**2005 Report to Congress**

Pursuant to the

# Shark Finning Prohibition Act of 2000

(Public Law 106-557)

U.S. Department of Commerce
National Oceanic and Atmospheric Administration

**Prepared by the**
**National Marine Fisheries Service**

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## 1.  Introduction

Sharks, skates, and rays are within the class Chondrichthyes—the cartilaginous fishes—and the subclass Elasmobranchii.  Sharks are an ancient and diverse group of fishes presenting an array of issues and challenges for fisheries management and conservation due to their biological and ecological characteristics.  Most sharks are predators at the top of the food chain, and many shark species are characterized by relatively late maturity, slow growth, and low reproductive rates.  Abundance of these top predators is often low compared to organisms at lower trophic levels, which can make them particularly vulnerable to overexploitation.

Sharks have not been a major priority for fisheries management agencies because the volume and value of shark landings were considerably less than commonly exploited commercial fishes.  On a global level, however, shark catches are commonly underreported and in some coastal waters, such as those of mainland China, there is no requirement to report shark catches; therefore, actual landings may be much greater than previously surmised.  Within the past decade, however, concern has increased about the status of shark stocks and the sustainability of their exploitation in world fisheries.  As demand for some shark species and shark products has grown, international fishing effort directed at sharks and evidence of overfishing have increased.  This situation has resulted in several international initiatives to promote greater understanding of sharks in the ecosystem and in greater efforts to conserve the many species in world fisheries.

On December 21, 2000, President Clinton signed into law the Shark Finning Prohibition Act of 2000.  Section 3 of the Shark Finning Prohibition Act amended the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) to prohibit any person under U.S. jurisdiction from:  (i) engaging in the finning of sharks; (ii) possessing shark fins aboard a fishing vessel without the corresponding carcass; and (iii) landing shark fins without the corresponding carcass.  In addition, Section 3 of the Shark Finning Prohibition Act contains a rebuttable presumption that any shark fins landed from a fishing vessel or found on board a fishing vessel were taken, held, or landed in violation (of the Act) if the total weight of shark fins landed or found on board exceeds 5 percent of the total weight of shark carcasses landed or found on board.  Section 9 of the Shark Finning Prohibition Act defines finning as the practice of taking a shark, removing the fin or fins from a shark, and returning the remainder of the shark to the sea.

The Shark Finning Prohibition Act requires NOAA's National Marine Fisheries Service (NMFS) to promulgate regulations to implement its prohibitions (Section 4), initiate discussion with other nations to develop international agreements on shark finning and data collection (Section 5), provide Congress with annual reports describing efforts to carry out the Shark Finning Prohibition Act (Section 6), and establish research programs (Sections 7 and 8).  This *Report to Congress* fulfills the requirements of Section 6 and provides a description of NMFS activities relative to other sections of the Shark Finning Prohibition Act.  This report also provides an update to last year's report, and includes complete information for 2004 activities plus additional information from a portion of the current year.

## 1.1 Management Authority in the United States

The Magnuson-Stevens Act and other legal authorities for management entities governing U.S. fisheries in which sharks are directed catch, incidental catch, or bycatch are discussed in the previous reports to Congress. The Magnuson-Stevens Act forms the basis for fisheries management in federal waters, and requires NMFS and the eight regional fishery management councils to take specified actions. State agencies and interstate fishery management commissions are bound by state regulations and, in the Atlantic region, by the Atlantic Coast Fisheries Cooperative Management Act.

## 1.2 Current Management of Sharks in the Atlantic Ocean

Development of fishery management plans (FMPs) is the responsibility of one or more of the eight regional fishery management councils, except for Atlantic highly migratory species (HMS), which include tunas, swordfish, billfish, and sharks. Since 1990, shark fishery management in federal waters of the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea (excluding dogfishes, skates, and rays) has been the responsibility of the Secretary of Commerce, delegated to NMFS. The New England Fishery Management Council (NEFMC) has the lead in consultations with the Mid-Atlantic Fishery Management Council (MAFMC), for the management of spiny dogfish in federal waters of the Atlantic Coast pursuant to the Spiny Dogfish FMP, which became effective in February 2000. In June 1999, the Atlantic States Marine Fisheries Commission approved the development of an Interstate Fishery Management Plan (FMP) for Spiny Dogfish, as well as coastal sharks.

In 1993, NMFS implemented the FMP for Sharks of the Atlantic Ocean, which established three management units: large coastal sharks (LCS), small coastal sharks (SCS), and pelagic sharks (Table 1.2.1). Under the FMP, species groups were not managed on a regional basis. NMFS identified LCS as overfished, and therefore, among other things, implemented commercial quotas for LCS and established recreational harvest limits for all sharks. At that time NMFS also banned finning of all sharks in the Atlantic Ocean.

In April 1999, NMFS published the FMP for Atlantic Tunas, Swordfish, and Sharks, which included numerous measures to rebuild or prevent overfishing of Atlantic sharks in commercial and recreational fisheries. The 1999 FMP replaced the 1993 FMP and the implementing regulations were published on May 28, 1999 (64 FR 29090). The 1999 FMP addressed numerous shark management measures, including: reducing commercial LCS and SCS quotas; establishing a commercial quota for blue sharks and a species-specific quota for porbeagle sharks; expanding the list of prohibited shark species; implementing a limited access permitting system in commercial fisheries; and establishing season-specific over- and under-harvest adjustment procedures. The 1999 FMP also partitioned the LCS complex into ridgeback and non-ridgeback categories but did not include regional quota measures. Due to litigation, many management measures in the 1999 FMP were not implemented.

On December 24, 2003, the final rule implementing Amendment 1 to the FMP for Atlantic Tunas, Swordfish, and Sharks was published in the *Federal Register* (68 FR 74746). This final rule revised the shark regulations based on the results of the 2002 stock assessments for SCS and LCS. Results of these stock assessments indicate the SCS complex is not overfished and overfishing is not occurring; the LCS complex continues to be overfished and overfishing is occurring; sandbar sharks are not overfished but overfishing is occurring; blacktip shark stocks are rebuilt and healthy; and finetooth sharks are not overfished but overfishing is occurring. In Amendment 1 to the 1999 FMP, NMFS revised the rebuilding timeframe for LCS to 26 years from 2004, and implemented several new regulatory changes. Management measures enacted in the amendment included: re-aggregating the large coastal shark complex; using maximum sustainable yield (MSY) as a basis for setting commercial quotas; eliminating the commercial minimum size restrictions; implementing trimester commercial fishing seasons effective January 1, 2005; imposing gear restrictions to reduce bycatch; implementing a time/area closure off the coast of North Carolina effective January 1, 2005; and establishing three regional commercial quotas (Gulf of Mexico, South Atlantic, and North Atlantic) for LCS and SCS management units. The regions include the Gulf of Mexico (Texas through the west coast of Florida), the South Atlantic (the east coast of Florida through North Carolina including the Caribbean Sea), and the North Atlantic (Virginia north). As a result of using the MSY as a basis for setting quotas and implementing a new rebuilding plan, the overall quota for LCS in 2004 of 1,017 metric tons (mt) dressed weight (dw) (2.24 million lbs dw) was lower than both the 2002 LCS quota of 1,285 mt dw (2.83 million lbs dw) and the 2003 LCS quota of 1,714 mt dw (3.78 million lbs dw). The overall LCS quota in 2005 remained unchanged at the current level of 1,017 mt dw. Depending on the results of a new LCS stock assessment, the quotas may be changed in 2006. The annual SCS quota is 454 mt dw, and the annual pelagic shark quota (other than blue or porbeagle sharks) remains at 488 mt dw.

A new LCS stock assessment will begin during the fall of 2005, with a data workshop currently scheduled for October 31–November 4, 2005, in Panama City, Florida, to collect and analyze the necessary data. The LCS stock assessment will follow the Southeast Data Assessment and Review (SEDAR) process and have assessment and review workshops in early 2006. The process should be completed in 2006.

Most of the regulations in Amendment 1 to the FMP for Atlantic Tunas, Swordfish, and Sharks became effective on February 1, 2004; however, the change in commercial quotas, removal of the commercial minimum size, establishment of regional quotas, and change in recreational bag limit became effective on December 30, 2003. The time/area closure off North Carolina and the trimester seasons became effective January 1, 2005. In addition, as of November 15, 2004, directed shark vessels with gillnet gear onboard, regardless of location, are required to have a Vessel Monitoring System (VMS) installed and operating during right whale calving season (November 15–March 31); and, as of January 1, 2005, directed shark vessels with bottom longline fishing gear onboard, located between 33° and 36° 30’ N latitude, are required to have a VMS installed and operating during the mid-Atlantic shark closure period (January 1–July 31). The VMS requirement was finalized on December 24, 2003 (68 FR 74746), and was delayed pending a type-approval notice, which was published on April 15, 2004 (69 FR 19979). The final rule announcing the effective date for the VMS requirement was published on August 17, 2004 (69 FR 51010).

NMFS is preparing a proposed rule requiring fishermen in the shark bottom longline (BLL) fishery to possess and use NMFS-approved dehooking devices similar to the requirement for vessels fishing with pelagic longline gear, to reduce post-hooking mortality of leatherback and loggerhead sea turtles. This rule is necessary to ensure compliance with the October 2003 Biological Opinion (BiOp). The rule is expected to be finalized in early 2006.

On August 19, 2005, NMFS published a Draft Consolidated Atlantic HMS FMP and proposed rule (70 FR 48804), which included, among other things, several alternatives for addressing overfishing of finetooth sharks and a complete review of all new information related to essential fish habitat (EFH) for sharks. The 2005 Draft HMS FMP and proposed rule; copies of Amendment 1 to the FMP for Atlantic Tunas, Swordfish and Sharks; and Atlantic commercial and recreational shark fishing regulations and brochures can be found on the Highly Migratory Species Management Division website listed in Appendix 1. Information on Atlantic shark fisheries is updated annually in the Stock Assessment and Fishery Evaluation (SAFE) Report for Atlantic HMS, which is also available on the website. The website includes links to current fishery regulations (50 CFR part 635), shark landings updates, the U.S. National Plan of Action (NPOA) for Sharks, and other HMS information.

The 2004 preliminary Atlantic shark landings estimates in metric tons (mt) dressed weight (dw) for the Atlantic shark commercial fisheries are shown in Table 1.2.2. The 2005 first, second, and third trimester shark fishing season quotas, landings, and opening and closing dates for all species groups and all regions are shown in Table 1.2.3. Because the third trimester season began on September 1, 2005, that season’s landings estimates were not yet available for this document. During a closure of a particular region, retention of, fishing for, possessing, or selling LCS in the region are prohibited for persons fishing aboard vessels issued a federal limited access shark permit under 50 CFR 635.4. In addition, in a closed region, the sale, purchase, trade, or barter of carcasses or fins of LCS harvested by a person aboard a vessel issued a permit under 50 CFR 635.4 are prohibited, except for those harvested; offloaded; and sold, traded, or bartered prior to the closure and held in storage by a dealer or processor. The quotas were adjusted to account for any over- or under-harvest in the same season during the 2004 fishing year. Landings data for Atlantic sharks based on the quota monitoring system for the 2004 second semi-annual season (July–December 2004) are also shown in Table 1.2.2.

In 2005, NMFS transferred the shark bottom longline observer program from the University of Florida to the NMFS Southeast Fisheries Science Center in Panama City, Florida. Observer coverage in the shark bottom longline fishery has been mandatory since 2002, and NMFS anticipates deploying approximately five to seven observers to monitor 300–400 commercial fishing trips per year. The data collected through the observer program is critical to the monitoring of takes and mortality estimates for protected sea turtles, sea birds, marine mammals, and smalltooth sawfish. Data obtained through the observer program are also vital for conducting stock assessments of sharks and for use in the development of fishery management measures for Atlantic sharks.

**Table 1.2.1** Atlantic sharks in the management unit by species groups.

| Large Coastal Sharks (LCS) | |
|---|---|
| Sandbar | *Carcharhinus plumbeus* |
| Silky | *Carcharhinus falciformis* |
| Tiger | *Galeocerdo cuvier* |
| Blacktip | *Cancharhinus limbatus* |
| Spinner | *Carcharhinus brevipinna* |
| Bull | *Carcharhinus leucas* |
| Lemon | *Negaprion brevirostris* |
| Nurse | *Ginglymostoma cirratum* |
| Scalloped hammerhead | *Sphyrna lewini* |
| Great hammerhead | *Sphyrna mokarran* |
| Smooth hammerhead | *Sphyrna zygaena* |

| Prohibited Species | |
|---|---|
| Sand tiger | *Carcharias taurus* |
| Bigeye sand tiger | *Odontaspis noronhai* |
| Whale | *Rhincodon typus* |
| Basking | *Cetorhinus maximus* |
| White | *Carcharodon carcharias* |
| Dusky | *Carcharhinus obscurus* |
| Bignose | *Carcharhinus altimus* |
| Galapagos | *Carcharhinus galapagensis* |
| Night | *Carcharhinus signatus* |
| Caribbean reef | *Carcharhinus perezi* |
| Narrowtooth | *Carcharhinus brachyurus* |
| Caribbean sharpnose | *Rhizoprionodon porosus* |
| Smalltail | *Carcharhinus porosus* |
| Atlantic angel | *Squatina dumeril* |
| Longfin mako | *Isurus paucus* |
| Bigeye thresher | *Alopias superciliosus* |
| Sevengill | *Heptranchias perlo* |
| Sixgill | *Hexanchus griseus* |
| Bigeye sixgill | *Hexanchus vitulus* |

| Small Coastal Sharks (SCS) | |
|---|---|
| Atlantic sharpnose | *Rhizoprionodon terraenovae* |
| Finetooth | *Carcharhinus isodon* |
| Blacknose | *Carcharhinus acronotus* |
| Bonnethead | *Sphyrna tiburo* |

| Pelagic Sharks | |
|---|---|
| Shortfin mako | *Isurus oxyrinchus* |
| Common thresher | *Alopia vulpinus* |
| Porbeagle | *Lamna nasus* |
| Oceanic whitetip | *Carcharhinus longimanus* |
| Blue | *Prionace glauca* |

**Table 1.2.2.** 2004 preliminary landings estimates in metric tons (mt) dressed weight (dw) for the Atlantic shark commercial fisheries. Landings are based on the quota monitoring system.

| Species Group | Region | Quota (mt dw) | Preliminary Landings (mt dw) |
|---|---|---|---|
| Large Coastal Sharks, i.e., sandbar, silky, tiger, blacktip, spinner, bull, lemon, nurse, hammerheads | Gulf of Mexico | 477.7 | 465.8 |
| | South Atlantic | 614.2 | 525.5 |
| | North Atlantic | 47.6 | 41.6 |
| Small Coastal Sharks, i.e., Atlantic sharpnose, finetooth, blacknose, bonnethead | Gulf of Mexico | 21.4 | 16.5 |
| | South Atlantic | 445.4 | 117.1 |
| | North Atlantic | 69.7 | .44 |
| Blue sharks | No regional quotas | 273 | 72.6 |
| Porbeagle sharks | | 92 | |
| Pelagic sharks other than blue or porbeagle | | 488 | |

