about 44 percent of the annual average of 3,444 during the period 1986-1991 (Table 4.7). This reduction in landings will result in a large, but unavoidable, negative impact on the commercial fishing industry and accompanying losses in consumer surplus in the short run while the resource is rebuilding. For example, the loss in ex-vessel revenue would be about \$1,889,000 in 1993.

Despite these expected losses, the quota should help to rebuild the large stocks to MSY by the year 1994 (Table 9.6). The commercial quota will increase by 10 percent as the rebuilding process continues to 1994 and thereby reaching the MSY level of landings 3,192 mt (84 percent of the MSY level of 3,800 mt). A comparison between Tables 9.4 and 9.6 shows that by 2000 the annual catches without rebuilding are projected to be lower than the catches under management. At the end of 2002, the cumulative discounted value of the landings under regulation is projected not to exceed the value without regulation by \$2.0 million.

9.3.5.2.4 COMMERCIAL QUOTAS - LARGE SPECIES GROUP - OPTION 1 (F(REP))

There will be a short-term negative impact on the commercial fishery and consumers from the initial quota of 2,957 mt for large species for the 1993 fishing year. The 1993 quota represents a reduction of about 14 percent of the annual average

Table 9.5

**Large Shark Landings, Commercial Share,
Annual Value, and Cumulative Present Value (CPV) With
Fishery Management Plan (Option 2, (F(5%)) In Place**
(Dressed Weight Metric Tons, \$ Millions)

<u>Year</u>	<u>Landings</u> (mt)	<u>Com*</u> <u>Share</u> (mt)	<u>Annual</u> <u>Value</u>	<u>CPV</u>
1993	2,900	2,436	3.1	2.9
1994	3,060	2,570	3.2	5.8
1995	3,800**	3,192	4.0	9.2
1996	3,800	3,192	3.6	12.4
1997	3,800	3,192	3.7	15.5
1998	3,800	3,192	3.9	18.4
1999	3,800	3,192	4.0	21.1
2000	3,800	3,192	4.0	23.7
2001	3,800	3,192	4.0	26.2
2002	3,800	3,192	4.0	28.5

* Based on the current shares of 84 percent commercial landings and 16 percent recreational landings.

** MSY reached.

Source: Derived from Parrack 1992.

Table 9.6

Large Shark Landings, Commercial Share, Annual Value, and
 Cumulative Present Value (CPV) With Fishery Management Plan
 (Option 3, F(10%)) In Place
 (Dressed Weight Metric Tons, \$ Millions)

<u>Year</u>	<u>Landings</u> (mt)	Com* <u>Share</u> (mt)	<u>Annual</u> <u>Value</u>	<u>CPV</u>
1993	2,311	1,941	2.4	2.3
1994	3,800**	3,192	4.0	5.9
1995	3,800	3,192	4.0	9.3
1996	3,800	3,192	4.0	12.5
1997	3,800	3,192	4.0	15.6
1998	3,800	3,192	4.0	18.5
1999	3,800	3,192	4.0	21.2
2000	3,800	3,192	4.0	23.8
2001	3,800	3,192	4.0	26.3
2002	3,800	3,192	4.0	28.6

* Based on the current shares of 84 percent commercial landings and 16 percent recreational landings.

** MSY reached.

Source: Derived from Parrack 1992.

of 3,444 during the period 1986-1991 (Table 4.7). This reduction in landings will result in a large, but unavoidable, negative impact on the commercial fishing industry and accompanying losses in consumer surplus in the short run while the resource is rebuilding. For example, the loss in ex-vessel revenue would be about \$606,000 in 1993.

Despite these expected losses, the quota would never help to rebuild the large stocks to MSY (Table 9.7). The commercial quota never increases since the purpose of this measure is to replace what is caught. A comparison between Tables 9.4 and 9.7 shows that by 1998, the annual catches without rebuilding are projected to be lower than the catches under management. At the end of 2002 the cumulative discounted value of the landings under regulation is projected to exceed the value without regulation by \$1.3 million.

9.3.5.2.5 COMMERCIAL QUOTAS - PELAGIC AND SMALL COASTAL SPECIES GROUP

A stock assessment was not conducted for the pelagic species group of sharks, so the analysis provided for the large group is not possible. However, it is possible to at least provide some insight as to the potential effect of the pelagic species group quota on landings. The commercial quota for the pelagic species group is 580 mt and is based on the average landings during the period 1986-1991. Parrack, 1990 observed in the stock assessment document that "Current landings indicate significant exploitation...", but was unable to make any more definitive statements.

As more data become available, the pelagic species group quota can be adjusted as necessary, but at this time it appears that the quota would merely cap an unexpected future increase in pelagic species group landings but would have no immediate economic impact.

9.3.5.2.6 COMMERCIAL QUOTAS - PELAGIC AND SMALL SPECIES GROUP - RECREATIONAL BAG LIMITS

The Shark FMP proposes recreational bag limits of four sharks per boat per trip for large and pelagic species group sharks combined and a daily bag limit of five sharks per person for small sharks. The recreational catch and landings data for large sharks are sparse and extremely difficult to interpret. Further, recreational landings have apparently declined in recent years. The four-fish limit for large sharks was chosen based largely to equalize the regulatory induced percentage reduction, e.g., about 29 percent, in landings between commercial and recreational fishermen. In addition, throughout the public comment periods, the recreational community wanted a more strict

Table 9.7

Large Shark Landings, Commercial Share, Annual Value, and
 Cumulative Present Value (CPV) With Fishery Management Plan
 (Option 1, F(REP)) In Place
 (Dressed Weight Metric Tons, \$ Millions)

<u>Year</u>	<u>Landings</u> (mt)	Com* <u>Share</u> (mt)	<u>Annual</u> <u>Value</u>	<u>CPV</u>
1993	3,520	2,957	3.7	3.5
1994	3,520	2,957	2.7	6.9
1995	3,520	2,957	3.0	10.0
1996	3,520	2,957	3.2	13.0
1997	3,520	2,957	3.6	15.8
1998	3,520	2,957	3.9	18.5
1999	3,520	2,957	4.0	21.0
2000	3,520	2,957	4.0	23.4
2001	3,520	2,957	4.0	25.7
2002	3,520	2,957	4.0	27.9

* Based on the current shares of 84 percent commercial landings and 16 percent recreational landings.

Source: Derived from Parrack 1992.

regulation than a bag limit of one shark per person per trip (the original NMFS proposal) would not be restrictive enough. Based on a limited sample of 112 trips recorded in the 1980's where the anglers landed large sharks, the four sharks per trip limit would be expected to reduce catch by 28 percent (Table 4.8). This reduction will reduce the benefits from the recreational fishery in the short term until the resource improves. Since catching sharks is not restricted, only retention, the negative impact on trip satisfaction related to retaining sharks will be mitigated.

This is an important consideration for shark fishing, because recreational anglers currently release or discard far more sharks than they land (NMFS, 1979-1988; Marine Recreational Fishery Statistics Surveys, Atlantic and Gulf Coasts). Therefore, retention may contribute relatively less value to shark fishing trips versus trips directed at other species. As is the usual assumption, long-term gains should result at some point in time as the stocks rebuild. Since about half of the recreational shark mortality comes from sharks which are landed (type A catch) the bag limit should contribute to some rebuilding of the stocks via the effect on that half of the recreational mortality. More importantly, the rebuilding effects from the commercial quota should add a considerable, but not quantifiable, increase in value to the recreational fishery via increased shark abundance and resulting increased trip satisfaction.

The bag limit of 5 small coastal species group sharks will probably have no measurable economic effect because the regulations apply only in the EEZ and a significant portion of these sharks are caught in state waters. In addition, the bag limit may not limit landings even if applied in state waters. Regardless, this bag limit should foster a conservation ethic among anglers and help prevent overfishing the resource.

An important consideration will be the enforcement of the bag limits. Since shark identification is extremely difficult, especially if the sharks have the heads, tails and/or fins removed, enforcement will be difficult and may result in a low compliance level. This will reduce both the short-term losses and longer-term gains that would otherwise be associated with the bag limits.

In summary, the large coastal/pelagic species group bag limit is expected to have a small net benefit following a period during which short-term recreational values may decline. This small benefit will be reduced, perhaps to zero, due to the enforcement problem created by having the dual bag limit system in effect. The daily bag limit of 5 small coastal species sharks per person is expected to foster a conservation ethic among recreational anglers and contribute towards prevention of overfishing of the small coastal species resource.

9.3.5.3 RELEASE CONDITION

Since the requirement for live release of sharks that are not kept is largely unenforceable, it will not have any significant economic consequences on commercial or recreational fishermen unless there is some degree of purely voluntary compliance. Any reduction in shark mortality that results from the implementation of the measure will have a net positive benefit because there are essentially no costs associated with the measure.

9.3.5.4 FRAMEWORK PROCEDURE

Establishing a framework procedure for determining annual harvest levels will have no direct impact on the recreational or commercial fishery. The indirect effect on the economic value of the fishery would be positive to the extent that the procedure allows timely adjustments and ensures that the shark fishery is maintained at the MSY level.

9.3.5.5 PROHIBIT FINNING

This action was proposed to address the problem of "physical waste." Parrack (1992) reviewed the information obtained from fishermen, fish house owners/processors, fin dealers, etc., and concluded that the extent of finning may equal the number of sharks harvested for meat and fins. Regardless of the level of physical waste of sharks, the RIR is concerned with economic effects. In the case of "finning," the practice results in economic waste if the potential landed value of the carcasses being discarded exceeds the cost of landing them. The problem presented is that this potential value may not accrue to the fishermen who originally catch these sharks. Obviously, for the fishermen who practice finning it is not economically rational to land these carcasses for any of a variety of reasons, including the costs of handling and processing on board or the need to reserve hold space for more valuable species.

To the extent it is not economically feasible for some fishermen to land whole sharks, the requirement to land carcasses along with fins may, assuming that the regulation is enforceable, result in the live or dead release of sharks currently taken for fins alone. According to information in the Shark FMP, the finning situation is believed to occur in association with the pelagic longline fishery, and for this fishery the amendment indicates a shark bycatch mortality rate of over 50 percent. This means that half of the sharks subject to the finning regulation will be released dead and this will obviously offset some of the potential benefits from the finning regulation. The value from the half of the sharks that survive will come from two sources, their contribution to increased shark numbers via their reproductive potential and their potential use if caught later by a user who receives value from the catch. These users will

either be recreational fishermen who derive value from catching and perhaps retaining the sharks or commercial fishermen (other than pelagic longline fishermen) who would retain the sharks for the value of the fins and perhaps the meat. The magnitude of these values depend upon the chance that sharks released alive can be recaptured and the value of these sharks in recreational or commercial terms. In the absence of complete information it is not possible to calculate the value derived from the finning regulation. However, the discussion shows that there are losses and gains associated with the requirement and the probable outcome is a relatively minor though intermediate net economic change.

9.3.5.6 PROHIBIT SALE OF RECREATIONAL CATCH

The commercial permit requirement will effectively prohibit recreational fishermen from selling their catch. Parrack (1990) estimated that in some years 10 percent of recreational caught sharks, mostly makos, are sold in the Northeast, and the market is the restaurant trade. The amendment does not contain information on other species taken by recreational fishermen and the assumption is made that such sales are minor. Hence, a prohibition on sale of shark meat and shark products by recreational fishermen is expected to have a small negative economic impact on recreational fishermen.

9.3.5.7 REQUIRE COMMERCIAL FISHERMEN PERMITS

The requirement for an annual fishing permit is not expected to direct economic impact on the fishery in terms of quantity and value of landings. The permit requirement will increase the cost of doing business by the cost of a permit, approximately \$53.

9.3.5.8 COMMERCIAL PERMIT ELIGIBILITY

To be eligible for a Federal commercial permit, the owner or operator (including charter vessel and headboat owners/operators who intend to sell their catch) must derive at least 50 percent of earned income from 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 year for which the permit is requested. The income requirement limits potential commercial shark fishing permit holders to persons with some commercial fishing experience. This requirement is expected to eliminate part time commercial and recreational fishermen from the fishery. Finally, this requirement is a step towards standardizing the earned income requirements for Federal permits under the jurisdiction of the SEO, that will improve processing of applications for permits and reduce confusion among applicants.

9.3.5.9 PERMITTED FISHERMEN AND TOURNAMENT REPORTING

The cost of reporting catch and purchases of sharks is expected to be somewhat greater (Section 9.3.7). However, the resulting improved data base will be used to refine management measures and, consequently, could increase the annual economic value of the shark fishery above the cost of the permit and associated data collection and management systems.

The requirement for selected tournament directors to report catch and effort data is expected to have minimal impact on the value of recreational shark fishing. Increased record keeping costs are assumed to be offset by improved fishing resulting from improved management. Since most tournaments keep careful records on catch to determine winners, and probably monitor effort to prevent illegal fishing methods, it is likely that there will be little increase in record keeping and only the transfer of data to the management authority would represent an additional cost (Section 9.3.7).

9.3.5.10 OBSERVERS

The requirement that selected permitted fishing vessels accommodate a NMFS observer will involve a cost to fishermen. They will be expected to bear the expense of food, provide sleeping space and use of radio equipment, and generally make records and catch available. NMFS will pay observers' salaries and benefits. The principal purpose of observers is to document catches of marine mammals, endangered species, and shark discards. NMFS monetary constraints will undoubtedly limit observer coverage, and will affect the total cost to the fishermen as well (Section 9.3.7). Society will benefit from information gained and applied in the form of better shark management, and the conservation of marine mammals and endangered species.

9.3.6 IMPACT OF RESERVED MEASURES

9.3.6.1 MAKO MINIMUM SIZE LIMIT

This measure was reserved because of inadequate supporting biological information. There is no clear evidence that significant conservation benefits would accrue. The proposed application of the measure differently to the recreational and commercial fisheries raised many public objections that could not overcome with demonstrable (tangible) stock conservation benefits. In the future, NMFS will ask the OT to review this measure, as well as possible minimum sizes for other species, and provide NMFS with its recommendations regarding the implementation of and benefits from shark minimum sizes. Provisions for their subsequent incorporation through the framework regulatory adjustment procedure (see Section 7.1.4)

have been made. The impacts of these measures would become part of the RIR associated with the implementation of these measures.

9.3.7 IMPACTS OF REJECTED MANAGEMENT MEASURES

9.3.7.1 NO ACTION

Commercial shark landings increased from 1,618 mt in 1986, peaked at 7,122 mt in 1989, and declined by 16 percent to 5,950 mt in 1990 (Table 3.1). If the 16 percent decline in landings accurately reflects the status of shark resources and is not a result of adverse market conditions or other factors that could reduce landings, this reduction indicates that the fishery complex is unable to sustain previous harvest levels.

Recreational shark landings have also been significant and exceeded commercial landings in all years during the period 1979-1987 (Tables 3.1 and 3.3). As for commercial landings, recreational landings have recently declined.

Parrack (1990) conducted a stock assessment for three separate shark species groups: large; small; and pelagic species group and calculated MSY's for each group. His analysis indicated that the large shark species group is overfished (catch exceeds production), and a stock rebuilding program is required to achieve MSY. The species group, comprised of small sharks, is fully exploited. Parrack was unable to carry out a quantitative assessment of the pelagic species group due to data limitations and concluded that there is no evidence available to suggest that the MSY is being exceeded but the group likely is fully exploited. The proposed FMP incorporated this assessment and a management regime to rebuild the large species group that appeared to be overfished and to maintain the small and pelagic stocks at the current levels.

During the public comment period held on the proposed FMP and on the proposed implementing rule, significant new fishery information was received from fishermen, fish dealers/processors, and several state fishery agencies. This new information included: (1) data showing fishery removals in recent years higher than those used as a basis for determining MSY and stock conditions in the May 1990 stock assessment; (2) records on the size frequency of shark species caught in commercial fisheries; and (3) information on the commercial fishing fleet. NMFS reviewed this new information and determined that incorporation of these new data in the stock assessment could result in conclusions about the abundance, productivity, and condition of the managed shark species significantly different from those used in the proposed FMP (dated October 28, 1991).

To ensure that all FMP management measures are based upon the best scientific information available, a revised assessment of

the condition of the large coastal species group was completed by the NMFS Southeast Fisheries Science Center. The revised assessment was reviewed by a scientific peer committee consisting of both outside scientific experts and NMFS scientists. The Review Committee issued its final report on November 23, 1992 (Report of the Atlantic Coastal Shark Fishery Analysis Review, November 23, 1992).

The Review Committee reported evidence of overfishing for the large coastal group during 1986 through 1992 (except for 1987 and 1990). The Review Committee recommended that the calendar year 1993 landings for the large coastal be reduced below the calendar year 1991 landings level of 4,319 mt dressed weight.

9.3.7.2 Alternative Fishing Years

Consideration was given to establishing a fishing year based upon July 1-June 30 and January 1-December 31. These alternatives were rejected as follows.

July 1 - June 30

The Southeast Fisheries Science Center has advised that retention of this alternative fishing year (with associated fishing year commercial quotas) could (1) encourage rapid expansion of a new shark fishery in the previously unfished area off the northeastern states and, as such, be potentially destructive to already overfished shark resources--a growing new fishery on an overexploited resource in a previously unfished area, and (2) damage the historic fishery off the southern states by allowing the new northern fishery to take an unfair share of the annual quota. Also, it is noted that the Review Committee's stock rebuilding schedule and NMFS' collection of fishery statistics are both based on a calendar year. Implementing calendar year quotas while retaining a July 1 through June 30 fishing season poses several problems that are difficult to resolve.

For these reasons, NMFS decided to establish calendar year commercial quotas divided into two equal halves that would apply respectively to two fishing periods (January 1 through June 30; July 1 through December 31). This approach to applying the commercial quotas should spread the commercial fisheries in both southern and northern areas reasonably equally throughout the year, as well as addressing the Center's specific concerns. Also, this approach should not eliminate the historic peak months of the established southern fisheries while ensuring an open season and a new, unfished quota for the peak fishing months of a new, expanding fishery in the northeast.

January 1 - December 31

A 12-month fishing year should result in a fishing season of less than 12 months for sharks in the large coastal and pelagic species groups (assuming that the preferred quota options are adopted). The shortened season will unavoidably increase fishing activity during the early part of the season, raise costs, and alter the historical supply and price situation. The short-term results will be lower profits for commercial fishermen and lower consumer surplus resulting from less product and less availability of fresh product during the closed season. While these effects will be fully expected, the magnitude of the effects, including a prediction on the length of the season, cannot be estimated in the absence of information about predicted landings if a quota was not in effect.

NMFS rejected this alternative since use of this alternative would provide the conditions under which the entire quota taken in the Gulf of Mexico, Caribbean, and South Atlantic fisheries before resources become available to the New England and Mid-Atlantic fisheries. From 1984 to 1988, about 7 percent of all commercial shark landings were made in the New England and Mid-Atlantic areas, primarily during June through October, while about 93 percent of the landings came from the South Atlantic, Gulf of Mexico, and Caribbean areas where landings are slightly higher during March through July (Table 9.1). If the fishing year was the calendar year, the entire quota might be taken before fish became available in the Mid-Atlantic and New England.

9.3.7.3.1 MANAGEMENT STRATEGIES - LARGE COASTAL SPECIES GROUP

Based on Parrack's 1992 assessment, the Shark FMP consisted and rejected one more restrictive strategy and two less restrictive strategy for managing the large resource (See Sections 9.3.5.2.1, 9.3.5.2.3, and 9.3.5.2.4.).

9.3.7.3.2 MANAGEMENT STRATEGIES - LARGE COASTAL SPECIES GROUP- SHARK FMP (OCTOBER 28, 1991)

Based on Parrack's 1990 assessment, the Shark FMP (October 28, 1991) considered and rejected 6 alternative management strategies to rebuild the overfished large coastal species group resource through different sets of quotas on the commercial sector and bag limits on the recreational sector and the no-action alternative. These strategies were rejected in favor of the current strategies embodied in the Parrack's 1992 assessment. The rejected strategies are discussed below.

9.3.7.3.3 MORE RESTRICTIVE STRATEGIES

Four management alternatives would rebuild the large sharks before year 2000 through quotas and bag limits which would be

more restrictive than under the preferred alternative (Figure 4.1, Section 4.5.1, Section 7.2, Table 7.1, Shark FMP, October 28, 1991). The main differences among the alternative strategies were the length of the recovery periods and the size of the short term adverse economic impacts on the dependent user groups. All of these options would rebuild the overfished large shark resources quicker than the proposed alternative, but would involve larger short term adverse impacts on the user groups.

Two of these alternatives, the no harvest strategy which would not allow any harvest until the stocks were rebuilt and the 40 percent strategy which would allow harvest of 40 percent of production (refer to earlier parts of the RIR for an explanation of the term "production"), were analyzed using the methods applied to the preferred alternative of allowing harvest of 80 percent of production. The results are displayed in Table 9.6 along with the basic results for the preferred alternative (refer to earlier discussion and Table 9.4, Shark FMP, October 28, 1991). These results indicate that the more restrictive alternatives result in higher cumulative present values at the end of the period chosen for analysis, but the results can be considered to be identical over the long term since they differ by about 3 percent. However, there are significant differences in the results in terms of the time paths by which the overall identical results are achieved. For example, the 80 percent or preferred alternative is clearly superior through the year 1995, but by the end of the year 1998 the other two alternatives are slightly superior. Similar conclusions could be drawn concerning the 20 percent and 60 percent alternatives. These alternative strategies were rejected since the preferred alternative achieves the same goals without the degree of adverse impacts on the dependent fishermen and support industries before 1998.

9.3.7.3.4 LESS RESTRICTIVE STRATEGIES

This category consists of two alternatives. The first management strategy proposes to rebuild the large sharks by year 2007 through a less restrictive quota for the commercial sector and trip limit for the recreational sector (Figure 4.1, Section 4.5.1, Section 7.2, Table 7.1, Shark FMP (October 28, 1991)). This option should not adversely affect commercial and recreational fisheries during the 15-year recovery period. After the recovery period, commercial and recreational fisheries would operate at a level designed to maintain the resources at a fully exploited level. This strategy was rejected on biological rather than economic grounds, because the preferred alternative achieves the biological goals over a shorter recovery period with less risk to the resource.

The second strategy consists of not taking any management actions to assist the recovery of the resource. This strategy was rejected because the resource is overfished. Continued

overfishing could lead to collapses of the large shark resources and concomitant adverse economic impacts on the dependent commercial and recreational fisheries. Some species could be reduced to levels that would require listing on the Endangered Species List.

9.3.7.3.5 NO-ACTION ALTERNATIVE

Commercial shark landings increased from 1,618 mt in 1986, peaked at 7,122 mt in 1989, and declined by 16 percent to 5,950 mt in 1990 (Table 3.1, Shark FMP [October 28, 1991]). If the 16 percent decline in landings accurately reflects the status of shark resources and is not a result of adverse market conditions or other factors that could reduce landings, this reduction indicates that the fishery complex is unable to sustain previous harvest levels.

Recreational shark landings have also been significant and exceeded commercial landings in all years during the period 1979-1987 (Tables 3.1 and 3.3, Shark FMP (October 28, 1991)). As for commercial landings, recreational landings have recently declined.

Parrack (1990) conducted a stock assessment for three separate shark species groups: large ; small ; and pelagic species group and calculated MSY's for each group. His analysis indicated that the large shark species group is overfished (catch exceeds production), and a stock rebuilding program is required to achieve MSY (Section 4.4.1). The species group, comprised of small sharks, is fully exploited (Section 4.4.2). Parrack was unable to carry out a quantitative assessment of the pelagic species group due to data limitations and concluded that there is no evidence available to suggest that the MSY is being exceeded but the group likely is fully exploited (Section 4.4.3).

The outcome of the No Action alternative is covered earlier in the RIR in Section 9.3.5.2 which describes the economic outcome of the preferred quota and bag limit measures with reference to the No Action alternative. According to Table 9.4, the outcome of the No Action alternative for the large species is for a steady decline in landings and an associated loss of net benefits if some action is not taken. For the pelagic species group species, the RIR concludes that the No Action alternative has basically the same outcome as the preferred management regime because the commercial quota for pelagic species group is not expected to limit the catch. However, the No Action alternative would allow the continued recreational landing of small mako sharks and the continued recreational sale of all sharks. The economic outcome of the former is unknown because there is no stock assessment for mako sharks--if makos are overfished the outcome of No Action is negative and if they are not fully exploited then the outcome of the No Action alternative is

positive. The net effect of continuing to allow sale of recreational caught sharks is expected to have only a minor net impact if any at all because changing the status quo largely involves transferring income between groups without creating major aggregate effects.

9.3.7.4 PROHIBIT FINNING BY EMERGENCY ACTION

The same considerations apply that are discussed in Section 9.3.5.4, but only for 90 or 180 days, the limit of the Secretary's emergency action authority. In this event, the cost of implementing the action would probably outweigh any gain as there would be no lasting regulation and, thus, no lasting positive effect on the fishery.

9.3.7.5 HARVEST ONLY MALE SHARKS

This option was considered because it offers some potential for reducing mortality of females and enhancing reproductive potential. The impact of this measure on the fishery is unclear. To the extent that male sharks can be identified (by claspers) prior to death, it could result in reducing mortality to female sharks and contribute to maintaining shark populations and a viable fishery. However, fishing gear is not selective and discard mortality of females would be high. In addition, enforcement in the commercial and recreational fisheries would be very difficult as carcasses would be identifiable only if claspers were left intact. The expected economic outcome of this alternative is negative.

9.3.7.6 ALLOCATE COMMERCIAL QUOTA BY REGION

Assuming that a single commercial quota is adopted, the fishery is likely to be closed before the end of the fishing year. This alternative was considered to address the equity issue by employing the same reasoning used in the decision regarding the fishing year. That is, the intent is to manage the fishery under quota in a fashion that gives various fishing areas their historical portion of the catch. From the economics viewpoint the area quota concept would not result in the highest value because there are likely to be disparities among the net marginal values by area and the fishery could not be prosecuted on a least-cost basis. Allocations based on historical shares, or any other non-economic criterion, is no more likely to be economically optimal than is the catch distribution resulting from no allocation, but does have a cost of administration and enforcement. Since the setting of the season appears to resolve the potential equity problem without distorting the rational economic behavior of the fishermen, it was preferred to the area quota solution.

9.3.7.7 CLOSE NURSERY AREAS

In theory, closing nursery areas to fishing would benefit shark populations and thus increase the economic value of the shark fishery. However, nursery areas are not well defined so the target closure areas are largely unknown. In lieu of closing nursery areas, the choice of a July 1-June 30 fishing year, in conjunction with a restrictive commercial quota, is expected to provide for a closure of the entire fishery. Since the pupping season is April-June and the quota should be reached before April and the season reopened the following July of any given year, this would include a cessation of fishing in the nursery areas during the pupping season regardless of the location of the nursery areas.

9.3.7.8 SIZE LIMITS FOR SHARKS OTHER THAN MAKOS

Data are not available to estimate the short-term reduction in landings (recreational or commercial) or the long-term benefits of size limits on sharks. Minimum size by species would cause some short-term reduction in landings and thus commercial revenues and recreational satisfaction. This would be offset to an unknown degree by increased long-term landings resulting from a stabilized population. The net effect is unknown.

9.3.7.9 ALTERNATIVE RECREATIONAL BAG LIMITS

The bag limit of one shark per person for the large and pelagic species group sharks combined is less restrictive than the preferred measure, which calls for a trip limit of two sharks per boat regardless of the size of the fishing party. The reasons for the choice of the preferred alternative versus this alternative are discussed in the section describing the impacts of the preferred measure in the proposed FMP (dated October 28, 1991).

