Apex Predator Protection:

Assessing Shark Landings and Conservation Measures in Rhode Island

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Executive Summary

Sharks are among the most successful predators in the sea, with few known enemies and an evolutionary history dating back more than 400 million years. As apex predators, sharks fill an important niche, in preying on sick or weak prey. Altering food webs by removing predators, prey, competitors, and alternative hosts of parasites can result in unintended changes in populations and marine ecosystems. The removal of sharks occupying the role of top predators in their ecosystems can have unexpected consequences for whole ecosystems.[1] My thesis has two primary questions. The first is to evaluate the status of large coastal sharks, small coastal sharks, and pelagic sharks that may transit or inhabit Rhode Island waters. The second part, is to assess what the State can do to protect and conserve sharks, given the migratory nature of many of these species, and the existing fisheries management structure.

In recent decades humans have increasingly expanded their recreational and commercial activities within the shark's ecosystems and the life histories of most sharks make them highly vulnerable to overfishing and slow to recover once their populations have been depleted. The number and size of commercial fisheries for sharks has increased globally in response to the public appetite for more and different sources of protein, luxury meals, nutritional supplements, and other shark products. The main sources of mortality for sharks in U.S. waters include: recreational fishing, commercial fishing, and bycatch from commercial fishing. Sport fishing and shark fishing derbies continue to attract growing numbers of people. The number of recreational fishermen targeting sharks in Rhode Island's Snug Harbor Tournament grew three-fold in only 13

[1] Myers, R. and B. Wurm. 2003. Rapid worldwide depletion of predatory fish communities. Nature 423:280-283

years, from 1986 to 1999.[2] Within Rhode Island, recreational fishers landed more sharks in the 1990s, than the commercial sector, though because of bycatch, commercial fisheries most likely result in greater mortality for sharks than the recreational sector. While many shark tournaments are now run as tag-and-release programs, not including Rhode Island's Snug Harbor Tournament or the Oak Bluffs Tournament in Massachusetts, an estimated 25 to 30 sharks still die needlessly.[3] In addition, contestants in the recreational shark fishing tournament at Snug Harbor land the largest sharks in order to be considered for the trophy. Additionally, the lack of species-specific and size-specific catch and discard data, in identifying what is caught, remains one of the greatest impediments to improved shark fishery management.

During seasonal migrations and during different periods of their life, sharks migrate freely through state, federal, and international waters. Because sharks are migratory, and do not abide by any arbitrary jurisdictions, consistent and proactive management among states is not only fair, but also necessary to secure the recovery of these shared living marine resources. The uncertainty regarding the scientific assessments, including those of maximum sustainable yield (MSY), the intrinsic rebound rates of species, predator-prey relationships, competition with sympatric species, landings data, gear-specific habitat damage and the effects of bycatch, can be high, if data are available at all, which makes decision making difficult. Furthermore, failing to implement shark fishery management at the state level may undermine shark conservation and management efforts at the national level. Federal assessments have determined that overfishing is occurring for pelagic sharks and large coastal sharks, and

[2] From 110 fishermen in 1986 to more than 300 in 1999. See Appendix 12 and 13.

[3] See Appendix 12 and 13.

the entire large coastal shark complex has been determined to be overfished in the waters of the U.S. Atlantic. Furthermore, independent assessments by the fisheries biologists Ransom Myers and Julia Baum, in 2004, documented declines of more than 50% for all species in the Northwest Atlantic Ocean in the past 15 years, with the exception of makos, which they determined had declined by approximately 39%.[4]

U.S. participation in international fishery management initiatives is guided by the Atlantic Tunas Convention Act, and the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks. As part of its' treaty obligations, a U.S. National Plan of Action for the Conservation and Management of Sharks (NPOA) has been developed by the National Marine Fisheries Service (NMFS), in consultation with stakeholders, to fulfill the national responsibility of the United States. Management of sharks is carried out at the Federal level by NMFS through Fishery Management Plans (FMPs) for Highly Migratory Species (HMS), which include tuna, swordfish, billfish, and sharks. Comprehensive regulations, which include limited access and weight limits for commercial vessels, recreational bag limits, and a prohibition on the catch of 19 species, have only recently been implemented.[5] The NPOA recommends that the Interstate Marine Fisheries Commissions and appropriate State agencies analyze the fisheries under their jurisdiction to determine if their elasmobranch catches are sustainable.[6] To date, neither the Atlantic

[4] Baum, J. and R. Myers. 2003. Collapse and conservation of shark populations in the Northwest Atlantic. Science 299:389-392.

[5] 50 CFR part 635

[6] NOAA. NMFS. 2/2001. United States National Plan of Action for the Conservation and Management of Sharks.

States Marine Fisheries Commission (ASMFC) nor any of the New England states have done so.

In addition, Rhode Island currently has no regulations in place for sharks, other than those for spiny dogfish, despite the fact that Rhode Island ranked 2nd for the North Atlantic States (VA-ME) in terms of pounds of shark landed in 2002. This may be because there are seven HMS dealers in the state, which accounted for both pelagic sharks and large coastal sharks being landed at a greater rate than any other state in New England in 2002. Rhode Island, does, however, retain jurisdiction over the management of sharks from the shore to 3 nmi, thus possessing the ability to regulate sharks within this boundary, as well as over vessels registered within the state. While the majority of sharks landed are caught some 60 to 100 offshore in Federal waters, there is direct evidence of landings within state waters of some of the most vulnerable shark species. Furthermore, the lack of species specific data for what sharks are caught make any biomass assessments virtually impossible.