**Table 1.2.3.** 2005 quotas, season opening and closing dates, and preliminary shark landings estimates in metric tons (mt) and pounds (lb) dressed weight (dw) for the Atlantic shark commercial fisheries. These landings estimates include landings reports received as of August 22, 2005.

| First Trimester Season (January 1 – April 30, 2005) | | | | | |
|---|---|---|---|---|---|
| **Species Group** | **Region** | **Closure date** | **Quota** | **Estimated landings** | **% Quota Taken** |
| Large Coastal Sharks, i.e., sandbar, silky, tiger, blacktip, spinner, bull, lemon, nurse, hammerheads | Gulf of Mexico | CLOSED February 28 | 156.3 mt dw (344,579 lb dw) | 109.6 mt dw (241,624 lb dw) | 70 |
| | South Atlantic | CLOSED February 15 | 133.3 mt dw (293,873 lb dw) | 130.9 (286,818 lb dw) | 98 |
| | North Atlantic | CLOSED April 30 | 6.3 mt dw (13,889 lb dw) | 9.4 (20,723 lb dw) | 149 |
| Small Coastal Sharks, i.e., Atlantic sharpnose, finetooth, blacknose, bonnethead | Gulf of Mexico | CLOSED April 30 | 13.9 mt dw (30,644 lb dw) | 14.2 mt dw (31,305 lb dw) | 102 |
| | South Atlantic | | 213.5 mt dw (470,682 lb dw) | 60.4 mt dw (133,157 lb dw) | 28 |
| | North Atlantic | | 18.6 mt dw (41,056 lb dw) | 0 | 0 |
| Blue sharks | No regional quotas | CLOSED April 30 | 91 mt dw (200,619 lb dw) | 0 | 0 |

| | | | | | |
|---|---|---|---|---|---|
| Porbeagle sharks | | | 30.7 mt dw (67,681 lb dw) | .22 mt dw (485 lb dw) | <1 |
| Pelagic sharks other than blue or porbeagle | | | 162.7 mt dw (358,688 lb dw) | 22.7 (50,044 dw) | 14 |

**Second Trimester Season**
**(May 1 – August 31, 2005)**

| Species Group | Region | Closure date | Quota | Estimated landings | % Quota Taken |
|---|---|---|---|---|---|
| Large Coastal Sharks, i.e., sandbar, silky, tiger, blacktip, spinner, bull, lemon, nurse, hammerheads | Gulf of Mexico | CLOSED July 23 | 148 mt dw (326,280 lb dw) | 105 mt dw (231,483 lb dw) | 71 |
| | South Atlantic | CLOSED August 31 | 182 mt dw (401,237 lb dw) | 113 (249,119 lb dw) | 62 |
| | North Atlantic | | 65.2 mt dw (143,739 lb dw) | 9.7 (21,385 lb dw) | 15 |
| Small Coastal Sharks, i.e., Atlantic sharpnose, finetooth, blacknose, bonnethead | Gulf of Mexico | CLOSED August 31 | 30.5 mt dw (67,240 lb dw) | 3.4 mt dw (7,495.6 lb dw) | 11 |
| | South Atlantic | | 281.3 mt dw (620,153 lb dw) | 49 mt dw (108,025 lb dw) | 17 |
| | North Atlantic | | 23 mt dw (50,706 dw) | 0 | 0 |
| Blue sharks | No regional quotas | CLOSED August 31 | 91 mt dw (200,619 lb dw) | 0 | 0 |
| Porbeagle sharks | | | 30.7 mt dw (67,681 lb dw) | 0 | 0 |
| Pelagic sharks other than blue or porbeagle | | | 162.7 mt dw (358,688 lb dw) | 29.8 (65,697 dw) | 18 |

**Third Trimester Season**
**(September 1 – December 31, 2005)**

| Species Group | Region | Opening Date | Closure date | Quota |
|---|---|---|---|---|
| Large Coastal Sharks, i.e., sandbar, silky, tiger, blacktip, spinner, bull, lemon, nurse, hammerheads (annual quota 1,017 mt dw) | Gulf of Mexico | September 1, 2005 | October 31, 2005 | 167.7 mt dw (369,711 lb dw) |
| | South Atlantic | September 1, 2005 | November 15, 2005 | 187.5 mt dw (413,362 lb dw) |
| | North Atlantic | September 1, 2005 | September 15, 2005 | 4.8 mt dw (10,582 lb dw) |
| Small Coastal Sharks, i.e., Atlantic sharpnose, finetooth, blacknose, bonnethead (annual quota 454 mt dw) | Gulf of Mexico | September 1, 2005 | TBD | 31.7 mt dw (69,885 lb dw) |
| | South Atlantic | | | 201.1 mt dw (443,345 lb dw) |
| | North Atlantic | | | 15.9 mt dw (35,053 lb dw) |
| Blue sharks (annual quota 273 mt dw) | No regional quotas | September 1, 2005 | TBD | 91 mt dw (200,619 lb dw) |
| Porbeagle sharks (annual quota 92 mt dw) | | | | 30.7 mt dw (67,681 lb dw) |

| | | | | |
|---|---|---|---|---|
| Pelagic sharks other than blue or porbeagle (annual quota 488 mt dw) | | | | 162.7 mt dw (358,688 lb dw) |

### 1.3 Current Management of Sharks in the Pacific Ocean

In the Pacific, three regional councils are responsible for developing fishery management plans: the Pacific Fishery Management Council (PFMC), the North Pacific Fishery Management Council (NPFMC), and the Western Pacific Fishery Management Council (WPFMC).

Pacific Fishery Management Council (PFMC)

The PFMC's area of jurisdiction is the Exclusive Economic Zone (EEZ) off the coasts of California, Oregon, and Washington. In late October 2002, the PFMC adopted its Fishery Management Plan (FMP) for U.S. West Coast Highly Migratory Species (HMS) Fisheries. This FMP's management area also covers adjacent high seas waters for fishing activity under the jurisdiction of the HMS FMP. The final rule implementing the HMS FMP was published in the *Federal Register* on April 7, 2004 (69 FR 18443). This FMP manages several sharks as part of the management unit, including the common thresher *(Alopias vulpinus)* and shortfin mako *(Isurus oxyrinchus),* sharks valued but not primarily targeted in the West Coast–based fisheries, as well as blue sharks (*Prionace glauca,* a frequent bycatch species), bigeye thresher *(Alopias superciliosus)* and pelagic thresher (*Alopias pelagicus,* incidental catch) sharks. The HMS FMP also designated some shark species as prohibited because of their special status. If intercepted, these species—including great white, megamouth, and basking sharks—must be released immediately, unless other provisions for their disposition are established.

The FMP proposed precautionary annual harvest guidelines for common thresher and shortfin mako sharks to prevent localized depletion, which could take decades to correct given the biological characteristics of the species. The common thresher shark and the shortfin mako shark are considered vulnerable to overexploitation due to their low fecundity, long gestation periods, and relatively high age at maturation. Shortfin makos are thought to be mature between 7 and 8 years, although age determination methods are still being validated, and predicted gestation lasts 15 to 18 months. Fisheries off the U.S. West Coast mainly take juvenile and subadult shortfin makos of age 3 or less, of unknown proportion to the overall stock (*California's Living Marine Resources: A Status Report.* California Department of Fish and Game: Resources Agency). Off southern California, common thresher shark females mature at lengths of 8.5 to 10 feet at a still unknown age, have a litter size from two to six pups, and may live from 15 to 19 years. The FMP also establishes a formal requirement for fishery monitoring and annual SAFE reports as well as a full FMP effectiveness review every 2 years. This should ensure new information will be collected and analyzed so additional conservation action can be taken if any species is determined to need further protection.

The Pacific Coast Groundfish FMP includes several shark species (e.g., leopard, soupfin, and spiny dogfish) in the groundfish management unit. Under regulations promulgated for 2003 and likely to be in effect for some time, a "rockfish conservation area" has been established closing large areas to fishing for groundfish, including sharks, by most gear types that catch groundfish. In addition, the Pacific Coast Groundfish FMP manages its shark species with a combined annual harvest guideline for all "other fish," which includes sharks, skates, ratfish, morids, grenadiers, kelp greenling, and some other groundfish species. This harvest guideline is reduced by a precautionary adjustment of 50 percent from the acceptable biological catch (ABC). Table 1.3.1 lists landings (round weight equivalent in metric tons) for various sharks from fisheries off California, Oregon, and Washington from 1992 through 2004.

**Table 1.3.1 Shark Landings (mt) for California, Oregon, and Washington, 1992-2004, Organized by Species Group**
Source: NWFSC fishticket data and the Pacific States Marine Fisheries Commission, PacFIN Database, Report # 307, September 2004, www.psmfc.org/pacfin/data

| Species Name | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bigeye thresher shark | 22 | 44 | 37 | 31 | 20 | 32 | 11 | 6 | 5 | 2 | -- | 5 | 5 |
| Blue shark | 1 | <1 | 12 | 5 | 1 | 1 | 3 | <1 | 1 | 2 | 42 | 1 | <1 |
| Common thresher shark | 292 | 276 | 330 | 270 | 319 | 320 | 361 | 320 | 295 | 373 | 301 | 294 | 115 |
| Leopard shark | 19 | 24 | 11 | 10 | 8 | 11 | 15 | 14 | 13 | 12 | 13 | 10 | 11 |
| Other shark | 8 | 12 | 4 | 1 | 2 | 3 | 5 | 6 | 5 | 38 | 4 | 20 | 3 |
| Pelagic thresher shark | <1 | <1 | 0 | 5 | 1 | 35 | 2 | 10 | 3 | 2 | 2 | 4 | 2 |
| Shortfin mako | 142 | 122 | 128 | 95 | 96 | 132 | 100 | 63 | 80 | 46 | 82 | 69 | 54 |
| Soupfin shark | 46 | 40 | 55 | 44 | 65 | 63 | 54 | 75 | 48 | 45 | 32 | 35 | 27 |
| Spiny dogfish | 1,100 | 1,270 | 1,392 | 367 | 249 | 425 | 462 | 514 | 624 | 564 | 875 | 447 | 667 |
| Unspecified shark | 6 | 5 | 6 | 16 | 5 | 7 | 7 | 13 | 6 | 3 | 4 | 3 | 6 |
| Pacific angel shark | 112 | 61 | 21 | 18 | 16 | 31 | 50 | 48 | 34 | 28 | 22 | 17 | 13 |

North Pacific Fishery Management Council (NPFMC)

The NPFMC manages fisheries in federal waters off Alaska. Sharks are managed under the "other species" category in the Gulf of Alaska (GOA) Groundfish FMP and the Bering Sea/Aleutian Island (BSAI) Groundfish FMP. "Other species" comprises taxonomic groups of slight economic value that are not generally targeted. The category includes sharks, skates, octopi, and sculpins in the BSAI and sharks, octopi, squid, and sculpins in the GOA. These species have limited economic potential and are important components of the ecosystem, but sufficient data are lacking to manage each separately; therefore, an aggregate annual quota limits their catch. Aggregate catch of the whole category must be recorded and reported. Research trawl surveys are conducted annually in the Bering Sea and in alternate years in the Aleutian Islands (e.g., 2004, 2006) and Gulf of Alaska (e.g., 2005, 2007). The BSAI Plan Team and Science and Statistical Committee provide annual recommendations to the Council for OFL (overfishing level) and ABC (Allowable Biological Catch) amounts for the "other species" category based on the best available and most recent scientific information. The Council adopts OFL, ABC, and Total Allowable Catch (TAC) levels for "other species" in the BSAI. The GOA Groundfish FMP does not allow for setting an OFL or ABC for the "other species" category. Instead, the FMP provides for an annual TAC for the "other species" category set at 5 percent of the sum of all other TACs established for assessed species.

In June 2005, the Council recommended an amendment to the GOA FMP to set the TAC at ≤5 percent of the sum of all other target species TACs in the GOA. If approved by the Secretary of Commerce, this amendment would be implemented in 2006. This action is intended as a short-term, proactive management measure to better conserve those stocks in the "other species" complex while the Council develops a more comprehensive long-term approach for the management of the "other species" complex in both the GOA and BSAI. A second interim step that would allow an OFL and ABC to be set for the GOA "other species" category is scheduled for Council action in 2006. Both FMP amendments are intended to enhance conservation of the species managed within the assemblage (including sharks).

Seven shark species have been identified during fishery surveys or observed during groundfish fishing in the Alaskan waters (Table 1.3.2).

**Table 1.3.2 North Pacific Shark Species**

| Common Name | Species Name |
|---|---|
| Pacific sleeper shark | *Somniosus pacificus* |
| Salmon shark | *Lamna ditropis* |
| Spiny dogfish shark | *Squalus acanthias* |
| Brown cat shark | *Apristurus brunneus* |
| Basking shark | *Cetorhinus maximus* |
| Sixgill shark | *Hexanus griseus* |
| Blue shark | *Prionace glauca* |

The brown cat, basking, sixgill, and blue sharks are very rarely taken in any sport or commercial fishery and are not targeted for harvest. Pacific sleeper, salmon, and spiny dogfish sharks are taken incidentally in groundfish fisheries and are monitored in season by NMFS. Sharks are the only group in the complex consistently identified to species in catches by fishery observers. Most of the incidental shark catch occurs in the midwater trawl pollock fishery and in the hook-and-line fisheries for sablefish, Greenland turbot, and Pacific cod along the outer continental shelf and upper slope areas. The most recent estimates of the incidental catch of sharks in the North Pacific are from 2004. These data are included for the BSAI and GOA in Appendix C to the November 2004 SAFE report. Estimates of the incidental catch of sharks in the GOA and BSAI groundfish fisheries from 1997–2001 have ranged from 850–2,390 mt and 370–760 mt, respectively. In the GOA, incidental catch of sharks in 2001 totaled 853 mt (down from 1,118 mt in 2000) and incidental catch of skates in 2001 totaled 1,828 mt (down from 3,238 mt in 2000). In the BSAI, incidental catch of sharks in 2001 totaled 763 mt (up from 590 mt in 2000) and incidental catch of skates in 2001 totaled 20,570 mt (up from 18,876 mt in 2000). Due to limited catch reports on individual species and larger taxonomic groups in the "other species" category, estimates of the incidental catch of sharks in the BSAI and GOA are largely based on NMFS survey results and observer data.