An alternative of not having a bag limit for small sharks was considered and rejected on the non-economic grounds that a positive bag limit on a fully utilized resource promotes conservation ethics among recreational anglers and helps prevent overfishing. Since there are minimal biological or economic reasons to have a bag limit for the small , the no bag limit alternative may produce a net benefit relative to the preferred alternative of a bag limit of five. Information in the amendment concludes that the fish are of limited commercial or recreational value. The positive economic outcome of this alternative relative to the outcome of the preferred measure is expected to be small because more trip satisfaction appears to be related to catching rather than keeping sharks.

9.3.7.10 CLOSING FISHERIES WHICH KILL SHARKS AS BYCATCH

Closing the shrimp, swordfish, or tuna fisheries, which kill sharks as incidental catch, would result in major negative impacts. The exvessel values associated with these fisheries are in the hundreds of millions of dollars and the associated economic values would be very large when compared to the value of sharks being protected from incidental take.

9.3.7.11 PROHIBIT SHARK GILLNETS TO PROTECT LISTED SPECIES

During the period 1986-1989, there were 10-12 gillnet boats directing effort on sharks, about 12-15 swordfish vessels which had a significant catch of sharks, 3-4 vessels which used a combination of gillnets and longlines in the directed shark fishery and an unknown number of gillnet craft that target a variety of other species and catch sharks in the process. In 1989, the combined shark landings of these craft were about 622 mt or about 10 percent of the total shark landings for that year. A portion of the losses, which are implied by this alternative, would be reduced because fishermen have the opportunity to switch to other gear types and because the quota rather than the amount or types of gears employed in the fishery will limit the catch. However, there will still be economic losses associated with the measure because the gear would have to be written off and because the gear must represent an efficient operation in a substantial portion of the fishery at certain times of the year and in certain areas. The losses associated with this alternative would increase over time as the stocks recover.

The increased value associated with this measure would be in terms of the value of marine mammals or endangered/threatened species not killed. As noted in Section 7.3 and 7.6, gillnets are known to cause mortalities of marine mammals although the extent of these mortalities is unknown. Gillnets may also be associated with lethal takes of endangered or threatened species, principally sea turtles, and may impact the shortnose sturgeon. Numbers or values of animals saved are not available, so there is no way to calculate the benefits which the alternative could create. The preferred alternative which will require onboard observers on selected shark-fishing vessels should enable NMFS to assess the impacts of gillnets on listed species.

9.3.7.12 REQUIRE ANNUAL DEALER PERMITS

This option was considered as a means of identifying the dealers that purchased shark products from commercial fishermen. Statisticians planned on using this information to design efficient data collection systems. Agents planned on using this information to design efficient law enforcement activities.

Requiring annual dealer permits was rejected since the scientists could obtain the necessary catch and other information directly from fishermen via logbooks, weight-out slips and other existing collection systems. It was determined that law enforcement agents could use other sources of information to design efficient enforcement activities. In other words, this alternative was rejected on the basis that it would involve additional costs but would not generate additional benefits.

9.3.7.13 ALTERNATIVE COMMERCIAL PERMIT ELIGIBILITY REQUIREMENTS

Three alternatives considered and rejected were:

1. To be eligible for a Federal commercial permit, the owner or operator (including charter vessel and headboat owners/operators who intend to sell their catch) must derive at least 10 percent of earned income from sale of the fish or fish products or charter vessel and headboat operations during the calendar year preceding the permit request.

2. To be eligible for a Federal commercial permit, the owner or operator (including charter vessel and headboat owners/operators who intend to sell their catch) must derive at least 50 percent of earned income from sale of the fish or fish products or charter vessel and headboat operations during the calendar year preceding the permit request.

3. To be eligible for a Federal commercial permit, the owner or operator (including charter vessel and headboat owners/operators who intend to sell their catch) must derive at least 50 percent of earned income from 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 two years preceding the permit request.

These alternative income requirements were rejected because none of them provided the flexibility that would allow commercial fishermen to exit and reenter the fishery due to "Acts of God, e.g., such as loss of a vessel or illness." NMFS considers such situations as reasonable limits on those individuals wishing to earn their living from public resources such as sharks.

9.3.8 GOVERNMENT AND PRIVATE COSTS OF MANAGEMENT

The development and implementation of the Shark FMP has or will create costs that should be addressed in the RIR and used in the calculation of the overall net economic changes that result from the associated management regime. These costs are estimated to be.

Plan Preparation

The cost to the Federal government of preparing the Shark FMP includes expenses and salaries of NMFS, NOAA, and DOC personnel; printing; and public hearings. The total cost is estimated at \$600,000. This estimate does not include any costs borne by the Regional Fishery Management Councils and is a one-time cost.

Enforcement

Enforcement costs for NMFS and the Coast Guard are estimated at be \$500,000 yearly. State enforcement costs are not included in this estimate.

Government Costs Related to Fishing Permits

There are no government costs because the NMFS is allowed to recover all administrative costs via permit fees.

Private Costs Related to Permit Application and Cost of Permits

A total of 700 fishermen are expected to apply for commercial shark fishing permits and the public cost, including the permit application fee and the value of time preparing the application form, is estimated at \$55.50 for each application. The annual cost is therefore projected at \$38,850.

Government Costs Related to Logbooks

The Federal costs will be related to the value of time required to print and mail the logbooks, prepare the logbook responses for data entry, enter the data, and verify/analyze the entered data. The annual total cost of these items combined is estimated at \$24,400.

Private Costs Related to Logbooks

It is expected that 200 fishermen will be selected to receive logbooks under a mandatory reporting system. The aggregate annual cost of time for these 200 fishermen to report on an average of 24 fishing trips per year is estimated at \$18,400.

Government Costs Related to Tournament Reporting

Costs related to printing and mailing of reporting forms, preparing data for entry, entering data and verifying/analyzing these data are estimated at \$4,260 annually.

Private Costs Related to Tournament Reporting

Costs related to completing and mailing information on the biological information collected on sharks landed during an

estimated 200 tournaments per year will result in an annual private sector cost of \$1,052.

Government Costs Related to At-Sea Observer Program

The government will bear the salary, benefits and other related costs of the observer program. At a cost of \$150 per day, the cost of 3,840 at-sea days is estimated at \$576,000. This is a maximum amount and depends heavily on the ability of NMFS to receive a budget increase to pay for the proposed program.

Private Costs Related to At-Sea Observer Program

The Shark FMP contains a mandatory observer program for those vessels selected and the vessel owner/operator is responsible for providing food and quarters for the observer. There will be an estimated maximum of 40 vessels selected for observer coverage involving an average of 24 trips per year and an average of 4 days at sea for bottom and pelagic longline trips combined. At an estimated cost of \$25 per day, the total maximum cost of providing food and quarters is \$96,000. The actual level of private costs will depend on the ability of NMFS to support the government costs of the program.

9.3.9 SUMMARY OF IMPACTS

Although data are not available to fully quantify impacts of all of the management measures, there is enough information to indicate the likely direction and general magnitude of effect for most of the measures. Table 9.8 summarizes the expected economic impacts for the preferred measures in terms of changes from the baseline of No Action. While the aggregate net benefit of the accepted measures is expected to be positive, some of the individual actions are forecast to have a zero or small negative economic effect on the commercial and/or recreational sectors. The table also includes a summary of the government and private costs associated with plan development and implementation. The process of developing, implementing, and maintaining the Shark FMP will involve government and private costs that are independent of the net economic benefits derived from the management measures. These costs are expected to total \$1,704,600 for the government sector and \$576,000 of this amount is related to the observer program, which may or may not be implemented. The private sector costs are estimated at \$154,302, of which \$96,000 results from the observer program.

In summary, this is not a major rule under Executive Order 12291. The proposed rule, if adopted, is not likely to result in an annual effect on the economy of \$100 million or more; a major increase in costs or prices for consumers, individual industries, Federal, state, or local government agencies, or geographic

Table 9.8

Summary of Net Benefits and Government/Private Costs
of Preferred Management Measures

<u>PREFERRED MEASURE</u>	<u>COMMERCIAL</u> ¹	<u>RECREATIONAL</u> ¹
Semi-Annual Quotas	Small Positive	None
Commercial Quota	\$1.9 million	None
Rec. Bag Limit		
4 Large Coastal or Pelagic Sharks	None	Small Positive
Rec. Bag Limit		
5 Small Coastal Sharks	None	Small Positive
Live Release Condition	Small Positive	Small Positive
Framework Procedure	None	None
Prohibit Finning	Small Positive	Positive
Prohibit Recreational Sale	Small Positive	Negative
Commercial Fishing Permits	Negative ²	None
Tournament Reporting	None	Negative ²
Observer Program	Negative	None
Commercial Permit Eligibility	Positive	Negative
Mako Minimum Size	Reserved	Reserved
<u>COST ITEM</u>	<u>GOVERNMENT</u>	<u>PRIVATE</u>
Plan Preparation ¹	\$ 600,000	None
Law Enforcement	500,000	None
Permits	None	\$ 38,850
Logbooks	24,400	18,400
Tournament Reporting	4,260	1,052
Observer Program (Max Cost)	<u>576,000</u>	<u>96,000</u>
TOTAL COSTS	\$1,704,660	\$154,302

¹ Benefits and costs generally occur annually except for the cumulative costs incurred to date for preparing the Shark FMP and the cumulative net present value of the commercial landings ending by year 2002.

² The negative outcome refers to the economic impact on the commercial and recreational sectors only. Both measures are designed to gather information to improve management, and this positive effect is expected to exceed any negative user impacts.

regions; or a significant adverse effect on competition, employment, investment, productivity, innovation, or the ability of U.S.-based enterprises to compete with foreign-based enterprises in domestic or export markets.

9.3.10 REGULATORY FLEXIBILITY ANALYSIS

The Regulatory Flexibility Act requires a determination as to whether or not a proposed rule has a significant impact on a substantial number of small entities. If the rule does have this impact then an Initial Regulatory Flexibility Analysis (IFRA) has to be completed for public comment. The IRFA becomes final after the public comments have been addressed. If the proposed rule does not meet the criteria for "substantial number" and "significant impact," then a certification to this effect must be prepared.

For the purposes of the IFRA, the firms directly involved in the fishery and potentially affected by the proposed rules are considered to be commercial fishing vessels (over 800 will be affected), processing businesses (unknown number) and charter vessels and headboats that provide recreational fishing opportunities for a fee (several hundred directly affected). All of these commercial firms are classified as small entities and almost all of them will be affected by the action to some degree. Therefore, for this proposed rule the "substantial number" part of the determination will be met. The outcome of "significant impact" can be triggered by several conditions, one of which is that the regulations are likely to result in a reduction in annual gross revenues by more than 5 percent. Implementation of the anti-finning regulations may reduce the commercial landings by more than 5 percent, the criterion for the commercial fishing and processing small entities should be met. The situation for the charter vessels and headboats is less clear because these firms would be affected less by the commercial permit requirements than by the imposition of bag limits that would govern the number of sharks paying passengers would be allowed to retain. Although a reliable estimate of the number or percentage that would be affected cannot be ascertained, it is certain that some, but not all, of these small entities would be affected. Considering the small entities in aggregate, the criteria for "substantial number" and "significant impact" are met and an RFA is required. The RFA follows and is based largely upon the findings of the accompanying Shark FMP and its accompanying RIR.

Explanation of Why the Action is Being Considered: The proposed FMP identified the large coastal shark species as being overfished due to significant and continuing commercial and recreational fishing effort. The pelagic species group shark and small coastal species are considered fully utilized and could be overfished if fishing effort increases.

During the public comment period held on the proposed FMP and on the proposed implementing rule, significant new fishery information was received from fishermen, fish dealers/processors, and several state fishery agencies. This new information included: (1) data showing fishery removals in recent years higher than those used as a basis for determining MSY and stock conditions in the may 1990 stock assessment; (2) records on the size frequency of shark species caught in commercial fisheries; and (3) information on the commercial fishing fleet. NMFS reviewed this new information, and determined that incorporation of these new data in the stock assessment could result in conclusions about the abundance, productivity, and condition of the managed shark species significantly different from those used in the proposed FMP (dated October 28, 1991).

Objectives and Legal Basis for the Rule: The basic objectives are to prevent overfishing, provide for management throughout the range of the sharks and to establish a data collection, research and monitoring program. The Magnuson Fishery Conservation and Management Act of 1976 provides the legal basis for the rule.

Identification of Alternatives: A number of alternatives to the proposed action were considered. Refer to the Shark FMP for a complete discussion and to the RIR for the economic evaluation of the alternatives.

Demographic Analysis: A demographic analysis was not conducted.

Cost Analysis: A cost analysis was completed and for all the actions in aggregate, it was determined that the rule would be cost-effective. Refer to RIR.

Competitive Effects Analysis: The industry is composed entirely of small businesses (harvesters, processors and charter vessel/headboat operators). Since no large businesses are involved, there are no disproportional small versus large business effects.

Reporting, Recordkeeping, and Compliance Requirements: These measures are designed to obtain the minimum amount of information necessary to monitor the resource, develop the regulations required to rebuild the overfished large coastal species group, and to maintain the small coastal and pelagic species at current levels.

Identification of Overlapping Regulations: The rule would apply to fishing activities conducted in the United States EEZ. There is some overlapping logbook requirements in the regulations governing the harvest of Gulf of Mexico reef fish and Atlantic swordfish. The NMFS plans to consolidate all highly migratory species in the future to reduce the reporting burden.

9.4 PAPERWORK REDUCTION ACT

The purpose of the Paperwork Reduction Act is to control the burden on the public, businesses, local, county, and state governments, and other entities of providing information to the Federal Government. The primary regulatory tool is the Information Collection Budget. The authority to manage information collection and record keeping requirements rests with the Office of Management and Budget. This authority encompasses establishment of guidelines and policies, approval of information requests, and reduction of paperwork burdens and duplications.

9.4.1 PROPOSED DATA COLLECTION PROGRAM

The Secretary proposes to establish: a Federal permit program for commercial shark fishermen; a Trip Interview Program (TIP) to collect effort and other fishery-dependent information; a system requiring fishermen to report information on a per-trip basis; and a system for shark tournament fishing activity.

Fishermen permitted in the shark fishery, if selected, must provide information on kind and amount of gear used; time fished; number of each species caught by market category, landed, and discarded; location fished; exvessel price by market category; total, fixed, and variable costs of production, and unit costs; any other economic, sociological/anthropological information the Assistant Administrator may deem appropriate or desire. NMFS will also select fishermen who hold Federal permits for swordfish, Gulf reef fish, and/or commercial shark fishing for reporting and surveying of harvest operations. Fishermen who hold a Federal permit for swordfish will be required to report their catches on the Swordfish Logbook Daily Form. Fishermen holding a Federal permit for Gulf of Mexico reef fish will be required to report their shark catches on the Gulf Reef Fish Logbook Trip Report Form. Fishermen who hold a Federal permit for commercial shark fishing will be required to complete a logbook and make their shark catches available for examination and provide information about their fishing trip to NMFS port samplers who will collect size frequency, species identification, and other biological and fishery information through the TIP sampling program. These data will provide biological and CPUE information necessary for stock assessment and other analyses. Fishermen who fail to report or provide information timely and accurately may lose their permits (Section 7.1.3.1).

Shark tournament directors, if selected by NMFS, must provide information on number of boats, number of anglers, number and weight of each species landed and discarded, information necessary for the estimation of recreational angler value of catch, and a copy of the tournament regulations with specific rules that might have affected the results (e.g., line test restrictions, minimum entry weights, bait restrictions, etc.).

Many tournaments in the Gulf of Mexico, to their credit, voluntarily provide catch and effort data to NMFS. However, a goal of this Shark FMP is that tournament coverage be mandatory when in the interest of fisheries management.

9.4.2 ESTIMATE OF REPORTING BURDEN AND COST

Approximately 700 persons are expected to apply for commercial shark fishing permits. The administrative cost of application, staff, overhead, and postage is expected to be about \$53 per commercial permit. The program cost is expected to be about \$37,100. Estimated burden hours are 175 for the commercial permittees.

Estimated burden hours for the logbook system is 1,430. The Science and Research Director may determine that information collected by other states' trip reporting systems, when properly submitted, will satisfy the reporting requirements for the commercial sector.

In addition to mandatory logbooks for all commercial fishermen targeting sharks, NMFS may select shark fishermen to provide catch information via interview. This will include fishermen already required to report catch information via logbook for other fisheries; e.g., swordfish and Gulf reef fish. Fishermen selected for interview will be required to provide information to NMFS port samplers via the Trip Interview Program already in existence. The interview effort will be directed at fishermen who target sharks in their fishing operations. Target shark fisheries are generally concentrated in certain geographical areas. Interview sampling of this sector of the fishery will be efficient and produce accurate information on species and size composition which often cannot be provided from fishermen -submitted reports. As fishermen are already required to report, the additional estimated burden hours are negligible.

Approximately 200 shark tournaments will be selected to maintain and report catch records to NMFS. Estimated costs are \$1,052 for the tournament organizers and \$4,260 for NMFS. The burden hours are estimated at 100.

9.5 COASTAL ZONE MANAGEMENT CONSISTENCY

The Coastal Zone Management Act (CZMA) of 1972, and its implementing regulations, require that all Federal activities which directly affect the coastal zone be consistent with approved coastal zone management programs to the maximum extent practicable. A determination that this action is consistent with approved state coastal zone management programs was prepared and submitted for review on October 31, 1989 to each of the state coastal zone management agencies during the review process. The states of New York, New Jersey, New Hampshire, Massachusetts,

Connecticut, South Carolina, Pennsylvania, Maryland, Florida, and Delaware concurred with the Federal consistency determination. Georgia, Texas, and Maine do not participate in the Federal coastal zone management program. North Carolina commented it would review the final Shark FMP. Louisiana, Mississippi, and Puerto Rico submitted comments, but failed to state concurrence or disagreement with the consistency determination. Alabama, Rhode Island, Virginia, and the Virgin Islands did not respond. Copies of the final Shark FMP were sent to states for further comment relative to coastal zone management consistency.

Ten states reviewed the FMP and concluded that the proposed measures were consistent with their coastal zone management plans. These states were Connecticut, Delaware, Florida, Mississippi, New York, North Carolina, Pennsylvania, Puerto Rico, South Carolina, and Virginia. None of the other states commented on the Shark FMP, dated October 28, 1991, and therefore, consistency is automatically implied.

One state, New Jersey, stated that the FMP was inconsistent with their coastal zone management plan. New Jersey did not approve of the exception that permitted commercial vessels would have been able to land undersized mako sharks retrieved dead on longlines or in gillnets. This issue is moot since NMFS has reserved the mako minimum size limit.

On February 5, 1993, Florida indicated to NMFS that the state believes the final FMP, as preliminarily approved and released on December 11, 1992, is inconsistent with the Florida Coastal Management Program that was prepared and implemented under provisions of the CZMA. Florida argued that the final FMP measures regarding bag limits, fishing season dates, and finning prohibition, are inconsistent with the state's more restrictive regulations concerning these measures and, as a result, preempt their management authority. These measures in the final FMP were changed from those in the proposed FMP and proposed regulations. In March 1992, Florida issued state fishing regulations regarding bag limits, fishing year dates, and finning measures based on consistency with the Federal measures proposed at that time. Florida regulations also require a resident to have a Federal permit if he/she is to catch and sell sharks from state waters.

In response to Florida's concerns regarding the preliminarily approved final FMP, NMFS reviewed the FMP measures and the implementing regulations. To avoid any inadvertent Federal limitation of state management authority, NMFS changed the FMP and final regulations regarding conditions associated with accepting a Federal shark fishing permit. The final regulations were revised to require that a Federal permit recipient must agree that the vessel's fishing, catch, and gear will be subject to the Federal shark fishing regulations regardless of where the fishing occurs, with the exception that if a permitted vessel

fishes only in state waters on a given trip, the vessel's fishing, catch, or gear may be subject to the more restrictive state requirements for that trip. Any state regulations limiting the landing or possession of sharks by commercial fishermen fishing legally in the waters of another state, in the EEZ, or outside the EEZ in a more restrictive manner than Federal requirements would frustrate the intent of the FMP to allow a commercial fishery in the EEZ.

The FMP measures objected to by Florida as inconsistent with its Coastal Management Program will be implemented by an interim final rule with request for public comment. A final rule will be issued subsequently after considering the comments received and making necessary changes. NMFS has determined that the interim final rule will be implemented in a manner that is consistent to the maximum extent practicable with the approved coastal management programs of all the affected coastal states. This determination will be submitted for review by the responsible state agencies under section 307 of the CZMA at the time of publication of the interim final rule. State comments regarding this consistency determination will be considered by NMFS in issuing the final rule.

9.6 ENDANGERED SPECIES ACT AND MARINE MAMMAL PROTECTION ACT

Approximately 100+ commercial fishing vessels operating in U.S. waters of the Atlantic Ocean, Gulf of Mexico, and Caribbean spend a portion of their time targeting sharks. The 1988 shark longline fishery caught 80 percent of commercial landings, or 4,215 mt. About 15 net gear vessels caught the remaining 1,061 mt. The net gear consisted of drift gillnets, purse seines, and otter trawls. Of this, drift gillnetters targeting schools of blacktip and operating in state and Federal waters, landed about 750 mt in Florida in 1988 (Schaefer, 1990). An estimated 50 percent, or 500 mt, of net gear landings occur in Federal waters.

Longlines and net gear are known to kill marine mammals and sea turtles (Witzell, 1984). Components of the shark fishery are known to or suspected of interacting with marine mammals. With respect to the drift gillnet fishery that targets schooling blacktip sharks, no data presently exist as to the exact number of marine mammals or listed species are incidentally captured in this fishery.

The bottom longline fishery for snapper-grouper and other reef fish (including sharks) in the South Atlantic and Gulf of Mexico and the pelagic hook-and-line fishery in the Gulf of Maine, southern New England, and the Mid-Atlantic for tuna, shark, swordfish are listed as Category III fisheries (*Federal Register*, Vol. 56, No. 26, February 7, 1991). These fisheries are required to report any lethal takes to NMFS within 10 days of the

interaction. Components of the shark fishery listed as Category II are the Florida east coast gillnet fishery and the Atlantic Ocean, Caribbean, and Gulf of Mexico tuna, shark, swordfish longline fishery. They are required to register their vessels in the Marine Mammal Exemption Program and to complete vessel owner logs which document the daily fishing effort as well as any marine mammal interactions. Vessels are required to carry observers in the Category 1 Atlantic Ocean, Caribbean, and Gulf of Mexico swordfish, tuna, and shark drift gillnet fishery, if requested by NMFS. Registration and reporting requirements for Category I vessels are the same as for Category II.

On July 5, 1989, NMFS issued a Biological Opinion (BO) on the implementation of the Marine Mammal Exemption Program (MMEP). The impacts of all U.S. fisheries on threatened and listed species were assessed. The BO concluded that the continued activities of U. S. fisheries would not jeopardize the existence of threatened and endangered species but may adversely affect these species. An Incidental Take Statement (ITS) was given that allowed the take of sea turtles and shortnose sturgeon. The requirements of the ITS included observer coverage and documentation of any takes. NMFS has implemented some of these requirements through the MMEP logbook and observer program.

In September of 1989, an informal Section 7 consultation was conducted by the SEO regarding the management measures proposed by the initial draft of the Shark FMP. The consultation concluded that the proposed measures would not adversely affect threatened or endangered species but that the fisheries being managed might adversely affect listed species. The changes in the Shark FMP since the 1989 draft have increased the regulations to these fisheries. These changes do not change the determinations of the September 1989 consultation.

A Biological Assessment (BA) discussing the effects of the fisheries involved in the Shark FMP was submitted by the SEO on April 2, 1991, with a request for initiation of consultation pursuant to Section 7 of the ESA. The BA concluded that the continued activities of the directed fisheries would not jeopardize the recovery or existence of any endangered or threatened species, or their habitat. The resulting BO considers the effects of the fisheries on the listed species in the area. Listed species under the jurisdiction of the NMFS that occur in the Atlantic Ocean, Gulf of Mexico and the Caribbean and may be affected by the shark fishery include:

WHALES:

- (1) the endangered northern right whale - Eubalaena glacialis
- (2) the endangered humpback whale - Megaptera novaeangliae
- (3) the endangered fin whale - Balaenoptera physalus
- (4) the endangered sei whale - Balaenoptera borealis
- (5) the endangered sperm whale - Physeter macrocephalus

SEA TURTLES:

- (6) the endangered Kemp's ridley turtle - Lepidochelys kempii
- (7) the endangered leatherback turtle - Dermochelys coriacea
- (8) the endangered hawksbill turtle - Eretmochelys imbricata
- (9) the endangered/threatened green turtle - Chelonia mydas
- (10) the threatened loggerhead turtle - Caretta

Green turtles in U.S. waters are listed as threatened except for the Florida breeding population which is listed as endangered.

FISH:

- (11) the endangered shortnose sturgeon - Acipenser brevirostrum

Additional species known to occur in the EEZ of the U.S. in the Atlantic Ocean, Gulf of Mexico and Caribbean Sea:

- (1) the endangered blue whale - Balaenoptera musculus

NMFS has determined that the proposed activities are not likely to affect this species.

Based on data from logbooks and observer reports, NMFS anticipates that the direct and indirect fisheries for sharks may result in the injury or mortality of loggerhead, leatherback, and green turtles. NMFS also believes that Kemp's ridley and hawksbill turtles and shortnose sturgeon may also be injured or killed by these fisheries. Therefore, NMFS has established a low level of incidental take and terms and conditions necessary to minimize and monitor this impact. An incidental take (by injury or mortality) level of ten (10) shortnose sturgeons, two (2) Kemp's ridley, two (2) hawksbill, four (4) green, four (4) leatherback, or ten (10) loggerhead turtle mortalities is set pursuant to Section 7(b)(4) of the ESA. If the incidental take meets or exceeds this level, consultation must be reinitiated and area closures, seasonal closures, or gear restrictions may be necessary.

Reasonable and prudent measures that NMFS believes are necessary to minimize the impacts of the shark fisheries on listed species are listed below as well as the measures to document the incidental take, should such take occur:

1. Regional observer programs will be implemented to document incidental capture, injury, and mortality of listed species. This program should emphasize monitoring of gill net and longline fisheries that take sharks directly or indirectly.
2. All incidents of take of endangered or threatened species will be reported within 10 days of the take. The report shall include a description of the animal's condition at the time of release.

3. Any sea turtle incidentally taken must be handled with due care to prevent injury to live specimens, observed for activity, and returned to the water as provided in 50 CFR Part 227.72(e)(1)(i).
4. Regulations should be considered to reduce/eliminate mortalities where the take of threatened or endangered species exceeds levels specified in this incidental Take Statement.

In July 1992, the shark gillnet fishery came under suspicion of taking sea turtles when over 20 loggerhead turtles stranded on Cumberland Island, Georgia during a 10-day period. Three shark gillnet vessels were reportedly fishing off this island during this period. On October 13, 1992, (57 FR 46815) NMFS established a temporary observer requirement in the shark gillnet fishery. This rule was in effect from October 7 through November 5, 1992. Under this regulation, NMFS could place observers on these vessels to determine whether these vessels take turtles. The accompanying biological opinion analyzed the impact of this fishery on threatened and endangered sea turtles. That opinion reemphasized the need for an observer program to determine the impact of this fishery on seas turtles and established an incidental take statement that allowed the documented take by injury or mortality of: one Kemp's ridley, or one green, or one hawksbill, or one leatherback turtle, or two loggerhead turtles.