The Ocean State thus has a prime opportunity to become engaged in affording protection to these vulnerable species through several means. Viable recommendations, which might meet less resistance from fishermen, include:

- Adopt federal regulations by reference in R.I.§ 20-7 and § 20-11, within it's jurisdictional waters;
- Improve data collection, e.g. by requiring catch report cards for all HMS fishermen;
- Require fishermen to display and possess a species ID guide;
- Convene workshops for HMS fishermen which discuss the importance of catch-and-release for the recreational sector as well as the function and vulnerability of sharks in the ecosystem;

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http://www.nmfs.noaa.gov/sfa/Final%20NPOA.February.2001.pdf#search='U.S.%20National%20Plan%20Of%20Action%20sharks'

- Allow greater transparency between State and Federal agencies and independent requests for data; and, finally,
- Require additional observer coverage on commercial vessels.

More proactive measures which should be considered, but which may be less likely to be adopted immediately because of opposition from both the commercial and recreational sectors, include:

- Restricting the take of overfished sharks within state waters;
- Requiring a recreational shark license;
- Imposing and enforcing a bycatch quota, and,
- Approving shark repellant technology to limit bycatch.

Beyond these actions, the Federal government should consider the broader development of Marine Protected Areas as well as market-based tools, including requiring eco-labeling on products, which could assist and influence the purchasing habits of concerned citizens.

The threat to shark populations is part of an immense problem confronting world fisheries. Most seas have been fished to the limits of their productivity. Advances in fishing technologies, along with rising demands by a growing human population, have led to heightened efforts to catch sharks, in addition to most other fish. As a result, the stability of marine ecosystems is in serious danger, and it is incumbent on states, as well as the Federal government, to act to protect and restore the populations of these sea creatures.

Part 1:

Defining the Problem

Thesis Question:

Given the trans-boundary migratory nature of sharks, swimming in and out of political jurisdictions and protection, should the State of Rhode Island manage sharks to better protect or conserve them?

CHAPTER 1 – INTRODUCTION

"Who but a fool would discard seemingly useless parts? To keep every cog and wheel is the first precaution of intelligent tinkering."

- Aldo Leopold, *Sand County Almanac*

Whether on land or in the sea, top predators play a significant and complicated role, one that is just beginning to be understood. As we continue to impact habitats and predator populations, we risk losing insight into how these animals influence the dynamics of our natural systems. In addition to this vital knowledge essential for the wise management of our environments, without large predators, our lives and the lives of future generations will be diminished. Far from being the inexhaustible harvest grounds touted by renowned biologist Thomas Huxley in 1883, the oceans are showing marked signs of depletion. Human-induced pressures on the ocean, including on large marine predators, have grown so rapidly in the past 50 years, that the once unthinkable prospect of a marine fish going extinct is fast becoming an accepted reality. The fisheries biologists Ransom Myers and Boris Worm in their 2003 paper in *Nature*, note that the preindustrial level of large predatory fishes and certain groundfishes were shown to have been reduced to 10 percent of their former numbers.[7] They further comment that "declines of large predators in coastal regions have extended throughout the global ocean, with potentially serious consequences for ecosystems."[8] The declines in many of these species, has been exacerbated in recent years with the expansion of fishing and technological advances that make it easier.

[7] Myers, R. and B. Wurm. 2003. Rapid worldwide depletion of predatory fish communities. Nature 423:280-83

[8] Ibid

By the late 1980s, it was becoming clear that fishing pressure was decimating shark populations, and that further regulation was needed.[9] In the last decade alone, demand for shark products, fins and meat in particular, has skyrocketed.[10] Approximately 100 million sharks a year are killed to produce materials such as sandpaper, fins, food and other resources.[11] Table 1 displays the common uses of several shark products, which range from being eaten as cuisine to their use as souvenirs and as pharmaceuticals.

Table 1 – Common Use of Sharks and Shark Products[12]

Sharks	Laboratory animals, commercial and domestic aquaria
Fins	Soup, traditional medicine
Jaws and Teeth	Jewelry, curios
Skin	Leather, abrasives
Entrails	Fishmeal
Flesh	Food, fertilizer
Liver	Oil – vitamins, hemorrhoid medicine, paint base Squalene – Cosmetics, pharmaceuticals, perfumery, lubricate fine mechanisms such as aircraft hydraulic systems and electronics
Cartilage	Burn treatment (Chondroiten – artificial skin) and biochemicals
Blood	Anticoagulants
Eye	Corneal implants

Some sharks, such as the mako and thresher, are sought after as gamefish, while others are considered important commercial species, and some are even killed out of pure fear or revenge. As a result of this and the overall expansion of fisheries to meet the growing demand for virtually all waters of the world, scientists and conservation groups began to push for federal management for shark fisheries in the U.S. Atlantic. After

[9] Camhi, M. 1999. Sharks on the Line. National Audobon Society

[10] FAO. 1998. "Status of international trade in shark species." From Committee on Fisheries: Sub-Committee on Fish Trade. Bremen, Germany. http://www.fao.org/docrep/meeting/x4575E.htm

[11] Ibid.