The Alaska Department of Fish and Game (ADF&G) manages the recreational/sport fishery with a daily bag limit of one shark per day and a limit of two sharks annually. In this sport fishery, the sharks are most commonly photographed and then released live. The catch consists almost entirely of spiny dogfish, salmon shark, and Pacific sleeper shark. No current reports of sport-caught sharks being finned and discarded were reported. The total estimated number of sharks harvested in the sport fishery in Southeast and South Central Alaska was 979 in 2001 (up from 753 in 2000). No sport harvest of sharks was reported in the Arctic-Yukon-Kuskokwim region. In state waters, ADF&G expressly forbids the finning of sharks. Although the targeting of sharks is prohibited in state waters, the incidental catch of sharks in other commercial fisheries may be retained provided the fish are fully utilized (5 AAC 28.084). The state has established limits for the amount of sharks that may be retained, similar to the maximum retainable amounts (MRAs) in the federally managed groundfish fisheries.

The following information is from the summary for the November 2004 Shark Appendix to the SAFE report, sharks in the Gulf of Alaska, Eastern Bering Sea, and Aleutian Islands:

> There is no evidence to suggest overfishing is occurring for any shark species in the GOA or BSAI. There are no directed commercial fisheries for shark species in federal or state managed waters of the GOA or BSAI and most incidentally captured sharks are not retained. Incidental catches of shark species in the GOA and BSAI fisheries have been very small compared to catch rates of target species. Preliminary comparisons of incidental catch estimates with available biomass estimates suggest current levels of incidental catches are low relative to available biomass for spiny dogfish and Pacific sleeper sharks in the GOA and for Pacific sleeper sharks in the BSAI. There is also an increasing trend in bottom trawl survey biomass estimation (used here as an index of relative abundance) for Pacific sleeper sharks and perhaps for spiny dogfish in the GOA. An independent analysis of NMFS AFSC bottom trawl surveys in the GOA also found Pacific sleeper shark abundance had significantly increased in the Central GOA during 1984–1996. Salmon sharks are rarely captured in the GOA and BSAI in either the fishery or the bottom trawl surveys. However, a recent demographic analysis suggests salmon shark populations in the eastern and western North Pacific are stable at this time. Spiny dogfish are rarely captured in the BSAI in either the fishery or the bottom trawl surveys. Other shark species are rarely captured and incidental catches are not likely to play a significant role in their stock structure because catches were small and generally occurred near the edge of their ranges.

It should be clear from this assessment that data limitations are severe, and further investigation is necessary to be sure shark species are not adversely affected by groundfish fisheries. Salmon sharks in particular, and other less common pelagic sharks such as blue sharks, are not likely to be effectively sampled by bottom trawl surveys. In addition, the catchability of sharks in bottom trawl gear is unknown. Bottom trawl survey biomass estimates for shark species should be considered a relative index of abundance at best. If target fisheries develop for any shark species, effective management will be extremely difficult with the current limited information. Regardless of management decisions regarding TAC and the future structure for the "other species" management category, it is essential to continue to improve shark species survey sampling and biological data collection to ensure their continued conservation through effective management.

Western Pacific Fishery Management Council (WPFMC)

The WPFMC is developing an amendment to its Fishery Management Plan for Pelagic Fisheries of the Western Pacific Region for the purpose of conserving and managing sharks in the western Pacific region. Management options being considered include: instituting harvest guidelines (e.g., caps on shark landings by weight or number) for all sharks or by individual shark species; prohibiting the retention, landing, and domestic transshipment of sharks (all or by species); establishing minimum/maximum harvest sizes or prohibiting harvest of female sharks; and requiring more selective gear and/or minimizing the mortality of released sharks. A redesignation of shark management species was accomplished through implementation of Amendment 10 to the Pelagics FMP in conjunction with the Coral Reef Ecosystem FMP (69 FR 8336; February 24, 2004).

Shark landings by the Hawaii-based longline fishery peaked at 6.3 million pounds (28,576.3 mt) in 1999, due in large part to the practice of finning blue sharks. Most recent landings data show shark catch remained low in 2004 at 74,917 sharks with estimated landings of 510,000 pounds. The shark catch from 2001 was not marketed as dried fins but as fresh shark fillets and steaks in supermarkets and restaurants. Fresh shark meat was also exported to the U.S. mainland. The American Samoa Department of Marine and Wildlife Resources (DMWR) reports catch data from commercial and recreational fishing to the Western Pacific Fishery Information Network (WPacFIN). These data, (taken from the WPacFIN website), indicate in 2004, a reported 9,921 sharks were caught in American Samoan fisheries. The total number of American Samoa–caught sharks reported in 2004 was down slightly from the 2003 catch 10,968.

The combined catch of the Hawaii and American Samoa–based fisheries was 84,838 sharks; however, only 3,094 (3.6 percent) were retained. The predominant species of shark taken in these fisheries was the blue shark (71,829 or 85 percent), of which 1,329 (2 percent) were retained. The total number of non-blue sharks caught was 13,009 (15 percent) of which 1,765 (13.5 percent) were kept. The non-blue sharks consisted of thresher sharks (5,655), mako sharks (2,117), white tip sharks (1,876), and other miscellaneous sharks (3,361). The predominant non-blue shark species kept was the mako shark.

**Table 1.3.3 Pacific Sharks in the Pelagic Management Unit by Species (as amended in March 2004)**

| Common Name | Scientific Name |
|---|---|
| Blue shark | *Prionace glauca* |
| Shortfin mako shark | *Isurus oxyrinchus* |
| Longfin mako shark | *Isurus paucus* |
| Oceanic white tip shark | *Carcharhinus longimanus* |
| Common thresher shark | *Alopias vulpinus* |
| Pelagic thresher shark | *Alopias pelagicus* |
| Bigeye thresher shark | *Alopias superciliosus* |
| Silky shark | *Carcharhinus falciformis* |
| Salmon shark | *Lamna ditropis* |

### 1.4 NMFS Enforcement Actions Pertaining to the Shark Finning Prohibition Act

During 2004 and 2005, NMFS agents initiated 16 investigations involving the finning of sharks, or the illegal offload of shark fins in U.S. ports. The NOAA Office of General Counsel for Enforcement and Litigation has instituted several enforcement actions for violations of the Shark Finning Prohibition Act (SFPA). The following closed cases resulted in legal actions:

- The owner and operator of the longline fishing vessel were charged with harvesting 12 sets of shark fins from large coastal sharks during a closure and failing to retain the carcasses (finning). The shark fins and other shark carcasses were seized. The case was initiated on May 18, 2004, after NOAA/NMFS Special Agents boarded the vessel along with the U.S. Coast Guard (USCG). Questioning by the agents led to the discovery of hidden shark fins. Following additional investigation and interviews, the agents were able to obtain a confession from the vessel captain along with a written statement in which he admitted he had hidden the fins after observing the approach of the USCG vessel. After reviewing the evidence and history of the vessel, the Southeast Office of General Counsel for Enforcement and Litigation (GCEL/SE) imposed a $15,000 Notice of Violation and Assessment (NOVA) and a Notice of Permit Sanction for 30 days.

- On August 27, 2004, law enforcement agents with the Louisiana Department of Wildlife and Fisheries were working under the provisions of the NOAA Joint Enforcement

Agreement and followed up on complaints regarding the alleged illegal landing and subsequent sale of shark carcasses and shark fins. As a result, they conducted an inspection of a seafood dealer and an associated fishing vessel. They discovered the vessel had landed shark fins constituting approximately 33 percent (by weight) of the shark carcasses landed from the same trip. This far exceeded the allowed 5 percent of the dressed weight of the shark carcasses. The LDWF agents seized 1,125 pounds of shark fins and 3,380 pounds of shark carcass that were sold for $12,376.25. The case was forwarded to the NOAA Office of General Counsel for Enforcement and Litigation, which imposed a $30,000 Notice of Violation and a Notice of Permit sanction for 45 days to the owner.

Other pending cases of note are as follows:

- In January 2005, NMFS OLE investigated a domestic corporation for purchasing illegally obtained fins from domestic fishing boats. These fins were commingled with legally imported fins and exported from the United States. Investigation is ongoing.

- In March 2005, NMFS OLE investigated a foreign flagged fish carrier in American Samoa. Two foreign longline vessels transshipped more than 8,000 lbs of shark fins to a foreign flagged fish carrier while inside Pago Pago harbor. The fins were landed without corresponding carcasses. The foreign fish carrier intended to export the shark fins from American Samoa to Taiwan. The case is currently under review with the Office of General Counsel.

- In June 2005, NMFS OLE assisted the government of the Cook Islands in the investigation of a Cook Islands licensed fishing vessel suspected of violating a condition of its license. The specific condition breached was related to the taking of sharks. In the Cook Islands, if a licensed longline fishing vessel catches a shark and chooses to keep the shark fins, the carcass must be retained. In this case the vessel's master was only retaining the shark fins, not the carcasses. The breach was detected, in the Cook Islands, by a NMFS Special Agent while he was conducting dockside fishery enforcement training with a group of Cook Islands Fisheries Officers.

- In July 2005, NMFS OLE investigated a foreign flagged fishing vessel that offloaded a bag of dried shark fins, weighing approximately 40 pounds. The dried fins were landed without corresponding carcasses and were intended for sale in the Cook Islands. Investigation is ongoing.

## 2. U.S. Imports and Exports of Shark Fins

Summaries of U.S. imports and exports of shark fins in Tables 2.1 and 2.2 are based on information submitted by importers and exporters to the U.S. Customs and Border Protection

Data, and U.S. Census Bureau as reported in the National Marine Fisheries Service Trade database. Data for 2005 were available from January through July. Data are provided for the same period in 2002 through 2004 for purposes of comparison. Exports of shark fins far exceed imports of shark fins in both weight and value. In 2005, import amounts exceeded those of the specified period (January through July) of the previous 3 years. In 2005, during the period January to July, exports of shark fins were consistent in weight and value with those of 2003 and 2004.

## 2.1 Imports of Shark Fins

Most imports of shark fins were unloaded at the following ports in 2004–2005: Honolulu, Seattle, New York City, Miami, San Diego, and Los Angeles. Other ports where lesser amounts of shark fins were unloaded include Boston; Portland, Maine; and Nogales, Arizona. In 2004, countries of origin in order of importance were Panama, Hong Kong, India, and China (see Table 2.1.1). It should be noted that, due to the complexity of the shark fin trade, fins are not necessarily produced close to or even in the same country as those from which they are exported. In the United States, factors such as availability of labor, overseas contacts, and astute trading can all play a role in determining the locale from which exports are sent.

**Table 2.1.1 Weight and Value of Dried Shark Fins Imported into the United States in 2004, by Country of Origin**
(Source: U.S. Customs and Border Protection Data and U.S. Census Bureau)

| Country | Kilos (lbs) | Value |
|---|---|---|
| AUSTRALIA | 28 (62) | $2,592 |
| CHINA | 1,565 (3,450) | $19,211 |
| CHINA - HONG KONG | 4,893 (10,787) | $106,573 |
| JAPAN | 489 (1,078) | $28,013 |
| INDIA | 2,808 (6,191) | $16,500 |
| VIETNAM | 551 (1,215) | $10,767 |
| PANAMA | 4,119 (9,081) | $160,034 |
| **Total: SHARK FINS DRIED** | **14,453 (31,864)** | **$343,690** |

**Table 2.1.2 Weight and Value of Dried Shark Fins Imported into the United States from 2002 to 2005, by Country of Origin from January to July Each Year**
(Source: U.S. Customs and Border Protection Data and U.S. Census Bureau)

| Country | 2002 Kilos | 2002 Value | 2003 Kilos | 2003 Value | 2004 Kilos | 2004 Value | 2005 Kilos | 2005 Value |
|---|---|---|---|---|---|---|---|---|
| Argentina | 0 | $0 | 450 | $7,425 | 0 | $0 | 0 | $0 |
| Australia | 1,018 | $12,232 | 475 | $9,675 | 28 | $2,592 | 192 | $11,286 |
| Bangladesh | 52 | $5,303 | 0 | $0 | 0 | $0 | 0 | $0 |
| Brazil | 0 | $0 | 353 | $2,001 | 0 | $0 | 637 | $7,448 |
| Canada | 375 | $35,114 | 0 | $0 | 0 | $0 | 0 | |
| China | 3,566 | $88,142 | 0 | $0 | 0 | $0 | 150 | $8,004 |
| Guatemala | 0 | $0 | 0 | $0 | 0 | $0 | 102 | $2,120 |
| Hong Kong | 1,036 | $47,835 | 453 | $10,677 | 712 | $26,513 | 2,522 | $156,943 |
| India | 1,872 | $9,167 | 5,686 | $30,000 | 2,808 | $16,500 | 0 | $0 |
| Indonesia | 0 | $0 | 0 | $0 | 0 | $0 | 24 | $4,660 |
| Japan | 1,100 | $86,964 | 0 | $0 | 0 | $0 | 0 | $0 |
| Madagascar | 190 | $7,441 | 0 | $0 | 0 | $0 | 0 | $0 |
| Mexico | 2,760 | $34,370 | 0 | $0 | 0 | $0 | 0 | $0 |
| Namibia | 130 | $7,450 | 0 | $0 | 0 | $0 | 0 | $0 |
| Panama | 0 | $0 | 0 | $0 | 4,119 | $160,034 | 381 | $46,200 |
| Philippines | 0 | $0 | 0 | $0 | 0 | $0 | 15,866 | $67,101 |
| Singapore | 318 | $16,095 | 0 | $0 | 0 | $0 | 0 | $0 |
| Taiwan | 0 | $0 | 200 | $4,796 | 0 | $0 | 0 | $0 |
| Vietnam | 0 | $0 | 50 | $7,500 | 551 | $10,767 | 0 | $0 |
| **Total: Shark Fins Dried** | **12,417** | **$350,113** | **7,667** | **$72,074** | **8,218** | **$216,406** | **19,874** | **$303,762** |

## 2.2 Exports of Shark Fins

The vast majority of shark fins exported in 2004 were sent from the United States to Hong Kong, China, Thailand, Canada, Mexico, and Taipei, and small amounts were sent to Columbia and Portugal (see Table 2.2.1).