Implementation of the Shark FMP will reduce fishing effort. A reduction in marine mammal and endangered species mortality should occur with a reduction of shark fishing effort. The presence of onboard observers will help quantify the impact of shark fishing on these species.

The Shark FMP recognizes the need to assess possible gear restrictions to reduce bycatch mortality in the future. At present, information on which to base restrictions does not exist. The gear restriction issue will be addressed by the OT after the Shark FMP is implemented.

9.7 FEDERALISM

Executive Order 12612 requires that "Federalism" principles be considered in the formulation and implementation of Federal policies. The official designated by the Secretary has determined that the Federal regulations governing fishing for sharks in the EEZ has sufficient Federalism implications to warrant preparation of a FA. The FA is available upon request to NMFS. The FA concludes that the implementation of regulations managing sharks in Federal waters is not only required by Federal law, but clearly in the Nation's best interest since they are a valuable resource that are in danger of a stock collapse due to overfishing. This is done without limiting the policy-making

discretion of the states or preempting state laws. The proposed management measures and the implementing regulations are therefore consistent with the principles, criteria, and requirements of Executive Order 12612. The concepts of Federalism support approval of the management measures and issuance of the regulations.

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10.2 CONSULTATIONS

The action by the Secretary to develop the Shark FMP was requested by the five Councils. To ensure maximum impact into the FMP development process, the NMFS drafting team assigned to this task met with Council staffs on July 20, 1989, to discuss concepts, problems, objectives, and data availability. A second meeting was held on September 26, 1989, with Council staffs and their Council/Committee representatives to review a preliminary draft of the Shark FMP. This meeting resulted in numerous recommendations and suggestions for consideration by NMFS in finalizing the FMP. During the week of October 9-13, 1989, a Council representative assisted NMFS in the redrafting effort. The Intercouncil Shark Committee and NMFS officials met again on January 11, 1990, to discuss public response to the FMP. During the week of January 16-19, 1990 a Council representative assisted in the redrafting effort. The Intercouncil Shark Committee met on November 15, 1990, to review the new stock assessment and management measures. A Council representative worked with the task team in preparing the updated draft FMP. The NMFS task team also consulted with shark experts in academia, and a number of shark fishermen, processors, and dealers.

10.3 PUBLIC MEETINGS AND PROCEEDINGS

Twenty-two public hearings were held to obtain public comment on the initial draft of the Shark FMP (including the proposed regulations). The hearings were held between mid-November and the end of December 1989. The meetings were taped and copies can be obtained through NMFS, at cost. The locations of the meetings were: Portland, Maine; Eastham and Fairhaven, Massachusetts; Galilee, Rhode Island; Cape May and Wall, New Jersey; Ocean City, Maryland; Freeport and Riverhead, Long Island, New York; Hampton, Virginia; Beaufort, North Carolina; Charleston, South Carolina; Jacksonville, Ft. Pierce, Key West, Madeira Beach and Panama City, Florida; Mobile, Alabama; Thibodeaux, Louisiana; Port Aransas, Texas; La Parguera, Puerto Rico; and St. Thomas, Virgin Islands. Approximately 100 written comments were received on the initial draft FMP. These have been compiled in book form and can be obtained through NMFS.

Based on public comments received on the initial draft and a new shark assessment undertaken by NMFS, a second draft FMP was prepared. This version, was released to the public on April 19, 1991, and was the subject of eight additional public hearings. The hearings were conducted in May 1991 at the following locations: Ronkoma, New York; Wall, New Jersey; Ocean City, Maryland; Morehead City, North Carolina; Fort Pierce, Florida; Madeira Beach, Florida; La Parguera, Puerto Rico; and Kenner, Louisiana. Approximately 70 comments were received on the plan. The major issues discussed at these hearings, and the resolutions thereto, were summarized in a forward section of the plan

entitled "Major Issues of Public Hearings."

NMFS prepared a third draft, dated October 1991, based on the comments received during the previous eight public hearings and public review process. NMFS released the third draft for public comment from January 8 through March 9, 1992, and the proposed implementing regulations for public comment July 23, 1992. These have been compiled and can be obtained through NMFS.

Based on comments received during the public review periods on the third draft and on the associated documents, and on the latest available scientific information, NMFS prepared the final FMP, dated December 10, 1992, that incorporated the resulting changes in the management measures for the fishing year, bag limits, commercial quotas, and permit conditions. This preliminarily approved FMP and Final Environmental Impact Statement were released on December 11, 1992, for a final public review and comment. Comments were received during this period from about 70 parties. These have been compiled and can be obtained from the Director, Office of Fisheries Conservation and Management, National Marine Fisheries Service (NOAA), 1335 East-West Highway, Silver Spring, MD 20910. Telephone (301) 713-2334.

Following the 30-day cooling-off period for the Final Environmental Impact Statement, which began on December 18, 1992, and ended on January 18, 1993, the Assistant Administrator approved the FMP in final (approval date of February 25, 1993).

December 11, 1992

Dear Reviewer:

In accordance with provisions of the National Environmental Policy Act of 1969, we enclose for your review the Final Environmental Impact statement (FEIS) for the Fishery Management Plan for Sharks of the Atlantic Ocean (FMP).

The FMP, when implemented, would regulate commercial and recreational shark fisheries in the Exclusive Economic Zone of the Atlantic Ocean, Gulf of Mexico, and the Caribbean Sea. The FMP's management objectives include preventing overfishing of shark resources, encouraging consistent management of oceanic shark species throughout their ranges, preventing the wasteful practice of "finning" sharks (removing the fins and discarding the carcass at sea), and establishing a shark fisheries data collection program. The FMP and implementing regulations would establish (1) annual commercial quotas for several major groups of sharks, (2) recreational bag limits, (3) commercial permit requirements, (4) fishery information reporting requirements, (5) a regulatory adjustment procedure, and (6) other measures.

Any written comments, requests for additional copies of the FEIS, or questions you may have regarding this FEIS should be submitted to the responsible official identified below by (January 18, 1993). Also, one copy of your comments should be sent to me in Room 6222, CS/EC, U.S. Department of Commerce, Washington, D.C. 20330.

RESPONSIBLE OFFICIAL: William w. Fox, Jr.
Assistant Administrator for Fisheries
Attention: Richard H. Schaefer
National Marine Fisheries Service
1335 East-West Highway
Silver Spring, MD 20910.
Telephone (301) 713-2334

Sincerely,

/s/ Donna Weiting for
David Cottingham
Director, Office of Ecology
and Environmental Conservation

Enclosure

APPENDIX I

FINAL ENVIRONMENTAL IMPACT STATEMENT

Responsible Agency

National Marine Fisheries Service

Cooperating Agency

Regional Fishery Management Councils (Covering the Atlantic,
Gulf of Mexico, and Caribbean Sea)
Intercouncil Shark Advisory Committee

Title of Action

Fishery Management Plan for Sharks of the Atlantic Ocean (FMP)

Contact Person

Richard H. Schaefer, Director
Office of Fisheries Conservation and Management
National Marine Fisheries Service (NOAA)
1335 East-West Highway, Silver Spring, MD 20910.
Telephone (301) 713-2334

Copies of the FMP/FEIS are available from this address.

Designation of the Statement

Final Environmental Impact Statement

Abstract

The Secretary of Commerce (Secretary) will issue a final FMP and implement through Federal regulations. The FMP is prepared under authority of the Magnuson Fishery Conservation and Management Act (Magnuson Act) and will place 39 species of sharks under management within the U.S. exclusive economic zone (EEZ) of the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea. The FMP should rebuild the overfished large coastal species group to a maximum sustainable yield level, prevent overfishing of the fully utilized pelagic and small coastal species groups, and curtail the practice of "finning" (practice of harvesting sharks for the fins alone). The FMP establishes commercial and recreational catch restrictions and a fishery data collection and reporting system, and requires commercial permits for sale of sharks harvested in the EEZ. Management measures may be adjusted by the NOAA Assistant Administrator for Fisheries through a framework regulatory adjustment procedure. There is no indication that the FMP will have any adverse impact on the physical environment. However, the shark fisheries are observed to have certain adverse impacts on marine mammals and protected species; the FMP does not directly reduce or eliminate these impacts but could reduce them by limiting the amount of shark fishing effort. While the new management program is expected to cause short term economic losses to the commercial fishery through imposition of commercial

quotas, permits, and finning restrictions, the FMP should produce long term resource and economic benefits. Recreational and commercial fisheries should continue indefinitely, under regulatory controls, supported by a healthy shark resource.

Comment Due Date

Comments on the statement are required by **January 19, 1993**.

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The Final Environmental Impact Statement (FEIS) consists of the text incorporated in this Appendix I as well as those sections of the Fishery Management Plan for Sharks of the Atlantic Ocean (FMP) referenced below in the FEIS Table of Contents:

FEIS Table of Contents

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Purpose of and Need for Action. p. 25
(FMP references: Prologue, Pages 1-2; Section 4.4, Pages 37-63; Section 5, Pages 68-71)

Alternatives Including Proposed Action. p. 26
(FMP references: Section 7.1, Pages 73-82; Section 7.3, Pages 83-94; Section 9.3, Pages 110-142)

Affected Environment. p. 41
(FMP references: Section 2, Pages 16-25; Section 3.0, Pages 26-47)

Environmental Consequences. p. 43
(FMP references: Section 7.2, Pages 83-88; Section 9.3, Pages 110-142; Section 9.6, Pages 146-150)

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List of Agencies, Organizations and Persons to Whom Copies of the Statement are Sent p. 48

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SUMMARY OF THE FEIS

BACKGROUND

Preparation of the Proposed FMP

The National Marine Fisheries Service (NMFS) prepared the FMP on behalf of the Secretary of Commerce (Secretary) under authority of the Magnuson Fishery Conservation and Management Act (Magnuson Act). Preparation of the FMP began under section 304(c) of the Magnuson Act, which provides for Secretarial preparation under certain circumstances. The Fishery Conservation Amendments of 1990 (1990 Amendments) gave the Secretary full management responsibility for managing Atlantic highly migratory species, including "oceanic sharks." Accordingly, the FMP and implementing regulations are being issued under section 304(f) of the Magnuson Act.

In the late 1980's, the five Regional Fishery Management Councils (Councils) with management responsibilities covering the exclusive economic zone of the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea recognized: (1) the need for the FMP due to rapidly increasing catches attributed to the demand for shark fins and meat; and (2) that the expected lengthy schedule for developing and implementing a five-Council FMP would delay those actions necessary to conserve the exploited shark resources. On June 3, 1989, the five Councils recommended that the Secretary develop an FMP that would: (1) cap the growth of the commercial fishery; (2) establish a recreational bag limit; (3) eliminate "finning" (harvesting sharks for fins only); and (4) initiate a fishery data collection program. Their concern was that the late maturity and low fecundity of sharks, coupled with increasing fishing mortality, could result in long-term damage to shark resources. The management objectives and measures of the FMP are intended to address these concerns.

NMFS has prepared three sequential drafts of the and a final FMP. The first draft, completed in October 1989, was presented at 22 public hearings and was commented upon extensively. Based on the comments received, NMFS determined that an updated stock assessment was necessary. In December 1990, the Southeast Fisheries Science Center (SEC) completed a new shark stock assessment. The 1990 Amendments and the new assessment necessitated significant changes to the initial draft. The second draft was completed in April 1991 and was presented at eight additional public hearings. The third draft ("proposed FMP"), revised based on the comments received during the second round of public hearings, was completed on October 21, 1991, and released for public review and comment from January 8 to March 9, 1992. The proposed rule was published and made available for public review and comment from June 5 through July 23, 1992.

Preparation of the Final FMP and FEIS

Some 1,159 individual public comments were received on the FMP, DEIS, and proposed regulations. Commenters included: (1) numerous individuals with a variety of views (e.g., recreational and commercial fishermen, fish dealers or processors, charter vessel and headboat owners, and interested citizens); (2) many groups or organizations representing diverse fishery interests, including commercial and recreational sectors, fish processing or export-import businesses, environmental organizations, animal rights groups, and scientific research entities; (3) state and Federal agencies; and (4) five regional fishery management Councils covering the east coast, Gulf of Mexico, and Caribbean areas.

NMFS has evaluated the public comments received and presents the following summary of the public concerns. There was overwhelming support for management of Atlantic sharks and general support for approval and implementation of the FMP. In terms of number of comments, some 57 times (1,030 commenters) more commenters supported management of Atlantic Ocean sharks than (18 commenters) opposed it, and some 4 times more (765) commenters supported implementation of the FMP than opposed (175) it. Support for the FMP was from a broad cross section of constituents, including citizens, commercial and recreational fishermen, many coastal state agencies, and the five Councils. Opposition to the FMP came primarily from several commercial fishermen associations, the State of North Carolina and certain North Carolina shark fishermen, and individual shark dealers/processors along the Atlantic and Gulf of Mexico coasts. A summary of the issues raised by the public comments is available. The public comments are summarized in the FEIS and in the final rule preamble with the agency responses.

During the public comment periods held on the proposed FMP, DEIS, and the proposed rule, significant new information was received from fishermen, fish buyers, and state fishery management agencies. This information included: (1) fishery removals not previously recorded; (2) sizes of landed sharks; and (3) the number of commercial fishing vessels targeting sharks. The additional information significantly changed the analytic results of the last stock assessment done in 1990 (Parrack, M.L., 1990, A Study of Shark Exploitation in U.S. Atlantic Coastal Waters during 1986-89).

To ensure that the FMP management measures are based upon the best scientific information available, a revised assessment of the condition of the large coastal species group was completed recently by the Southeast Fisheries Science Center, NMFS. The revised assessment was reviewed by a scientific peer committee consisting of both outside scientific experts and NMFS scientists. The Review Committee issued its final report on

November 23, 1992 (Report of the Atlantic Coastal Shark Fishery Analysis Review, November 23, 1992).

The Review Committee reports evidence of overfishing for the large coastal group during 1986 through 1992 (except for 1987 and 1990). The Committee recommends that calendar year 1993 landings for the large coastal group be reduced below the calendar year 1991 landings level of 4,319 mt dressed weight. The Committee Report establishes three options for the calendar year 1993 landings limit (recreational and commercial combined) for the large coastal group. Each option provides a specific degree of conservation and economic benefits.

NMFS considered the Review Committee's recommendations for the conservation of the shark resources, specifically the large coastal group, and adopted the conservation option that provides for stock rebuilding of the large coastal group biomass at 5 percent a year until it reaches MSY level by the beginning of 1995. NMFS has adopted the Review Committee's specific rebuilding schedule for this option with certain changes. The Committee indicated that stock yields would not approach MSY level until the end of 1998 under its rebuilding schedule. NMFS believes that a rebuilt large coastal species group stock size of 14,900 metric tons dressed weight reached by 1995 will yield MSY.

Based on public comments and the provision of new data and analysis, certain management measures in the final FMP were changed from the proposed FMP. These changed measures include the following:

1. Large coastal species group--revised optimum yield, total annual landings, commercial quotas, MSY, and recreational fishery limits (see discussion below).

2. Pelagic species group--revised optimum yield, total annual landings, commercial quotas, MSY, and recreational fishery limits (see discussion below).

3. Mako minimum size was reserved. The mako minimum size was reserved in the final FMP because of inadequate supporting biological information. There was no clear evidence that significant conservation benefits would accrue. Our proposed application of the measure differently to the recreational and commercial fisheries raised many public objections that could not be overcome with demonstrable stock conservation benefits. NMFS will ask the Operations Team to review this measure, as well as possible minimum sizes for other species, and provide NMFS with its recommendations regarding appropriate measures for implementation.

4. Fishing season and assignment of commercial quotas was changed. Specifically, changed from (1) a fishing year running from July 1 of each year through June of the next year with associated fishing year commercial quotas for the large coastal and pelagic species groups to (2) calendar year commercial quotas for the large coastal and pelagic species groups; each annual quota will be divided into two equal half-year quotas that will apply to the following two fishing periods--January 1 through June 30 and July 1 through December 31.

Finally, NMFS has prepared the FEIS herein based on the public comment which has been summarized and addressed.

Contents of Final FMP

The Secretary has determined that action is necessary to conserve and manage Atlantic shark resources. The FMP measures are based on the best available scientific information. The present state of resource and fishery knowledge makes shark management difficult on an individual species basis. However, the FMP moves in that direction by establishing certain separate groups of species (based on their being caught in the same or similar fisheries and on occupying similar oceanic niches) for management and assessment purposes: (i.e., large coastal, small coastal, and pelagic species groups). Immediate management measures will be placed on fishing for the managed shark species (see FMP section 7).

The objectives of the FMP are to: (1) prevent overfishing of Atlantic shark resources; (2) encourage management of shark resources throughout their full geographical ranges; (3) establish a data collection, research, and monitoring program for the shark resources and associated fisheries; and (4) increase the benefits from shark resources to the United States while reducing waste consistent with the other objectives.

The FMP's management unit contains 39 species of sharks found in the western north Atlantic Ocean. These species are frequently caught in commercial and/or recreational fisheries. Species in the management unit were separated into three groups for assessment and regulatory purposes: large coastal sharks (22 species), small coastal sharks (7 species), and pelagic sharks (10 species). The stock assessment determined that large coastal sharks are overfished, while pelagic and small coastal sharks appear to be fully exploited.

The FMP lists 34 additional species for data collection purposes, but they are not part of the management unit. These species are not overfished and are not included in MSY estimates. Most of these 34 species are small, deep-water sharks that are taken incidentally in directed shark, swordfish, or tuna longline fisheries. This group also includes the spiny dogfish and the

smooth dogfish that enter shallow water. These latter two species are extremely abundant, but are in relatively low demand. The FMP includes the following management measures:

(1) calendar year commercial quotas (divided into two equal half year quotas for the fishing periods January 1 through June 30 and July 1 through December 31) for large coastal and pelagic species groups;

(2) a recreational trip limit of 4 sharks per vessel per trip for large coastal and pelagic species combined and a bag limit of 5 fish per person per day for small coastal species;

(3) a requirement for annual permits for vessels fishing sharks commercially; 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 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.

(4) a limitation on the sale of sharks harvested in the exclusive economic zone (EEZ) to those caught from permitted vessels-- permits are contingent on meeting a commercial fishing income requirement during previous years;

(5) a prohibition on finning by requiring permitted vessels to land fins in proportion to carcasses (a ratio by weight of wet fins to the dressed carcass that does not exceed 5 percent);

(6) a requirement that sharks not harvested as part of the commercial quota or used for home consumption be released in a manner that will ensure maximum probability of survival;

(7) a requirement for data reports from all owners/operators of permitted vessels and persons conducting shark tournaments, and a log book requirement for selected vessels and tournaments;

(8) a requirement that permitted vessels accommodate observers upon request;

(9) a requirement that permitted vessels cease fishing in all waters (including state waters) when the commercial fishery is closed;

(10) authorization for the Assistant Administrator for Fisheries to implement or adjust certain measures (i.e., following an established framework regulatory procedure);

(11) a zero total allowable level of foreign fishing (TALFF) for sharks in the Atlantic, Gulf of Mexico, and Caribbean EEZ; and

(12) establishment of an FMP Operations Team (OT) composed of representatives from NMFS (management and scientific management personnel), the five Regional Fishery Management Councils (Councils) covering the east coast, Gulf of Mexico and Caribbean Sea (Council members, staff, and advisory panel or scientific committee members), and the ICCAT Advisory Committee. The OT will monitor the fishery and FMP and recommend regulatory adjustments for implementation by the Assistant Administrator for Fisheries.

Discussion of Changed Measures and Means of Implementation

1. Revised stock assessment and new MSY estimates, optimum yields, commercial quotas, and bag limits.

During the public comment period held on the proposed FMP and on the proposed implementing rule, significant new fishery information was received from fishermen, fish dealers/processors, and several state fishery agencies. This new information included: (1) data showing fishery removals in recent years higher than those used as a basis for determining MSY and stock conditions in the May 1990 stock assessment; (2) records on the size frequency of shark species caught in commercial fisheries; and (3) information on the commercial fishing fleet. NMFS reviewed this new information and determined that incorporation of these new data in the stock assessment could result in conclusions about the abundance, productivity, and condition of the managed shark species significantly different from those listed in the proposed FMP (dated October 28, 1991).

To ensure that all FMP management measures are based upon the best scientific information available, a revised assessment of the condition of the large coastal species group was completed by the NMFS Southeast Fisheries Science Center. The revised assessment was reviewed by a scientific peer committee consisting of both outside scientific experts and NMFS scientists. The Review Committee issued its final report on November 23, 1992 (Report of the Atlantic Coastal Shark Fishery Analysis Review, November 23, 1992).

The Review Committee reported evidence of overfishing for the large coastal group during 1986 through 1992 (except for 1987 and 1990). The Review Committee recommended that the calendar year 1993 landings for the large coastal species group be reduced below the calendar year 1991 landings level of 4,319 mt dressed weight. The Committee Report establishes three options for the calendar year 1993 landings limit (recreational and commercial combined) for the large coastal group. Each option provides a specific degree of conservation and economic benefits.

Under the Committee's first option for the 1993 calendar year total landings (3,520 mt dressed weight), the large coastal stock

would not rebuild to the MSY level (14,900 mt). To ensure that the large coastal group is rebuilt to the MSY level, NMFS has selected the Committee's recommended second option (Option 2--see Table 4 of the Committee Report) establishing 1993 total landings of 2,900 mt dressed weight (a 34 percent reduction from the 1991 landings; a 29 percent reduction from the 1986-91 annual average landings). Under this option, NMFS has determined that stock abundance will rebuild 5 percent each year back to the MSY level (estimated by NMFS to be 14,900 mt dressed weight) by 1995. The Review Committee's rebuilding schedule shows that annual fishery yields would increase about 5 percent each year but would not equal MSY until 1999. Option 3 of the Committee Report requires a 1993 landings limit of 2,311 mt (a 50 percent reduction from the 1991 level; a 44 percent reduction from the 1986-91 annual average). This option achieves a 10 percent annual increase in stock abundance until the MSY level is reached. NMFS determined that this option would cause unacceptable short-term costs in lost fishery revenues, and is not necessary to achieve stock rebuilding in a reasonable time period. While NMFS adopted option 2 for stock rebuilding and will implement the recommended calendar year total landings (and derived calendar year commercial quotas) from 1993 to 1995, NMFS believes that the large coastal species group will be rebuilt by 1995 (contrasted with the rebuilding schedule contained in the Committee Report) and at that point the stock size should be sufficient to provide MSY. Based on Center information, NMFS believed that a modification of the Committee's rebuilding schedule is justified. NMFS noted that under the Committee's schedule, the large coastal species group would not yield MSY until 1999.

The 1993 and 1994 calendar year commercial quotas for the large coastal group is determined based on the historical commercial average annual share (percentage of average total annual landings) for the period 1986 through 1991; this average annual share is 84 percent. The same approach was used in the proposed FMP to determine commercial and recreational fishery shares. The recreational share of the total 1993 landings is also based on the historical average annual percentage share from 1986 through 1991; this value is 16 percent. The recreational fishery limits (trip limit for large coastal and pelagic species group and bag limit for small coastal species group) have been changed to ensure that 1993 commercial and recreational landings are reduced by approximately the same percentage (29 percent) below their respective recent annual averages.

The commercial quota for the pelagic group is changed from the quota in the proposed FMP based on revised landings statistics and on several years' additional data; the 1993 calendar year commercial fishery quota is now established at 580 mt dressed weight. Combining this commercial quota with the estimated recreational fishery share (under the bag limits) of 980 mt

dressed weight, the total 1993 landings for the pelagic group are established at 1,560 mt dressed weight.

As in the proposed FMP, no quotas are established for the small coastal species group. The MSY remains unchanged because NMFS had no new information upon which to base the MSY estimate.

MSY estimates for the three species groups have been reevaluated. Based on the Committee Report, NMFS estimates that the MSY for the large coastal species group is 3,800 mt dressed weight. (The MSY stock biomass level is estimated to be about 14,900 mt dressed weight). Due to revised landing statistics, the MSY for the pelagic species group is changed from 2,800 mt whole weight (corrected to 3,000 mt whole weight or 2,158 mt dressed weight) in the proposed FMP to 1,560 mt dressed weight in the final FMP. This change was necessary since the pelagic species MSY is determined based on the average annual landings (recreational and commercial combined) during the period January 1, 1986, to January 1, 1992. These landings have been revised. Significant landings of large coastal species were incorrectly included in the pelagic species group in the proposed FMP. Refer to the tables below that illustrate changed values from the proposed FMP and that summarize commercial quotas for calendar years 1993 and 1994.

**LARGE COASTAL SPECIES GROUP REBUILDING SCHEDULE
ANNUAL STOCK YIELD AND STOCK BIOMASS SIZE
(values in metric tons, dressed weight (mt dw))**

<u>Year</u>	<u>Stock Biomass</u>	<u>Yield</u>
1993	13,824	2,900
1994	14,515	3,060
1995	15,241	3,800 ¹

Footnotes:

- 1 Annual stock yield should reach the MSY level (estimated at 3,800 mtdw by the Southeast Fisheries Science Center (SEC)) by 1995 based upon an expected rebuilding of the stock biomass to 14,900 mt dw (stock size estimated by SEC to produce MSY).

**CY 1994 COMMERCIAL QUOTAS, RECREATIONAL FISHERY SHARE
(mt dw)**

	<u>Small Coastal</u>	<u>Large Coastal</u>	<u>Pelagic</u>
Comm. quota	No quota	2,570	580
Rec. land.	No est.	490	980
Total land.	2,590	3,060	1,560

PROPOSED AND FINAL COMMERCIAL QUOTAS AND
MSY ESTIMATES

MSY Estimates, CY 1993 Commercial Quotas,
Expected 1992 Total Landings (proposed FMP),
Expected 1993 Total Landings (final FMP),
Recreational Fishery Share
(mt dw)

	<u>Small Coastal</u>		<u>Large Coastal</u>		<u>Pelagic</u>	
	Proposed	Final	Proposed	Final	Proposed	Final
Comm. quota	No quota	No quota	1,043	2,436	1,151	580
Rec. land.	No est.	No est.	324	464	978	980
Total land.	2,590	2,590	1,367	2,900	2,158	1,560
MSY Est.	2,590	2,590	2,226	3,800	2,158	1,560

2. Approach to implementing commercial quota during the first several years

NMFS intends to implement commercial quotas for the large coastal and pelagic groups during the first several years of FMP implementation (1993 and 1994) in a manner somewhat different from that presented in the proposed FMP.

The Southeast Fisheries Center has advised that retention of the proposed fishing year of July 1 through June 30 (with associated fishing year commercial quotas) could (1) encourage rapid expansion of a new shark fishery in the previously unfished area off the northeastern states and, as such, be potentially destructive to already overfished shark resources--a growing new fishery on an overexploited resource in a previously unfished area, and (2) damage the historic fishery off the southern states by allowing the new northern fishery to take an unfair share of the annual quota. Also, the Review Committee's stock rebuilding schedule and NMFS' collection of fishery statistics are both based on a calendar year. Implementing calendar year quotas while retaining a July 1 through June 30 fishing season poses several problems that are difficult to resolve.