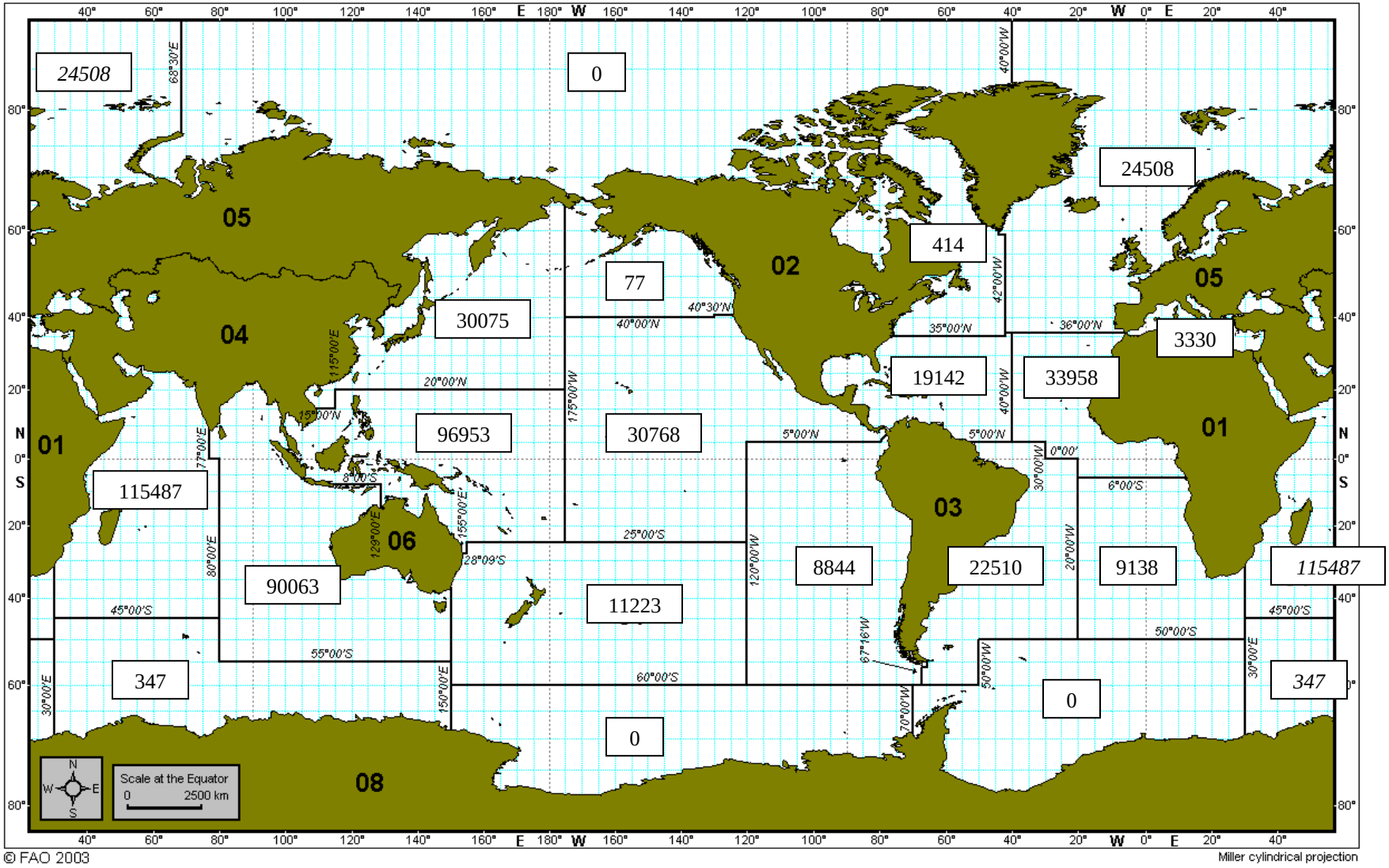
[12] Cunningham-Day, R. 2001. Sharks in Danger: Global Shark Conservation Status. Universal Publishers. Parkland, FL.

several years of preparation and negotiation, the National Marine Fisheries Service (NMFS) released the first Fishery Management Plan for Sharks of the Atlantic Ocean in February 1993. The plan established a suite of management measures for 39 species of sharks taken in fisheries in the Atlantic and Gulf of Mexico.[13] While over 125 countries fish or trade in shark products, only four – Australia, Canada, New Zealand, and the U.S. – have implemented management plans for their shark fisheries. Beyond federal boundaries, however, shark fishing is essentially a free-for-all in an unmanaged commons, with limited management carried out by the International Commission for the Conservation of Atlantic Tunas (ICCAT) in the Atlantic, and a set of non-binding recommendations by the U.N. Food and Agriculture Organization (FAO) for shark fisheries in international waters.[14] Figure 1 shows the global landings of sharks (excluding dogfish, skates and rays) in 2002 by region. (See Appendix 1) Landings of sharks were largest in the Indian and Western Central Pacific Oceans, which accounted for almost 2/3rds of all landings of sharks in 2002. Landings in the Northwest Atlantic appear rather small in comparison at a little more than 400 MT landed.

[13] http://www.nmfs.noaa.gov/sfa/hms/ By the time the plan was implemented in 1993, many sharks had already declined by more than 75% from their population levels in the 1970s.

[14] FAO. FishStat Plus. http://www.fao.org/docrep/meeting/x4575E.htm

Fig. 1 - FAO 2002 Global Landings of Sharks by Region (in MT): Total = 496,837 MT



In their analysis of shark species in the Northwest Atlantic, despite the relatively low level of shark landings compared to other regions, Julia Baum and Ransom Myers concluded that "all recorded shark species, with the exception of makos, have declined by more than 50% in the past 8 to 15 years."[15] Their results show that overfishing is threatening large coastal and pelagic sharks in the Northwest Atlantic.[16] They concluded that several species, including the hammerhead, great white, tiger, thresher, blue shark, mako, oceanic white tip, and large coastal sharks may be at risk of extinction or local extirpation as a result.[17] IUCN criteria states that if a species has declined by more than 20% over ten years, however big its population, it is 'vulnerable' to further depletion.[18] In their analysis of global fish populations, Worm and Myers discovered that the risk of extinction depends on the age at which fish enter the fishery.[19] In this way, the extinction risk declines as fishing becomes more selective for older fish. Based on these estimates of extinction risk in shark species in the Northwest Atlantic, Worm and Myers predicted the collapse and extinction of several species if current levels of fishing mortality remain the same. In order to ensure the survival of sharks in the Northwest Atlantic, these researchers recommend fishing mortality be reduced by 40-80%.[20] Figure 2, taken from

[15] Baum, J. and R. Myers. 2003. Collapse and conservation of shark populations in the Northwest Atlantic. Science 299:389-392. The abundance of makos declined moderately.