**Table 2.2.1 Weight and Value of Dried Shark Fins Exported from the United States to Destinations in 2004**
(Source: U.S. Customs and Border Protection Data and U.S. Census Bureau)

| Country | Kilos (lbs) | Value |
|---|---|---|
| Canada | 2,309 (5,090) | $265,853 |
| China | 15,876 (35,001) | $150,000 |
| China – Hong Kong | 32,130 (70,835) | $2,343,242 |
| China – Taipei | 1,359 (2,996) | $69,292 |
| Colombia | 377 (831) | $2,752 |
| Mexico | 2,153 (4,747) | $86,049 |
| Portugal | 100 (220) | $2,717 |
| Thailand | 9,381 (20,682) | $106,925 |
| **Total: SHARK FINS DRIED** | **63,685 (140,402)** | **$ 3, 026,830** |

**Table 2.2.2 Weight and Value of Dried Shark Fins Exported from the United States to Destinations from January to July Each Year from 2002 to 2005**
(Source: U.S. Customs and Border Protection data and U.S. Census Bureau)

| Country | 2002 Kilos | 2002 Value | 2003 Kilos | 2003 Value | 2004 Kilos | 2004 Value | 2005 Kilos | 2005 Value |
|---|---|---|---|---|---|---|---|---|
| Canada | 34,461 | $213,386 | 2,647 | $285,969 | 1,515 | $169,663 | 977 | $124,472 |
| Denmark | 0 | $0 | 0 | $0 | 0 | $0 | 999 | $55,000 |
| Hong Kong | 22,824 | $1,635,863 | 16,194 | $1,359,892 | 12,842 | $1,003,461 | 17,375 | $1,200,679 |
| Japan | 500 | $8,925 | 0 | $0 | 0 | $0 | 0 | $0 |
| Mexico | 7,889 | $55,120 | 1,334 | $9,702 | 0 | $0 | 113 | $4,539 |
| Portugal | 0 | $0 | 97 | $3,029 | 0 | $0 | 110 | $2,988 |
| South Korea | 12,939 | $28,525 | 809 | $22,400 | 0 | $0 | 0 | $0 |
| Taiwan | 3,100 | $18,283 | 361 | $18,299 | 1,359 | $69,292 | 0 | $0 |
| **Total: Shark Fins Dried** | **81,713** | **$1,960,102** | **21,442** | **$1,699,291** | **15,716** | **$1,242,416** | **19,574** | **$1,387,678** |

The mean value per kilo has been increasing since 2002, most notably in the Hong Kong market. Using data from Table 2.2.2, mean values of dried shark fins for all countries combined increased from approximately $24/kilo in 2002 to approximately $79/kilo in 2003, and down to $47/kilo in 2004. Hong Kong's significantly higher dollar value to quantity, as compared to shark fin trade with other countries, is associated with the higher quality demanded in Hong Kong's inelastic market, and historically high consumption patterns based on ethnic food consumption behavior patterns.

## 3. International Efforts to Advance the Goals of the Shark Finning Prohibition Act

Consistent with the provisions of Section 5 of the Shark Finning Prohibition Act, the Department of Commerce and the Department of State have initiated an ongoing consultation regarding the development of international agreements consistent with the Shark Finning Prohibition Act. Discussions have focused on possible bilateral, multilateral, and regional agreements with other nations. The law calls for the United States to pursue an international ban on shark finning and to advocate improved data collection (including biological data, stock abundance, bycatch levels, and information on the nature and extent of shark finning and trade). Determining the nature and extent of shark finning is the first step toward reaching agreements to decrease the incidence of finning worldwide.

### 3.1 Bilateral Efforts

In 2004, NMFS participated in bilateral discussions with Canada, Chile, the European Union, Iceland, Japan, Mexico, and Russia, which included the implementation of the Shark Finning Prohibition Act. Emphasis in these bilateral contacts has been on the collection and exchange of information, including requests for data such as shark and shark fin landings, transshipping activities, and the value of trade. In addition, the United States continues to encourage other countries to implement the United Nations Food and Agriculture Organization (FAO) International Plan of Action (IPOA) for the Conservation and Management of Sharks, by finalizing their own national plans of action (NPOA).

### 3.2 Regional Efforts

The U.S. Government will continue to work within regional fishery management bodies to facilitate shark research, monitoring, and management initiatives, as appropriate. Possible avenues for the development of international initiatives supporting the conservation of sharks include a number of regional fishery management organizations. Table 3.2 lists these regional fishery management organizations and regional programs, some with multilateral efforts.

**Table 3.2 Regional Fishery Management Organizations and Programs**

| |
|---|
| North Atlantic Fisheries Organization (NAFO) |
| Inter-American Tropical Tunas Commission (IATTC) |
| International Commission for the Conservation of Atlantic Tunas (ICCAT) |
| Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific (WCPFC) |
| Treaty on Fisheries Between the Governments of Certain Pacific Island States and the Government of the United States of America (South Pacific Tuna Treaty [SPTT]) |
| International Council for the Exploration of the Sea (ICES) |
| Asia Pacific Economic Cooperation Forum (APEC) and the Convention on Migratory Species |
| North Pacific Interim Scientific Committee for Tuna and Tuna-like Species (ISC) |
| Sub-Saharan Africa |
| Department of State Regional Environmental Hub Program |

Of the list in Table 3.2, the activities or planning of three organizations are discussed below as a supplement to last year's report to Congress.

### 3.2.1 North Atlantic Fisheries Organization (NAFO)

At its 26$^{th}$ Annual Meeting in September 2004, the NAFO Fisheries Commission became the first regional fisheries management organization in the world to establish a catch limit for a directed elasmobranch fishery. For each of the years 2005–2007, the total allowable catch (TAC) for skates in Division 3LNO (the "nose" and "tail" of the Grand Bank) will be 13,500 metric tons. This TAC was higher than the United States had supported, but the U.S. delegation joined the consensus of which this measure was a part. At its 27$^{th}$ Annual Meeting in September 2005, the NAFO Fisheries Commission adopted a ban on shark finning in all NAFO-managed fisheries and mandated the collection of information on shark catches.

### 3.2.2 Inter-American Tropical Tunas Commission (IATTC)

At its 73rd meeting in June 2005, the IATTC adopted a "Resolution on the Conservation of Sharks Caught in Association with Fisheries in the Eastern Pacific Ocean." This resolution, co-sponsored by the United States, European Union, Japan, and Nicaragua, bans shark finning and mandates the collection of information and advice on stock status of shark species as well as proposals for a comprehensive assessment of shark stocks in the Pacific Ocean. The resolution also requires that all members establish and implement a national plan of action for conservation and management of shark stocks in accordance with the *FAO International Plan of Action for the Conservation and Management of Sharks*; and take measures to require that their fishers fully utilize any retained catches of sharks—defined as retention of all parts of the shark excepting head, guts, and skins—to the point of first landing. By May 1 of each year, members must report data for catches, effort by gear type, landing and trade of sharks by species, where possible, and a progress report on implementation of this Resolution during the previous year.

### 3.2.3 International Commission for the Conservation of Atlantic Tunas (ICCAT)

In 2000, the Standing Committee on Research and Statistics (SCRS) recommended ICCAT take the lead in conducting stock assessments for Atlantic porbeagle *(Lamna nasus)*, blue *(Prionace glauca)*, and mako *(Isurus oxyrinchus)* sharks. The SCRS working group considered two assessment methods, both of which are general enough to use much of the available data for any species (e.g., catch, abundance indices, tagging, length frequencies, and sex-specific data). The working group suggested the focus of a future assessment be on stocks not assessed elsewhere, such as blue sharks and shortfin mako sharks.

In 2001, ICCAT adopted a non-binding resolution for sharks. The resolution includes measures for improved data collection for pelagic sharks; specifically, submission of all catch and effort data, including dead discard estimates, for porbeagle, shortfin mako, and blue sharks. The proposal also formally directed scientific stock assessments for shortfin mako and blue sharks be conducted in 2004 (assessment of porbeagle was being undertaken by another organization). Other measures provided for the release of incidentally caught live sharks, minimization of waste and discards, and a voluntary stay on fishing effort targeting porbeagle, shortfin mako, and blue sharks until sustainable levels of harvest can be determined through stock assessments.

At the 2003 annual meeting, Japan introduced a resolution with four components to be required by all ICCAT parties:

1. Provide the Bycatch Working Group with information on shark catches, effort by gear type, landings, and trade of shark products.
2. Fully implement an NPOA in accordance with the IPOA for the Conservation and Management of Sharks adopted by FAO.

3. Deter, to the extent possible under domestic law, their residents from being engaged in or associated with the rapid expansion of the shark fishery by the use of flag-of-convenience vessels.
4. Prevent rapid expansion of their shark fisheries in the Convention area.

The resolution was adopted, without paragraphs 3 and 4 (Res 03-10). Also at the 2003 meeting, Japan that requested Taiwan provide the SCRS with information regarding their shark fishing activities in the Caribbean. This request was supported by the United States and Brazil.

In June 2004, the Subcommittee on Bycatch conducted stock assessments for shortfin mako and blue sharks. The activities of the subcommittee included a review of shortfin mako and blue shark biology and catch data, a description of the fisheries, and analyses of the current status of the stocks and their outlook. The limited submissions of shark statistics indicated the overall volume of catch reported to ICCAT is not representative of the total removals. The size, age, and sex composition of the reported removals were also very limited. Furthermore, a recent study using shark fin trade to produce annual estimates of the number and biomass of sharks represented in the global fin trade based on data from 1999 to 2001 suggested much higher shark landings as compared to the data submitted to ICCAT. While estimates from this study were not used in the assessment, they did confirm the need for the SCRS to construct a more accurate picture of shark catch and mortality in the Atlantic tuna fleets for use in future model applications.

Due to the uncertainty associated with the catch estimates, results from the model applications are considered very provisional. The results of the assessment for North and South Atlantic blue sharks suggest the current biomass is above the biomass at MSY. This result was considered highly conditional on the assumptions made, and could have shown a current stock level well below biomass at MSY if historic catches were actually higher than estimated by the working group. The results of the assessment for North Atlantic shortfin mako suggest some level of stock depletion and the SCRS could not rule out the possibility of the current stock being below biomass at MSY and possible depletions of 50 percent or more. For South Atlantic shortfin mako, the results suggest the stock may have decreased since 1971, but the magnitude of the decline appears less than in the North Atlantic.

The working group made a number of recommendations on shark statistics and research. The main recommendation suggests there is insufficient infrastructure dedicated to monitoring sharks and therefore improvement in the advice on the status of shark species requires larger monitoring and research investments by the Parties. Other research recommendations included: (a) more research into stock assessment methodologies fully utilizing the available data, including data from tagging studies; (b) better use of historic effort patterns from the tuna fisheries; (c) provision of standardized CPUE patterns from major fishing fleets; (d) broader use of trade statistics (fins, etc.) and historic measures of relative abundance to extend the historical time series of estimates of removals; and (e) additional research on biological and stock characteristics. The Group also stressed the importance of regular participation from all major fishing nations (i.e., EC-Spain and EC-Portugal) during future assessments and other evaluations.

In 2004, ICCAT adopted a significant agreement on sharks. This measure marked the first time ICCAT has exerted management authority over sharks. In October 2004, the Chairman of ICCAT, Masa Miyahara of Japan, identified the issue of Pelagic Sharks on a list of priorities for the Commission, thus providing an opening for further discussion of shark conservation and management. The United States hosted the 14$^{th}$ Special Meeting of ICCAT, November 15–21, 2004, in New Orleans, Louisiana. Adopting management measures for sharks was one of the priority positions for the United States at this meeting. The United States introduced a joint shark proposal—sponsored by Canada, the European Community, Japan, Mexico, Panama, South Africa, Trinidad and Tobago, and Venezuela—requiring full utilization of shark catches and prohibiting vessels in ICCAT fisheries from retaining on board, transshipping, or landing any shark fins harvested in contravention of the recommendation. Brazil and Namibia also expressed their strong support. On the final day of the meeting, this binding recommendation was adopted with consensus among all ICCAT members (representing a total of 63 nations at that time).

The approved measure, requiring full utilization of shark catches, mandates fishermen to retain all parts of the shark except the head, guts, and skins to the point of first landing. Countries are required to ensure their vessels retain onboard fins totaling no more than 5 percent of the weight of sharks onboard up to the first point of landing. Parties not requiring fins and carcasses to be offloaded together at the point of first landing must ensure compliance with the ratio through certification, monitoring, or other means. These requirements, which parallel current U.S. law, are significant because they provide the means to enforce the prohibition on finning even when no fishery observers are aboard the vessel.

The 2004 agreement also (1) establishes requirements for data collection on catches of sharks, (2) calls for research on shark nursery areas, and (3) encourages the release of live sharks, especially juveniles. The SCRS will review the stock assessment of shortfin mako sharks in 2005 and also provide scientific advice on the 5 percent fin-to-body ratio. The Commission may consider additional management measures in 2005. In addition, the status of blue shark and shortfin mako shark populations will be reassessed by the SCRS no later than 2007.

ICCAT adopted this historic measure just days after the United Nations General Assembly passed a resolution urging nations to work together through regional fishery management organizations such as ICCAT to manage sharks. While the United States has already implemented a ban on finning domestically, the ICCAT agreement will require other countries fishing in the Atlantic Ocean and Mediterranean Sea to take similar measures.

### 3.2.4 Asia Pacific Economic Cooperation Forum (APEC) and the Convention on Migratory Species

The APEC Fisheries Working Group (FWG) sponsored a workshop on shark conservation and management in Mexico on December 3–6, 2002. This workshop produced recommendations on steps to reduce waste of sharks, improve data collection, improve national and regional management, and better implement the FAO IPOA on Sharks. In an effort to assist APEC FWG economies in implementing these recommendations, the FWG (with NGO and academic assistance) has produced a *Technical Manual on Elasmobranch Fisheries Management Techniques.* In addition, work on shark conservation and management continues through planned workshops focusing on policymakers and fisheries managers in economies in Latin America. These workshops will seek to help countries implement effective management of their elasmobranch fisheries and facilitate implementation of the FAO International Plan of Action for the Conservation and Management of Sharks.

## 3.3 Multilateral Efforts

The U.S. Government will also continue to work within other multilateral fora to facilitate shark research, monitoring, and management initiatives, as appropriate. Table 3.3 lists these multilateral fora.

**Table 3.3 Other Multilateral Fora**

| |
|---|
| Food and Agriculture Organization of the United Nations (FAO) Committee on Fisheries (COFI) |
| International Union for Conservation of Nature and Natural Resources (IUCN) |
| Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) |
| World Summit on Sustainable Development (WSSD) |
| United Nations General Assembly (UNGA) |

Of the list in Table 3.3, the activities or planning of four organizations are discussed below as a supplement to last year's report to Congress.

### 3.3.1 Food and Agriculture Organization of the United Nations (FAO) Committee on Fisheries (COFI)

NMFS prepared and submitted a major status report on the implementation of its National Plan of Action for the Conservation and Management of Sharks (NPOA) to the March 2005 meeting of COFI.

### 3.3.2 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

At the 13th meeting of the Conference of the Parties (CoP13), Australia and Madagascar proposed to include the great white shark (*Carcharodon carcharias*) in Appendix II, including an annotation stating a zero annual export quota be established. In 2004, CITES adopted a proposal to list the great white shark in Appendix II. Prior, at CoP11, a proposal to include the great white shark in Appendix I was submitted by Australia and the United States. This proposal was amended at CoP11 to include the species in Appendix II, but was rejected. Australia subsequently listed this species in Appendix III in October 2001.

In 2002, CITES listed two shark species in Appendix II—whale shark *(Rhincodon typu)* and basking shark *(Cetorhinus maximus).* The United States supported these proposals because it believes CITES offers numerous benefits for marine species conservation, e.g., enhanced and systematic trade monitoring, encouragement of national fishery management plans to bolster permit issuance, and regular reviews of trade patterns. The United States supports proposed CITES resolutions encouraging continued monitoring of the FAO Shark IPOA process and further FAO/CITES coordination on sharks.