NMFS considered how to resolve these problems. As a best compromise solution, NMFS decided to establish calendar year commercial quotas. Each annual quota is divided into two equal halves applying respectively to the two fishing periods of January 1 through June 30 and July 1 through December 31. This approach to applying the commercial quotas should spread the commercial fisheries in both southern and northern areas reasonably equally throughout the year, as well as address the Centers' specific concerns. Also, this approach should not eliminate the historic peak months of the established southern fisheries while ensuring an open season and a new, unfished quota for the peak fishing months of a new, expanding fishery in the northeast. The framework regulatory adjustment mechanism would allow expedited modification of fishing season dates.

Specific commercial quotas for 1993 and 1994 are derived from the Review Committee's rebuilding schedule which provides total annual landings (recreational and commercial combined) for these years. The annual commercial quota is divided into two equal parts assigned respectively to the fishing periods January 1 through June 30 and July 1 through December 31.

Large Coastal Group

The Review Committee's report recommended total landings of 2,900 mt, dressed weight, under the second option for stock conservation. Based on the historical shares of recreational and commercial landings during the period 1986-1991, the commercial quota for the large coastal group is 84 percent of 2,900 mt or

2,436 mt. For the period from January 1, 1993, through June 30, 1993, the commercial quota for the large coastal group is established at 50 percent of this amount or 1,218 mt dressed weight. When this amount is taken or projected to be taken prior to June 30, 1993, the large coastal fishery will be closed until the beginning of the next fishing period opening on July 1, 1993. A possible late spring closure would serve to protect female sharks during the spawning season. As explained above, the quota for the six month period beginning July 1, 1993, and ending December 31, 1993, will be 1,218 mt. The commercial quota for each six month fishing period will be adjusted to reflect any overruns or unused portions of the quota for the preceding six month period, with the limitation that annual landings will not exceed the level allowed. Such adjustments will be implemented through a notice published in the Federal Register.

The Review Committee's recommended total landings for calendar year 1994 are 3,062 mt dressed weight. The commercial quota is 84 percent of this or 2,572 mt dressed weight. Therefore, each of the quotas for the two six month fishing periods in 1994 is 1,286 mt. Again, the second half year quota will be adjusted to reflect any quota overruns or unused portions during the first half of the year.

The above method of establishing fishing season quotas will continue for subsequent years, unless modified by the Assistant Administrator under the framework regulatory adjustment procedure, and will closely follow the Review Committee Report. The Operations Team will review this method and the Committee's recommended rebuilding program and make appropriate recommendations for changes.

Pelagic Group

The same approach used for implementing the large coastal species quota will be used for implementing the quotas for the pelagic species group during 1993 and 1994. The Review Committee Report did not contain any recommendations for this species group since this resource is not considered to be overfished.

The table below illustrates the implementation of 1993 and 1994 quotas.

CALENDAR YEAR 1993 AND 1994 COMMERCIAL QUOTAS
 Six Month Fishing Period Quotas 1/
 Large Coastal and Pelagic Species Groups
 (mt dw)

<u>Calendar Year Fishing Period</u>	<u>Large Coastals</u>	<u>Pelagics</u>
1/1/93--6/30/93	1,218	290
7/1/93--12/31/93	<u>1,218</u>	<u>290</u>
1993 Total	2,436	580
1/1/94--6/30/94	1,285	290
7/1/94--12/31/94	<u>1,285</u>	<u>290</u>
1994 Total	2,570	580

¹ Overruns or unused portions of the quota for any given 6 month fishing period will be compensated for adjustments to the quota for the following 6 month period.

Resources and the Fisheries

Sharks have existed for over 400 million years. They have survived competition and evolved into large and aggressive predators inhabiting all the oceans. They are a diverse group of some 350 species that range in size from the gigantic whale shark at 12 meters to the tiny pygmy shark that is fully grown at only a few centimeters. Sharks generally grow very slowly, take many years to reach maturity, and produce few young (with a high survival rate) after long reproductive cycles. In summary, sharks have a very low reproductive potential when compared to other fish.

Most species of sharks are migratory, and a few species may range widely across the oceans. Their migrations are tuned to temperature and to their reproductive cycles. Adult sharks may congregate in certain areas for mating, and females generally travel to specific nursery areas to give birth to their young. With just one or two exceptions, sharks are predators or top predators armed with extremely acute senses that make them very effective at locating prey. These traits have contributed to the evolutionary success of sharks. The appearance of a formidable new predator, man, confronts sharks with higher mortalities than they may be able to withstand.

Historically, there have been few shark fisheries in North America. While small, localized shark fisheries existed throughout the Southeast for many years, sharks were underutilized until the late 1930s. Starting in 1938, intensive shark fisheries developed in several states, sparked by the high demand for the vitamin A-rich shark livers. These fisheries ceased to operate due to a combination of factors; i.e. synthesis and importation of vitamin A, low demand for other shark products, and overfishing. New shark fisheries developed in the 1980s fueled by a domestic demand for shark meat and a foreign demand for shark fins that led to the controversial practice of "finning." Finning involves removing the valuable fins from sharks and discarding the carcass. Although the extent of finning is unknown, this practice is perceived as wasteful and has brought considerable outcry from the public.

Major FEIS Conclusions

The FEIS concludes that management of sharks is necessary to protect and conserve this resource. The management measures will have no adverse effects on the physical environment, public health, or safety. They will have positive impacts on shark resources in that they will assist with the rebuilding of the overfished large coastal resource and with the prevention of overfishing of the small coastal, and pelagic species exploited by the directed and incidental commercial and recreational

fisheries. The management measures are also designed to obtain necessary data to monitor the condition of, and impose appropriate restrictions on all shark resources after an estimate of MSY is calculated. There will be a minimal negative impact as economic benefits to fishermen and consumers of shark products are reduced as a result of the imposition of the quotas and anti-finning measures. However, this is eventually expected to be offset when MSY is achieved and maximum yields can be sustained indefinitely.

Sharks consume mammals, reptiles (e.g., sea turtles), and fish. Interactions between predator and prey are unavoidable. Sharks are consumed or killed by other sharks, killer whales, dolphins, and some large fish species. These interactions are also considered unavoidable. The fishing gear used to catch sharks, longlines and gillnets, are known to kill protected and endangered species. The extent of such mortality is unknown. The Shark FMP provides a procedure to obtain such information (onboard observers) and provides for fishing gear limitations if deemed necessary. Sharks are killed in the non-directed shrimp trawl, swordfish and tuna fisheries, and also purposely by some recreational and commercial fishermen who feel that "the only good shark is a dead shark." The management measures, together with other regulations, such as the mandatory use of turtle excluder devices (TEDs) (which also exclude sharks) in the shrimp trawl fishery, will reduce overall shark mortality.

Alternatives Considered

Several alternatives to the proposed actions (see Section 9.3.4.3) were considered and were rejected. The no-action alternative would create the conditions for a collapse of shark resources and violate the purpose and intent of the Magnuson Act. It is unknown what ecological results would occur from drastically reducing the numbers of top predators in the oceans. Addressing the finning problem by emergency action was rejected as it was considered a stop-gap measure that would not correct the overfishing or waste problems. Closing fisheries which kill sharks as bycatch was deemed inappropriate because of the value of those fisheries. The value of shark fishery is approximately \$8 million, while the combined value of shrimp, tuna, and swordfish fisheries is about \$470 million. Prohibiting shark gillnets to protect marine mammals and endangered species was rejected because of their relatively small incidental take. Other rejected measures included:

1. Limit harvest to male sharks only.
2. Allocate commercial quotas by geographic region.
3. Close shark nursery areas to fishing.

4. Establish size limits for sharks.
5. Establish a recreational bag limit of one shark per person per trip in the EEZ.
6. Require annual permits for dealers; i.e., persons who purchase shark meat and fins from fishermen who fish in the EEZ.
7. Establish different earned income alternatives for holders of the annual commercial permits. Such measures may be considered in the future if additional information is acquired that dictates a need for such action.

Environmental Impacts

General

The assessment of the environmental impacts of the FMP indicates the following: (1) no adverse environmental effects of the management measures; (2) short-term economic costs to the direct shark fishery in the Atlantic, Gulf of Mexico, and Caribbean Sea; (3) certain adverse effects of the shark fishery on the environment, particularly on marine mammals and protected species (see discussion below). The full discussion of environmental effects of the final and alternative management measures considered is contained in sections 7 and 9 of the FMP and in the full FEIS.

Effects on Endangered Species and Marine Mammals

Approximately 100+ commercial fishing vessels operating in U.S. waters of the Atlantic Ocean, Gulf of Mexico, and Caribbean spend a portion of their time targeting sharks. The 1988 shark longline fishery caught 80 percent of commercial landings, or 4,215 mt. About 15 net gear vessels caught the remaining 1,061 mt. The net gear consisted of drift gillnets, purse seines, and otter trawls. Of this, drift gillnetters targeting schools of blacktip and operating in state and federal waters, landed about 750 mt in Florida in 1988 (Schaefer, 1990). An estimated 50 percent, or 500 mt, of net gear landings occur in federal waters.

Longlines and net gear are known to kill marine mammals and sea turtles (Witzell, 1984). Components of the shark fishery are known to or suspected of interacting with marine mammals. With respect to the drift gillnet fishery that targets schooling blacktip sharks, no data presently exist as to the exact number of marine mammals or listed species are incidentally captured in this fishery.

The bottom longline fishery for snapper-grouper and other reef fish (including sharks) in the South Atlantic and Gulf of Mexico and the pelagic hook-and-line fishery in the Gulf of Maine, southern New England, and the Mid-Atlantic for tuna, shark, swordfish are listed as Category III fisheries (*Federal Register*, Vol. 56, No. 26, February 7, 1991). These fisheries are required to report any lethal takes to NMFS within 10 days of the interaction. Components of the shark fishery listed as Category II are the Florida east coast gillnet fishery and the Atlantic Ocean, Caribbean, and Gulf of Mexico tuna, shark, swordfish longline fishery. They are required to register their vessels in the Marine Mammal Exemption Program and to complete vessel owner logs which document the daily fishing effort as well as any marine mammal interactions. Vessels are required to carry observers in the Category 1 Atlantic Ocean, Caribbean, and Gulf of Mexico swordfish, tuna, and shark drift gillnet fishery, if requested by NMFS. Registration and reporting requirements for Category I vessels are the same as for Category II.

On July 5, 1989, NMFS issued a Biological Opinion (BO) on the implementation of the Marine Mammal Exemption Program (MMEP). The impacts of all U.S. fisheries on threatened and listed species were assessed. The BO concluded that the continued activities of U. S. fisheries would not jeopardize the existence of threatened and endangered species but may adversely affect these species. An Incidental Take Statement (ITS) was given that allowed the take of sea turtles and shortnose sturgeon. The requirements of the ITS included observer coverage and documentation of any takes. NMFS has implemented some of these requirements through the MMEP logbook and observer program.

In September of 1989, an informal Section 7 consultation was conducted by the SEO regarding the management measures proposed by the initial draft of the Shark FMP. The consultation concluded that the proposed measures would not adversely affect threatened or endangered species but that the fisheries being managed might adversely affect listed species. The changes in the Shark FMP since the 1989 draft have increased the regulations to these fisheries. These changes do not change the determinations of the September 1989 consultation.

A Biological Assessment (BA) discussing the effects of the fisheries involved in the Shark FMP was submitted by the SEO on April 2, 1991, with a request for initiation of consultation pursuant to Section 7 of the ESA. The BA concluded that the continued activities of the directed fisheries would not jeopardize the recovery or existence of any endangered or threatened species, or their habitat. The resulting BO considers the effects of the fisheries on the listed species in the area. Listed species under the jurisdiction of the NMFS that occur in the Atlantic Ocean, Gulf of Mexico and the Caribbean and may be affected by the shark fishery include:

WHALES:

- (1) the endangered northern right whale - Eubalaena glacialis
- (2) the endangered humpback whale - Megaptera novaeangliae
- (3) the endangered fin whale - Balaenoptera physalus
- (4) the endangered sei whale - Balaenoptera borealis
- (5) the endangered sperm whale - Physeter macrocephalus

SEA TURTLES:

- (6) the endangered Kemp's ridley turtle - Lepidochelys kempii
- (7) the endangered leatherback turtle - Dermochelys coriacea
- (8) the endangered hawksbill turtle - Eretmochelys imbricata
- (9) the endangered/threatened green turtle - Chelonia mydas
- (10) the threatened loggerhead turtle - Caretta caretta

Green turtles in U.S. waters are listed as threatened except for the Florida breeding population which is listed as endangered.

FISH:

- (11) the endangered shortnose sturgeon - Acipenser brevirostrum

Additional species known to occur in the EEZ of the U.S. in the Atlantic Ocean, Gulf of Mexico and Caribbean Sea:

- (1) the endangered blue whale - Balaenoptera musculus

NMFS has determined that the proposed activities are not likely to affect this species.

Based on data from logbooks and observer reports, NMFS anticipates that the direct and indirect fisheries for sharks may result in the injury or mortality of loggerhead, leatherback, and green turtles. NMFS also believes that Kemp's ridley and hawksbill turtles and shortnose sturgeon may also be injured or killed by these fisheries. Therefore, NMFS has established a low level of incidental take and terms and conditions necessary to minimize and monitor this impact. An incidental take (by injury or mortality) level of ten (10) shortnose sturgeons, two (2) Kemp's ridley, two (2) hawksbill, four (4) green, four (4) leatherback, or ten (10) loggerhead turtle mortalities is set pursuant to Section 7(b)(4) of the ESA. If the incidental take meets or exceeds this level, consultation must be reinitiated and area closures, seasonal closures, or gear restrictions may be necessary.

Reasonable and prudent measures that NMFS believes are necessary to minimize the impacts of the shark fisheries on listed species are listed below as well as the measures to document the incidental take, should such take occur:

1. Regional observer programs will be implemented to document incidental capture, injury, and mortality of listed species. This program should emphasize monitoring of gill

net and longline fisheries that take sharks directly or indirectly.

2. All incidents of take of endangered or threatened species will be reported within 10 days of the take. The report shall include a description of the animal's condition at the time of release.
3. Any sea turtle incidentally taken must be handled with due care to prevent injury to live specimens, observed for activity, and returned to the water as provided in 50 CFR Part 227.72(e)(1)(i).
4. Regulations should be considered to reduce/eliminate mortalities where the take of threatened or endangered species exceeds levels specified in this incidental Take Statement.

On October 13, 1992, (57 FR 46815) NMFS established a temporary observer requirement in the shark gillnet fishery. This rule was in effect from October 7 through November 5, 1992. In July 1992, the shark gillnet fishery came under suspicion of taking sea turtles when over 20 loggerhead turtles stranded on Cumberland Island, Georgia during a 10-day period. Three shark gillnet vessels were reportedly fishing off this island during this period. Under this regulation, NMFS could place observers on these vessels to determine whether these vessels take turtles. The accompanying biological opinion analyzed the impact of this fishery on threatened and endangered sea turtles. That opinion reemphasized the need for an observer program to determine the impact of this fishery on seas turtles and established an incidental take statement that allowed the documented take by injury or mortality of: one Kemp's ridley, or one green, or one hawksbill, or one leatherback turtle, or two loggerhead turtles.

Implementation of the Shark FMP will reduce fishing effort. A reduction in marine mammal and endangered species mortality should occur with a reduction of shark fishing effort. The presence of onboard observers will help quantify the impact of shark fishing on these species.

The Shark FMP recognizes the need to assess possible gear restrictions to reduce bycatch mortality in the future. At present, information on which to base restrictions does not exist. The gear restriction issue will be addressed by the OT after the Shark FMP is implemented.

Areas of Controversy

The principal controversy was over the adequacy of the data upon which the initial draft Shark FMP was developed. Fishermen

questioned stock estimates that indicated a problem existed. Many believed there were more sharks than ever. As a result of these and other concerns, a second draft of the Shark FMP was prepared. It was based on the results of a 1990 shark stock assessment prepared by the Southeast Fisheries Center to confirm or revise the initial (and dated) stock assessments on which the October 20, 1989 draft Shark FMP conclusion of overfishing was based. The new stock assessment confirmed overfishing is occurring and that better fishery and resource information is needed to improve the effectiveness of the management measures.

Issues to be Resolved

It is believed that all significant problems and issues associated with the proposed management action have been identified and assessed, or resolved to the extent practicable.

There is a need for cooperative and coordinated management since sharks migrate between state, federal, and international jurisdictions. For the recreational sector, the different federal and state jurisdictions complicate management of the resource. This need is identified in the final FMP and several states are expected to adopt compatible regulations. For the commercial sector the differences between regulatory jurisdictions is minimal since the permit condition requires the permittee to agree to adhere to the federal regulations regardless where fishing. Finally, coordinated management with foreign nations targeting migrating shark resources is critical and should be pursued through existing cooperative agreements. A shark import problem could develop when the U.S. shark fishery is closed for conservation purposes and foreign interests harvest migrating sharks for importation back to the United States.

Mitigation

No mitigation measures need to be taken at the present time. Alternative management measures were considered and rejected during the development of the Shark FMP including public hearings. The Operation Team (OT) will review potential mitigating measures as new information required by the Shark FMP becomes available.

PURPOSE OF AND NEED FOR ACTION

The Magnuson Fishery Conservation and Management Act of 1976, as amended, requires the preparation and implementation of FMPs for U.S. offshore resources in need of conservation. In recent years, species of sharks have been heavily exploited as a result of increased demand for both their meat and fins. In addition, pelagic sharks are discarded dead or partially used (i.e., "finned") after being caught as bycatch in the swordfish and tuna fisheries. Large numbers of small sharks are also discarded dead in the shrimp trawl fishery. Sharks are often purposely killed and discarded by recreational and commercial fishermen out of ignorance and the widely held belief that "the only good shark is a dead shark." Sharks have a low reproductive capability. When coupled with high fishing mortality levels, they are very susceptible to serious stock depletion. The Shark FMP determined that the large coastal species group is overfished, while the pelagic and small coastal species group are fully utilized. These conditions will eventually cause a collapse of the stocks that could take the fishery decades to recover from.

A management program is necessary to prevent overfishing, to rebuild overfished stocks, and to ensure that sharks are conserved and maintained to provide optimum yields on a continuing basis. A data collection system, and a cooperative approach to management by affected states and foreign nations is essential to provide optimum yields on a continuing basis.

ALTERNATIVES INCLUDING PROPOSED ACTIONS

While a few alternatives do exist and are discussed in this section, the following proposed actions are the preferred agency alternative.

Proposed Actions

The proposed actions will meet the intent of the Magnuson Act by placing the 73 species of sharks which inhabit U.S. waters under federal management. The proposed management measures follow. Pertinent discussion and references to appropriate sections in the Shark FMP are included.

1. Commercial Fishing Year and Quotas

- A. Revised stock assessment and new MSY estimates, optimum yields, commercial quotas, and bag limits.

During the public comment period held on the proposed FMP and on the proposed implementing rule, significant new fishery information was received from fishermen, fish dealers/processors, and several state fishery agencies. This new information included: (1) data showing fishery removals in recent years higher than those used as a basis for determining MSY and stock conditions in the May 1990 stock assessment; (2) records on the size frequency of shark species caught in commercial fisheries; and (3) information on the commercial fishing fleet. NMFS reviewed this new information and determined that incorporation of these new data in the stock assessment could result in conclusions about the abundance, productivity, and condition of the managed shark species significantly different from those listed in the proposed FMP (dated October 28, 1991).

To ensure that all FMP management measures are based upon the best scientific information available, a revised assessment of the condition of the large coastal species group was completed by the NMFS Southeast Fisheries Science Center. The revised assessment was reviewed by a scientific peer committee consisting of both outside scientific experts and NMFS scientists. The Review Committee issued its final report on November 23, 1992 (Report of the Atlantic Coastal Shark Fishery Analysis Review, November 23, 1992).

The Review Committee reported evidence of overfishing for the large coastal group during 1986 through 1992 (except for 1987 and 1990). The Review Committee recommended that the calendar year 1993 landings for the large coastals be reduced below the calendar year 1991 landings level of 4,319 mt dressed weight. The Committee Report establishes three options for the calendar

year 1993 landings limit (recreational and commercial combined) for the large coastal group. Each option provides a specific degree of conservation and economic benefits.

Under the Committee's first option for the 1993 calendar year total landings (3,520 mt dressed weight), the large coastal stock would not rebuild to the MSY level (14,900 mt). To ensure that the large coastal group is rebuilt to the MSY level, NMFS has selected the Committee's recommended second option (Option 2--see Table 4 of the Committee Report) establishing 1993 total landings of 2,900 mt dressed weight (a 34 percent reduction from the 1991 landings; a 29 percent reduction from the 1986-91 annual average landings). Under this option, NMFS determined that stock abundance will rebuild 5 percent each year back to the MSY level (estimated by NMFS to be 14,900 mt dressed weight) by 1995. The Review Committee's rebuilding schedule shows that annual fishery yields would increase about 5 percent each year but would not equal MSY until 1999. Option 3 of the Committee Report requires a 1993 landings limit of 2,311 mt (a 50 percent reduction from the 1991 level; a 44 percent reduction from the 1986-91 annual average). This option achieves a 10 percent annual increase in stock abundance until the MSY level is reached. NMFS determined that this option would cause unacceptable short-term costs in lost fishery revenues, and is not necessary to achieve stock rebuilding in a reasonable time period. While NMFS adopted option 2 for stock rebuilding and will implement the recommended calendar year total landings (and derived calendar year commercial quotas) from 1993 to 1995, NMFS believes that the large coastal species group will be rebuilt by 1995 (contrasted with the rebuilding schedule contained in the Committee Report) and at that point the stock size should be sufficient to provide MSY. Based on Center information, NMFS believed that a modification of the Committee's rebuilding schedule was justified. NMFS noted that under the Committee's schedule, the large coastal species group would not yield MSY until 1999.

The 1993 and 1994 calendar year commercial quotas for the large coastal group is determined based on the historical commercial average annual share (percentage of average total annual landings) for the period 1986 through 1991; this average annual share is 84 percent. The same approach was used in the proposed FMP to determine commercial and recreational fishery shares. The recreational share of the total 1993 landings is also based on the historical average annual percentage share from 1986 through 1991; this value is 16 percent. The recreational fishery limits (trip limit for large coastals and pelagics and bag limit for small coastals) have been changed to ensure that 1993 commercial and recreational landings are reduced by approximately the same percentage (29 percent) below their respective recent annual averages.

The commercial quota for the pelagic group is changed from the quota in the proposed FMP based on revised landings statistics and on several years' additional data; the 1993 calendar year commercial fishery quota is now established at 580 mt dressed weight. Combining this commercial quota with the estimated recreational fishery share (under the bag limits) of 980 mt dressed weight, the total 1993 landings for the pelagic group are established at 1,560 mt dressed weight.

As in the proposed FMP, no quotas are established for the small coastal species group. The MSY remains unchanged because NMFS had no new information upon which to base the MSY estimate.

MSY estimates for the three species groups have been reevaluated. Based on the Committee Report, NMFS estimates that the MSY for the large coastal species group is 3,800 mt dressed weight. (The MSY stock biomass level is estimated to be about 14,900 mt dressed weight). Due to revised landing statistics, the MSY for the pelagic species group is changed from 2,800 mt whole weight (corrected to 3,000 mt whole weight or 2,158 mt dressed weight) in the proposed FMP to 1,560 mt dressed weight in the final FMP. This change was necessary since the pelagic species MSY is determined based on the average annual landings (recreational and commercial combined) during the period January 1, 1986, to January 1, 1992. These landings have been revised. Significant landings of large coastal species were incorrectly included in the pelagic species group in the proposed FMP. Refer to the tables below that illustrate changed values from the proposed FMP and that summarize commercial quotas for calendar years 1993 and 1994.

**LARGE COASTAL SPECIES GROUP REBUILDING SCHEDULE
ANNUAL STOCK YIELD AND STOCK BIOMASS SIZE
(mt dw)**

<u>Year</u>	<u>Stock Biomass</u>	<u>Yield</u>
1993	13,824	2,900
1994	14,515	3,060
1995	15,241	3,800 ¹

Footnotes:

- 1 Annual stock yield should reach the MSY level (estimated at 3,800 mt dw by the Southeast Fisheries Science Center (SEC)) by 1995 based upon an expected rebuilding of the stock biomass to 14,900 mtdw (stock size estimated by SEC to produce MSY).

**CY 1994 COMMERCIAL QUOTAS, RECREATIONAL FISHERY SHARE
(mt dw)**

	<u>Small Coastal</u>	<u>Large Coastal</u>	<u>Pelagic</u>
Comm. quota	No quota	2,570	580
Rec. land.	No est.	490	980
Total land.	2,590	3,060	1,560

PROPOSED AND FINAL COMMERCIAL QUOTAS AND
MSY ESTIMATES

MSY Estimates, CY 1993 Commercial Quotas,
Expected 1992 Total Landings (proposed FMP),
Expected 1993 Total Landings (final FMP),
Recreational Fishery Share (mt dw)

	<u>Small Coastal</u>		<u>Large Coastal</u>		<u>Pelagic</u>	
	Proposed	Final	Proposed	Final	Proposed	Final
Comm. quota	No quota	No quota	1,043	2,436	1,151	580
Rec. land.	No est.	No est.	324	464	978	980
Total land.	2,590	2,590	1,367	2,900	2,158	1,560
MSY Est.	2,590	2,590	2,226	3,800	2,158	1,560

B. Approach to implementing commercial quota during the first several years

NMFS intends to implement commercial quotas for the large coastal and pelagic groups during the first several years of FMP implementation (1993 and 1994) in a manner somewhat different from that presented in the proposed FMP.

The Southeast Fisheries Center has advised us that retention of the proposed fishing year of July 1 through June 30 (with associated fishing year commercial quotas) could: (1) encourage rapid expansion of a new shark fishery in the previously unfished area off the northeastern states and, as such, be potentially destructive to already overfished shark resources--a growing new fishery on an overexploited resource in a previously unfished area, and (2) damage the historic fishery off the southern states by allowing the new northern fishery to take an unfair share of the annual quota. Also, the Review Committee's stock rebuilding schedule and NMFS' collection of fishery statistics are both based on a calendar year. Implementing calendar year quotas while retaining a July 1 through June 30 fishing season poses several problems that are difficult to resolve.

NMFS considered how to resolve these problems. As a best compromise solution, NMFS decided to establish calendar year commercial quotas. Each annual quota is divided into two equal halves applying respectively to the two fishing periods of January 1 through June 30 and July 1 through December 31. This approach to applying the commercial quotas should spread the commercial fisheries in both southern and northern areas reasonably equally throughout the year, as well as address the Center's specific concerns. Also, this approach should not eliminate the historic peak months of the established southern fisheries while ensuring an open season and a new, unfished quota for the peak fishing months of a new, expanding fishery in the northeast. The framework regulatory adjustment mechanism would allow expedited modification of fishing season dates.

Specific commercial quotas for 1993 and 1994 are derived from the Review Committee's rebuilding schedule which provides total annual landings (recreational and commercial combined) for these years. The annual commercial quota is divided into two equal parts assigned respectively to the fishing periods January 1 through June 30 and July 1 through December 31.

Large Coastal Group

The Review Committee's report recommended total landings of 2,900 mt dressed weight, under the second option for stock conservation. Based on the historical shares of recreational and

commercial landings during the period 1986-1991, the commercial quota for the large coastal group is 84 percent of 2,900 mt or 2,436 mt. For the period from January 1, 1993, through June 30, 1993, the commercial quota for the large coastal group is established at 50 percent of this amount or 1,218 mt dressed weight. When this amount is taken or projected to be taken prior to June 30, 1993, the large coastal fishery will be closed until the beginning of the next fishing period opening on July 1, 1993. A possible late spring closure would serve to protect female sharks during the spawning season. As explained above, the quota for the six month period beginning July 1, 1993, and ending December 31, 1993, will be 1,218 mt. The commercial quota for each six month fishing period will be adjusted to reflect any overruns or unused portions of the quota for the preceding six month period, with the limitation that annual catches do not constitute overfishing. Such adjustments will be implemented through a notice published in the Federal Register.