[16] Ibid. If this is the case in one of the most regulated regions, what must be the status of sharks where landings are 200 to 300 times that landed in the Northwest Atlantic.

[17] Ibid.

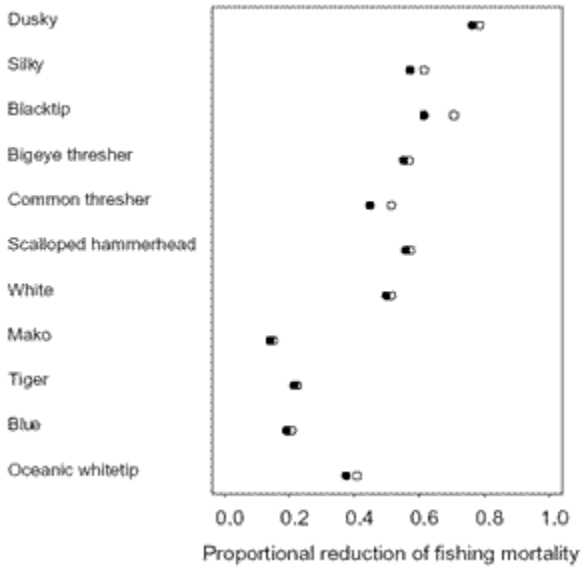
[18] IUCN definitions: http://www.redlist.org/info/categories_criteria2001.html#definitions

[19] Myers, R.A., and B. Worm. 2005. Extinction, survival, or recovery of large predatory fishes. Philosophical Transactions of the Royal Society of London: B. http://as01.ucis.dal.ca/ramweb/papers-total/Myers_Worm_2005.pdf

[20] Ibid.

their research, shows the reduction in fishing mortality needed for the survival of the Northwest Atlantic shark populations.

Fig. 2 – Fishing Mortality Reduction – North Atlantic Sharks



Though extinction rates are commonly greatest among large taxa,[21] large carnivores have even higher extinction rates than do other large consumers.[22] Furthermore, ecological extinctions in which a species loses its interaction strength due to rarity[23] can have the same effect of weakening top-down control and increasing the importance of bottom-up forces.[24] Many scientists have hypothesized that a careful study in many ecosystems would find the baseline interaction strength from large predators has shifted. Studies of

[21] Duffy, J.E. 2002. Biodiversity and ecosystem function: the consumer connection. Oikos 99: 201-219. Body mass, in fact, was the only factor strongly associated with the probability of extinction following the great biotic interchange between North and South America 2.5 million years ago. This conforms with evolutionary theory that predicts extinction rates will be higher due to morphological specializations necessary to attain large size.

[22] Ibid.

[23] Estes, J.A. et al. 1989. The ecology of extinctions in kelp forest communities. Conservation Biology 3: 252-264

[24] Duffy. 2002

historical ecology suggest that predator baselines began to shift thousands of years ago in some ecosystems,[25] and that these shifts have accelerated in recent centuries.[26]

While there is no recorded case of a marine fish species going extinct – as there is of large sea mammals, how would one know if the last fish of a species has died out? The great white shark was recently assessed by the World Wildlife Fund in September 2004 as one of ten species globally likely to become extinct.[27] This position, supported by several conservation groups including the U.S. delegation, aided in the listing of the white shark under Appendix II of the most recent Convention on the International Trade in Endangered Species (CITES) convention.[28] Additionally, the International Union for Conservation of Nature and Natural Resources (IUCN) has red listed 82 species of sharks and rays worldwide (there are roughly 370 species of sharks).[29] Of the 208 species of sharks the IUCN has assessed, they classified over one-third as threatened, while more than half lack sufficient data for an assessment.[30]

Altering food webs by removing predators, prey, competitors, and alternative hosts of parasites can result in unintended changes in populations and marine

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[25] Jackson, J. et al. 2001. Historical overfishing and the recent collapse of coastal ecosystems. Science 293:629-638.

[26] Steneck, R. et al. 2004. Accelerating trophic level dysfunction in kelp forest ecosystems of the western North Atlantic. Ecosystems 7:323-331.

[27] WWF predicts great white shark's extinction. 9/10/04. http://www.flmnh.ufl.edu/fish/sharks/innews/predict2004.html

[28] CITES accepts protection plan for 'jaws' shark. 10/12/04. http://www.flmnh.ufl.edu/fish/sharks/innews/citesjaws2004.html Appendix II listing of a species allows international trade, but requires importing and exporting countries to ensure that trade is sustainable and legal. CITES has already listed the basking and the whale shark in addition to the white shark.

[29] IUCN. Shark Specialist Group. http://iucn.org/themes/ssc/sgprofiles/sharksg.htm

[30] 19 species are listed as vulnerable; 17 endangered; and, 4 critically endangered. IUCN definitions: http://www.redlist.org/info/categories_criteria2001.html#definitions

ecosystems.[31] As apex predators, sharks fill an important niche, in preying on sick or weak prey. By eating the sick and the weak, sharks keep the gene pool of their prey healthy and essentially improve the health of ocean ecosystems.[32] The removal of sharks occupying the role of top predators in their ecosystems can have not only the expected effect of "releasing control" over their main prey, but it has been found in some instances to have unexpected second and third degree effects on non-prey species through trophic linkages.[33] Several studies from widely divergent ecosystems have found that a single predator can control the distribution, abundance, body size, and species diversity of all other species in the system.[34] Usually there are relatively few carnivorous species at the highest trophic levels. These "apex" predators are so named because no predator controls their abundance (they are resource limited). It is immaterial whether a single or several predators are controlling prey densities. What matters most is that carnivores at or near the top level control consumers at lower trophic levels, thus creating ripple effects throughout the food web. It is critical then, because some of the larger species of sharks and rays have population dynamics that are more similar to whales or sea turtles (which have been widely recognized by both international[35] and national agencies[36] to be

[31] Pauly, D. et al. 1998. Fishing down the marine food webs. Science 279:860-863

[32] Ibid.