### 3.3.3 United Nations General Assembly (UNGA)

In November 2004, the UNGA adopted by consensus a resolution on Oceans and the Law of the Sea: "Sustainable Fisheries, including through the 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, and related instruments." The resolution, strongly supported by the United States, includes important provisions to encourage shark conservation and discourage finning. It calls for the implementation of the FAO International Plan of Action for Sharks by developing and implementing NPOAs; ensuring the conservation and management of sharks and their long-term sustainable use, including banning directed shark fisheries conducted solely for the purpose of harvesting shark fins and taking measures for other fisheries to minimize waste and discards from shark catches and encouraging full use of dead sharks; providing assistance to developing states so they can address shark conservation needs; and inviting the FAO to prepare a study of the impact on shark populations of shark catches from directed and non-directed fisheries and on ecologically related species, and to update its 1999 FAO Technical Paper 389 on shark utilization, marketing, and trade. The FAO is hosting a Technical Consultation on the conservation and management of sharks in December 2005.

### 3.3.4 International Union for Conservation of Nature and Natural Resources (IUCN)

At its 2004 World Congress in Bangkok, Thailand, IUCN—the World Conservation Union, made up of over 1,000 governmental and nongovernmental organizations from over 140 countries—adopted a recommendation urging all states to ban shark finning and require shark fins to be landed attached to their bodies. The United Nations estimates over 100 million sharks are killed each year and studies show shark populations have declined by 90 percent worldwide in the past 50 years. The IUCN's shark specialist group hopes the recommendation will encourage governments and organizations around the world to consider this and related policies of CITES when adopting national and regional programs for the conservation and sustainable management of sharks.

## 4. NMFS Research on Sharks

### 4.1 Data Collection and Quality Control, Biological Research, and Stock Assessments

#### Pacific Islands Fisheries Science Center (PIFSC), Honolulu Laboratory

*Data Collection and Quality Control:* Market data from the shoreside sampling program contains detailed biological and economic information on the Hawaii-based longline fishery since 1987. These data are primarily collected from the United Fishing Agency (UFA), a public fish auction on Oahu, which handles nearly 100 percent of the longline catch sales. The State of Hawaii now classifies the UFA as a dealer and requires it to submit sales/transaction data to the State. The UFA has been providing near-complete electronic submission of the market data since 2001. Other dealers in Hawaii are also required to report to the State. The Western Pacific Fishery Information Network (WPacFIN) is a federal–state partnership collecting, processing, analyzing, sharing, and managing fisheries data from American island territories and states in the Western Pacific. Within WPacFIN's data collection, over 100 dealers report monthly and 10 of the largest seafood dealers in Hawaii are using electronic means to file their reports in a timely and efficient manner. The WPacFIN program has also assisted other U.S. islands' fisheries agencies in American Samoa, Guam, and the Northern Mariana Islands to modify their data collecting procedures to collect bycatch information documenting more shark interactions with fishing gear.

For several years, the Hawaii Longline Observer Program has collected tissue samples from pelagic and common thresher and longfin mako in support of NMFS' Southwest Region research to identify stocks and better understand basic shark biology and movement. Shortfin mako was recently added.

*Insular Shark Surveys*: Densities of insular sharks have been estimated at most of the U.S. island possessions within the tropical central, Northern, and Equatorial Pacific on annual or biannual surveys since 2000. These estimates include the 10 major shallow reefs in the Northwestern Hawaiian Islands (NWHI) within the Hawaiian Archipelago (2000, 2001, 2002, 2003, 2004); the Pacific Islands Remote Island Areas (PRIAs) of Howland and Baker in the Phoenix Islands and Jarvis Island, and Palmyra and Kingman Atolls in the Line Islands (2000, 2001, 2002, 2004); and American Samoa including Rose Atoll and Swains Reef (2002, 2004). Similar surveys at Guam, the Commonwealth of the Northern Marianas Islands (CNMI), and Johnston Atoll in the Line Islands were conducted during summer 2003 and winter 2004. To date, the surveys have established that (1) shark stocks appear healthy at most reefs in the NWHI and PRIAs, and (2) shark stocks are noticeably sparse and small-bodied at most reefs in American Samoa and the southern Marianas Archipelago.

The most significant result to date relating to sharks at Pacific Island reefs has been the contrast in densities of sharks and other large-bodied apex predator fishes between the largely unfished NWHI and the heavily fished Main Hawaiian Islands (MHI). Surveys conducted in the NWHI and MHI during 2000 encountered apex predator stocks averaging 100-fold less dense in the MHI (A.M. Friedlander and E.E. DeMartini. 2002. Contrasts in density, size, and biomass of reef fishes between the northwestern and the main Hawaiian Islands: the effects of fishing down apex predators. Marine Ecology Progress Series 230:253–264). Observations made in the NWHI during 2001–2004 have generally affirmed the greater abundances of sharks and other apex predators in the NWHI relative to the MHI.

In the Marianas Archipelago, sharks were found to be more than an order of magnitude less dense around the southern inhabited islands (e.g., Guam and Saipan), compared to the remote northernmost islands (Schroeder, et al. Submitted. Status of fishery target species on coral reefs of the Marianas Archipelago. 10 ICRS, Okinawa, 2004).

*Stock Assessment of Pelagic Sharks*: Pelagic shark stock assessment work was initiated in 2000 as a collaborative effort with scientists at the National Research Institute for Far Seas Fisheries (NRIFSF). A report was produced (P. Kleiber, Y. Takeuchi, and H. Nakano. 2001. Calculation of plausible maximum sustainable yield (MSY) for blue sharks *(Prionace glauca)* in the North Pacific. Southwest Fisheries Science Center, Admin. Rep. H-01-02.) but was not published in the peer-reviewed literature. The report indicated the stock was not being overfished. PIFSC and NRIFSF scientists are renewing the collaboration to update the blue shark assessment with the latest Japanese and Hawaiian longline fishery data, as well as with better estimates of Taiwanese and Korean catch and effort data.

To accomplish this task, standardized data sets are being created:

1) Hawaii longline—catch and effort as reported in logbooks with catch modified based on observer and auction data. Size sample data from observers.

2) Japan longline—Effort from logbooks raised according to coverage rate. CPUE of sets that pass Nakano's 80 percent reporting filter is standardized to calculate raised catch from the raised effort. Size sample data from various sources including Japan's research and training vessel data.

3) Taiwan/Korea/etc longline—Effort is estimated by subtracting Japan's and U.S. effort from effort reported in SPC 5X5 data base. Catch then estimated from Japan's CPUE in 2) above.

4) Driftnet catch, effort, and size data (Japan, Korea, Taiwan combined): Data gleaned from literature. Squid net and large mesh separate.

Analytical approach:

1) Production model—Size sample data not needed.

2) MULTIFAN-CL—Six subregions with three longline fleets (Japan, Hawaii, other) in each and two driftnet fleets (large mesh and squid).

*Publication:* Co-authorship of a manuscript that critically evaluated shark declines in the Atlantic Ocean and Gulf of Mexico (G.H. Burgess, L.R. Beerkircher, G.M. Cailliet, J.K. Carlson, E. Cortés, K.J. Goldman, R.D. Grubbs, J.A. Musick, M.K. Musyl, and C.A. Simpfendorfer. 2005. Is the collapse of shark populations in the Northwest Atlantic Ocean and Gulf of Mexico real? Fisheries. In press.).

**Southwest Fisheries Science Center (SWFSC, La Jolla)**

*Juvenile Shark Survey*: The 2004 shark survey was completed July 7, 2004. One to three fishing sets were conducted each day. A total of 6,692 hooks were fished at the 38 sampling stations. Captured sharks were tagged with conventional spaghetti tags, satellite transmitting tags, and tetracycline. Catch included 88 mako, 127 blue, and two common thresher sharks, and 59 pelagic rays. The preliminary data indicate the overall catch rate was 0.399 per 100 hook-hours for mako and 0.499 per 100 hook-hours for blue sharks. The catch per-unit effort (CPUE) for mako was slightly higher than in 2003 but continues a declining trend. The CPUE for blue sharks was slightly lower than in 2003 and also continues a declining trend.

In addition, 62 sharks were tagged with conventional tags for movement data, 61 were marked with oxytetracycline (OTC) for age and growth studies, and 74 DNA samples were collected. Three adult blue sharks were tagged with a total of six satellite archival tags in a cooperative Tagging of Pacific Pelagics (TOPP) project to define the physical habitat of Pacific blue sharks. Four satellite pop-up tags and nine satellite transmitter tags were deployed on 10 individual mako sharks in a continuing series of habitat, migration, and condition studies. Two common thresher sharks were also tagged with satellite pop-up and transmitter tags. Early results indicate blue and mako sharks surface briefly and data transmissions are providing temperature and location data. Five pelagic rays were collected by UCLA graduate students for age and growth studies. Monterey Bay Aquarium staff tested a new transport system designed to move live mako sharks to the Monterey Bay Aquarium for display purposes.

*Essential Fish Habitat (EFH) and Pup Abundance Survey of Common Thresher Shark:* Like many other sharks, the pups of the common thresher are found in nearshore waters. Such waters are Essential Fish Habitat (EFH) for this shark, but the extent of this habitat is poorly defined. The purpose of this EFH/Pup Abundance survey is to (1) determine the continuity of thresher pup distribution along the Southern California Bight coast, and (2) develop a pup abundance index. The first (pilot study) surveys were completed in September 2004. Sampling took place in inshore waters out to 200 fathoms from Point Conception south to San Diego, California, with many juvenile thresher sharks tagged and released, some with archival tags to record physical habitat preferences. Preliminary results of depth-stratified sampling indicate juvenile common thresher sharks prefer shallow water less than 25 fathoms deep.

*Shark Feeding Habits*: A new study has been completed comparing the common thresher shark's feeding during El Niño (1998–1999) and La Niña (1999–2000) conditions. This work, soon to be published in California Cooperative Oceanic Fisheries Investigations (CalCOFI) Reports, showed species composing the threshers' diet became more diversified in the warm water years as the production of preferred prey declined. A new feeding study was begun, which will compare the diets of shortfin mako, blue, and common thresher sharks when these species co-occur off the U.S. West Coast.

*Leopard Shark In Situ Mating Behavior Described*: In August 2003, mating behavior was observed in an aggregation of leopard sharks near the surf zone along a sandy beach in La Jolla, California. A resulting paper will provide the first documented observations of leopard sharks mating in the wild. Just as muddy bays, estuaries, and sloughs serve as important habitat for this species in northern California, shallow, surf-protected areas along sandy beaches and coves may be similarly important to leopard sharks in Southern California for feeding, pupping, and mating.

*Mako Aging:* Marking of shortfin mako with tetracycline continues during the annual Juvenile Shark Survey. Recaptures will help validate the age-length relationship determined from examination of vertebrae. Accurate aging is essential for understanding this shark's productivity and resilience to exploitation. The capture locations of the examined specimens indicate a widespread ocean distribution of both juveniles and adults.

*Harvest Guidelines for West Coast Common Thresher and Shortfin Mako Sharks:* The SWFSC, working with the Pacific Fishery Management Council, estimates that 340 and 150 metric tons (round weight) of common thresher and shortfin mako, respectively, are precautionary harvest guidelines. In 2005, these guidelines and catch trends will be re-examined as part of the Pacific Council's periodic Stock Assessment and Fishery Evaluation (SAFE) process.

*Ocean Explorations: Eastern Tropical Pacific (ETP) Pelagic Shark Cruise:* The ETP Shark Cruise departed Acapulco September 21, 2004, and began fishing outside Mexico's EEZ on September 22. The cruise plan was to travel roughly southwest toward Clipperton Island then north, fishing during the day and transiting at night. Night transits covered roughly 100–120 miles and followed a stair-step pattern of alternate latitudinal and longitudinal transits between stations. Typically two 4-hour deployments of up to 150 hooks over 1.5 miles of longline were made per day. In all, 30 sets were made with over 15,000 hook-hours. The gear worked well and caught a wide variety of tropical species with almost no mortality of target fish species and no bycatch of turtles, marine mammals, or birds. Circle hooks and mackerel were used in accordance with NOAA's bycatch reduction guidelines. Catch included silky, oceanic whitetip, and pelagic thresher sharks; sailfish; striped marlin; mahi; and black skipjack. Three oceanic whitetip and four silky sharks were equipped with one or both types of satellite transmitters (SPOT and PAT tags). Almost all animals were given a conventional NMFS tag and an oxytetracycline injection for aging studies, and tissue samples for DNA and tissue culture were taken. The handling platform worked flawlessly and provided a safe and secure working environment for the scientists and the sharks. Worries about heat and hooking stress in tropical sharks appeared to be unfounded, and most animals came up in excellent condition after the 4-hour soak.

On the negative side—and in keeping with indications from directed fisheries, incidental take by sportfishing camps, purse seine bycatch records, and studies in other parts of the world's oceans—we experienced low catch rates and encountered mostly small animals, including neonates. No adult animals capable of spawning were encountered for either silky or whitetip in either longline or directed bait fishing. A total of 25 sharks were captured in 30 sets. There are many possible explanations for low catch rates, and this was at best a preliminary study, but it is worrisome given the effectiveness of the gear off California.

To date, two of the three SPOT tags placed on oceanic whitetips are transmitting and providing the first location information of this type for ocean whitetips. In summary, the system of longline fishing with subsequent handling on the shark platform appears to be a safe and effective means of gathering information on the biology and population status of pelagic sharks in the ETP. This cruise demonstrates the feasibility of integrating this type of survey into ongoing studies of pelagic ecosystems should opportunities and resources permit.

## Northwest Fisheries Science Center (NWFSC)

The NWFSC conducts and supports several activities addressing the monitoring and assessment of sharks along the West Coast of the United States and in Puget Sound. As noted above, PacFIN serves as a clearinghouse for commercial landings data, including sharks. In addition, the West Coast Groundfish Observer Program collects data on discards of all shark species on vessels selected for coverage by the program.

The NWFSC conducts periodic trawl surveys of the West Coast, designed primarily to acquire abundance data for West Coast groundfish stocks. The tonnages of all shark species collected during these surveys are documented. In addition, the survey program has conducted numerous special projects in recent years to help researchers acquire data and samples necessary for research on shark species. Since 2002, the survey has collected biological data from spiny dogfish, including dorsal spines, which can be used to age the fish. Tissue samples were also collected as part of a special project in 2003. Biological data and tissue samples were collected from leopard sharks during 2004 as part of another project. Biological data and tissue samples were collected from cat sharks during the 2003 survey.

In addition to these monitoring activities, the NWFSC is supporting graduate research at the University of Washington to assess the abundance of spiny dogfish. The status of spiny dogfish in the northeastern Pacific is being assessed through integrated modeling using all available data sources. Both a single stock model and a metapopulation model, including movement between subpopulations, are being developed. The effect of movement of dogfish between the United States and Canada on the level of sustainable catch is being examined. Alternative management strategies for this long-lived, late-maturing species are also considered.