The Review Committee's recommended total landings for calendar year 1994 are 3,062 mt dressed weight. The commercial quota is 84 percent of this or 2,572 mt dressed weight. Therefore, each of the quotas for the two six month fishing periods in 1994 is 1,286 mt. Again, the second half year quota will be adjusted to reflect any quota overruns or unused portions during the first half of the year.

The above method of establishing fishing season quotas will continue for subsequent years, unless modified by the Assistant Administrator under the framework regulatory adjustment procedure, and will closely follow the Review Committee Report. The Operations Team will review this method and the Committee's recommended rebuilding program and make appropriate recommendations for changes.

Pelagic Group

The same approach used for implementing the large coastal species quota will be used for implementing the quotas for the pelagic species group during 1993 and 1994. The Review Committee Report did not contain any recommendations for this species group since this resource is not considered to be overfished.

The table below illustrates the implementation of 1993 and 1994 quotas.

CALENDAR YEAR 1993 AND 1994 COMMERCIAL QUOTAS
 Six Month Fishing Period Quotas 1/
 Large Coastal and Pelagic Species Groups
 (mt dw)

<u>Calendar Year Fishing Period</u>	<u>Large Coastals</u>	<u>Pelagics</u>
1/1/93--6/30/93	1,218	290
7/1/93--12/31/93	<u>1,218</u>	<u>290</u>
1993 Total	2,436	580
1/1/94--6/30/94	1,285	290
7/1/94--12/31/94	<u>1,285</u>	<u>290</u>
1994 Total	2,570	580

¹ Overruns or unused portions of the quota for any given 6 month fishing period will be compensated for adjustments to the quota for the following 6 month period.

2. No Sale Provision

The prohibition on the sale of shark or shark products by recreational fishermen will have a minor impact. It is estimated that 10 percent of the recreational-caught sharks are sold. If fishermen have sold their catch in the past, and can meet the income requirement for a federal permit, they may continue to sell sharks but, in fact are commercial fishermen. The prohibition on recreational sales is consistent with the growing philosophy in the recreational fishing community that sport anglers should not sell their catch, and that a clear separation between commercial and recreational user groups will minimize conflicts between those who fish for a living and those who fish for fun.

3. Finning

Finning, i.e., removing the valuable fins and discarding the carcass, will be prohibited. Fins may be sold, traded, or bartered at the first point of landing, but only in proper proportion to carcasses sold, traded, or bartered, with the ratio of fins per dressed carcass weight not exceeding 5 percent. Fins may not be stored aboard the vessel after associated carcasses are sold, traded, or bartered. These measures will stop the practice of finning even though some discarding may still occur, particularly on those vessels that catch sharks as bycatch.

Six alternative ways of controlling finning were considered and rejected. First, all fins must be attached to the carcass at the time of landing, except for the caudal fin that could be removed to bleed the carcass and help ensure product quality. Second, fishermen could land up to four fins per carcass landed. Third, fishermen could land up to five fins per carcass landed. Fourth, all sharks must be landed with the fins attached to the carcasses. Fifth, fishermen could land shark parts up to a 6 percent ratio of wet fins per dressed carcass weight. Sixth, fishermen could land shark parts up to a 10 percent ratio of wet fins per dressed carcass weight. Fishermen favored the adopted measure.

4. Release Condition

Sharks not retained as part of a commercial fishery or for domestic consumption, must be released uninjured by cutting the line near the hook, with the shark in the water, or for net-caught sharks, by returning the shark to the water quickly in a manner that minimizes injury. This provision was recommended during public comment on the initial draft of the Shark FMP as a means of reducing shark mortality. It is estimated that mortality may be reduced by as much as 50 percent with this measure.

5. Charter Vessel/Headboat Sale of Catch

Charter vessel and headboat operators, who qualify for the commercial shark fishing permit and wish to sell sharks, may continue that practice as long as the commercial fishing season is open. This measure essentially continues a practice that is common in the northern Atlantic region.

6. Federal Commercial Fishing Permits and Reporting

Vessel owners or operators must purchase a federal permit to fish for sharks in federal waters. There are several conditions to the permit. At least 50 percent of the applicants' earned income must have been derived from the sale of fish or fish products or from charter vessel or headboat operations, or \$20,000 from the sale of fish or seafood products during any of one of three years preceding the permit application. All applicants must agree to stop fishing in all waters (EEZ, international, and state waters) when the fishery is closed; and they must report on their fishing operations to NMFS. The purpose of these conditions is to discourage new entries into the directed fishery, prevent overfishing, and improve management in all U.S. waters.

A 10-percent earned income requirement was considered and rejected because of public opposition during the public hearing process. The eligibility period was changed from one to three years before the date of application to provide greater flexibility in dealing with hardship cases such as loss of a vessel due to storms. This approach is also a move towards standardizing the earned income requirements throughout all of the fisheries with a federal permit managed under the NMFS Southeast Regional Office.

Trip reporting and logbook keeping by commercial fishermen is essential to obtain biological and economic information necessary to manage shark resources. An owner or operator of a vessel, which a permit has been issued, under must submit copies of logbook reports and sales receipts (trip tickets) that record the weights of fish sold from any trip from which a shark is off-loaded. Initially, all permit holders will be selected, however, information may become available that would enable random sampling of the universe. Such logbook reports and sales receipts must be submitted as follows.

(a) The owner or operator of a vessel that has been selected by the Science and Research Director, Southeast Fisheries Science Center to maintain and submit the logbook forms must submit the copies of the sales receipts attached to such logbook forms.

(b) The owner or operator of a vessel that has not been selected to submit the logbook forms but has been selected to maintain and submit logbook forms to the Science and Research

Director, Southeast Fisheries Science Center in a fishery other than shark must attach the copies of the sales receipts to the logbook forms for that other fishery and submit them in the time frame required for those logbook forms.

(c) The owner or operator of a vessel that has not been selected to submit logbook forms to the Science and Research Director in any fishery must submit the copies to the Science and Research Director, Southeast Fisheries Science Center postmarked not later than the third day after sale of the fish off-loaded from a trip.

Additional data (Trip Interview Program) will be collected by authorized statistical reporting agents, as designees of the Science and Research Director, Southeast Fisheries Science Center, and by authorized officers. An owner or operator of a fishing vessel and a dealer are required to make sharks available for inspection by the Science and Research Director or an authorized officer and to provide data on catch and effort, as requested. There are no acceptable alternatives to this requirement.

The permit fee is necessary to cover the administrative expense of issuing the permit. Fees for federal permits are becoming standard practice for NMFS and expected by the fishing community. The \$53 fee is not expected to discourage entry into the fishery.

8. Tournament Reporting

A person conducting a shark tournament who is selected by the Science and Research Director must maintain and submit a record of catch and effort on forms available from the Science and Research Director, Southeast Fisheries Science Center. Completed forms must be submitted to the Science and Research Director postmarked not later than 7 days after the conclusion of the tournament and must be accompanied by a copy of the tournament rules. This information is necessary for shark management.

9. Observers

Vessel owner/operators selected by NMFS must accommodate a NMFS observer aboard their vessel. The observers will monitor and document interaction of shark fishing with listed and protected species, and problems associated with bycatch. Such information is necessary to meet the intent of the Marine Mammal Protection Act and Endangered Species Act, and to obtain better data on the extent of bycatch discards for shark management.

10. Framework Procedure and Operational Team

The Assistant Administrator for Fisheries, NOAA (Assistant Administrator) will be responsible for monitoring the Shark FMP.

An OT appointed by the Assistant Administrator and headed by his designee, will recommend adjustments to the management measures through the framework regulatory adjustment procedure. The OT will include representatives from the NMFS Northeast and Southeast Regional Offices, and the Washington Office, a member and/or a staff person from each of the five Councils, and a scientist from NMFS Southeast and Northeast Fisheries Science Centers. During the adjustment process, the OT will interact with the public, fishermen, and other interested entities.

Rejected Actions

1. No-Action Alternative

The option of taking no conservation and management action was considered and rejected. To take no action would violate the purpose and intent of the Magnuson Act. The most recent stock assessment indicated that the large coastal species group is overfished, while the pelagic and small coastal species groups are fully utilized.

Before the development of the stock assessments, the five Regional Fishery Management Councils responsible for developing FMPs in the Atlantic Ocean recognized the potential danger of overfishing sharks and requested the Secretary (through NMFS) to develop a Shark FMP as soon as possible. Without management, there is a distinct potential for long-term damage, or worse, collapse of the shark stock complex or targeted species. The rapid increase in commercial shark landings in U.S. waters; the rising price of fins, and unknown extent and perceived waste from finning; and the unique biology of sharks, characterized by a low number of births, long reproductive cycles and slow sexual maturation, dictate a critical need for management.

2. Address the Finning Problem Under Emergency Action

The practice of finning was, in part, a driving force for bringing sharks under management. A considerable and vocal U.S. public sector is strongly against this practice and is calling for action to prohibit it. The Secretary has the authority to take emergency action under the Magnuson Act; however, the law limits such action to 90 days, with a possible extension of another 90 days. The emergency action alternative was rejected because the finning issue is just one of the problems facing the fishery, and a 180-day period of protection was perceived as merely a stop-gap measure. Long-term resolution of this problem is required.

3. Closing Fisheries That Kill Sharks as Bycatch

Pelagic sharks are taken on longlines as bycatch in the swordfish and tuna fisheries. When sharks come up dead or alive on the

longline, it is presumed that fins of valuable species are retained for sale and that carcasses are discarded at sea. It is unknown how many sharks are released alive and how many are finned. Generally, vessel hold space is reserved for valuable, targeted species. Consideration was given to evaluating the feasibility of closing the swordfish and/or tuna fishery to protect sharks, but was rejected because of the importance of these fisheries and the fact that some management measures will reduce shark discards; i.e., the quota on pelagic species, the prohibition of finning, and the "must release" provision. The level of mortality reduction will not be known until the proposed reporting system is operational and possibly not until onboard observers are used to document fishery activities.

The shrimp trawl fishery results in shark discards estimated at 2,800 mt yearly, consisting mostly of sharpnose sharks in the Gulf of Mexico. Closing or restricting the shrimp fishery was considered but rejected because of the importance of that fishery. Further, the mandatory use of TEDs is expected to largely reduce shark mortality. Also, it is anticipated that, beginning in 1994, fish excluder devices may be required as a management measure to protect red snapper stocks. Such action, if adopted, would further reduce shark mortality.

Closing the shrimp, swordfish, or tuna fisheries, which kill sharks incidentally, would result in major negative impacts. The 1989 landings value of Gulf of Mexico and Atlantic shrimp is estimated at \$435 million, swordfish at \$32 million, and tuna at \$52 million. The value of shark landings is approximately \$8 million. The management measures are expected to reduce shark bycatch mortality.

4. Federal Dealer Permits and Reporting

Federal dealer permits and reporting were considered but rejected in favor of less burdensome requirements. First, commercial shark fishermen must attach a copy of their sales receipt or weigh-out slip to the real-time logbook report containing landings data. This data will: (1) better enable the Southeast Fisheries Science Center to monitor the quota and to calculate when fishery closures occur; and (2) allow scientists to match fishing effort information with specific size and species composition data that are critical to estimating stock abundance. Second, this improved data collection procedure reduced the proposed reporting burden on the dealers by eliminating the needs for mandatory reporting burden on the dealers by eliminating the needs for mandatory reporting and federal permits that were proposed under the draft Shark FMP. The present voluntary dealer reporting system is not affected by these changes.

5. Prohibiting Shark Gillnets to Protect Marine Mammals and Species Listed as Threatened or Endangered

Approximately 15 of the 100+ vessels that seasonally target sharks use drift gillnets near shore, primarily on blacktip sharks, in the late summer and early autumn. Some of these boats are less than 30 feet in length. The degree of turtle or dolphin loss is unknown. Florida, whose waters yield the majority of blacktip landings, has passed emergency legislation to reduce the number of listed species taken by limiting the lengths and numbers of gillnets that can be used in commercial fishing operations on the east coast of Florida, and requires that the nets be tended. Florida also recently adopted a 6-in maximum-mesh size limit on gillnets. It is expected that losses of listed species will be reduced. Consideration was given to imposing a prohibition on the use of gillnets in federal waters but was rejected because of inadequate information on their impact on listed species. A provision in the Shark FMP is for the OT to assess gear restrictions, including the use of observers to verify impacts of gillnet gear. Gillnets are an efficient gear for harvesting schooling blacktip sharks and insufficient evidence presently exists to warrant prohibiting their use.

The impact of eliminating approximately 15 gillnet vessels from the shark fishery would be significant. Almost 20 percent of the total catch is landed with gillnets (less than 10 percent in federal waters). It is unknown to what extent marine mammals and species listed as threatened or endangered are killed in the gillnet fishery. Also, it is unclear to what extent displaced gillnetters would convert to longline gear or redirect efforts to other fisheries. The measure requiring onboard observers on selected vessels will enable NMFS to assess the impacts of gillnets on listed species. As noted in the Shark FMP, gillnets are suspected of interacting with marine mammals. The Marine Mammal Protection Act lists the Florida east coast gillnet fishery as Category II. Accordingly, vessels must be registered in the Marine Mammal Exemption Program and complete marine mammal logs which document the vessel's daily fishing effort as well as any marine mammal interactions.

On September 7, 1989, a Section 7 consultation of the ESA was conducted on the potential impacts of the management action proposed in the initial draft Shark FMP. It concluded that the proposed management measures would not jeopardize the continued existence of threatened or endangered species, but that the fishery itself may adversely affect listed species.

On April 2, 1991, an Endangered Species Act Section 7 consultation concluded that neither the fishery nor this action are likely to jeopardize the continued existence of endangered or

threatened species such as sea turtles in the Atlantic Ocean but the shark fisheries may adversely affect listed species.

On October 13, 1992, (57 FR 46815) NMFS established a temporary observer requirement in the shark gillnet fishery. This rule was in effect from October 7 through November 5, 1992. In July 1992, the shark gillnet fishery came under suspicion of taking sea turtles when over 20 loggerhead turtles stranded on Cumberland Island, Georgia, during a 10-day period. Three shark gillnet vessels were reportedly fishing off this island during this period. Under this regulation, NMFS could place observers on these vessels to determine whether these vessels take turtles. The accompanying biological opinion analyzed the impact of this fishery on threatened and endangered sea turtles. That opinion reemphasized the need for an observers program to determine the impact of this fishery on sea turtles and established an incidental take statement that allowed the documented take of by injury or mortality of: one Kemp's ridley, or one green, or one hawksbill, or one leatherback turtle, or two loggerhead turtles.

Implementation of the Shark FMP will reduce fishing effort. A reduction in marine mammal and endangered species mortality should occur with a reduction of shark fishing effort. The presence of onboard observers will help quantify the impact of shark fishing on these species.

AFFECTED ENVIRONMENT

Sharks are found in all oceans of the world. Of the approximately 350 species found worldwide, about 73 species inhabit the waters along the east coast of the United States, including the Gulf of Mexico and the waters around Puerto Rico and the Virgin Islands. Of the 73 species, 39 are included in the Shark FMP management unit. Others may be added if management becomes necessary. Virtually all shark species are migratory. Some move between shallow and deep water, while others move extensively along the coasts. Still others are highly migratory, crossing the entire Atlantic Ocean. The Shark FMP encompasses all U.S. waters, including state jurisdictions (from shore outward to three nautical miles [most states] or out to nine nautical miles [Texas, west coast of Florida, and Puerto Rico]; and the U.S.EEZ (from where state jurisdiction ends [the inner boundary of the EEZ] to 200 nautical miles offshore). However, the Shark FMP does not preempt state authority or impose management measures in state waters, even though 14 percent of the commercial landings and 64 percent of the recreational landings occur there. Rather, it is expected that state and international shark management will result through cooperative arrangements with NMFS.

Sharks are apex predators known to prey on fish, mammals, and reptiles (exceptions are the whale sharks, basking sharks, and megamouth sharks, which are filter feeders). The extent of predation is unknown. Sharks usually select weak, sick, injured, or dying prey because such prey is easier to overcome than healthy individuals. Despite being aggressive predators, sharks are preyed upon as well. Sharks prey on other sharks, and other species such as killer whales, dolphins, wreckfish, and grouper are known to kill or prey on sharks. The extent of such predation is unknown. The ecological relationships of sharks are also unknown. The effects of sharks on other fish stocks are poorly understood, although some studies suggest that the removal of large sharks from an area results in proliferation of smaller species of sharks.

Shark fishermen, shark fin dealers, and persons consuming shark products will be affected by the proposed actions. Peripheral users such as medical researchers studying immunity of sharks to cancer, shark-skin dealers, and pharmaceutical interests that use shark parts will be affected by management. Oceanic and coastal habitat is not expected to be significantly impacted by shark fishing activities. The shark fishery is relatively small and the gear used generally does not measurably affect ecologically sensitive habitats.

Humans in marine waters undoubtedly think about the possibility of a shark attack. Unrealistic fears are heightened by "extreme"

movies. In the U.S., the number of shark attacks remains constant (about 20-25 a year, with an annual average of less than one death per year) despite increased human-in-the-water hours.

Marine mammals and endangered species, primarily dolphins and sea turtles, are known to be killed by longlines and gillnets. The extent of the mortality is unknown. The requirement for observers aboard selected vessels participating in the shark fishery will help quantify these unknowns.

ENVIRONMENTAL CONSEQUENCES

Physical Environment

There will be no adverse effects on the physical environment.

Public Health and Safety

There will be no effect on public health and safety resulting from the proposed management measures. The proposed management regime will not force any operator or owner of a vessel to fish in unsafe conditions. No significant increase is expected in the number of shark "attacks" (human-shark interactions) as these events are mainly dependent on human behavior rather than shark abundance.

Shark Fishery Resource

The proposed actions will place shark resources under management. Finning will be controlled and the fishery will eventually be maintained at maximum sustainable yield levels. Other proposed actions provide for the acquisition of critical data and information to improve future shark management. A framework adjustment procedure is incorporated in the Shark FMP to allow changes to be made in the management measures as new and better information is acquired. It is important to note that the cooperation of state governments is essential if sharks are to be successfully managed throughout their range. Further, coordinated international management of sharks needs to be pursued since many species migrate across international boundaries and are consequently subject to international jurisdiction.

Social and Economic Impacts

The proposed actions, primarily the commercial quotas, anti-finning measures, will effect the commercial fishermen and the consumer. The quotas will limit the amount of sharks that fishermen may land. The anti-finning measures may cause some fishermen to reduce the length of their trips due to the need to land the previously discarded carcasses. Based on information from the data collection program, NMFS will review situation and make adjustments through the regulatory framework adjustment procedure.

Recreational catch has declined in recent years. The proposed measures, primarily the bag limits, no-sale, and live-release measures, are not expected to significantly affect recreational landings. These measures should promote a conservation ethic among anglers and thus provide benefit to the nation. Shark tournaments have declined in number as abundance of large coastal

species has diminished. Effective management should reverse this situation.

Sharks benefit the human environment in many, little-known ways. Shark tissues and cartilage are studied because of their immunity to cancer, and a variety of shark products, including pharmaceutical drugs, vitamins, hides, and curios are produced from sharks, in addition to meat and fins. A collapse of the shark fishery will result in a reduction or loss of these benefits to society.

Impact of Shark FMP on Other Fisheries

The proposed actions are not expected to: (1) have an impact on other commercial or recreational fisheries; or (2) divert fishermen to other fisheries.

Impact of Sharks and Shark Fishing on Protected Species

Sharks are apex predators that consume dolphins, whales, seals, and sea turtles to an unknown extent. It is assumed that sharks prey on weak and impaired creatures, similar to other predators. If the level of protected species mortality is related to shark population size, then as shark stocks become more abundant as a result of the management measures, increased predation on prey species may occur. Given the congressional mandate to prevent overfishing (which the Shark FMP does), there will be a continuous, unavoidable interaction between prey and predator species.

Components of the shark fishery are known to or suspected of interacting with marine mammals and endangered species. The management measures and the fishery itself are not expected to jeopardize the recovery or continued existence of threatened or endangered species. The extent of mortality is not well documented. The Shark FMP requires that onboard observers be accommodated on shark fishing vessels when requested by NMFS. The results of observer studies may dictate the need to modify or prohibit some gear types. An amendment to the Shark FMP is necessary to restrict gear used in the fishery. Other options acknowledged in the Shark FMP as ways to promote conservation are closures of fishing areas or closed seasons.

Impact of Sharks on Other Species

Sharks consume other fish as well as being the primary predator on other sharks. The effects of sharks on other fish are not known although some studies suggest that the removal of large sharks from an area results in a proliferation of small shark species.

Impact of Other Species on Sharks

The effect on sharks of other predators such as killer whales and dolphins is unknown. Large grouper and wreckfish are known to prey on smaller sharks. The extent of such predation and interactions is unknown.

Impact of Non-directed Fisheries on Sharks

The shrimp trawl fishery kills large quantities of sharks, principally small sharpnose sharks in the Gulf of Mexico. TEDs presently being used and fish excluder devices anticipated to be used in the future will significantly reduce shark mortality. The swordfish and tuna fisheries take extensive shark bycatch. Thus, mortality is unavoidable. Proposed management measures, specifically the finning prohibition, must-release provision, and quotas, will minimize waste of shark resources.

Alternative Actions

The Shark FMP considered restrictions on finning (Section 7.1.2.1), shark release conditions (Section 7.1.2.2), mako minimum size limit (Section 7.1.2.3), no-sale of recreational catch (Section 7.1.2.4), boat and headboat sale of catch (Section 7.1.2.5), commercial permits (Section 7.1.3.1), commercial vessel owner and operation reporting requirements (Section 7.1.3.2) and tournament reporting requirements (Section 7.1.3.3). The Shark FMP also considered and rejected alternatives such as: no-action alternative (Section 7.3.1), addressing the finning problem under emergency action (Section 7.3.2), harvesting male sharks only (Section 7.3.3), allocation of commercial quotas (Section 7.3.4), closure of the commercial fishery for large coastal sharks upon plan implementation until the start of the new fishing year (Section 7.3.5), closing the directed commercial fisheries for sharks (Section 7.3.6), closing nursery areas to fishing (Section 7.3.7), alternative recreational bag limits (Section 7.3.8), alternative ways to control finning (Section 7.3.9), closure of recreational fisheries (Section 7.3.10), size limits for sharks other than makos (Section 7.3.11), closing fisheries that kill sharks as bycatch (Section 7.3.12), prohibiting shark gillnets to protect marine mammals and listed species (Section 7.3.13), and dealer permits (Section 7.3.14), and mandatory dealer reporting (Section 7.3.15).

Mitigation Measures Related to the Proposed Actions

No mitigation measures related to the proposed actions are recommended at this time but may become necessary as additional data are acquired.

Unavoidable Adverse Impacts

There will be some short-term adverse impacts to resource-user groups. However, these impacts are unavoidable and necessary to prevent overfishing and shark fishery collapse. An unknown number of protected species, principally dolphins and turtles, will be killed by shark fishing gear. This loss is unavoidable, but possibly correctable, as better information is acquired through onboard observers and possible future gear restrictions. Shark mortality in the shrimp, swordfish, and tuna fisheries is unavoidable, but is expected to be reduced.

Irreversible and Irrecoverable Commitment of Resources

There will be no irreversible and irretrievable commitment of financial and personnel resources.

LIST OF PREPARERS

The Shark FMP, referenced in the Final Environmental Impact Statement, was prepared by a task team of individuals from the National Marine Fisheries Service.

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The Task Team received assistance and guidance from many people within NMFS and outside the agency. Among these were statisticians, managers and scientists from NMFS' offices; NOAA's General Counsel; and concerned citizens, fishermen and industry officials. In addition, the five Councils, operating through a Shark Advisory Committee, provided the Task Team with guidance and support.

**LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM
COPIES OF THE STATEMENT ARE SENT**

U.S. Army Corps of Engineers
U.S. Department of Agriculture
U.S. Department of Commerce
 Office of Ocean and Coastal Resource Management
U.S. Department of Energy
U.S. Department of the Interior
 Mineral Management Service
U.S. Department of State
U.S. Department of Transportation
U.S. Coast Guard
U.S. Environmental Protection Agency
U.S. Food and Drug Administration
U.S. Small Business Administration
Regional Fishery Management Councils
State of New Hampshire
State of Massachusetts
State of Connecticut
State of New Jersey
State of New York
State of Maine
State of Rhode Island
State of Pennsylvania
State of Delaware
State of Maryland
State of Virginia
State of North Carolina
State of South Carolina
State of Georgia
State of Florida
State of Alabama
State of Mississippi
State of Louisiana
State of Texas
Commonwealth of Puerto Rico
U.S. Virgin Islands
State of California
State of Oregon

New England Hand-Gear Alliance
American Society for the Prevention of Cruelty to Animals
Blue Water Fishermen's Association
Florida Conservation Association
Delaware Captains Association
Pensinular Saltwaters Sport Association
Massachusetts South Shore Gillnetters Association
Montauk Boatmen & Captains Association
Jersey Anglers Association
International Game & Fish Association

Marine Gillnetters Association
Blue Water Fishermen's Association
Southern Offshore Fisherman's Association
New Jersey Commercial Fishermen's Association
Cape Ann Gillnetters Association
Louisiana Gulf Coast Conservation Association
Bluewater Fisherman's Association
National Aquarium in Baltimore
Auburn Marine Extension & Research Center
Babylon Tuna Club
Berkeley Striper Club
Stuart Sailfish Club
Saco Bay Tackle Co.
Harbor Fish and Oyster Co.
Clifford Marine Co.
Union Fish Company
Walt Disney World Company
R.J. Peacock Canning Company
National Coalition for Marine Conservation
Center for Marine Conservation
Yankee Fishermen's Cooperative
Portsmouth Fishermen's Cooperative
Miridon Corporation
Zapata Haynie Corporation
Fish & Wildlife Information & Exchange
National Wildlife Federation
New York Sport Fishing Federation
Atlantic Flying Fish
Inlet Fisheries
Gulf City Fisheries
Star Fisheries
Atlantic Cape Fisheries
Organized Fishermen of Florida
World Wildlife Fund
GEOCEAN
New York Sea Grant
Aquatic Resources Conservation Group
Bellmore Rod & Gun Club, Inc.
Cox Wholesale Seafood, Inc.
Tri-Coastal Cooperative, Inc.
Atlantic Flying Fish, Inc.
Shinnecock Marlin & Tuna Club, Inc.
Gulf Star Seafood, Inc.
Jersey Coast Shark Anglers, Inc.
Downeast Marine Seafood, Inc.
FS Fisheries, Inc.
Rabait Community Fisheries, Inc.
Shinnecock Marlin & Tuna Club, Inc.
Cormorant Sport Fishing, Inc.
McAnliffe Fishing Inc.
Sundancer Fisheries, Inc.
Pocahontas, Inc.