[33] Schindler, T.R. et al. 2002. Sharks and tunas – Fisheries impacts on predators with contrasting life histories. Ecol. Appl. 12(3)735-748

[34] Paine, R.T. 1966. Food web complexity and species diversity. American Naturalist 100:65-75

[35] Baillie, J., and B. Groombridge. 1996. IUCN red list of threatened animals. IUCN (International Union for the Conservation of Nature). Gland, Switzerland.

[36] NMFS. Office of Protected Resources, Silver Spring, Maryland

endangered with extinction, then the same may be true of some sharks and rays[37]) that we act to insure the survival of these animals. Indeed, the sand tiger, dusky, and night sharks have all been recently added to the NMFS Candidate List for Threatened and Endangered Species because of large documented declines caused by overfishing.[38]

Sharks are among the most successful predators in the sea, with few known enemies and an evolutionary history dating back more than 400 million years. They display an amazing assortment of diversity in form, behavior, and the habitats that they occupy. From the tiny spiny dogfish (*Squalus acanthias*) to the infamous great white (*Carcharodon carcharias*) to the immense planktonic feeding whale shark (*Rhincodon typus*), all possess exceptionally acute sensory systems and physical adaptations that have allowed them to persist into modern times. In recent years, however, humans have increasingly expanded their recreational and commercial activities within the shark's ecosystems. The life histories of most sharks make them highly vulnerable to overfishing and slow to recover once their populations have been depleted. As K-strategists, sharks live in conditions where mortality is density-dependent.[39] The main sources of mortality for sharks include: recreational fishing, commercial fishing, and bycatch[40] from commercial fishing. Sport fishing and shark fishing derbies have continued to attract

[37] Musick, J. A. 1999. Ecology and conservation of long-lived marine animals. Pages 1–10 *in* J. A. Musick, ed. Life in the slow lane: ecology and conservation of long-lived marine animals. Am. Fish. Soc. Symp. 23.

[38] Diaz-Soltera, H. 1999. Endangered and threatened species; revision of candidate species list under the Endangered Species Act. Federal Register 64(120):33166–33467.

[39] A typical *K*-strategist has a relatively long life span and invests a relatively large amount of energy in each of the few offspring it produces.

[40] Bycatch is the incidental catching and discarding of species alive, injured, or dead, while fishing.

growing numbers of people.[41] As a competition, recreational shark fishing tournaments remove the largest sharks from the ecosystem. While many shark tournaments are now run as tag-and-release programs, a great number of sharks still die needlessly. The smaller catches are often thrown back, with hooks and fishing gear still in their mouths, and survivorship estimates for catch and release suggest that the duration of the struggle on the line often determines the sharks' ability to recover from the physical trauma.[42] The number and size of commercial fisheries for sharks has increased globally in response to the public appetite for more and different sources of protein, luxury meals, nutritional supplements, and other shark products. Additionally, the lack of species-specific and size-specific catch and discard data, in identifying what is caught, remains one of the greatest impediments to improved shark fishery management.

During seasonal migrations and during different periods of their life, sharks move in and out of state, federal, and international waters. Because sharks are migratory, and do not abide by any arbitrary jurisdictions, consistent and proactive management among states is not only fair, but also necessary to secure the recovery of these shared living marine resources.[43] Several conservation groups and marine biologists now advocate for both greater attention to and greater protection for sharks. The American Fisheries Society (AFS) recommends, "that regulatory agencies give shark and ray management high priority because of the naturally slow population growth inherent to most sharks and rays, and their resulting vulnerability to overfishing and stock collapse…The AFS

[41] S. Offshore Fishing Ass'n, 995 F. Supp. at 1415.

[42] Skomal, G. and B. Chase. 2002. The Physiological effects of angling on post-release survivorship in large pelagic gamefish. Mass. Division of Marine Fisheries. Many fishermen, commercial or recreational, rarely take the time to disentangle an unwanted shark from their gear - it's far easier to just set the animal free by cutting the line with a knife.

[43] Camhi, M. 1999.

encourages the development and implementation of management plans for sharks and rays in North America. Management practices including regulations, international agreements and treaties should err on the side of the health of the resource rather than short-term economic gain."[44] The uncertainty regarding the scientific assessments, including those of maximum sustainable yield (MSY), the intrinsic rebound rates of species, predator-prey relationships, competition with sympatric species, landings data, gear-specific habitat damage and the effects of bycatch, can be high, if data are available at all, which makes decision making difficult. Furthermore, failing to implement shark fishery management at the state level may undermine shark conservation and management efforts at the national level. My thesis has two primary goals. The first is to define and evaluate the status and sources of mortality of those sharks managed by the Federal government's Highly Migratory Species Division (which includes large coastal sharks, small coastal sharks, and pelagic sharks – but not dogfish or deep-water sharks) that may transit or inhabit Rhode Island waters. The second part, is to assess what if anything, given the migratory nature of many of these species, and the existing management structure, the State can do to further protect and conserve sharks overall.