*Sixgill Shark Abundance Increases:* For decades (at least) the sixgill shark (*Hexanchus griseus*) was rare in Puget Sound, but in recent years, this species has shown dramatic increases in abundance. It is now commonly seen throughout Puget Sound and surrounding environments, with juveniles frequently observed near beaches, swimming piers and other shallow habitats in the region. Sixgill sharks grow to be large when mature—up to 3.3–4 m (10–12 feet). Males are sexually mature at about 2.3 m in length and 182–273 kg (400–600 pounds). Clearly, these large predators have the potential to be a major restructuring force in the dynamics of the Puget Sound ecosystem. NWFSC scientists, in collaboration with researchers from the University of Washington and Washington Department of Fish and Game, have commenced a project to investigate the causes and consequences of the extraordinary increase in sixgill sharks.

In this project we are addressing a number of interrelated questions: (1) What habitats are juvenile sixgill sharks using, and is the south Puget Sound Region (near Tacoma) a critical pupping ground? (2) What role do sixgill sharks play in Puget Sound food webs? What are the food web consequences of their rise in abundance? (3) What is the relationship between spiny dogfish (a declining species in Puget Sound) and sixgill sharks? Are sixgill sharks directly or indirectly responsible for the local demise of dogfish? This project will rely on longline samples taken throughout the Sound, with special emphasis in this first year on shallow areas in south and central Puget Sound, and in deep trenches in the San Juan Islands (where mature adults are thought to occur). Upon capture, biological data (e.g., genetic samples, blood samples, gut contents, and length/weight) will be collected. Sharks will then be tagged with numbered external tags, and a subset of sharks will be tagged with acoustic tags. A network of more than 100 acoustic receivers (deployed by NWFSC, NWIFC, and USACOE) will be strategically placed in constrictions in Puget Sound and allow us to track the movements of sharks across habitats and over time. Such data will be crucial in understanding where, when, and (in concert with diet data and blood samples for isotopic analyses) why sharks use specific habitats.

### Alaska Fishery Science Center Auke Bay Laboratory

*Shark Research and Assessments:* Research efforts are focused on: (1) collection of data to support stock assessments of shark species subject to incidental harvest in Alaskan waters; (2) Pacific sleeper shark predation of Steller sea lions; (3) movement and diet studies of salmon sharks; and (4) tagging studies of Pacific sleeper sharks and spiny dogfish.

*Stock Assessments of Shark Species Subject to Incidental Harvest in Alaskan Waters*: Collection and interpretation was begun of existing fisheries incidental catch and fishery-independent bottom trawl survey biomass from the Gulf of Alaska, Eastern Bering Sea and Aleutian Islands was begun. This work supports stock assessments for Pacific sleeper sharks *(Somniosus pacificus),* piked or spiny dogfish *(Squalus acanthias)*, and salmon sharks *(Lamna ditropis)*—the three shark species most likely to be encountered in Alaskan fisheries. This work is summarized annually in an appendix to the Stock Assessment and Fishery Evaluation (SAFE) Report.

Fishery-independent surveys suggest that Pacific sleeper shark abundance is increasing. Existing Pacific sleeper shark catches from fishery-independent longline surveys in the Gulf of Alaska, Eastern Bering Sea, and Aleutian Islands were analyzed to determine the trend in abundance. Relative population numbers (RPN) of sleeper sharks captured in the NMFS domestic sablefish longline survey appeared to increase significantly between 1990 and 2003. A peer-reviewed manuscript of the study is being prepared.

*Pacific Sleeper Shark Predation of Steller Sea Lions*: In August 2001 and May 2002, scientists from the Auke Bay Laboratory investigated the diet of Pacific sleeper sharks to test the hypothesis that sleeper sharks prey on Steller sea lions *(Eumetopia jubatus)*. Scientists collected 198 stomach samples and found predominant prey items to be walleye pollock, octopus, unidentified teleost fish, Pacific salmon, and marine mammal tissue appearing to be from cetaceans. Stomach content analysis found no direct evidence of sea lion predation. In addition to the diet study, data on the vertical and geographic movement of sleeper sharks were collected by tagging for comparison with the vertical distribution of Steller sea lions. Thirty-three sleeper sharks were tagged with archival satellite tags designed to transmit depth data and location to polar orbiting Argos satellites. Data from 25 satellite tags have been recovered. Based on tag endpoint locations, the sharks typically moved less than 100 kilometers from the release locations. Archived depth data shows some sleeper sharks regularly traverse depths at rates over 200 meters per hour and sometimes come to the surface at night. Two manuscripts from the study have been submitted for peer review.

*Salmon Shark Movements*: During the summers of 1998–2001, scientists from the Auke Bay Laboratory investigated the movements and diet of salmon sharks aggregating in Prince William

Sound (PWS), Alaska. During the study, 246 salmon sharks were tagged with conventional (spaghetti) tags and 16 salmon sharks with satellite transmitters. Movement data from satellite tag transmissions and conventional tag recoveries provided insights into the seasonal residency and movement patterns of salmon sharks in PWS and the eastern North Pacific Ocean. Observations suggest salmon sharks are attracted by Pacific salmon *(Oncorhynchus spp.)* runs returning to the streams and hatcheries in PWS during summer months. In PWS, large salmon shark aggregations peaked with salmon spawning migrations during July and August. As the summer salmon runs declined in late summer, the sharks dispersed. Some continued to forage in PWS and the Gulf of Alaska into autumn and winter months, while others underwent rapid migrations hundreds to thousands of kilometers toward the west coasts of Canada and the United States. Fifty percent of the sharks tracked by this study traveled long distances.

*Salmon Shark Diet:* Adult Pacific salmon—pink *(Oncorhynchus gorbuscha),* chum *(Oncorhynchus keta),* and coho *(Oncorhynchus kisutch)*—were the principal prey as measured by both percent number (35 percent) and percent weight (76 percent). Even when adult salmon were locally abundant, salmon sharks had a varied diet including squid *(Teuthoidea spp.),* sablefish *(Anoplopoma fimbria),* Pacific herring *(Clupea pallasii),* rockfish *(Sebastes spp.),* Eulachon *(Thaleichthes pacificus)*, capelin *(Mallotus villosus)*, spiny dogfish *(Squalus acanthias),* arrowtooth flounder *(Atheresthes stomias)*, and cods *(Gadidae).* Salmon sharks consumed at least 263,000 kg of prey in Port Gravina during a 45-day period of peak salmon shark abundance in 2000. Assuming the sharks consumed equal proportions of pink and chum salmon by weight, the sharks would have consumed 116,000 pink salmon and 36,000 chum salmon. Based on Alaska Department of Fish and Game estimates of salmon escapement and commercial harvest for Port Gravina in 2000, the sharks would have consumed 12 percent and 29 percent of the pink and chum salmon runs, respectively. A manuscript has been accepted for publication in the Journal of Fish Biology.

*Tagging Studies of Pacific Sleeper Sharks in Southeast Alaska:* During the summers of 2003–2005, scientists from the Auke Bay Laboratory deployed 91 electronic archival tags and 24 acoustic tags on Pacific sleeper sharks in the upper Chatham Strait region of Southeast Alaska. The recovery of temperature, depth, and movement data from the electronic archival and acoustic tags will aid in the identification of Pacific sleeper shark habitat utilization and distribution in Southeast Alaska and identify the potential for interactions between Pacific sleeper sharks and other species in this region.

*Tagging and Life History Studies of Spiny Dogfish in the Gulf of Alaska:* A joint study was conducted during 2004 and 2005 by scientists from the Auke Bay Laboratory and the University of Alaska Fairbanks School of Fisheries and Ocean Sciences, Juneau Center, to investigate the life history and ecological role of spiny dogfish in the North Pacific. As part of this study, scientists from the Auke Bay Laboratory have deployed 100 electronic archival tags, 617 numerical tags, and one satellite popup tag on spiny dogfish in Yakutat Bay, Alaska. Movement data from tag recoveries will provide insights into the seasonal residency and movement patterns of spiny dogfish in Yakutat Bay and the North Pacific Ocean.

**Northeast Fisheries Science Center (NEFSC)**

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

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

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

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

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

*Essential Fish Habitat and Shark Identification Updates:* In cooperation with NMFS staff in the Highly Migratory Management Division (Silver Spring, Maryland), updates of essential fish habitat maps began for shark, tuna, and billfish species using information from observer and tagging databases. In addition, a guide was published to aid in identification of these highly migratory species.

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

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

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

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

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

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

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

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

*Overview of Gulf and Atlantic Shark Nurseries:* To meet the need for a better understanding of shark nursery habitat in U.S. coastal waters, NEFSC staff are editors for an American Fisheries

Society symposium proceedings volume on U.S. Atlantic and Gulf of Mexico coastal shark nursery ground and habitat studies.

**Southeast Fisheries Science Center (SEFSC)**

*Stock Assessments of Pelagic, Large Coastal, and Prohibited Sharks:* The ICCAT Sub-Committee on Bycatches conducted a stock assessment of blue sharks and shortfin makos in Tokyo, Japan, in June 2004. All information available on biology, fisheries, stock identity, catch, CPUE, and size of these species was reviewed and an evaluation of the status of stocks conducted using surplus production, age-structured, and catch-free stock assessment models. Assessment results and conclusions were considered to be very preliminary due to the limitations on quantity and quality of information available for the stock assessment of these two species. The Committee recommended increased research and monitoring efforts, particularly for sharks, and for other bycatch species in general, to improve the advice on their status as well as on the impacts of tuna fisheries on these species. In general, preliminary results for blue sharks indicate the current biomass in both the North and South Atlantic appears to be above the biomass that can support MSY. Current shortfin mako biomass may be below that producing MSY in the North Atlantic and above MSY in the South Atlantic, but results were highly conditional on the assumptions made and data available. U.S. scientists contributed eight working documents for this meeting on various aspects of shark biology and methods to assess stock status; SEFSC scientists participated in the assessment process and authored or coauthored six of those documents. A stock assessment of dusky shark—a prohibited species under the shark FMP and candidate for listing under the ESA—is almost completed and should be released by the end of FY 2005. Biological and fishery information available for this species is being synthesized and stock status will be evaluated using multiple stock assessment methodologies. The next assessment of large coastal sharks is planned for FY 2006, but data collection, synthesis, analysis, and preliminary stock evaluations will begin well in advance during FY 2005.

*Update on Catches of Atlantic Sharks:* An update on catches of large and small coastal and pelagic sharks in U.S. Atlantic, Gulf of Mexico, and Caribbean waters was generated in FY 2005 for inclusion in the 2005 *SAFE Annual Report* and future shark stock assessments (E. Cortés. 2005. Updated catches of Atlantic sharks. SFD Contribution SFD-2005-0054.). Time series of commercial and recreational landings and discard estimates from several sources were compiled for the large coastal shark complex and sandbar and blacktip sharks. In addition, recent species-specific commercial and recreational landings were provided for sharks in the large coastal, small coastal, and pelagic groups. Species-specific information on the geographical distribution of commercial landings by gear type and geographical distribution of the recreational catches was also provided. Trends in length-frequency distributions and average weights and lengths of selected species reported from three separate recreational surveys and in the directed shark bottom-longline observer program were also included. Another update on catches of Atlantic sharks will be generated in FY 2006.

*Ecosystem Modeling:* A dynamic mass-balance ecosystem model was used to investigate how relative changes in fishing mortality on sharks can affect the structure and function of Apalachicola Bay, Florida, a coastal marine ecosystem. Simulations were run for 25 years wherein fishing mortality rates from recreational and trawl fisheries were doubled for 10 years and then decreased to initial levels. In addition, effects of time/area closures on ecosystem components were tested by eliminating recreational fishing mortality on juvenile blacktip sharks. Simulations indicated biomass of sharks declined up to 57 percent when recreational fishing mortality was doubled. Simulating a time/area closure for juvenile blacktip sharks caused increases in their biomass but decreases in juvenile coastal shark biomass, a multispecies assemblage that is the apparent competitor. In general, reduction of targeted sharks did not cause strong top-down cascades. A manuscript from this study is currently in press.

*Elasmobranch Feeding Ecology and Shark Diet Database:* The current Fishery Management Plan for Atlantic Tunas, Swordfish, and Sharks gives little consideration to ecosystem function because there is little quantitative species-specific data on diet, competition, predator-prey interactions, and habitat requirements of sharks. Therefore, several studies are currently under way describing the diet and foraging ecology, habitat use, and predator–prey interactions of elasmobranchs in various communities. In 2005, a study on latitudinal variation in diet and daily ration of the bonnethead shark from the eastern Gulf of Mexico was completed and a manuscript is being prepared for publication. A database containing information on quantitative food and feeding studies of sharks conducted around the world has been in development for several years and presently includes over 200 studies. This fully searchable database will continue to be updated and fine-tuned in FY 2006. The goal is to make this tool available to researchers in the near future.

*Cooperative Gulf of Mexico States Shark Pupping and Nursery Survey (Gulfspan)*: The SEFSC Panama City Shark Population Assessment Group manages and coordinates a survey of coastal bays and estuaries between the Panhandle of Florida and Texas. Surveys identify the presence/absence of neonate and juvenile sharks and attempt to quantify the relative importance of each area as it pertains to essential fish habitat requirements for sharks. The SEFSC Panama City Shark Population Assessment Group also initiated a juvenile shark abundance index survey in 1996. The index is based on random, depth-stratified gillnet sets conducted throughout coastal bays and estuaries in northwest Florida monthly from April to October. The species targeted for the index of abundance are juvenile sharks in the large and small coastal management groups.

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

*Life History Studies of Elasmobranchs:* Biological samples are obtained through research surveys and cruises, recreational fishers, and collection by onboard observers on commercial fishing vessels. Age and growth rates and other life history aspects of selected species are processed and data analyzed following standard methodology. This information is vital as input to population models incorporating variation and uncertainty in estimates of life-history traits to predict the productivity of the stocks and ensure they are harvested at sustainable levels. Samples are obtained from commercial fishers and fishery-independent surveys. Life history studies on the Atlantic angel shark, a prohibited species, began in 2003 with the reproductive analysis completed in 2005. Samples and preliminary analysis began in 2005 on determining life history parameters for skates in the Gulf of Mexico, a group of elasmobranchs often ignored despite being harvested as catch and bycatch in commercial fisheries. The age and growth parameters of bull shark *(Carcharhinus leucas)* (Neer et al., Journal of Fish Biology 67-370:383) and spinner shark *(C. brevipinna)* (Carlson and Baremore, Fishery Bulletin 103:280–291) were published in 2005. A symposium for the 2005 American Elasmobranch Society/American Ichthyologists and Herpetologists Society meeting in Tampa, Florida (Age and growth of chondrichthyan fishes: new methods, techniques, and analyses) was co-chaired by SEFSC/Panama City Laboratory staff. A peer-reviewed publication of the symposium proceedings is scheduled for 2006.