Ardea Enterprises, Inc.
Portland Fish Exchange, Inc.
Trans Ocean Inc.
My Lady, Inc.
Southeast Seafood Inc.
D.A.C. Sportfishing, Inc.
A&C Southeast Seafood, Inc.
Sportfishing Institute
Florida Marine Research Institute
National Cancer Institute
World Watch Institute
Seabrook Marine Laboratory
Moss Landing Marine Laboratory
Mote Marine Laboratory
Associated Fisheries of Maine
The Cumberland Island Museum
South Africa Museum
Florida State Museum
U.S. Naval Observatory
Cape May County Extension Office
Green Peace
Institute Nacional de Pesca
Coastal Management Program
Sea Grant Program
Virginia Institute of Marine Science
Lee County Marine Sciences
Dick's Seafood
Save-On Seafood
Kiawah-Seabrook Seafood
Sea Grant Advisory Service
American Elasmobranch Society
National Audubon Society
Chicago Zoological Society
American Littoral Society
Salt Water Sportsman
Pacific Marine Technology
Seaworld of Texas
Steinhart Aquarium
Mystic Marine Life Aquarium
New England Aquarium
New England Aquarium
National Aquarium in Baltimore
Auburn Marine Extension & Research Center
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Sid F. Cook, *Chondros*
Glen Martin, *San Francisco Chronicle*
Chris Conway, *Philadelphia Inquirer*
Sharon Henson, *Islander*

Charles Squires, *News Journal*
Jeff Merrill, *The Fisherman Magazine*
Nic Stubbs, *Suncoast News*
Janice Plante, *Commercial Fisheries News*
Mark Ippolito, *Wilmington Star News*
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Kevin M. Nguyen
Hang Nguyen
Katie Nimo
Dr. Douglas Noltie
W. Bradley O'Bier
Gorgan O'Connor
William O'Hara
Donna O'Hearn
Bob Orr
Dr. Steve Otwell
Philip Pace
Phillip Palmerson
Capt. James H. Paulk
Steven Pennoyer
Joseph Persia
Bill Peters
Steve Phanco
Becky Phillips
Mike Phillips
Michael Pia
Kevin Pilichowski
Peter Piscitello
James H. Polk
Robert Powell
Gene Pratt
Dr. Jenifer Preston
Nadene Prince
Peter C. H. Pritchard
John Raguso
Lenny Raiford
Ken Randall
Allan Rankin
Peter C. Rao
Sandra Rawe
Capt. Anna Rae Roberts
Capt. David Rojas
Nicholas Rosa
Mary Beth Rossomando
John Rourke
Peter Ruel
Kirstin E. Salvo
Lazaro Sanchez
Gayle Sanfilippo
Frank Sargent
Dr. Carl Safina
Kenneth L. Schmieder
Stephanie Schueler

Frank J. Schwartz
Tom Scott
Ruth M. Seppala
Laurette G. Serilla
Gail Shaffer
Bill Sherburne
Sheba Shlensky
Todd Simmons
Judy Slaughter
Gene Smith
Franklin F. Snelson
Dr. Frank Snelson
Harry H. Snider
David Soest
Enrique Somoza
Marguerite Spencer
Capt. Thomas E. Spencer
George Stanford
Russ Stauff
Captain George F. Steller
Dr. John Stevens
Byron Stout
Dr. Stephen T. Szedlmayer
Charles Tambiah
Linda Taylor
Ken Teeples
Dr. Antonio D. Testi
Dr. Bruce Thompson
Bradley Thompson
Edward Thorbjornsen
Steven P. Thorsteinsson
Julie Timm
Mary Ellen Timmons
Peter Trznadel
Sam Tseng
Becky Utecht
J. A. Verstegen
Neil Vincent
Quy Hong Vo
Jim Waldvogel
William E. Walker
W. Borden Wallace
Hans Walters
R. R. Warny
Diane Watson
Mike Weber
Dick Weber
Richard Weissmans
Robert West
Pam Whitman
Paul Wiener
Daniel Wiest

Joan M. Winblad
Christina Wilkins
Page S. Williams
Tamara Williams
Charles Witek
Barbara Wombles
Claudia Wong
Prof. John Wourms
Edward J. Zinke
George Zorzi
Juan Zumbado

Summary of Public Comments Received on the Proposed Fishery Management Plan for Sharks of the Atlantic Ocean and on the Proposed Implementing Regulations

General Summary

The proposed FMP was released for public review and comment from January 8 through March 8, 1992. Proposed regulations were published in the Federal Register for public review and comment from June 5 through July 23, 1992 (57 FR 24222 and 57 FR 29859). During these comment periods, NMFS received written comments from some 1,159 entities. Commenters included: (1) numerous individuals with a variety of views (e.g., recreational and commercial fishermen, fish dealers or processors, charter vessel and headboat owners, and interested citizens); (2) many groups or organizations representing diverse fishery interests including commercial and recreational sectors, fish processing, export-import businesses, environmental conservation and animal rights, and scientific research; (3) State and Federal agencies; and (4) Regional Fishery Management Councils.

NMFS has evaluated the public comments received and presents the following summary of the public concerns raised below. In terms of number of comments, some 57 times more commenters supported management of Atlantic Ocean sharks than opposed it and some 5 times more commenters supported implementation of the FMP than opposed it. Support for the FMP was from a broad cross section of constituents including citizens, commercial and recreational fishermen, many coastal states, and the Councils. Opposition to the FMP came primarily from several commercial fishermen associations, the State of North Carolina and certain North Carolina shark fishermen, and individual shark dealers/processors along the Atlantic and Gulf of Mexico coasts. Table A presents general summary information regarding the public comments received. Table B lists those commenters representing constituent groups, states, councils, or other organized entities or institutions.

Table A Number of commenters supporting and opposing management of Atlantic Ocean sharks and FMP implementation.

Commenters	Number	Percentage
Support Shark Management	1,030	98
Opposed Shark management	18	2
Total	1,048	100
Support FMP Implementation	765	81
Opposed FMP Implementation	175	19
Total	940	100

Table B List of major organizations that commented on Fishery Management Plan for Sharks of the Atlantic Ocean

Recreational

International Game Fish Association
Jersey Coast Shark Anglers Inc.
Jersey Coast Anglers Association
Maryland Saltwater Sportfishermen's Association, Inc.
New York Sportfishing Federation
Peninsula Salt Water Sport Fisherman's Association

Congressional

Rep. James Saxton

Environmental/Academic/Scientific Groups

American Littoral Society
American Elasmobranch Society
Center for Marine Conservation
Fund for Animals
Herpetologist's League
Mote Marine Laboratory
National Coalition for Marine Conservation
National Audubon Society
National Aquarium in Baltimore
Society for Animal Protective Legislation

Federal/State Comments

Connecticut
Florida
Louisiana
Mississippi
New York
New Jersey
North Carolina
Puerto Rico
Virginia
U.S. Small Business Administration
U.S. Coast Guard
U.S. Environmental Protection Agency
U.S. Department of Interior
U.S. Department of State

Dealer/Processor Interests

Blue Water Fishermen's Association
Commercial Fishermen's Interest
Commercial Anglers Association
Directed Shark Fisheries Association
Maine Fishermen's Wives Association
New Jersey Commercial Fishermen's Association
North Carolina Fisheries Association, Inc.
Seafood Consumers and Producers Association, Inc.

Charter Vessel and Headboat Interests

Greater Point Pleasant Charter Boat Association
Montauk Boatmans and Captains Association
New York Sportfishing Federation

Regional Management Council

Caribbean Fishery Management Council
Gulf of Mexico Council
Mid-Atlantic Fisheries Council
New England Fishery Management Council
South Atlantic Fishery Management Council

Evaluation of the Public Comments--Specific Issues and Concerns

Numerous issues and concerns were raised by the public comments. Many comments were supportive of all or specific FMP management measures. However, many comments also were critical of the FMP generally or of specific measures. NMFS identified 23 major public issues/concerns in the public comments regarding the FMP that are stated below under the appropriate FMP management measures or management objective. Some of these publically expressed issues/concerns represent endorsement of the proposed FMP objective or measure, but many voice disagreements with the subject FMP objective, measure, or other area indicated. Agency responses to these comments (major issues/concerns) and other comments (significant but less critical issues/concerns) are provided below.

Summary of Major Public Comments and NMFS Responses

1. Objective: Prevent overfishing of shark resources.
 - a. Comment: We support management of Atlantic Ocean shark resources.

Response: NMFS acknowledges this support.
 - b. Comment: We support implementation of proposed FMP.

Response: NMFS acknowledges this support.
 - c. Comment: We agree with the FMP's assessment of the fishery problem of overfishing.

Response: NMFS acknowledges this agreement and notes that the revised NMFS stock assessment altered somewhat the FMP's conclusions about the condition of large coastal species group. While this species group is still considered overfished, the time required for stock rebuilding to the MSY level should be less than indicated in the proposed FMP.

During the public comment periods for the FMP and the proposed rule, significant new fishery information was received from fishermen, dealers/processors, and several state fishery management agencies. This new information included the following: (1) data showing higher fishery removals in recent years than those used as a basis for determining maximum sustainable yield (MSY) and stock conditions in the NMFS 1990 stock assessment for Atlantic coast sharks (the

assessment used as a basis for commercial quotas and recreational bag limits in the proposed FMP); (2) two additional years' landings data, (3) records on the sizes of landed sharks; and (4) information on the numbers of commercial fishing vessels targeting sharks. NMFS reviewed this new information and determined that it could result in significantly revised conclusions about the abundance, productivity, and condition of the managed shark species from those presented in the proposed FMP; the latter were based on the 1990 NMFS stock assessment for Atlantic coast sharks.

To ensure that all FMP management measures are based upon the best scientific information available, a revised assessment of the condition of the large coastal species group was completed by the NMFS Southeast Fisheries Science Center, using the new or corrected information. The revised assessment was reviewed by a scientific peer committee consisting of both outside scientific experts and NMFS scientists (Review Committee). The Review Committee issued its final report on November 23, 1992 (Report of the Atlantic Coastal Shark Fishery Analysis Review, November 23, 1992).

The Review Committee reported evidence of overfishing for the large coastal species group during 1986 through 1992 (except for 1987 and 1990). The Review Committee recommended that the calendar year 1993 landings for the large coastal species group be reduced below the calendar year 1991 landings level of 4,319 mt dressed weight. The Committee Report identifies three options for the calendar year 1993 landings limit (recreational and commercial combined) for the large coastal species group. Each option provides a specific degree of conservation and economic benefits.

Under the Review Committee's first option for the level of 1993 calendar year total landings (3,520 mt dressed weight), the large coastal species group stock would remain overfished and the abundance would not rebuild to the MSY biomass level (estimated by NMFS to be 14,900 mt dressed weight). NMFS estimates MSY for the large coastal species group to be 3,800 mt dressed weight. To ensure that the large coastal species group stock is rebuilt to the MSY level, NMFS has selected the Review Committee's recommended

second option (Option 2--see Table 4 of the Review Committee Report) that would establish 1993 total landings of 2,900 mt dressed weight (a 34 percent reduction from the 1991 landings; a 29 percent reduction from the 1986-91 annual average landings). Under this option, NMFS has determined that stock abundance will rebuild. NMFS's conclusions about stock rebuilding differ from the Review Committee's rebuilding schedule, which shows that annual fishery yields would increase about 5 percent each year but would not equal MSY until 1999. Option 3 of the Review Committee Report requires a 1993 landings limit of 2,311 mt (a 50 percent reduction from the 1991 level; a 44 percent reduction from the 1986-91 annual average). This option achieves a 10 percent annual increase in stock abundance until the MSY level is reached. NMFS has determined that this option would cause unacceptable, short-term costs in lost fishery revenues, and is not necessary to achieve stock rebuilding within a reasonable time period.

While NMFS adopted the Review Committee's Option 2 for stock rebuilding and will implement the recommended calendar year total landings (and derived calendar year commercial quotas) from 1993 to 1995, NMFS believes that the large coastal species group will be rebuilt by 1995 (contrasted with the longer rebuilding schedule contained in the Review Committee Report). At that point, NMFS believes that the stock size should be sufficient to provide MSY on a continuing basis and, based on available information, that a modification of the Review Committee's rebuilding schedule is justified. It is noted that closure of the fishery for the large coastal species group immediately upon FMP implementation, as contemplated by the proposed FMP and regulations, will not be necessary if implementation occurs early in 1993.

The 1993 and 1994 calendar year commercial quotas for the large coastal species group were determined based on the historical commercial average annual share (percentage of average total annual landings) for the period 1986 through 1991; this average annual share is 84 percent. The same approach was used in the proposed FMP to determine commercial and recreational fishery shares. The recreational share of the total 1993 landings is also based on the historical average

annual percentage share from 1986 through 1991; this value is 16 percent. Recreational fishery limits (a trip limit for the large coastal and pelagic species groups and a bag limit for the small coastal species group) have been changed to ensure that 1993 commercial and recreational landings are reduced by approximately the same percentage (29 percent) below their respective recent annual averages.

The commercial quota for the pelagic group is changed from the quota in the proposed FMP based on revised landings statistics and on several years' additional data; the 1993 calendar year commercial fishery quota is now established at 580 mt dressed weight. Combining this commercial quota with the estimated recreational fishery share (under the bag limits) of 980 mt dressed weight, the total 1993 landings for the pelagic group are established at 1,560 mt dressed weight. As in the proposed FMP, no quotas are established for the small coastal species group.

The estimates of MSY for the three species groups have been reevaluated. Based on the Review Committee Report, NMFS estimates that the MSY for the large coastal species group is 3,800 mt dressed weight. (The MSY stock biomass level is estimated to be about 14,900 mt dressed weight). Due to revised landings statistics, the MSY for the pelagic species group is changed from 2,800 mt whole weight (corrected to 3,000 mt whole weight or 2,158 mt dressed weight based on corrected data) in the proposed FMP to 1,560 mt dressed weight in the final FMP. This change was necessary since the pelagic species MSY is determined based on the average annual landings (recreational and commercial combined) during the period January 1, 1986, to January 1, 1992. These landings have been revised because significant landings of large coastal species were incorrectly included in the pelagic species group in the proposed FMP. The MSY estimate for the small coastal species group remains unchanged because NMFS did not have any new information.

d. Comment: We agree with FMP's conclusion that the large coastal species group is overfished.

Response: See response to comment 1.c. above.

2. Objective: Encourage consistent management of shark resources throughout their oceanic ranges.
- a. Comment: While domestic management of the shark fisheries is a good first step, it is imperative that consistent international management be undertaken. Otherwise, costs to U.S. fishermen from restrictive quotas will not be justified if there are no restraints on foreign harvest from the same resources. Both the economic costs and benefits of conserving oceanic shark resources should be shared by foreign fishermen using the same resources; this must involve bilateral or multilateral agreements among harvesting nations and might involve adding sharks to management under the International Convention for the Conservation of Atlantic Tunas (ICCAT).

Response: NMFS agrees that consistent international management is necessary to maximize the conservation benefits from the management of highly migratory (oceanic) shark species. Other nations have expressed interest in this FMP. As appropriate, NMFS and the United States will encourage other nations to adopt compatible conservation measures for the management of sharks, either independently or through ICCAT.

3. Objective: Establish a shark resource and fishery data collection, research, and monitoring program.
- a. Comment: NMFS should require dealer/processor permits for those who purchase sharks and shark fins along with mandatory dealer/processor reporting. This information is critical to ensure reliable information on total fishing mortality by species required for stock assessments and to provide important economic information needed for economic impact analyses.

Response: NMFS believes that the reporting measures pertaining to fishermen and recreational tournament operators in this rule initially will provide adequate information to monitor and assess the fishery and shark resources, and to enforce quotas and bag limits. However, as discussed under the section "Other Matters," NMFS is considering adding a mandatory dealer permitting and reporting system that could significantly improve the reliability of fishery data on annual catches by species as well as total catches. Also, NMFS will direct the OT to

review the benefits from this additional reporting system.

4. Objective: Increase the benefits from shark resources to the U.S. while reducing waste, consistent with the other management objectives.

a. Comment: Numerous commenters agreed with the FMP's assessment of the problems with finning.

Response: NMFS acknowledges this agreement.

5. Measure: Fishery management unit consists of 39 species grouped by small coastal, large coastal, and pelagic species groups.

a. Comment: There were numerous objections to the grouping of 39 species into the proposed three resource categories; there were many suggestions for different groupings or different assignments of a given species to a different group. For example, it was recommended that bignose and silky sharks be moved from the large coastal species group to the small coastal species group. It is noted that the latter group does not have restrictive commercial quotas.

Response: NMFS acknowledges the suggestions for different species groupings but has decided to make no changes at this time. The three resource categories are not intended to represent ecologically distinct groups of species. Rather, the species groups are based on what species are caught predominately in which fisheries. Since a given species may occur in several fisheries (e.g., in both inshore and offshore fisheries), it could have been assigned to several species groups (e.g., to both large coastal and pelagic species groups). However, for management and assessment purposes, a given species is listed under only one species group. The OT will review the three species groups and the assignment of individual species, and may recommend changes. Such changes, if approved by NMFS, could be implemented through the framework regulatory adjustment procedure.

- b. Comment: It will be difficult for many fishermen to distinguish species and, accordingly, to know what quotas or bag limits apply.
- Response: NMFS will encourage fishermen to identify sharks. Field guides for identifying sharks are available in local stores. As appropriate, NMFS will supply information to interested fishermen.
- c. Comment: The placement of the whale shark, basking sharks, and other similar species in the large coastal species group (which has a commercial quota) will not provide necessary protection for these species. NMFS should undertake an aggressive rebuilding program for the populations of these species.
- Response: NMFS believes that the measures in this rule provide adequate protection. However, if new information indicates that these species need additional protection, the OT may consider recommending changes. NMFS is interested in reviewing any specific data bearing on the condition of these species.
- d. Comment: Management units should be revised by establishing specific commercial quotas on individual shark species. NMFS should modify the large coastal and pelagic species groups to reflect what fishermen catch, and the different abundances in species.
- Response: NMFS does not agree that sufficient information is available on the biology of individual shark species that would allow management through individual species commercial quotas. The OT may consider this management approach when the necessary information becomes available.
6. Measure: Fishing year from July 1 through June 30.
- a. Comment: Some commenters supported the proposed fishing year of July 1 through June 30; others objected to it (see also comment 6.b.).
- Response: NMFS acknowledges this support. However, the proposed fishing year was changed to a calendar year. This was based on several considerations: adoption of the Review Committee's recommended rebuilding schedule which is based on calendar year; a revised NMFS stock assessment with all estimates of fishing mortality, stock abundance,

and yield based on a calendar year; and a determination by NMFS that a calendar fishing year with semi-annual quotas will ensure equal access to available harvests for all coastal areas while still being consistent with the Review Committee's stock rebuilding schedule. Also, NMFS believes that the retention of the proposed fishing year of July 1 through June 30 (with full fishing year commercial quotas) could (1) encourage rapid expansion of a new shark fishery in the previously unfished area off the northeastern states, and, as such, be potentially destructive to already overfished shark resources, and (2) damage the historic fishery off the southern states by allowing the new northern fishery to take an unfair share of the annual quota.

For the above reasons, NMFS decided to establish calendar year commercial quotas for the large coastal and pelagic groups during the first several years of FMP implementation (1993 and 1994). Each calendar year quota is divided into halves, each half applying respectively to the fishing periods of January 1 through June 30 and July 1 through December 31. This approach to applying the commercial quotas should spread the fisheries in both southern and northern areas reasonably even throughout the year. Also, this approach should not eliminate the historic peak months of the established southern fisheries in the Gulf of Mexico and South Atlantic while still ensuring an open season and an unfished quota for the peak fishing months for the Northeast and Mid-Atlantic fisheries.

- b. Comment: There were objections to the proposed fishing year based on alleged geographic discrimination regarding access to available commercial quotas. Alternative fishing years suggested included January 1 through December 31, November 1 through October 31, and April 1 through March 31.

Response: See response to comment 6.a. above.

- c. Comment: NMFS should start the fishing year on April 1 or September 1 to allow fishermen off North Carolina to harvest large coastal species during the two peak fishing periods of March-June and October-December. A July 1 start date would allow fishermen more to the south an unfair advantage in harvesting available quotas.

Response: NMFS was aware of North Carolina's concerns throughout the development of the FMP and has tried to ensure that the measures do not discriminate against the residents of any particular state(s). NMFS believes that the costs as well as benefits of the final FMP are distributed equally across all states and that no state bears an unfair burden of the conservation measures (reduced landings, fishery closures, etc.). In establishing season dates and commercial quotas in both the proposed and final FMPs, NMFS's objective is to provide equitable access to the allowable fishery harvest for all coastal states without adopting a more complicated system for geographic allocations. NMFS believes that the final FMP measures meet this objective.

NMFS adopted a calendar year (CY) for the fishing year based on the following considerations: (1) data are collected on CY basis; (2) biological model used to assess the resource is based on data collected on a CY; (3) biological conclusions and the rebuilding schedule are based on CY data; (4) NMFS scientists indicate that the Review Committee's rebuilding schedule cannot be easily changed from a CY basis to a different basis; and (5) retaining the proposed fishing year beginning July 1 may, based on new information, encourage development of a new shark fishery in the northeast--this new fishery would be exploiting an overfished resource in new area and could adversely affect the data base used by NMFS for assessing the condition of the large coastal species group.

NMFS decided on a split fishing year and semi-annual quotas (January-June and July-December) based on the following considerations: (1) The shark fishery occurs primarily in waters off the coastal states bordering the Gulf of Mexico and the Atlantic Ocean south of Virginia. The split fishing year and the semi-annual quotas should prevent the residents of those states from taking most of the annual quota; (2) the July-December season should enable the coastal states north of Virginia to obtain a fair share of the resource while yet retarding the development of new fisheries on the overfished large coastal species resource within this area; (3) NMFS's review of the landings data in 1991, the latest year with reliable statistics, shows that while North

Carolina has spring and fall season peaks for its fishery, so do other regions, particularly the Gulf of Mexico. While the semi-annual quotas, split season dates, and possible fishery closures may reduce North Carolina landings, it is not clear that North Carolina fishermen will suffer impacts greater than fishermen from any of the other states. NMFS concludes, at this time, that the split seasons and associated semi-annual quotas will serve to ensure that each coastal region receives a fair share of the available resource. In summation, NMFS believes that the calendar fishing year and the associated semi-annual commercial fishing quotas will provide equitable access to available quotas for all coastal fishermen.

7. Measure: Annual commercial fishing quotas.

a. Comment: The proposed estimates of MSY are too low and the commercial quotas, particularly the quota for the large coastal species group, are unreasonably low and are not justified based on conservation grounds.

Response: The estimates of MSY, as well as the commercial quotas, were changed in the final FMP based on the NMFS revised stock assessment and on the Review Committee Report. See response to comment 1.c. above.

b. Comment: Commercial fishing for sharks should be eliminated by Federal regulations.

Response: NMFS does not agree. One of the objectives of any FMP, as mandated by the Magnuson Act, is to obtain the optimum yield from the fishery. Optimum yield refers to a harvest of fish that will provide the greatest overall benefit to the nation, with particular reference to food production and recreational opportunities. All sectors of the commercial and recreational fishing interests are treated equally, sharing the shark resources landings based upon historical shares and fishing practices.

c. Comment: The FMP is a pro-commercial fishery management plan, favoring commercial fishing over recreational fishing and over conserving the shark resources.

Response: NMFS does not agree. See response to comment 7.b. above. Commercial quotas and recreational bag limits were adjusted so that both sectors' landings would be reduced annually over their recent historical average annual levels by about the same percentage (29 percent), and so that they would retain their relative recent historical shares (84 percent for commercial and 16 percent for recreational). The average annual commercial and recreational landings for the period 1986 through 1991 were used to determine recent historical levels and shares.

d. Comment: The fishery for the large coastal species should be closed immediately upon FMP implementation to protect this overfished species group.

Response: NMFS does not agree. See response to 1.c. above. The best available scientific information indicates that the large coastal species group is overfished, but that it can support commercial harvests while rebuilding to the MSY level by 1995.

e. Comment: The fishery for the large coastal species should not be closed immediately upon FMP implementation because these species are not overfished and such closure would be too disruptive for the fresh shark meat market.

Response: The subject fishery will not be closed immediately upon FMP implementation assuming that this FMP is implemented in early 1993. NMFS is establishing a restrictive annual commercial quota and bag limits that will prevent further overfishing and that should allow rebuilding the large coastal species group to the MSY level by 1995.

f. Comment: NMFS should review the quota for the pelagic species in view of the FMP's acknowledged problems with the data base. The quota for this species group is based directly on recent reported landing information that may not accurately reflect actual landings.

Response: The NMFS quota for the pelagic species group was reviewed and changed based upon the latest available scientific information. These changes included adjustments for previous errors in landings statistics. See response 1. c. above.

g. Comment: Separate quotas should be established for each of the three species groups for vessels in (1) the directed commercial shark fishery, (2) the incidental catch fishery, and (3) the charter/headboat fishery to ensure equitable allocation of available catches based on historical participation by these different user groups.

Response: NMFS does not believe sufficient, reliable fishery information currently exists to establish separate quotas for these fishery elements. The OT and NMFS will consider this proposal in the future when more data are available.

8. Measure: Recreational fishery bag limits.

a. Comment: NMFS should establish one bag limit for all recreational vessels (private and charter vessel/headboat alike) and for all species. For example, the bag limit could be two sharks per vessel per trip, irrespective of the type of vessel or species of shark. This approach would be easier to enforce and would not require fishermen to identify species and determine which bag limit applies.

Response: NMFS may consider this suggestion in the future when more data are available. The present recreational bag limits were determined based on the condition of the several species groups, achieving approximately equal landing reductions in both recreational and commercial fisheries, and general support from the fishing community. Also, it was assumed that recreational anglers know, or will be able to learn, how to differentiate between a small coastal species and the large coastal or pelagic species.

b. Comment: FMP is pro-recreational, favoring recreational fishing over legitimate commercial interests.

Response: NMFS does not agree. See response to comment 7.b., above.

c. Comment: The FMP should contain a specific recreational fishery quota for each of the three species groups just as is applied to the commercial fisheries.

- Response: NMFS does not agree. Use of bag limits will control the fishery and prevent overfishing of the resource. As part of standard procedure, the OT will review the effectiveness of the bag limits for controlling the recreational catch before recommending use of a quota.
- d. Comment: The FMP should establish a recreational bag limit for mako sharks of two per trip for swordfish and tuna longline vessels to reduce incidental fishing mortality on this valuable and heavily exploited resource.
- Response: The best available scientific information does not support this type of bag limit.
- e. Comment: Commenters indicated general support for bag limits, but a number of alternatives were proposed. These included: (1) one shark per vessel per trip; (2) two sharks per vessel per day with exception for Atlantic sharpnose (5 per angler per day); (3) one shark from the large coastal species group per vessel per trip during April through June spawning season; (4) revised bag limits for headboats allowing anglers to catch and retain more large coastal or pelagic species; and (5) two sharks per vessel per trip for private recreational or charter vessels.
- Response: NMFS and the OT may consider these alternative measures after more data are gathered. If the OT recommends any of these alternatives, NMFS could implement them through the framework regulatory adjustment procedure. This procedure provides an opportunity for public review and comment on proposed measures before they are implemented.
9. Measure: Prohibition on finning (proposed as five fins per carcass landed).
- a. Comment: The FMP's anti-finning measure should be based on a ratio by weight of total fins to total carcasses landed because it would either allow landing more than 5 fins per carcass or be easier to measure (ratio of two total weight measurements) while still preventing finning. Several specific percentages were suggested including the 10 percent weight ratio used by Virginia and North Carolina (currently 7 percent) and the 6 percent ratio recommended by several dealers/processors. Some commenters objected to the proposed measure (5 fins per carcass landed)

alleging that it would not adequately prevent finning since it would allow mixing large fins and small carcasses.