[44] Musick, J., G. Burgess, G. Cailliet, M. Camhi, and S. Fordham. AFS Policy Statement #31b: Management of Sharks and Their Relatives (Elasmobranchii). http://www.fisheries.org/html/Public_Affairs/Policy_Statements/ps_31b.shtml

CHAPTER 2 – BACKGROUND

Biology/Life History

Sharks, skates, and rays collectively are part of the chondrichythyian or cartilaginous fishes known as elasmobranchs. They are one of the oldest living groups of jawed vertebrates and have evolved independently for at least 400 million years. Sharks comprise approximately 394 species inhabiting continental and insular shelves, open oceans, continental and insular slopes, as well as freshwater.[45] Sharks give birth in a variety of habitats from the deep ocean floor to coral reef environments, but many of the commercially important species have pupping and nursery areas in estuaries, bays and shallow near shore waters.[46] Most sharks, such as the Great white (*Carcharodon carcharias*), are apex predators feeding on the upper trophic levels, but a few, such as the Basking shark (*Cetorhinus maximus*) are planktivorous. Many of the larger species have world-wide ranges; some, like the Blue shark (*Prionace glauca*) make frequent trans-oceanic migrations, while others (i.e. the Nurse shark, *Ginglymostoma cirratum*) have more localized distributions.

While sharks exhibit considerable taxonomic, morphological, ecological and behavioral diversity, they share common life history traits and strategies.[47] These biological characteristics include: slow growth rate, large adult size, late age at maturation, low fecundity (small numbers of relatively large, precocial young), extended

[45] Cortes, E. 2000. Life history patterns and correlations in sharks. Reviews in Fish Science 8(4): 299-344

[46] Compagno, L.J.V. 1990. Alternative life-history styles of cartilaginous fishes in time and space. Environmental Biology of Fishes 28:33-75.

[47] Ibid.

reproductive cycles, lengthy gestation periods, and long life-spans.[48] Fecundity generally varies by species, with the number of embryos ranging from 1 or 2 (Bigeye thresher, *Alopias superciliosus*) to 300 (Whale shark, *Rhincodon typus*).[49] Most of the reproductive cycles and gestation periods, each, are usually 1 to 2 years and may run concurrently or consecutively.[50] Typically, species of large sharks mature at approximately 200 centimeters and bear 4 to 16 young that are 30 to 50 centimeters long at birth.[51] Sexual maturity generally occurs at about 75% of maximum size for both males and females.[52] Sharks are among the longest-lived fishes with a reported maximum age of 70 years (Spiny dogfish, *Squalus acanthias*) or more, with those species of sharks tending to complete their growth at a slower rate than shorter-lived species.[53] In general, elasmobranchs produce relatively few young and the level of recruitment is largely determined by the time they are born.[54] As a result, some fisheries biologists have argued that sharks and rays cannot exploit favorable environmental conditions to the same

[48] Ibid. In general, this combination of factors gives rise to long generation times and low reproductive potentials for many species of sharks.

[49] Castro, J.I. et al. 1999. A preliminary evaluation of the status of shark species. FAO Fisheries Technical Paper 380. Rome. p72

[50] Ibid. Known gestation ranges from 70-80 days (Grey bamboo shark, *Chiloscyllium griseum*) to 23 months (Spiny dogfish, *Squalus acanthias*).

[51] Pratt Jr., H.L. and J.G. Casey. 1990. Shark reproductive strategies as a limiting factor in directed fisheries. Elasmobranchs as Living Resources: Advances in Biology, Ecology, Systematics and Status of the Fisheries. H.L. Pratt Jr., and S.H. Gruber and T. Taniuchi (eds.). NOAA Technical Report NMFS 90:97-109. Size at birth can be over 150 cm with offspring size expressed as a percentage of maternal size ranging from 3% (Basking shark, *Cetorhinus maximus*) to 49% (Sliteye shark, *Loxodon macrorhinus*) and averaging 27%.

[52] Ibid. Most shark species grow slowly and take years to reach sexual maturity with female maturity ranging from 1 year (Australian sharpnose shark, *Rhizoprionodon taylori*) to 29 years of age (Spiny dogfish, *Squalus acanthias*).

[53] Cortes, E. 2000. Age at maturity is generally reached at about 50% of the maximum age in both males and females.

[54] Bonfil, R. 1994. Overview of world elasmobranch fish. FAO Fisheries Technical Paper No. 341:1-119. This results in a stock-recruitment relationship that is linear or slightly curvilinear.

degree as species with higher levels of reproductive output (such as teleosts).[55] The annual intrinsic rate of population increase for shark species calculated from a variety of sources generally ranges from 1-10%[56] with a maximum of 22.8%[57] and 32.7%[58], with vulnerability to mortality being "inversely proportional to the annual rates of increase (r) with groups that have r less than 10% being particularly at risk."[59] As a result, this makes elasmobranchs particularly vulnerable to over-exploitation due to these K-selected life history characteristics, such as the slow growth rates and low rates of reproduction, and the fact that stock and recruitment are tightly coupled.

Historically, directed fisheries for sharks have been characterized as "boom and bust" enterprises. For most targeted shark fisheries where there has been no regulation or management has been short-lived, the general course is that after initial exploitation, there is a rapid decline in catch rates, followed by a collapse of the fishery. [60] It is generally understood that recoveries of population numbers, from severe depletions caused either by natural phenomena or human action, takes many years for the majority

[55] Fogarty, M.J. et al. 1990. Reproductive dynamics of elasmobranch populations in response to harvesting. ICES Mini-symposium: Reproductive Variability. Paper No. 9. The Hague, Netherlands. Elasmobranchs appear to make up for low fecundity by investing in large offspring with relatively high survival rates.

[56] Hoenig, J.M. and S.H. Gruber. 1990. Life-history patterns in the elasmobranchs: implications for fish management. NOAA Technical Report NMFS 90. Elasmobranchs as Living Resources: Advances in the Biology, Ecology, Systematics and the Status of the Fish. H.L. Pratt Jr., S.H. Gruber and T. Taniuchi. (eds.)