*Using elemental chemistry of shark vertebrae to reconstruct large-scale movement patterns of sharks:* A project examining ontogenetic shifts in habitat utilization of bull sharks using Sr:Ca ratios of vertebrae will begin in FY 2006, funds permitting. Laser ablation ICPMS will be used to assay transects across the entire vertebral section along the corpus calcareum. Given the relationship of Sr:Ca to habitat developed from the reference samples, habitat type (freshwater, estuarine, or marine) will be assigned to each growth band, thereby reconstructing the migration history of the shark on a year-by-year basis over its lifetime.

*Status of the oceanic whitetip shark in the western North Atlantic Ocean*: A proposal was submitted in 2005 to gather data to help clarify the uncertainty on the current status of oceanic whitetip sharks in the western North Atlantic Ocean. Data on behavior and movement patterns will be collected using on-board observers on pelagic longline vessels. Archival satellite pop-up tags will be used to monitor the movement patterns, depth, and temperature preferences of this species. In addition, time-depth recorders and hook-timers will be used to determine the depth and times at which sharks take baits. These data will be incorporated with sea-surface temperature data from satellites and incorporated into new habitat-based analyses of the data to provide a better picture of the status of oceanic whitetip sharks.

*Utilizing Bioenergetics and Matrix Projection Modeling to Quantify Population Fluctuations in Long-lived Elasmobranchs: Tools for Fisheries Conservation and Management*: Under the supervision of SEFSC scientists at the Panama City Laboratory, the NMFS–Sea Grant Fellow in

Population Dynamics and Resource Economics conducted research that sought to use a bioenergetics and matrix approach to examine the population dynamics of the cownose ray *(Rhinoptera bonasus).* Laboratory experiments and field data were used to obtain basic life history information, and that information configured the individual-based bioenergetics model. The bioenergetics model was coupled to a matrix projection model, and the coupled models were used to predict how warmer and cooler water temperatures would affect the growth and population dynamics of the cownose rays. Changes in growth rates under the warmer and cooler conditions lead to changes in age-specific survivorship, maturity, and pup production, which were used as inputs to a matrix projection model. Faster growth of individuals under the cooler scenarios translated into an increased population growth rate (4.4–4.7 percent/year versus 2.7 percent/year under baseline), shorter generation time, and higher net reproductive rates, while slower growth under the warmer scenarios translated into slower population growth rate (0.05–1.2 percent/year), longer generation times, and lower net reproductive rates. Elasticity analysis indicated that population growth rate was most sensitive to adult survival. Reproductive values by age were highest for intermediate ages.

*Cooperative Research—Definition of Winter Habitats for Blacktip Sharks in the Eastern Gulf of Mexico*: A collaborative effort between SEFSC Panama City Shark Population Assessment Group and Mote Marine Laboratory is under way to define essential winter habitats for blacktip sharks *(Carcharhinus limbatus).* Deployment of two pop-off satellite archival tags (PAT) on sharks during January–February 2005 in the Florida Keys was accomplished with the cooperation of the charter boat industry. Preliminary results from these two sharks indicate one shark remained in the Keys while the other moved to an area southwest of the coast of Cuba. Additional PAT tags will be placed on sharks during summer 2005.

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

*Cooperative Research—Definition of Summer Habitats and Migration Patterns for Bull Sharks in the Eastern Gulf of Mexico*: A collaborative effort between SEFSC Panama City Shark Population Assessment Group, University of Florida, and Mote Marine Laboratory is under way to determine summer habitat use and short-term migration patterns of bull sharks *(Carcharhinus leucas).* Sharks are being outfitted with pop-off satellite archival tags (PAT) during July and August 2005 and scheduled to deploy in autumn. This project is driven by the lack of data for this species and its current prominence within the Florida coastal community. A better understanding of this species is required to effectively manage this species for both commercial and recreational fishers as well as the general public. Concerns regarding this species will continue to be an issue as fishers and the public demand that state and federal governments provide better information concerning the presence and movements of these sharks.

*Coastal Shark Assessment Research Surveys*: The SEFSC Mississippi Laboratories in Pascagoula have been operating annual research cruises aboard NOAA vessels since 1995. The objectives of this program are to conduct bottom longline surveys to assess the distribution and relative abundance of coastal sharks along U.S. and Mexican waters of the Gulf of Mexico and the U.S. eastern seaboard. This is the only long-term, nearly stock-wide, fishery-independent survey of Atlantic sharks conducted in U.S. and neighboring waters. Ancillary objectives are to collect biological and environmental data, and to tag-and-release sharks. Starting in 2001 and under the auspices of the Mex-US Gulf Program, the Pascagoula Laboratories have provided logistical and technical support to Mexico's Instituto Nacional de la Pesca to conduct a cooperative research cruise aboard the Mexican research vessel *Onjuku* in Mexican waters of the Gulf of Mexico. The cruise also took place in 2002, but was suspended in 2003 and 2004 because of mechanical problems with the research vessel and other issues.

## 4.2 Incidental Catch Reduction

### Pacific Islands Fisheries Science Center (PIFSC)

*Reducing longline bycatch:* The resumption of the previously closed Hawaii shallow-set longline fishery for swordfish in late 2004 and 2005 will likely increase blue shark catches, as in the past blue sharks made up about 50 percent of the total catch in this fishery. With the ban on finning, these sharks will not be retained and will be categorized as regulatory bycatch. Researchers at PIFSC conducted a pilot study in 2005 to determine the potential use of an olfactory deterrent to reduce shark bycatch. This study used recent discoveries by Dr. Eric Stroud, from Shark Defense LLC (New Jersey), who identified semiochemicals (chemical messengers important for shark orientation and survivorship) shown to trigger a "flight reaction" in sharks, even while feeding (presented at the 2004 Joint Meeting of Ichthyologists and Herpetologists May 26–31, 2004, in Norman, Oklahoma). One series of semiochemical repellents have shown favorable behavioral shifts in six species of sharks, and can be administered by dosing a "cloud" of the repellent into a feeding school of sharks. Teleost fishes such as pilot fish and remora accompanying the sharks are not repelled and continue to feed, suggesting the repellant might reduce shark bycatch without affecting target species catch rates. Dr. Stroud's team is also developing a semi-solid repellent. The upcoming PIFSC research cruise will be the first test of these shark repellant chemicals with longline fishing gear.

*Operational factors*: To explore operational changes that might reduce shark bycatch, the observer database is being used to compare bycatch rates under different operational factors (e.g., hook type, bait type, the presence of light sticks, and the soak time). A preliminary analysis comparing tuna hooks to circle hooks has been completed but was inconclusive due to the small number of vessels using circle hooks. There are now more records of vessels using circle hooks and the analysis is being reinitiated.

*Experimental deep longlines*: Researchers are also exploring the efficacy of an experimental deep setting longline technique, which eliminates shallow hooks, to reduce bycatch and maximize the catch of target species such as bigeye tuna. Six-pound weights and 100 m floatlines will demarcate the start and end of each longline basket, which will be 50 m from the next basket, and so on. For example, the shallowest hooks could be designed to fish at 100 m. Furthermore, data from pop-up satellite archival tags suggest bycatch of epipelagic sharks such as silky and oceanic white-tip and marlin (blue and striped) in the Pacific could potentially be reduced by this technique since they spend approximately 80 percent of their time—day and night—at depths less than 100 m. It is anticipated that several commercial longline trips in the Hawaii-based fishery in early 2006 will initiate the study, whereby the catch of deep experimental sets will be compared with control sets targeting the same species. These data will then be compared to vertical distribution data from PSATs to get an overall understanding of temporal and spatial habitat preferences for 11 different species of pelagic tunas, sharks, billfish, swordfish, and turtles in order to predict level of fisheries interaction.

*Chemical shark repellent*: Chemical engineers and biologists associated with Shark Defense LLC have identified naturally derived semiochemicals that have a repellent effect on several shark species. These semiochemicals were originally derived from decayed shark carcasses and may function as inter- or intra-specific “alarm” substances to elicit an escape response in elasmobranchs. Laboratory experiments have shown that introduction of semiochemicals into the nares of sharks causes immediate and dramatic reversal of tonic immobility. Furthermore, when certain mixtures of semiochemicals are introduced into feeding aggregations of sharks and teleost fish in a reef environment, sharks will quickly leave the feeding area whereas bony fish will stay and continue feeding. Development of an effective shark repellent that does not adversely affect teleost feeding behavior would be of obvious benefit to commercial fisheries. Shark Defense LLC has taken care to ensure that its chemistry does not involve systemic poisons, marine pollutants, or compounds with long marine fates. While the chemistry of olfactory and gustatory compounds suggest that they are able to be utilized by chemotropic bacteria, a biodegradation study will be performed by an independent NIST-certified laboratory prior to widespread deployment.

Incidental capture of non-target shark species in longline fishing gear is of increasing concern to fisheries managers and conservationists, and various methods to reduce or prevent shark bycatch are currently under investigation. PIFSC is interested in investigating the potential for using chemical repellents developed by Shark Defense LLC to prevent shark captures in longline fishing gear. Primary goals were to assess the efficacy of semiochemicals in reducing shark captures and the effects of using chemically treated bait on capture rates for target fish species. We compared capture rates of elasmobranch and teleost fishes in longline sets using bait treated with synthetic shark semiochemicals (CHEMICAL; Shark Defense LLC “Composition 1”) versus longline sets with untreated bait (CONTROL). Trials were conducted on the NOAA R/V

Oscar Elton Sette January–February 2005 longline fishing cruise (OES 05-01) to seamounts in the vicinity of Palmyra Atoll.

A total of 15 sets were made during the cruise. Twelve of those sets were made on seamounts within the general vicinity of Palmyra Atoll (5°14–9°31 N latitude, 160°15–163°09 W longitude), two sets were made on the Cross Seamount (18°36–18°52 N latitude, 158°01–158°11 W longitude), and one set was made off the Kona Coast of Hawaii (19°39 N latitude, 155°58 W longitude). Of the 15 total sets, six were CHEMICAL sets (in which every bait was injected with shark semiochemical) and nine were CONTROL sets. There was an average of 514 ± 60 hooks per set. Gear was typically set between 19:00 and 23:00 and gear haulback occurred between 08:00 and 12:00 the following day. Due to limited data set gathered during the cruise, however, it would be premature to draw any strong conclusions about the efficacy of shark semiochemicals in preventing shark captures in longline gear. Overall fish capture rates were low for both CHEMICAL and CONTROL sets, so this will make statistical inference difficult. Also, location of sets varied widely so it is possible that environmental conditions and abundance of and catchability fish in the vicinity of gear also varied between sets for CHEMICAL and CONTROL treatments.

Several matters related to chemical concentration and delivery mechanisms should be addressed prior to further field tests with shark semiochemicals. Investigators at Shark Defense LLC recommended injecting bait with 50–60 ml of semiochemical to ensure that chemical was present in effective concentrations for the duration of an 8-hour set. The sardine bait used for sets in the experiment was quite small and only a small amount of semiochemical (maximum of 5 ml) could be injected before the chemical began leaking out through the skin or gills. It is unlikely that semiochemicals were present in effective concentrations for the entire soak time of gear, although this is difficult to confirm. An effective method for slowly releasing semiochemical over the duration of gear soak time should be investigated and implemented into future field trials. Treating each individual bait is messy and time-consuming. Ideally, future delivery mechanisms will use mechanical means or a dissolving foam matrix that would be easy for fishers to incorporate into their gear. If a chemical shark repellent is to be adopted by commercial longline fisheries, the method for delivering chemicals must be easy and safe for fishers to use. Future tests of shark semiochemicals are to be conducted in November 2005 during a PIFSC longline cruise.

## Southeast Fisheries Science Center

*Cooperative Research—The capture depth, time, and hooked survival rate for bottom longline-caught large coastal sharks*: A collaborative effort between SEFSC Panama City Shark Population Assessment Group and the University of Florida to examine alternative measures (such as reduced soak time, restrictions on the length of gear, and fishing depth restrictions) in the shark bottom longline fishery to reduce mortality on prohibited sharks will be tested using hook timers. Funding is being sought through the NMFS Cooperative Research Program.

## 4.3 Post-Release Survival

### Pacific Islands Fisheries Science Center

*Improved release technology:* The recently resumed Hawaii-based swordfish longline fishery is required to carry and use newly developed dehookers for removing hooks from sea turtles. These dehookers are reported to be effective in removing hooks from sharks as well. The deep-hooked de-hooking device removes deep swallowed hooks from the mouth, throat, and esophagus of fish, sea turtles, marine mammals, and sea birds. This should improve post-release survival and condition of released sharks.

*Using biochemical predictors and PSATs to evaluate post-release survival in large pelagic fish:* Many large marine animals (sharks, turtles, and marine mammals) are accidentally caught in commercial fisheries. While conservationists and fisheries managers encourage release of these non-target species, the long-term fate of released animals is uncertain. Successful management strategies in both sports fisheries and commercial fisheries require information about long-term survival of released fish. Catch-and-release sports fishing and non-retention of commercially caught fish are justifiable management options only if there is a reasonable likelihood that released fish will survive for long periods. All recreational anglers and commercial fisherman who practice catch-and-release fishing hope that the released fish will survive. While it is safe to say that 100 percent of retained fish will die, it is not known what proportion of released fish will survive. Many factors—such as fish size, water temperature, fight time, and fishing gear—could influence survival.

Researchers have been developing tools aimed at reducing the need for tagging studies. Whereas tagging studies assess how many fish survive, they are trying to understand why fish die. PIFSC researchers and collaborators from other agencies, academia, and the industry are developing a set of diagnostic tools to assess the biochemical and physiological status of fish captured on various gear. Application of these tools is integrated into a comprehensive pop-up archival satellite tag (PSAT) program.

Managers and conservationists are concerned about the influence of fishing, both on target and non-target species. Although sharks are specifically targeted in only a few fisheries, they dominate the by-catch of most marine fisheries. There is only a modest international demand for shark meat, but there is a large Asian market for shark fins. As the commercial value of a shark lies in the fins rather than the carcass, the practice of finning has become common; landed sharks have fins removed and the remainder of the animal is discarded at sea. Finning is a fishing practice that is predicated on the assumption that sharks landed as by-catch would be unlikely to survive upon release. The uncertainty about the survival of such non-target species released from commercial fishing gear is a challenge that faces many fisheries managers.

Long-term post-release survival, which is not well established for any marine species, is typically estimated using tagging programs. Historically, large-scale conventional tagging programs were employed. These yielded low returns rates, consistent with a high post-release mortality. For example, in a 30-year study of Atlantic blue sharks, only 5 percent of tags were recovered. Short-duration studies using ultrasonic telemetry have shown that large pelagic fish usually survive for at least 24 to 48 hours following release from sportfishing or longline gear. More recently, PSATs have been used to assess post-release behavior, which coincidentally provides information about long-term survival of released animals. Due to the cost of the tags, such studies have focused on high-profile species such as blue marlin, white sharks, and bluefin tuna. Focusing on blue sharks—a species that dominates the bycatch of tropical fisheries for large pelagics—they combine a PSAT tagging approach with development of biochemical predictors of survival. Such biochemical profiling can be an inexpensive alternative to large-scale tagging programs, making it feasible for fisheries managers to conduct intensive sampling programs to assess the consequences of fishing practices.