Response: NMFS has changed the finning measure to require that the total weight of wet fins not exceed 5 percent of the total weight of dressed carcasses at point of first landing. NMFS determined that the 5 percent by weight is appropriate and is supportable based on samples of sharks dressed at sea under commercial fishing conditions. NMFS believes that the fins-to-carcasses weight ratio will be easier to enforce and will better prevent finning.

b. Comment: There was universal and strong support for a measure to prohibit the wasteful practice of finning. Support was generally unqualified from parties not involved in commercial fishing.

Response: NMFS believes that finning is wasteful of valuable shark resources and poses a threat to attaining the conservation objectives of fishery management under the Magnuson Act. The FMP should minimize the waste of shark resources while still allowing fishermen to sell fins from legally landed sharks.

c. Comment: Some commercial fishermen and fishermen's organizations and some dealers/processors opposed the finning prohibition, indicating an important need to land fins taken from dead sharks and from certain species with limited markets for the meat (e.g., hammerhead sharks).

Response: NMFS does not agree that finning should be allowed for dead sharks or for species with limited markets for the meat. Allowing this would create a regulatory loophole making enforcement of the general finning prohibition very difficult.

10. Measure: Release sharks not retained by commercial fishermen under the quotas or by recreational fishermen under the caught bag limits in manner maximizing survival chances.

a. Comment: If a shark will not be landed by a commercial fishermen or consumed by a recreational angler, the fisherman should tag and release the shark without additional injury.

Response: NMFS agrees that sharks caught and not retained should be released in a manner that will ensure maximum probability of survival, but does not agree that all such released sharks must be tagged. A mandatory tag and release program would be expensive and difficult to enforce. NMFS will encourage a voluntary tagging program for both commercial and recreational fisheries.

11. Measure: Mako minimum size limit (66 inches).

a. Comment: Commenters from a wide cross section of constituent interests expressed general support for the mako minimum size measure, but some objected to the different application in the commercial and recreational fisheries.

Response: NMFS reevaluated this measure based on the public comment and on available biological data. The proposed minimum size limit is less than the smallest size at which shortfin mako become reproductively mature. Additionally, information for determining size-at-maturity does not exist for longfin mako sharks. Adequate scientific information is unavailable to assess the condition of mako stocks or to predict the stock conservation results of the proposed minimum size limit. Therefore, NMFS is reserving this measure until sufficient information is available to support this or other size limit measures.

b. Comment: The size limit measure was criticized for being unenforceable and having no legitimate biological basis.

Response: NMFS acknowledges these objections and decided, in part because of them, to reserve the mako size limit at this time.

c. Comment: There was general opposition to the proposed provision of the mako minimum size measure that allowed permitted commercial fishermen to retain and land dead, undersized makos, while recreational fishermen were prohibited from retaining dead, undersized makos. Arguments were made that all small mako sharks on the line would be considered dead and be retained; therefore, the conservation benefits would be lost. Arguments were made that the rationale of preventing waste (allowing small, dead sharks to be retained) is at the cost of favoritism for commercial fishermen. One state commented that

the exception for commercial fishermen is inconsistent with the conservation objectives of its approved coastal zone management plan.

Response: NMFS acknowledges these criticisms of this measure, and has decided to reserve the mako minimum size limit at this time for lack of adequate supporting scientific information.

12. Measure: No sale of recreational catch; exception for permitted charter vessels and headboats allowing sale of their catch within applicable bag limits.

a. Comment: Many commenters objected to prohibiting the sale of recreational caught fish.

Response: The FMP clearly differentiates between recreational and commercial fishermen. Allowing recreational fishermen to sell their catch would undermine the commercial allocation and enforcement of the commercial quotas. It could also limit the achievement of the conservation objectives of the FMP, including preventing overfishing and rebuilding the overfished large coastal species group stock. Owners or operators of permitted charter vessels and headboats are allowed to sell their shark catch, subject to the cumulative bag limits applicable to the vessel, as long as the relevant commercial quotas are unfilled. Catches sold by these permitted vessels will be counted against the relevant commercial quotas. See also the response to comment 13.a. below.

13. Measure: Mandatory commercial fishing permits.

a. Comment: Commercial permits should be available to anyone if the applicant pays a flat fee; there should be no criteria limiting such commercial permits to those meeting some percentage of previously earned income from commercial fishing. The flat fee permit would allow the individual to fish commercially and sell his/her catch.

Response: NMFS does not agree. The life history of shark resources makes these fish particularly vulnerable to overfishing. The best available information indicates that certain Atlantic shark species are overfished. Accordingly, restrictive commercial quotas are required. The earned income requirement for a permit will exclude recreational and part-time commercial fishermen

from participating in the commercial shark fishery and thereby lessen the impact of the restrictive commercial quotas on those who rely on fishing for their primary income.

b. Comment: There was wide support from diverse fishery interests for the FMP's proposed requirement that the sale of sharks be limited to commercial fishermen holding a Federal fishing permit. Some fishery interests opposed limiting the sale of sharks to those holding commercial permits and wanted to allow recreational fishermen to sell their catch, particularly to defray the costs of a fishing trip.

Response: No new information was provided to NMFS that would justify allowing the sale of recreational catches (other than by permitted charter vessels and headboats). See response to comment 13.a..

c. Comment: Commenters suggested different income criteria be used to qualify for a commercial permit such as the Gulf of Mexico Fishery Management Council's proposal that would allow qualifying on any one of two previous year's fishing income.

Response: NMFS agrees that different income criteria should be used and adopted revised criteria. In the preamble to the proposed rule, alternative earned income criteria for commercial vessel permits were discussed and comments on them were specifically requested. The discussion of alternatives included: (1) adding \$20,000 in gross sales of fish as an alternative to the 50 percent earned income from fishing requirement to qualify for a vessel permit; and (2) increasing the time frame for having met the required level of earned income/gross sales. These changes would ensure that an owner/operator was not unfairly excluded from renewing a vessel permit based on a poor year. Since the proposed rule was published, an earned income criterion has been developed and applied to nearly all the vessel permit applications processed by the Director, Southeast Region, NMFS. The final criterion, a variation of one discussed in the preamble to the proposed rule, requires that the applicant must have derived during one of the three years preceding the permit application, at least 50 percent of earned income from commercial, charter, or headboat fishing, or that gross sales of fish must have exceeded \$20,000.

This criterion is more liberal than that contained in the proposed rule and is contained in the regulatory text of this final rule.

While there was general public support for the commercial fishing income requirement for qualifying applicants for a commercial permit, NMFS received numerous comments objecting to the proposed income criterion as well as to the alternatives discussed in the proposed rule preamble. These objections included: (1) the criterion will eliminate many legitimate, part time fishermen who need to supplement their overall income; (2) recreational fishermen should be able to sell their shark catch to defray the costs of a fishing trip; and (3) some owners or operators of charter vessels or party boat do not want to be bound by the recreational bag limits for sharks landed even though they understand that they can sell shark catches if they have a Federal commercial permit. As a result of these public comments, and because of NMFS's intention to adopt standardized commercial permit criteria across several fisheries for purposes of administrative efficiency in issuing many Federal permits each year (e.g., same criterion applies in FMP as applies for Gulf of Mexico reef fish and South Atlantic snapper/grouper), NMFS modified the final income criterion. Under the final measure, a vessel owner or operator may qualify in any one of three previous years. NMFS is still interested in receiving additional public comment on this measure during the public comment period on the interim final rule, and is particularly interested in any data showing significant economic harm to commercial fishermen not meeting the income criterion.

- d. Comment: Commenters suggested different criteria be used to qualify for a commercial permit such as no qualifying income level or at least a level well below the proposed 50 percent level. These commenters alleged that the proposed criteria discriminated unreasonably against many legitimate part-time or seasonal shark fishermen (e.g., those earning something below 25 percent of their income from fishing).

Response: NMFS does not agree. See response to comment 13.a. above.

e. Comment: The FMP should contain a multi-tiered permit system providing separate permits (and separate harvesting quotas) for vessels in the directed commercial shark fishery, the incidental commercial fishery, and in the charter/headboat fishery. Separate permits and quotas would reduce user conflicts, simplify business planning, and ensure equitable allocation of available catches to these different groups.

Response: NMFS and the OT may consider this measure for future implementation.

f. Comment: The permit condition that the recipient agrees to abide by Federal measures regardless of where a vessel fishes for or catches sharks (inside or outside EEZ) preempts the states' authority to manage resources and fishermen in their waters.

Response: NMFS reviewed the provisions of the FMP and regulations, and has made a change in section 678.4(a)(4) regarding the permit condition wherein the recipient of a Federal permit is to agree that the vessel's fishing, catch, and gear will be subject to Federal shark fishing regulations regardless of where the fishing occurs (e.g., in state, Federal, or international waters). To ensure that the FMP's management measures can be effectively implemented and enforced as well as to avoid diminishing any state's management authority within its waters, section 678.4(a)(4) has been revised to require that a Federal permit recipient must agree that the vessel's fishing, catch, and gear will be subject to the Federal shark fishing regulations regardless of where the fishing occurs, with the exception that if a permitted vessel fishes only in state waters on a given trip, the vessel's fishing, catch, or gear may be subject to the more restrictive state requirements for that trip. Any state regulations limiting the landing or possession of sharks by commercial fishermen fishing legally in the waters of another state, in the EEZ, or outside the EEZ in a more restrictive manner than Federal requirements would frustrate the intent of the FMP to allow a commercial fishery in the EEZ. Permitted fishermen who fish for sharks in state waters during a closure of the shark fishery in the EEZ would violate a condition of the permit, not state law. Neither the final FMP, nor its Federal fishing permit conditions established by

this final rule, preempt state management authority of shark resources or fishing by state residents solely in state waters. The subject Federal permit condition is considered by NMFS to be essential for effective implementation of the FMP, including enforcement of any fishery closure in the EEZ. State residents who are unwilling to accept the Federal permit condition may still fish for sharks solely in state waters subject to state regulations.

14. Measure: Commercial vessel owner and operator reporting requirements.

a. Comment: Much better catch and effort data are needed for the commercial fishery; particular emphasis should be given to fishing mortality by species by gear type. Also attention should be given to improving the ability of pelagic longline fishermen targeting swordfish or tuna as well as bottom longline fishermen to identify shark species caught incidentally or directly as appropriate.

Response: NMFS agrees. Effective management of the shark fishery requires the receipt of timely catch and effort data from participants in the fishery. NMFS considers these reports to be of such importance to effective management that an applicant's submission of all required reports is necessary for renewal of a permit. An applicant for renewal of a permit who is deficient in a required report will be given an opportunity to correct the deficiency.

15. Measure: Tournament reporting requirements.

a. Comment: Much better data on numbers and weights by species landed are needed in the recreational fisheries.

Response: NMFS agrees and will obtain catch and effort information from selected shark fishing tournaments.

b. Comment: Much better catch and effort data are needed for the recreational fishery (from private, tournament, charter vessel, and headboat fishermen). Particular emphasis should be given to catch and effort data by species by areas. Also, education is required to improve anglers' ability to differentiate between various species.

- Response: NMFS agrees with this point. NMFS has recently improved the quality of its recreational fisheries statistics program through increases in survey sample sizes; greater statistical confidence in survey results is expected. NMFS will continue to develop better sampling methodologies to improve the quality of the data collected.
16. Measure: No foreign fishing in EEZ (zero total allowable level of foreign fishing (TALFF)).
- a. Comment: Commenters expressed strong support for prohibiting foreign shark fishing in U.S. waters.
- Response: Since there is no surplus allowable catch over what domestic fishermen are able to harvest, the TALFF in the EEZ is zero.
17. Measure: Vessel observers required at the direction of the NMFS Science and Research Director.
- a. Comment: NMFS should pay for the costs of mandatory observers on fishing vessels that catch sharks either in a directed or incidental fishery.
- Response: Under current agency policy, NMFS pays for salary and benefits for government employees. Vessel owners and operators must provide accommodations and food.
- b. Comment: NMFS should resolve the issue of who is liable for injuries to observers while on duty.
- Response: The vessel owner or operator is liable and should be insured accordingly.
18. Measure: Framework regulatory adjustment procedure.
- Comment: None received except those bearing on the authority of the Assistant Administrator to make management adjustments (see also comment 19 below).

19. Measure: The OT and FMP monitoring and changes.
- a. Comment: The Assistant Administrator for Fisheries has too much authority under the FMP to accept or reject the OT's recommendations, and to make management adjustments (regulatory actions) independent of the OT.
- Response: NMFS disagrees. Management actions of the Assistant Administrator are subject to the terms of the FMP and its implementing regulations and to the requirements of the Magnuson Act, E.O. 12291, and all other applicable Federal administrative and legal requirements. The Assistant Administrator does not have the authority to make regulatory changes without following such requirements. In addition, the framework regulatory adjustment procedure provides for notice and comment, which will provide an opportunity for public participation.
- b. Comment: The scope of the OT's recommendations should be limited to measures in the current FMP and not additional measures (e.g., trip limits, size limits for other species) that should be incorporated only by FMP amendment process and not through a framework regulatory adjustment mechanism.
- Response: NMFS does not agree. The OT, composed of representatives of NMFS, the five Councils (including Council members, staff, and advisory panel or scientific committee members), and the ICCAT Advisory Committee, is the primary group with responsibility to recommend regulatory improvements. The regulatory process for implementing the proposed regulation differs according to the type of change. Complex and contentious changes to the management regime will involve plan amendments while less complex changes will involve the regulatory adjustment process outlined in the FMP.
- c. Comment: The OT should include members from industry, environmental groups, or other constituent interests who are not already affiliated with the Regional Fishery Management Councils.
- Response: While NMFS seeks information and recommendations from all those knowledgeable of and experienced with the Atlantic shark fisheries, NMFS is restricted by Federal law in its use of non-

Federal or outside advisors. In part to avoid statutory limitations at this time, NMFS is establishing an OT that will utilize knowledgeable and experienced Council members, staff, and advisory panel or scientific and statistical committee members as members. Also, NMFS will include an ICCAT Advisory Committee member on the OT. NMFS will ensure that either the OT or NMFS consult with appropriate representatives of all major fishery interests including recreational and commercial fishermen, fish dealers and processors, scientific experts, and the environmental or natural resources conservation community. In amending the FMP, NMFS will follow the procedures set forth in its published final process for the management of Atlantic highly migratory species.

20. Supporting Environmental Impact Statement (EIS) and Regulatory Impact Review (RIR).

- a. Comment: The EIS requires additional information regarding the fishery data collection process and need for baseline catch data, potential impacts of foreign fleets, shark finning, and exploitation of small coastal species. This information is required to explain adequately why certain adverse environmental impacts could not be avoided or reduced. The FMP does not assess a wide enough range of alternatives, including prohibiting commercial shark fishing.

Response: In developing an initial shark management program, NMFS considered and rejected numerous alternatives for addressing identified problems with the fishery and shark resources. These alternative measures are discussed in the FMP, EIS, and RIR. Prohibiting commercial fishing was not considered to be a reasonable or appropriate management alternative, considering historical fishing practices and the overall condition of the shark resources. The OT could review this alternative at a future date, if there is new information. In time, through international agreements and associated data collection programs, NMFS may be able to determine the impact of different nations' fishing activities on the shark resources that move across international boundaries.

b. Comment: The regulatory impact review (RIR) is deficient because it: (1) is based on erroneous information about the true volume and value of recent shark landings; (2) underestimates the magnitude of adverse economic impacts on fishermen and dealers/processors by the restrictive quotas and probable fishery closures, particularly over the long term; and (3) does not adequately evaluate regional impacts of initial closures and market disruptions.

Response: The proposed FMP (dated October 28, 1991) was based on the best available scientific information at the time of its preparation. The final FMP was prepared based on a revised stock assessment that reflects the best available information at the close of 1992. See response to comment 1.c. above. Consistent with the above changes, the RIR was modified to include the new fishery information.

21. Habitat.

a. Comment: NMFS should review all available habitat information and determine if specific actions should be undertaken to protect and/or enhance shark habitat. The section on habitat should reflect such considerations.

Response: As part of FMP development, NMFS included what it believed to be all relevant information on shark habitat including a discussion of certain possible habitat protection/enhancement measures, such as closing nursery areas to fishing. NMFS is not aware of any information that would lead to specific actions to protect and/or enhance shark habitat not already discussed in the FMP. NMFS will assess new habitat information as it becomes available.

22. FMP consistency with state coastal zone management plans.

a. Comment: New Jersey stated that the FMP was not consistent with its coastal zone management plan because of the proposed different application of the mako minimum size measure to the recreational and commercial fishery sectors conflicted with its plan.

Response: This issue is resolved since NMFS is not implementing the mako minimum size limit at this time.

b. Comment: Ten coastal states concluded that the proposed FMP measures were consistent with their respective coastal zone management plans.

Response: NMFS acknowledges the responses from these states.

23. Other.

a. Comment: Approval and implementation of the FMP conflicts with the Presidential Moratorium on New Regulations.

Response: NMFS does not agree. First, the Presidential Moratorium ended with the recent change in the Administration. Second, approval and implementation of the FMP would not have conflicted with the Presidential Moratorium on New Regulations because the FMP will prevent overfishing and maintain the shark stocks at MSY levels. These management results should ensure continuation of viable recreational and commercial fisheries, create additional employment over the long term, and promote economic growth. Regulations promoting economic growth were generally exempted from the Presidential Moratorium.

b. Comment: NMFS should delay implementation of the FMP until implementation of the agency's proposed public process for preparing and amending fishery management plans for Atlantic highly migratory species, as defined in the 1990 Fishery Conservation Amendments.

Response: NMFS does not agree. The FMP was developed with substantial public participation and as such is consistent with the principles for preparing fishery management plans for Atlantic highly migratory species as set forth in the agency's proposed process.

c. Comment: NMFS should develop and implement a fishery management plan for Pacific ocean sharks.

Response: NMFS has reviewed these comments and forwarded them to the three west coast fishery management Councils for their consideration. These Councils have responsibility under the Magnuson Act for preparing management plans for Pacific sharks.

- d. Comment: The finning prohibition poses vessel safety problems because it requires that heavy carcasses be carried on board, which make vessels less seaworthy. Finning should be allowed to prevent these safety problems.
- Response: NMFS does not agree. There are strong rationales to prohibit finning. It is up to each Master to ensure safe operation of his vessel while fishing within the law.
- e. Comment: NMFS should adopt and implement an FMP with measures similar to those applied by North Carolina and Virginia including trip limits, year round fisheries with no closures, fins-to-carcass weight ratio of 10 percent with a 10 percent tolerance applied, etc.
- Response: NMFS does not agree. The proposed Federal regulations are generally more conservative than those implemented by the above states. Therefore, overfishing is more likely to be prevented. NMFS will work with the states toward conforming regulations.
- f. Comment: FMP should contain trip limits that would prevent fishery closures and dampen market fluctuations in supply.
- Response: NMFS considered and rejected this type of measure for the initial shark management program as not supportable based on available fishery information and too difficult to enforce at this time. The OT may consider this measure for implementation at a later date.
- g. Comment: FMP should contain specific provisions for a spawning season closure to protect pregnant females and pups from fishing mortality.
- Response: The OT may consider this measure for implementation at a later date when more data are available.
- h. Comment: FMP should consider a management alternative that would close all fisheries (recreational and commercial) that kill sharks.
- Response: NMFS does not agree. This alternative was considered and rejected. Available scientific information does not support this alternative.

- i. Comment: FMP should establish a control date to be used later as a basis for determining historical fishery participation if a limited entry or other limited access system is to be implemented.
- Response: NMFS will consider establishing a control date.
- j. Comment: FMP should be amended to establish an ITQ system.
- Response: The OT may consider this measure for implementation at a later date. Amending the FMP at this point to establish any ITQ system would cause long delays. FMP implementation and significant conservation benefits, including rebuilding overfished resources, would be delayed or lost.
- k. Comment: Species other than mako should be managed through use of minimum size limit.
- Response: The OT may consider this measure for implementation at a later date.
- l. Comment: NMFS should consider issuing commercial and recreational permits by lottery.
- Response: NMFS does not agree. The Magnuson Act does not allow this as a sole means of allocating permits.
- m. Comment: NMFS should consider limiting entrants by increased user fees.
- Response: NMFS does not agree. The Magnuson Act limits fees to the administrative costs.

REPORT OF THE ATLANTIC COASTAL SHARK FISHERY ANALYSIS REVIEW September 30,
1992

INTRODUCTION

On September 30, 1992 a Shark Fishery Management Plan Regulatory Review Meeting was held in Miami, Florida to reach conclusions regarding the resource assessment of the Atlantic coastal shark resource. Meeting participants included Dr. Donald McCaughran, Director, International Pacific Halibut Commission; Dr. Grant Gilmore, Director, Harbor Branch Oceanographic Institution, Inc., Dr. Andrew Rosenburg of the National Marine Fisheries Service Woods Hole Laboratory, Dr. Michael Parrack of the National Marine Fisheries Service Miami Laboratory, and Dr. Jose Castro, also of the National Marine Fisheries Service Miami Laboratory. The meeting participants are hereafter referred to as the Committee.

A major charge placed on the Committee was to determine an appropriate fishery analysis procedure for the 1993 coastal shark fishery. After careful consideration the Committee concludes that the available data is meager and uncertain; but that an analysis of those data does yield statistics comprehensive enough to allow the initialization of fishery regulations. The committee strongly believes that the continuance of a regulatory regime rests on a vast improvement in the quality and extent of shark fishery statistics. The Committee is very concerned as to the inordinately limited extent and quality of the existing shark fisheries statistics.

The Committee considered shark life history characteristics relevant to resource production, a complete description of the fishery, and an inventory of available coastal shark fishery statistics. Analysis methods appropriate to the shark fishery were discussed and decisions reached as to the method to be used and calculations to be employed to investigate the status of the resource and to recommend a 1993 removal level.

LIFE HISTORY PATTERNS

Most commercially important sharks are best characterized by the two most important species in the landings. Sandbar sharks, which compose about 80% of the landings, grow very slowly reaching maturity after about 20 years of life. Bull sharks, a species that is sometimes a significant component of landings, particularly in the Gulf of Mexico, have very similar characteristics. Blacktip shark, the second most important species in the coastal shark landings, reach maturity at about age seven. These species do not produce young every year, rather they "pup" on alternate years. On the average, a female sandbar shark gives birth to nine pups every second year. On the average, an adult female blacktip gives birth to four pups every second year. Adults of most important food fish species spawn hundreds of thousands of offspring every year. Coastal shark reproductive characteristics are similar to predatory mammals rather than fishes.

These reproductive characteristics are germane. The exploitation level that large coastal sharks might support was roughly approximated by assuming that the natural life span is about three times the age at maturity as for other vertebrates and that the rate of natural mortality is on the order of the reciprocal of half the life span. For the two most important species, these two assumptions and the life history characteristics indicate that

	Sandbar	Blacktip
Age at Maturity	20	7
Litter Size	9	4
Pupping Frequency - Every	2 years	2 years
Survival	0.97	0.91
Reproductive rate	2.25	1.00
Life span	60	21
Pups produced	26.25	4.30
Living Juvenile offspring	6.18	0.98
Living Adult offspring	5.89	0.86
Living Total offspring	12.08	1.85
per year of life	0.20	0.09

so 0.2 sandbar are replaced for each individual alive in the population each year and 0.09 black tip sharks are replaced. The Committee stresses that these theoretical replacement rates (1.20 and 1.09) are extremely low as compared to those of almost all fisheries resources of commercial importance.

The species of commercial importance undergo seasonal migrations from south to north in the spring. These species pup in shallow estuarine waters along the Atlantic coast and Gulf of Mexico. The fish then migrate back south when fall temperatures cool coastal waters. Sandbar sharks undergo lengthy northward migrations reaching Southern New England waters by late summer. Sandbar sharks are caught as far north as Nantucket Shoal and the southern Georges Bank. Blacktip sharks are not believed to exhibit as extensive northward movements and travel in shallower, more coastal waters. The extent of southern movements is not established beyond doubt, but mark-recapture data suggest no movement south of the Yucatan.

Field observations by both scientists and fishermen indicate that migratory movements of individual sharks might not be completely random in time and space. It has been observed that if fish are encountered on a particular date at a specific geographical location, they will likely return to near that location at that time year after year. Fishermen depend on that information to a large degree for success. It is also true that the locations of migratory routes to pupping areas

and the locations of pupping concentrations are known to fishermen and that significant removals occurred in these locations.

FISHERY DESCRIPTION

Sharks of United States Atlantic coastal waters have been exploited for many years. The original fishery that began in 1936 for hides and livers (vitamin A) ceased in 1950. The recent fishery existed at a very low level until 1985 because the market value of and sport fishing interest in sharks was low. Due to successful food product marketing and increased sport fishing interest, exploitation increased dramatically after the first half of 1985. An intensive fishery has developed in both the Atlantic and Gulf of Mexico coastal waters Southern New England to Louisiana. The fishery provides shark meat to domestic markets and fins for export to Asian markets. It is the first large scale commercial shark fishery in the area in over four decades.

Shark meat was not a popular food item in the United States prior to the 1970's, although small quantities were sold in coastal areas throughout the southeastern states. These markets were supplied by small local fisheries. During the early 1970's shark meat consumption increased. In the mid-1970's, political and economic changes in the Asia opened the Asian shark fin market to the United States. Commercial marketing links between U.S. fishermen and consumers of shark fin in China and Hong Kong were established over a five to seven year period. A tremendous demand and high market value in Asia for shark fins encouraged the expansion of the U.S. Atlantic coastal shark fishery. The fleet targeting coastal sharks expanded quickly. In addition, due to escalating shark fin prices, vessels engaged in tuna and swordfish as well as other fisheries started removing the fins of sharks caught incidental to target species; before, the sharks were released unharmed. Thus, both the increased popularity of sharks as food and the demand for shark fins caused a very rapid increase in shark removals.

The southeastern United States directed coastal shark fleet employs longlines and gill nets from boats 20-120 feet in length, although most boats are about 40-55 feet. Monofilament mainlines are used when ever possible, but since fishing is carried out near the bottom, steel cable main line is used in waters deeper than about 180 feet. The cable longline is heavier and requires heavier handling equipment, so that gear is used on larger boats, usually those 52 feet in length and larger. Economic factors up to the present time are such that most fishermen prefer boats of about 42 feet. These boats use monofilament longlines usually in waters of 120 feet and less. Smaller boats use two to three man crews and larger boats use five or six man crews. Longliners operate during most of the year and the more successful boats following migrating sharks as they move north in the spring and summer and south in the fall. The majority of the longline catch is composed of sandbar, blacktip, bull, spinner, dusky, bignose, night, lemon, tiger, sand tiger, silky, scalloped hammerhead and great hammerhead sharks. Nurse and sand tiger sharks are also occasionally taken. Other species of smaller sharks including fine tooth, black nose, and Atlantic sharp nose are also caught, but the existing fishery targets the larger species.

Two distinctly different shark gill net fleets exist. A small boat fishery manually sets and retrieves nets in shallow coastal waters. A modern fleet with mechanized highly efficient gear fish on schools of sharks as they seasonally migrate along the coast.