[57] Liu, K.M. and C.T. Chen. 1999. Demographic analysis of the scalloped hammerhead in the northwestern Pacific. Fisheries Science 65(2):218-223

[58] Musick, J. 1999. Ecology and conservation of long-lived marine animals. In: Life in the Slow Lane: Ecology and Conservation of Long-Lived Marine Animals. J.A. Musick (Ed.). American Fisheries Society Symposium 23:1-10. 1999.

[59] Ibid.

[60] Holden, M.J. 1977. Elasmobranchs. Pp187-215 in: Fish Population Dynamics. J.A. Gulland (ed.), John Wiley & Sons, NY.

of elasmobranchs.[61] The history of the Porbeagle shark (*Lamna nasus*) fishery in the Northwest Atlantic is an example of a typical "boom or bust" fishery when a shark species is directly targeted. In 1961, a longline fishery was established by the Norwegians on a previously unexploited population of porbeagle sharks and ranged from the Newfoundland Grand Banks to the waters off the U.S. Mid-Atlantic States.[62] Vessels from the Faroe Islands also began fishing in 1961 in this same geographic area and combined landings from 1961 to 1964 increased from 1,924 to 9,281t, then declined sharply to 625t in 1967.[63] The Norwegian fishery lasted from 1961-1966 with small catches in 1968, 1972, and 1984.[64] By 1967, the fishery had almost disappeared with the Faroese fishery continuing at a very low level until 1994, and average catches of about 4,500t per year caused the fishery to collapse after only 6 years, while the recovery of the stock took another 20 years.[65] In his assessment of the porbeagle crash, Dr. Steve Campana states that, "catches of 1,000-2,000t throughout the 1990s have lowered catch rates, reduced the numbers of large sharks, and markedly lowered the numbers of mature females. Population dynamics analysis suggests that the porbeagle population in the western North Atlantic has again declined with stock abundance at about 15-20% of the

[61] Ibid.

[62] Campana, S. et. al. The rise and fall (again) of the porbeagle shark population in the northwest Atlantic. Pelagic Shark Conference. Environmental Biology of Fishes.

[63] Ibid. A decrease in catch per unit effort (CPUE) and average size of the fish also occurred during this time period.

[64] Ibid.

[65] Ibid. Low and apparently sustainable catches of about 350t in the 1970s and 1980s allowed the stock to rebuild before a new Canadian fishery arose in the early 1990s.

size of the unexploited population that was present in the 1960s."[66] Other examples of historical "boom and bust" shark fisheries include the harpoon fishery for the Basking shark (*Cetorhinus maximus*) off Ireland, the California drift-net fishery for the Thresher shark (*Alopias vulpinus*), the British Columbia Spiny dogfish (*Squalus acanthias*) fishery, and the Tope or Soupfin shark (*Galeorhinus galeus*) fisheries of southern Australia, California, South Africa, southern Brazil, Uruguay, northern Argentina, and New Zealand.[67] Catch rates of many of the species and species groups declined by about 50% from the 1990s to the early part of the 21st century, but that rapid rate of decline has slowed and have leveled off more recently.[68]

Overall, productivity and intrinsic rates of increase are low for shark species. In some instances, smaller, fast growing, early maturing, and more fecund species, while rarely targeted, are the basis of sustainable catches in managed shark fisheries in certain parts of the world.[69] However, several biologists have noted that based on the known ranges of k- and r-values for shark species, a historical decline percentage of the baseline level would vary by species or species group, and the effect of these management

[66] Ibid. Calculations show that even $F_{0.1}$ fishing target is inappropriate for the porbeagle shark and will eventually lead to stock collapse.

[67] Walker, T.I. 1998. Can shark resources be harvested sustainably? A question revisted with a review of shark fish. Marine and Freshwater Research.

[68] Ibid. Landings of the small and large coastal complexes and of pelagic sharks rapidly increased in 1981, before decreasing to slightly more than 50 mt landed in the mid-1980s and then rising again in the early 1990s. After peaking in 1993, landings of these three groups has dropped significantly to numbers not seen since the commercial value of these species was exploited, perhaps due to increased management and lower quotas, overharvesting, or some combination of factors.

[69] Cortes, E. 1999. A stochastic stage-based population model of the sandbar shark in the western North Atlantic. In: Life in the Slow Lane: Ecology and Conservation of Long-Lived Marine Animals. J.A. Musick (ed.) American Fish Society Symposium 23:115-136

strategies on population abundance should be tracked for at least a generation.[70] Shark species have been classified into three general groups based on a demographic technique to compare the intrinsic rates of population increase in 26 shark species hypothetically exposed to fishing mortality.[71] Sharks with the highest value for rebound capabilities were smaller, inshore coastal species that mature early and tend to be comparatively short-lived (i.e., Atlantic sharpnose shark, *Rhizoprionodon terraenovae*); those with the lowest recovery capabilities tended also to be coastal species but were generally medium to large-sized sharks, slow growing and late to mature (i.e., Dusky shark, *Carcharhinus obscurus*); and finally, the sharks within the mid range of rebound values were mostly large (> 2.5 m maximum size) pelagic species, relatively fast growing and early maturing (i.e., Blue shark, *Prionace glauca*).[72] Additionally, it is argued that these intrinsic rebound potential values should be used within a broad context of considerations, covering the vulnerability of a stock, and that many other factors, such as innate plasticity of growth and regeneration rates, extent of geographic range, abundance, extent of stock mixing, and vulnerability to fishing on pupping, nursery and feeding grounds also should be taken into account when developing management regimes.[73]

The low absolute numbers, or biomass, and social structure of most sharks add to the vulnerability factors they face. Sharks, as apex predators, have a relatively small

[70] Ibid.