PIFSC scientists therefore focused first on the post-release survival of blue sharks, which are frequently bycatch of Pacific long-liners. Using the NMFS vessel *Townsend Cromwell*, they captured blue sharks on scientific long-line gear off the cost of Hawaii. Over 2 years, blue sharks were captured by scientific longline in the central Pacific Ocean near the Hawaiian archipelago. Of the 522 large pelagic fish that where captured, 211 were sharks, of which 172 were blue sharks, constituting 82 percent of captured sharks and 33 percent of the total catch. Blood samples were collected from sharks that were fitted with PSATs. The information from the PSAT establishes how long the shark survives. Analysis of the blood sample allows us to evaluate the physiological condition of the shark when it was released. The goal is to develop predictors of survival based on analysis of a single blood sample taken just prior to release. Although they focused first on blue sharks, they are anxious to apply this approach broadly to other commercial and recreational fisheries.

Using blue sharks, PIFSC scientists and collaborators developed a model to predict long-term survival of released animals (verified by pop-up satellite archival tags) based on analysis of small blood samples. Five parameters distinguished survivors from moribund sharks: plasma $Mg2+$ ($p<0.00001$), plasma lactate ($p<0.001$), erythrocyte Hsp70 mRNA ($p<0.005$), plasma $Ca2+$ ($p<0.005$) and plasma $K+$ ($p<0.05$). A logistic regression model incorporating a combination of $Mg2+$ and lactate successfully categorized 19 of 20 (95 percent) fish of known fate and predicted that 21 of 22 (96 percent) sharks of unknown fate would have survived upon release. These data suggest that a shark landed without obvious physical damage or physiological stress (the condition of 95 percent of the sharks they landed) would have a high probability of surviving upon release. For example, one individual lost almost half its blood (hematocrit of 14 percent) yet managed to survive at least 244 days until its tag jettisoned.

*PSAT post-release results*: To date, the program has PSAT-tagged 146 specimens of pelagic species including 32 blue shark, eight bigeye thresher sharks, 13 oceanic white-tip sharks, four short-fin mako, and nine silky sharks. Of the 40 PSATs reporting from released sharks, in only one case was there an indication of mortality after release. This shark ranged locally with regular vertical movements for about 5 days before it sank to 1,200 m and the PSAT automatically jettisoned to the surface (as planned to prevent implosion), suggesting the shark had died. They are confident this represents a mortality because the system worked as designed in the event of a mortality. In summary, our PSAT results suggest that 97.5 percent of sharks survived after release from longline gear, sometimes soaking on the gear for 12 hours. These PSAT data complement the biochemical data indicating long-term survival after release from longline gear. Furthermore, for all reporting PSAT tags on pelagic fishes, in only two cases (blue marlin and blue shark) was a mortality indicated by the vertical data (blue marlin sank and died 4 months after release from sportsfishing gear, so it could not be concluded that the initial catch-tag-release insult was a contributing factor as other unknown factors could have intervened in the interim).

*Electronic tagging studies and movement patterns:* PIFSC scientists are using acoustic, archival, and pop-up satellite archival tags (PSATs) to study vertical and horizontal movement patterns in commercially and ecologically important tuna, billfish, and shark species, as well as sea turtles. The work is part of a larger effort to determine the relationship of oceanographic conditions to fish and sea turtle behavior patterns. This information is intended for incorporation into population assessments, addressing fisheries interactions and allocation issues, as well as improving the overall management and conservation of commercially and recreationally important tuna and billfish species, sharks, and sea turtles. The research, sponsored by the Pelagic Fisheries Research Program and PIFSC, has shown that some large pelagic fishes have much greater vertical mobility than others. More specifically, we have found that swordfish, bigeye tuna, and bigeye thresher sharks remain in the vicinity of prey organisms comprising the deep Sound Scattering Layer (SSL) during their extensive diel vertical migrations. In contrast, other billfish, tuna, and shark species stay in the upper 200 m of the water column both night and day.

The SSL comprises various species of squids, mesopelagic fish, and euphausiids that undertake extensive diurnal vertical migrations. Pelagic fishes able to mirror movements of the SSL can better exploit these organisms as prey. Also, the ability of swordfish, bigeye tuna, and bigeye thresher sharks to access great depths permits them to effectively exploit the SSL for prey even after they descend to deeper water at dawn (e.g., over 500 m). Certainly, the ability to mirror the movements of vertically migrating prey confers selective advantages. However, other pelagic species—such as yellowfin tuna, silky sharks, oceanic white tip sharks, blue marlin, and striped marlin—do not make extensive regular vertical excursions. Recent studies of tuna trophic ecology near the main Hawaiian Islands have confirmed that bigeye tuna generally select mesopelagic prey from the SSL, while yellowfin tuna feed primarily on epipelagic prey from the mixed layer even when the fish are caught in the same areas.

Although the daily vertical movements of swordfish mirror the movements of the SSL, they are most likely following the vertical movements of larger cephalopods (the neon flying squid), which they exploit as a primary food resource. The larger squid, in turn, are following the movements of the SSL.  PIFSC scientists have also found that one of the most ubiquitous large-vertebrate species in the pelagic environment—the blue shark—occasionally displays vertical movement behaviors similar to those of swordfish, bigeye tuna, and bigeye thresher sharks.  Blue sharks appear to have no unique anatomical or physiological adaptations, and investigators have characterized blue shark vertical movement patterns in terms of behavioral thermoregulation. Nevertheless, these observations lead directly to the question, "Why are blue sharks so successful?" They hypothesize that at least part of the answer is their ability to undertake extensive daily vertical movements, which result in better forage utilization and more effective niche partitioning.

It has been suggested that the organisms composing the SSL evolved the ability to migrate downward during the day into the cold oxygen minimum layer as a refuge against predation. Studies of crustaceans living in the cold oxygen minimum zone have shown they are able to do so because of a suite of morphological, physiological, and biochemical adaptations.  However, bigeye tuna, swordfish, bigeye thresher sharks, and neon flying squid have likewise evolved physiological abilities to invade the SSL organisms' predator refuge.  They view this situation as a sort of "physiological arms race." The parallel behaviors of both fish and organisms comprising the SSL adjusting their vertical movement patterns appear to strongly correlate with moon phase.

Researchers believe this behavioral modification helps "backlight" and silhouette prey organisms of the SSL.  Furthermore, they suggest, as have others, that the vertical movements of large pelagic predators mirror the movements of their prey to the extent allowed by each species' physiology.  Lastly, a logical hypothesis is that the vertical distributions of pelagic fishes are influenced by both oceanographic conditions and the density and distribution of their prey. PIFSC researchers expect to continue this line of inquiry and to develop unique characters based on vertical movement patterns in order to examine the evolution of ecological relationships and vertical niche partitioning in the ocean.

*PSAT Performance and Meta Data Analysis Project*:  The purpose of this study is to explore failure (or success) scenarios in PSATs attached to pelagic fish, sharks, and turtles.  As an example, of 146 PSATs attached to sharks, billfish, and tunas in Hawaii, 90 (62 percent) reported data with 38 percent of the tags listed as "non-reporters" (non-reporting is not synonymous with mortality).  Specifically, the study is designed to look for explanatory variables in the context of PSAT retention rates, percentage retrieved satellite data (i.e., depth, temperature, geolocations), and tag failure.  By examining several factors and information about PSATs attached to vastly different pelagic species, it is anticipated that certain patterns/commonalties may emerge to help improve understanding of attachment methodologies, selection of target species, and experimental design.  It is anticipated that this study will examine information from over 1,000 PSATs.  Lastly, information derived from this study will allow an unprecedented and critical appraisal of the overall efficacy of the technology.

**Southwest Fisheries Science Center**

*Survival of Caught and Released Sharks:* Studies on the survival rate of caught and released sharks are continuing. A recently completed study examined hormone and sugar lactate levels in the plasma of sharks to be released and sharks that died from longline capture on SWFSC's Juvenile Shark Survey. Results indicate fish chosen for tag-and-release are substantially healthier in spite of their trauma from being caught. A study of 17 electronically tagged and released shortfin mako sharks indicated 94 percent survival beyond 2 months after release.

**Northeast Fisheries Science Center**

*Post-Release Recovery and Survivorship Studies in Sharks—Physiological Effects of Capture Stress:* This ongoing research is directed toward the sandbar shark *(Carcharhinus plumbeus)* and is being conducted cooperatively with Massachusetts Division of Marine Fisheries biologists. The study uses blood and muscle sampling methods in addition to acoustic tracking to obtain physiological profiles of individual sharks to characterize stamina and to determine ultimate post release survival. These analyses are requisite in view of the extensive current and proposed catch-and-release management strategies for coastal and pelagic shark species.

## 4.4 Education and Outreach

The U.S. NPOA for the Conservation and Management of Sharks states that each U.S. management entity (i.e., NMFS, Regional Fishery Management Councils, Interstate Marine Fisheries Commissions, and states) should cooperate with regard to education and outreach activities associated with shark conservation and management. As part of the effort to implement the U.S. NPOA, NMFS and other U.S. shark management bodies have: (1) developed training tools and programs in elasmobranch identification (such as identification posters and color guidebooks); (2) developed information and materials to raise awareness among recreational fishermen, commercial fishermen, fishing associations, and other relevant groups about the need and methods to reduce bycatch mortality and increase survival of released elasmobranchs where bycatch occurs; and (3) attempted to raise awareness among the non-fishing public about the ecological benefits from elasmobranch populations, detrimental effects of habitat destruction (e.g., coastal development and coastal pollution), and appropriate conservation measures to avoid, minimize, or mitigate adverse effects on necessary habitats.

## 4.5 Fishing Capacity

A number of management tools are in use in U.S. fisheries to reduce capacity, including limited entry, vessel and permit buybacks, and exclusive quota programs (e.g., individual fishing quotas, community development quotas, and cooperatives). However, capacity reduction is still being investigated as an effective method for increasing the sustainability of elasmobranch fisheries.

NMFS is currently assessing levels of fishing capacity in federally managed commercial fisheries in the United States as part of the U.S. NPOA on the Management of Fishing Capacity. U.S. management entities are participating in this effort.

**4.6 Conclusion**

Consistent with the provisions of Section 5 of the Shark Finning Prohibition Act, the Department of Commerce and the Department of State have been active in promoting development of international agreements consistent with the Shark Finning Prohibition Act. The law calls for the United States to pursue an international ban on shark finning and to advocate improved data collection including biological data, stock abundance, bycatch levels, and information on the nature and extent of shark finning and trade.

During 2004 and the first part of 2005, there were several noteworthy and highly successful achievements toward advancing the provisions of Section 5 of the Act. In June 2005, members of the Inter-American Tropical Tuna Commission adopted a binding resolution banning shark finning in the eastern Pacific Ocean. This measure was initially co-sponsored by the United States, along with the European Union, Japan, and Nicaragua. The resolution aims to improve information about sharks in Eastern Pacific fisheries through data collection and assessment programs, while encouraging research into shark nursery areas and ways to avoid unintended bycatch of sharks. It also calls upon Nations to implement National Plans of Action for Shark Conservation in accordance with the United Nations Food and Agricultural Organization 1999 International Plan of Action for Sharks.

The passage of an international shark finning ban in Atlantic waters adopted by ICCAT also contributes to furthering the international provisions of the Act. The ICCAT recommendation was followed by adoption of a recommendation urging all IUCN member states to ban shark finning and require shark fins to be landed attached to the bodies. Trade in shark fins will also be restricted for some shark species and monitored for others as part of proposals adopted at the 2004 CITES meeting. Also in 2004, the NAFO Fisheries Commission became the first regional fisheries management organization in the world to establish a catch limit for a directed elasmobranch fishery. In 2005, it complemented ICCAT's action by banning shark finning and mandating information collection on sharks in NAFO-managed fisheries.

Continuing efforts are being made nationally and internationally to increase data collection on shark stock assessments, develop gear modifications and capture/release techniques to minimize lethal shark bycatch, and increase our knowledge of shark ecology. These efforts are supported through agreements with international fishery management organizations including NAFO, IATTC, ICCAT, UNGA, APEC, FAO, CITES, and IUCN, and should lead to improved shark management. In addition, as reported earlier in this report, an abundance of research studies undertaken by NMFS Science Centers have produced much valuable information on shark status, mobility, habitat, ecology, and age and growth characteristics—all of which will be incorporated into effective shark fishery management decisions. Overall, compared with the years prior to enactment of the Shark Finning Prohibition Act, great strides continue to be made in shark conservation, data gathering, management, research, and education on a national and global scale which will contribute to sustainable management.

## Appendix 1: Internet Information Sources

Atlantic Ocean Shark Management

The 2005 Draft HMS FMP and proposed rule; copies of Amendment 1 to the FMP for Atlantic Tunas, Swordfish and Sharks; and Atlantic commercial and recreational shark fishing regulations and brochures can be found on the Highly Migratory Species Management Division website at http://www.nmfs.noaa.gov/sfa/hms/. Information on Atlantic shark fisheries is updated annually in the Stock Assessment and Fishery Evaluation (SAFE) Report for Atlantic Highly Migratory Species (HMS), which are also available on the website. The website includes links to current fishery regulations (50 CFR 635), shark landings updates, the U.S. National Plan of Action (NPOA) for Sharks, and the Atlantic HMS SAFE Reports.

Pacific Ocean Shark Management

The final Fishery Management Plan for U.S. West Coast Highly Migratory Species Fisheries is currently available on the Pacific Fishery Management Council website: http://www.pcouncil.org/hms/hmsfmp.html.

Data reported in Table 1.3.1, shark landings for California, Oregon, and Washington, 1992–2003, from the Pacific States Marine Fisheries Commission, PacFIN Database, may be found on their website at www.psmfc.org/pacfin/data.html.

Western Pacific Shark Management

The Western Pacific Fishery Information Network (WPacFIN) is a federal–state partnership collecting, processing, analyzing, sharing, and managing fisheries data from American island territories and states in the Western Pacific. Website address is http://www.pifsc.noaa.gov/wpacfin/index.htm.

International Efforts to Advance the Goals of the Shark Finning Prohibition Act

Food and Agriculture Organization of the United Nations (FAO) Committee on Fisheries (COFI)

NMFS prepared and submitted a major status report on the implementation of its National Plan of Action for the Conservation and Management of Sharks (NPOA) to the March 2005 meeting of COFI, which is available online at http://www.nmfs.noaa.gov/sfa/international/CongressReports2.htm.

U.S. Imports and Exports of Shark Fins

Summaries of U.S. imports and exports of shark fins based on information submitted by importers and exporters to the U.S. Customs and Border Protection Data, and U.S. Census Bureau are reported in the National Marine Fisheries Service Trade database at: http://www.st.nmfs.gov/st1/trade/index.html.