Fishermen using small boats from 18-22 feet in length operate in very shallow waters with one or two man crews. They often fish in estuaries. They usually fish during May through November when sharks are in the shallows pupping or are migrating through. They catch the same species as the longline fishermen the proportional composition of their catches reflects the shallow waters where they fish. Recent legislation in several states has stopped the use commercial gill nets in state waters, so these fishermen now attempt to fish in deeper waters beyond 3 miles from the shore where their nets are much less effective.

The modern gill net fleet is composed of boats 36 to 55 feet in length. Hydraulic setting and retrieval machinery is employed as are spotter aircraft. Seven of these vessels directed their operations at blacktip sharks during 1991 off the Atlantic coast. These boats do not fish sharks year around, rather they opportunistically target peak concentrations of migrating schools close to shore in the spring and fall. Recently, legislation by several states has forced their operations, into deeper waters. These boats removed very large quantities of sharks from shallow, coastal waters and continued to do so this year (1992).

The number of boats targeting sharks increased rapidly until 1989, then decreased. After 1989 the larger vessels left the fishery until less than 100 remained in 1991. However, these and more boats entered in 1992 due to high fin prices and landings restrictions in other fisheries. The major ports for these vessels were Morehead City, North Carolina; Port Orange on the Atlantic coast of Florida, and Madeira Beach on the Gulf of Mexico coast of Florida; and Bayou LaBatre, Alabama. Currently (1992), ports in Louisiana, the Atlantic coast of northern Florida, and north of North Carolina are becoming major landing points.

Recreational fisheries also exist for Atlantic sharks in the United States. Although landings are small and sporadic, there has been an increasing interest in shark sport fishing during the 1980's. Decreasing recreational catches, particularly in shark fishing tournaments in the southern United States, has prompted concern by the sport fishing community for the status of the resource. Several shark fishing tournaments no longer occur due to the absence of success by tournament entries in recent years.

FISHERY STATISTICS

More than ten large coastal species are common in the landings, but the heads, guts, and fins were removed at sea so accurate shore identification was not attempted. The species landed therefore were not recorded nor were species composition samples collected. Lengths of fish in commercial landings were not comprehensively or consistently sampled during the fisheries history. A research cruise fishing success rate (CPUE) time series, or other consistent measure of relative abundance covering the geographical expanse of the fishery were not collected so fishery independent abundance indices are not yet developed. Some samplings do exist, however, and the possibility exists that these may be analytically equated to form an index. The data, however, reside in several different locations under different custodians and formats. Somatic samples (to interpret ages of landed fish) were not collected. Methods to interpret the age of sharks from body parts are not developed for many of the species taken by the fishery. Growth rates are not estimated for many species. Interview samples of commercial fishing trips were not collected so fishing time, location, and the gear employed were not recorded. In some instances, landings from several trips were recorded on a single sales receipt so the number of fishing trips can not be recovered. Finally, very large sharks (≥ 60 pounds dressed weight) and certain species caught by the directed shark fleet often are not accepted by fish brokers. The fins are valuable, so those sharks were often fined and discarded at sea. In addition, in southern areas, swordfish longline vessels fishing in shallow waters west of the Florida Current often catch large numbers of coastal sharks, but do not land them; they fin the fish and dump them at sea. The data were not collected to compute the magnitude, size frequency, or species composition of the discards.

Three data elements existed from the commercial fishery. First, the total brokered yield was available from fish buyers. These landings were gathered by a voluntary dealer reporting method. The Committee observed that these statistics are documented to have been in large error in the recent past and that there is indication problems still exist. The extent of error in the past (68% low in one year and 138% low in another) was large enough to render any past analysis result erroneous. Second, the number of fish in weighed bins was recorded on some sales slips. Also, several logbooks were obtained that recorded the dressed weights of individual fish on several trips. It was therefore possible to compute the sample average weight (and its variance) of commercial landings during latter years. Last, boats were identified that were targeting coastal sharks during all months of each year the boat fished. Almost all were longline boats. The number of boats operating full time in the fishery was used as a measure of the amount of commercial fishing (time fished).

Recreational fisheries data were different. The number of person-fishing-trips, both in total and directed at sharks, were estimated from telephone interviews. The Committee noted that the sample survey used estimated the numbers landed (catch) rather than the weight landed (yield) and that the estimator, a stratified mean catch per interviewed trip prorated to the total number of trips estimated from telephone interviews, should be distributed Gaussian (normal). Weight frequency sampling coverage was very sufficient for some portions of the recreational fishery, but not others. Enough weight frequencies were collected to compute sample average weights and variances.

After the assessment results based on the data available in 1990 were made public, shark fishermen became concerned. During the period between December, 1990 and July, 1992 several fishermen and two dealers supplied as much information regarding their activities as they could. Although some of the information was verbal, extensive written documents was also provided. These documents greatly affected the database. During this period those individuals made the contributions described below.

The personal fishing records of several fishermen are now available. These contain complete information as to number of sets, numbers of each species caught, location, total dressed weight landed, fish tagged and released etc.). The amount of detail included in these records and the willingness and interest shown by several fishermen indicate that a logbook system could successfully be the main bases for future analysis of the fishery.

Through verification with dealers and fishermen, it was determined that, several boats counted as shark boats in the past analysis where not fishing for sharks at all or did so occasionally, or (in one case) did not exist. It was also shown that the landings data were in large error because (1) the ex-vessel fish buyers did not report the transactions and (2) misclassification of reported landings. Under reporting resulted in the landed yield being low by at least 68% in 1986. Misclassification resulted in the landed yield of large coastal sharks being low by 138% in 1988. The landed yields used in the previous analysis are now known to have been biased low by at least 68% in 1986, 18% in 1987, 138% in 1988, and 34% in 1989. Dealer under reporting still seems to be occurring; so far 10% under reporting has been found in 1990 and 7% in 1991.

In addition, shark fin dealers indicated that "finning", i.e., cutting the fins off and dumping the carcass, might be of considerable magnitude. Apparently, in the area south of the Virginia coast, swordfish fishermen catch large coastal sharks, but they have not often landed these fish. They did, however, sell the fins. Information from 15 trips during April through August of 1992 suggest that on the average 56 large coastal sharks were dumped per swordfish trip in the southern area. In 1991 there were about 3300 trips so as many as 200,000 sharks might have been finned. If the average dressed weight of these fish is about 45 to 50 pounds, as much as 4,000 mt might have been finned. The 1991 large coastal shark landings were about 4000 mt. In 1987 there were about 2300 southern area swordfish trips which is equivalent to a discard of roughly 2800 mt, dressed weight; the landings were about 2450 mt. These very rough computations suggest that the amount finned might well be on the same order as that landed.

The Committee points out that interest and involvement by fishermen greatly strengthened the available data, perhaps to the point that analysis results might now be useful. The Committee believes that constant contact with and involvement by fishermen in the data used to formulate resource assessment and consequent regulations will increase the reliability and extent of fishery statistics over that now available and, most importantly, improve the credibility of analysis results.

ANALYSIS

After reviewing the available data, the Committee discussed the simple likelihood method of analysis described in attachment 1. The method combines the standard statistical method of obtaining dependable estimates with a simple, conventional fishery population model. The Committee concluded that the method efficiently subtracted all relevant information contained within the available data. It was pointed out that although the method estimated only a few statistics, those were the ones most germane to establishing the status of a resource and that the estimates were accurate, usefully precise, and seemed to be robust to common data deficiencies. Most importantly, Monte Carlo tests indicate the method is successful even if the time series of fishery statistics is very short and growth rates (or ages) of individual fish are not predictable.

The Committee decided that all computer code must be checked so the code was independently rewritten and results compared with results obtained from the previous code to insure against programming errors. The Committee decided that the variance of the removal ratios would be required so the computer output was modified to include it. Last, the Committee believed that variance estimates might be biased low because the re-sampling did not include drawing the variances of the Y variable (mean weights) or catch estimates), only the Y variable. The problem is that although the Y variable can be drawn Gaussian (the observed Y is a proxy for the expectation and the estimated variance is the proxy for the variance), since a proxy for the variance of the variance of the Y variable is not available, drawing that statistic is not possible so the resampling did not include it. The Committee thought that the components of the Y variable might be drawn since the Y variable and its estimated variance were available. Both the Y variable and its variance could then be computed from the draw. This method will work if the underlying distribution(s) of the components of Y variable are known and is (are) defined by the first two moments, but in this case this requires further development. The underlying distributions of the components of the Y variable are unknown. For instance, in the case of observations where the Y variable is sample mean weight, the estimator is not restricted to a specific distribution of individual weights, and in fact, accuracy seems to be unaffected by that distribution as theory predicts.

Data. The Committee decided to use all available data from 1986 through 1991. Statistics were combined to characterize a single commercial fishery and a single recreational fishery (Table 1). The commercial shark landings by all gears other than pelagic longline were assumed to be large coastal sharks. Directed shark boat years were used as an index of commercial fishing time. This statistic was simply an annual enumeration of boats that targeted sharks at least one trip each month that the vessel fished. These lists were formulated by fisheries statistics personnel from North Carolina through Louisiana. In most cases, the lists were verified, to the extent possible, with fishermen and dealers in each local area. The sample average weight of landed sharks and its sample variance were computed from the available dealer "tally sheets" and fishermen logbooks.

The recreational fishery is characterized by two data collections: the national Marine Recreational Fishery Statistics (MRFS) survey and the National Marine Fisheries Service Beaufort Laboratory Headboat Survey. The headboat survey covers the southern area recreational fishery that occurs on boats for hire that carry nine or more paying clients; the MRFS covers the rest of the recreational fishery.

The MRFS survey data was accessed for annual estimates of the number of large coastal sharks landed, the estimated variance of the catch estimate, and the number of total-angler-days-fished (TADs) and directed (at coastal sharks)

angler-days-fished (DADs). TADs are presented in the published statistics. The Committee estimated DADs from species sought information obtained on the survey's interview samples. Although these indices of recreational fishing time were estimates, they were assumed to be enumerations for the purpose of stock assessment. The Committee also obtained sample average weights from the survey's weight frequency samples; 1991 weight frequencies were not made available to the Committee.

Almost all headboats make complete reports of every trip. The species and weight of almost all sharks landed, the number of fishermen, and the target species are recorded. This data provided the total catch of coastal sharks, two indices of fishing time (TADs and DADs), and sample average weights. Some estimation occurs (simple proration) due to a very small amount of non-reporting, but the Committee assumed that landings and TADs measured without error for the purpose of estimation. The DADs all occurred on trips from just one port, Port Aransas, TX.

Models. The Committee decided that the results from both Model 1 (variant replacement rate as described in the attachment) and Model 2 (invariant replacement rate) would be considered. Since Model 1 accounted for annual variation in the rates of reproduction, finning, migration, and natural death, the Committee believes it is the best choice. The Committee also considered the results obtained by entering the two sets of recreational fisheries data (MRFS and Headboat) separately and from entering them as a single combined recreational fishery. The MRFS survey did not enumerate yields (weight caught), rather estimates of catch were the available statistic so, for the combined recreational fishery, the Y variable was estimated catch, not sample average weight as for the commercial fishery. In addition to these options, the Committee also used both directed recreational effort (DADs) and total recreational effort (TADs). Therefore, the Committee considered the results from eight combinations of population models and data groupings.

Results. The Committee concluded that analytic results with low probability of fit should be discarded. That statistic is, in simple terms, the probability that the model (including the parameter estimates) and the data all came from the same shark resource and fishery. That result (below) indicates that combining the MRFS and Headboat data into a single set of

Recreational Data		Replacement Rate	
MRFS, Headboat	Fishing Time	Model 1: Variant	Model 2: Invariant
Separate	DADs	< 0.001	< 0.001
Separate	TADs	0.110	< 0.001
Combined	DADs	0.014	0.020
Combined	TADs	0.536	0.932

recreational fishery statistics and using total angler days (TADs) to measure recreational fishing time is most appropriate (last line in the table).

The probability of fit for Model 1 and Model 2 were similar, however, in the case of Model 2, estimates were very imprecise (below), so imprecise that the lower bound of the

Model 1				Model 2			
Variant Replacement Rate				Invariant Replacement Rate			
54 Resamples				46 Resamples			
$\beta(k)$	MLE	$\sqrt{s^2} [\beta(k)]$	cv	MLE	$\sqrt{s^2} [\beta(k)]$	cv	
N(92)	1338262	160193	.12	2781695	16350130	5.88	
s(86)	.88	.3522	.40				
s(87)	1.59	.2422	.15				
s(88)	1.18	.1756	.15				
s(89)	1.29	.1644	.13				
s(90)	1.54	.2350	.15				
s(91)	1.25	.1932	.15				
s	(avg=1.29)			1.12	.1221	.11	
q(1)	.0016835480	.000251417	.15	.0007449800	.000470541	.63	
q(2)	.0000019840	.000000228	.11	.0000009320	.000000595	.64	

0.80 confidence interval on the estimates of stocksizes was less than zero for all years, 1986-92. The coefficient of variation of the 1992 estimate is particularly disturbing (588%). Even though the constant replacement rate model almost certainly (with 93% probability) fits the data, the resulting estimates are too uncertain to be used. The Committee decided that these results were not useful. The Committee decided to base its advice on the results of Model 1 (variable replacement rate). The variant replacement rate model probably does fit the data (53% probable) and the estimates are usefully certain. These results are detailed in Table 2. The Committee points out the following results:

- 1) 1991 landings are estimated to have been 0.370 million fish (4319 mt, Table 3), considerably less than the peak of 0.448 million in 1989 (5629 mt) and much more than the 1986 landing of 0.215 million fish (2057 mt). Commercial boats directing at sharks decreased from the peak in 1989 to 1991. The 1992 kill probably exceeded that of 1991. During 1992 there was a significant increase in fin prices, anticipation of a fishery closure, a displacement of boats from closed fisheries into the shark fleet, a higher than usual availability of fish during the spring, and an increase in dressed meat prices in the fall.
- 2) Abundance, in numbers of sharks regardless of size and species (of the large coastal group), has been relatively stable, 1986-92. If these fishery statistics are not biased (the commercial fishery landings available for the 1990 analysis were in huge error), with 80% confidence, there were between 1.1 and 1.5 million individuals (all sizes and species of the group combined) alive on January 1, 1992.
- 3) The annual replacement rate is estimated to have fluctuated between 0.88 and 1.59 during 1986-91. The average of annual point estimates is 1.29. These rates are precisely estimated ($cv \leq 0.15$ for most years). This rate includes additions and subtractions of sharks from reproduction, natural death, migration, and finning. As explained above in the relevant section, life history characteristics indicate that theoretically, the replacement rate from reproduction and accounting for natural death (but not considering migration and finning) of the main commercial species (sandbar shark) is about 1.20 annually.
- 4) The (exponential) fishing mortality rate increased from about 0.2 in 1986 to the current level of about 0.3. These estimates are precise ($cv \leq 0.11$). The average of estimates for 1988-91 is 0.30. $F(rep)$ is about 0.25; therefore, the current level might be slowly depleting abundance.

- 5) Analysis results indicate that overfishing occurred (landed removals exceeded production) in all years except 1987 and 1990; removal ratios (landings/replacement) indicate the resource was overfished in 1986, 1988, 1989, and 1991. However, removal ratios and production estimates are particularly uncertain in years where overfishing is indicated.
- 7) Projection of the fishery through 1992 indicate the landed yield (dressed weight) at the replacement level ($F(\text{rep})=0.2546$) would have been 3733 mt. This is 586 mt (about 30,000 fish) less than the 1991 landed yield of 4319 mt. As explained in 1) above, 1992 landings probably increased, not decreased. Stock abundance therefore probably decreased during 1992 due to fishing removals, i.e., the resource was probably overfished in 1992.
- 8) The effect of 1993 removals cannot be projected without 1992 landings. 1992 landings will not be compiled until mid 1993 or latter, so for the reasons in 1) above, 1992 landings were assumed to be 10% more than that of 1991. Projecting the average of 1986-91 replacement rates, the 1993 stocksize is 6% less than that of 1992. Projection of that stocksize (Table 4) indicates a 1993 landed removal of 3520 mt at the $F(\text{rep})=.2546$ fishing level. A fishing level that allows 5% annual abundance increase results in a 2916 mt landed yield (quota) in 1993 and a 5% increase each year thereafter ($F(5\%)=.2059$). The projection for $F(10\%)$ results in a 2311 mt quota in 1993 and large (10%) increases thereafter.

RECOMMENDATIONS

1. The simple likelihood method used to analyze the coastal shark fishery efficiently extracted all relevant information contained within the data. The method estimates the few statistics most germane to resource management. The estimates are accurate, precise, and seemed to be minimally affected by common data deficiencies. The Committee recommends use of the method for the Atlantic shark fishery and other cases where the statistical time series is short or where the growth rates or ages of individual fish are not known with certainty.
2. The Committee recommends that future stock assessments be based on statistics from a fishermen reporting system requiring fishermen submit two kinds of information:
 - (1) A copy of each sales transaction receipt when sharks are sold. The sales receipts must contain the dressed weight and species of each individual shark landed. The correct species identification of landed sharks will be difficult because sharks are beheaded, tailed, gutted, and finned at sea, but the separate assessments of each individual species requires the numbers landed of *each species*.
 - (2) Written records (logbooks) of fishing activities. The record must contain the date, species, sex, size (eye estimate of weight or measured total length), and disposition (landed, released alive or discarded dead) of each shark caught. The kind and amount of gear set, amount of time the gear fished, and supplementary information (gill net size, composition of mainline, bait, use of spotter aircraft, etc.) must also be included.
3. Extremely preliminary and scant data indicates that the coastal shark catch by the swordfish fleet in southern U.S. coastal waters might be extensive. Even though future regulations might prevent finning, the discarding of these fish might continue to be significant. In the future, a portion of these fish might be landed rather than dumped so that some of the kill will be included in the landings statistics, but dumping probably still will occur. Therefore, the Committee recommends an at sea observer sampling program to monitor the amount, sizes and species of those discards.
4. The Committee recommends reducing the 1993 landings below the 1991 level.

The $F(\text{rep})$ level (3520 mt in 1993) will reduce fishing mortality about 15% below the 1991 level and abundance will be stabilized.

The F(5%) level (2916 mt in 1993) will reduce landings 34% from the 1991 level and fishing mortality will be reduced from the current (overfishing) level of 0.3 to 0.2. This level will increase abundance by 5% each year back to the 1986 level by January 1, 1998.

The F(10%) level (2311 mt in 1993) will reduce 1993 landings to about half of the 1991 level. Fishing mortality will be substantially reduced; abundance will increase 10% each year. An abundance level 30% higher than the 1986 estimate is projected by 1998 with that fishing level.

5. The Committee did not deliberate the impact of drift gill nets nor was it presented data to analyze that specific gear. Drift gill nets are extremely efficient and often kill non-target species (turtles, dolphins, etc.) so the continued use of that gear is questionable.
6. The Committee was not presented data that would allow it to explicitly define nursery and mating locations for sharks. If existing studies document nursery grounds and or mating locations well enough to define their geographical boundries, the areas could be closed to directed shark fishing.
7. The Committee recommends granting shark fishing permits to **only** those persons who have demonstrated knowledge and sensitivity to the management and longevity of the fishery.

Table 1. Statistics of the United States Atlantic large coastal shark fishery.

Fishery	Yr	Fishing Time		Landings			Dressed		n	
		Directed Nos of Boats	Angler Directed	Days Total	Dressed Pounds	Estimates Numbers	variance	wt		s ² [wt]
Commercial	86	42			2868619			46.92	213.00	161
	87	55			5403658			46.03	323.54	64
	88	110			8944963			28.21	123.41	614
	89	132			11051596			28.89	468.41	3723
	90	123			8443853			28.75	343.35	1474
	91	96			8839573			40.66	446.81	154
Recreation (MRFS)	86		341300	53241000		150921	475381174	10.76	6.72	185
	87		282600	58266000		49332	748008566	10.74	1.63	240
	88		406300	57803000		153604	487203456	7.25	2.23	134
	89		189200	42693000		99328	301958950	10.37	4.07	153
	90		237900	47829000		120716	367763921	18.67	0.98	149
	91		170200	55105000		148456	232462032			
Recreation (Headboat)	86		1875	718000	40047	3278		11.11	6.22	25
	87		5039	733100	45069	4141		17.95	2.65	112
	88		6783	694700	72511	6099		12.35	1.32	84
	89		6757	695500	65055	6432		16.71	2.48	98
	90		4092	702200	34941	4350		5.06	93.93	180
	91		3291	629600	27556	4600		4.46	55.87	91
Combined Recreation (MRFS + Headboat)	86		343175	53959000		154199	475381174	10.80	5.30	210
	87		287639	58999100		153473	748008566	13.03	1.06	352
	88		413083	58497700		159703	487203456	9.22	1.06	218
	89		195957	43388500		105760	301958950	12.85	1.92	251
	90		241992	48531200		125074	367763921	11.22	28.39	329
	91		173491	55734600		153056	232462032	4.46	55.87	91

Table 2. Analysis results for U.S. Atlantic large coastal shark fishery, 1986 through 1991.

Solution Point for Model 1: Variant Replacement Rate

X^2	—	2.181278
Pr[X^2]	—	.536

Equality Definition — .0089 over the 8 best solutions.

The model fits.

$\beta(k)$	d[LL]/d[$\beta(k)$]	MLE	54 Resamples		Solution Precision
			$\sqrt{s^2[\beta(k)]}$	cv	
N(92)	.04	1338262	160193	.12	.023
s(86)	-41436.23	.88	.3522	.40	.107
s(87)	-43564.87	1.59	.2422	.15	.078
s(88)	-58418.33	1.18	.1756	.15	.073
s(89)	-53589.17	1.29	.1644	.13	.021
s(90)	-39840.44	1.54	.2350	.15	.022
s(91)	-44239.14	1.25	.1932	.15	.046
q(1)	68789901.93	.0016835480	.000251417000	.15	.009
q(2)	19138854843.58	.0000019840	.000000227998	.11	.008

Variance Estimation Equality Definition: 2.723

Solution Precision = [$\beta(\text{largest}) - \beta(\text{smallest})$] / $\beta(\text{MLE})$
 where $X^2[\beta(\text{largest})]$ and $X^2[\beta(\text{smallest})]$ are within the Equality
 Definition of $X^2[\beta(\text{MLE})]$

Table 2 cont. Analysis results for U.S. Atlantic large coastal shark fishery, 1986 through 1991.

	86	87	88	89	90	91	92
N(t)	1578368.	1158144.	1489091.	1302961.	1234302.	1406042.	1338262.
.8 CI lower	941593.	885299.	1209733.	996496.	976371.	1090625.	1133215.
upper	2215144.	1430989.	1768450.	1609427.	1492234.	1721459.	1543309.
√var	497481.	213160.	218249.	239426.	201509.	246420.	160193.
cv	.32	.18	.15	.18	.16	.18	.12
s(t)	.88	1.59	1.18	1.29	1.54	1.25	
.8 CI lower	.43	1.28	.96	1.08	1.24	1.00	
upper	1.33	1.90	1.41	1.50	1.84	1.50	
√var	.35	.24	.18	.16	.23	.19	
cv	.40	.15	.15	.13	.15	.15	
S(t)	.73	1.29	.88	.95	1.14	.95	
.8 CI lower	.36	1.04	.71	.80	.93	.77	
upper	1.11	1.53	1.04	1.10	1.35	1.13	
√var	.29	.19	.13	.12	.17	.14	
cv	.40	.15	.15	.13	.14	.15	
F(t)	.18	.21	.30	.31	.30	.27	
.8 CI lower	.16	.18	.26	.26	.26	.24	
upper	.20	.23	.34	.35	.35	.31	
√var	.02	.02	.03	.03	.03	.03	
cv	.09	.09	.10	.11	.11	.10	
P(t)	-194916.	678271.	271921.	377078.	670047.	350891.	
.8 CI lower	0.	0.	0.	0.	0.	0.	
upper	505316.	1616173.	752221.	940094.	1678399.	896102.	
√var	547057.	732736.	375235.	439857.	787775.	425946.	
cv	-2.81	1.08	1.38	1.17	1.18	1.21	
G(t)	-4103999.	18538680.	5941250.	9583777.	15755730.	9019248.	
.8 CI lower	0.	10858400.	0.	2958388.	7725736.	1284891.	
upper	9368149.	26218960.	13552900.	16209160.	23785710.	16753600.	
√var	10525120.	6000221.	5946599.	5176085.	6273430.	6042466.	
cv	-2.56	.32	1.00	.54	.40	.67	
r(t)	-1.10	.40	1.75	1.29	.62	1.06	
.8 CI lower	.00	.15	.00	.00	.31	.00	
upper	3.35	.65	11.15	6.70	.94	47.58	
√var	3.48	.20	7.34	4.22	.25	36.35	
cv	-3.15	.49	4.19	3.26	.40	34.43	

N(t) = Initial Abundance.

P(t) = Replacement: production in numbers.

r(t) = Removal Ratio: landings|production.

s(t) = Replacement Rate.

G(t) = Stock Growth: production in weight.

F(t) = Instantaneous Fishing Rate

Table 3. Estimated landings (dressed weights) of large coastal sharks.

Year	Fishery	Yield		Catch (nos.)	pounds avg.wt.
		pounds	mt		
1986	Commercial	2868619	1301	61139	46.92
	Recreational	1665349	755	154199	10.80
	Total	4533968	2057	215338	21.06
1987	Commercial	5403658	2451	117394	46.03
	Recreational	1999753	907	153473	13.03
	Total	7403411	3358	270867	27.33
1988	Commercial	8944964	4057	317085	28.21
	Recreational	1472462	668	159703	9.22
	Total	10417420	4725	476788	21.85
1989	Commercial	11051600	5013	382541	28.89
	Recreational	1359016	616	105760	12.85
	Total	12410610	5629	488301	25.42
1990	Commercial	8443854	3830	293699	28.75
	Recreational	1403330	637	125074	11.22
	Total	9847184	4467	418773	23.51
1991	Commercial	8839573	4010	217402	40.66
	Recreational	682630	310	153056	4.46
	Total	9522204	4319	370458	25.70

Table 4. Fishery projections for large coastal sharks. The 1992 landed catch is assumed to be 10% larger than that of 1991. The average of estimated annual replacement rates ($s = 1.29$) and of annual average weights (24.14 pounds dressed) is projected.

Fishing Mortality Rate (F)	Year	January 1 Exploited Stock		landed	
		Numbers	Biomass(mt)	Catch	Yield(mt)
F(assumed)= .3133	92	1338262	14660	407252	4461 mt
F(rep)= .2546	93	1261981	13824	321353	3520 mt
.2546	94	1261981	13824	321353	3520 mt
.2546	95	1261981	13824	321353	3520 mt
.2546	96	1261981	13824	321353	3520 mt
.2546	97	1261981	13824	321353	3520 mt
	98	1261981	13824		
F(assumed)= .3133	92	1338262	14660	407252	4461 mt
F(5%)= .2059	93	1261981	13824	266223	2916 mt
.2059	94	1325080	14515	279534	3062 mt
.2059	95	1391334	15241	293510	3215 mt
.2059	96	1460901	16003	308186	3376 mt
.2059	97	1533946	16803	323595	3545 mt
	98	1610643	17643		
F(assumed)= .3133	92	1338262	14660	407252	4461 mt
F(10%)= .1593	93	1261981	13824	210968	2311 mt
.1593	94	1388179	15206	232064	2542 mt
.1593	95	1526997	16727	255271	2796 mt
.1593	96	1679697	18400	280798	3076 mt
.1593	97	1847667	20240	308878	3384 mt
	98	2032434	22264		