[71] Smith, S.E. et al. Intrinsic rebound potentials of 26 species of Pacific sharks. Marine and Freshwater Research 49:663-678. These groupings are similar to those described by E. Cortes (2000) based on life history patterns and correlations.

[72] Ibid.

[73] Ibid. and E. Cortes 2000

abundance compared to other trophic levels.[74] Some species, such as the Great white, *Carcharodon carcharias*, may exist at very low levels even in an unexploited state.[75] In addition, as Enric Cortes explains, "sharks have unique life history characteristics as K-strategists, limited compensatory mechanisms, a tightly-coupled stock and recruitment relationship, and generally lack validated age estimates."[76] Many species also segregate by age, size, sex, and reproductive state that could make a particular life stage vulnerable to exploitation. The high mobility of many species, which often involves transboundary migrations, makes the determination of stock structure difficult.[77] Additionally, the determination of the reproductive cycle and gestation time is also complicated by the shoaling and migratory activities of most sharks that often result in making sampling inaccessible at certain life stages.[78] Furthermore, reduced genetic diversity within sharks is significantly lower than those in other marine species.[79] Sharks exhibit little genetic heterogeneity across wide geographic ranges (i.e., Blue shark, *Prionace glauca*, Spiny dogfish, *Squalus acanthias*), which may be due to their age structure and long generation times.[80] A home range and/or homing ability, and site affinity has been established for some shark species, and dietary specificity has been reported for some species of shark that demonstrate selective feeding at least in some parts of their geographic range (i.e.,

[74] E. Cortes 2000.

[75] Ibid.

[76] Ibid.

[77] Ibid. Juveniles of some species have been found to be more susceptible to overexploitation.

[78] Ibid.

[79] Heist, E.J. 1999. A review of population genetics in sharks. American Fisheries Society Symposium 23:161-168 Allozymes and mitochondrial DNA typically reveal levels of genetic variation within sharks that are significantly lower than those in marine teleosts.

[80] Ibid.

Shortfin mako, *Isurus oxyrinchus*).[81] However, pupping and nursery areas in estuaries, bays and shallow near shore waters that may offer the young some protection from predators and an abundant food supply, also make them accessible to subsistence and modern fishing operations[82] and susceptible to impact by pollution, encroaching industrialized development, and overburdening recreational use. [83] Ultimately, there is a great deal of uncertainty about the status of many species of shark in terms of abundance, recruitment, and exploitation rates. There are species identification problems with some groups of sharks (i.e., Carcharhinids) that partially contribute to the fact that catch information and fishery statistics are not species specific and are often lumped into aggregate categories. Species could be at high risk of depletion without even being identified in the catch.[84] Sharks are often not caught in directed fisheries, but as incidental or bycatch in multispecies and multigear fisheries. Generally, baseline information on fisheries that catch shark, historical abundance levels, time-series of catch and effort data, and information on the effects of trade is lacking. Moreover, the lack of historical time series (less than 15-20 years) in a particular region might not reflect the overall stock trends, and thus short time series for limited areas do not necessarily indicate historical status of the stock. Because of their low population resilience, most shark and ray populations can only withstand modest levels of fishing without depletion and stock

[81] Stillwell, C.E. and N.E. Kohler. 1982. Food, feeding habits and estimates of daily ration of the Shortfin mako in the northwest Atlantic. Canadian Journal of Fisheries and Aquatic Sciences 39:407-414

[82] Branstetter, S. 1990. Early life-history implications of selected carcharhinoid and lamnoid sharks of the northwest Atlantic. NOAA Technical Report NMFS 90. Elasmobranchs as Living Resources: Advances in the Biology, Ecology, Systematics and the status of the Fish. H.L. Pratt Jr., S.H. Gruber and T. Taniuchi (eds.)

[83] Pratt and Casey. 1990

[84] Walker. 1998

collapse.[85] Most sharks and ray populations decline more rapidly and are not able to respond or compensate as strongly or as quickly as other fishes to population reduction by fisheries[86], thus management must be implemented at the inception of shark fisheries.[87] However, this has not been the case for the vast majority of shark fisheries that have developed around the world. To the contrary, the overwhelming pattern has been one of no management, rapid stock decline

Federal Regulations

Throughout the late 1970s and the 1980s, tuna and swordfish vessels began to retain a greater proportion of their shark incidental catch, and some directed fishery effort expanded as well to meet the growing demand for shark products. In 1989, as a result of accelerating shark catches and declines in stocks, the five Atlantic Fishery Management Councils asked the Secretary of Commerce to develop a Shark Fishery Management Plan (FMP).[88] The Councils requested that the FMP cap commercial fishing effort, establish a recreational bag limit, prohibit "finning," and begin a data collection system.[89] In 1993, the Secretary of Commerce, through NMFS, implemented the first FMP for Sharks of the Atlantic Ocean, which included establishing a fishery management unit consisting of 39

[85] Camhi, M., S. Fowler, J. Musick, A. Bräutigam, and S. Fordham. 1998. Sharks and their relatives: ecology and conservation. Occas. Pap. IUCN Species Surviv. Comm. 20.

[86] Sminkey, T. R., and J. A. Musick. 1995. Age and growth of the sandbar shark, *Carcharhinus plumbeus*, before and after population depletion. Copeia 1995:871–883.

[87] Musick, J. A. 1999a. Ecology and conservation of long-lived marine animals. Pages 1–10 *in* J. A. Musick, ed. Life in the slow lane: ecology and conservation of long-lived marine animals. Am. Fish. Soc. Symp. 23.

[88] Final Amendment 1 to the FMP for Atlantic Tunas, Swordfish, and Sharks. NMFS. Highly Migratory Species Management Division. Silver Spring, MD. Nov. 2003. The councils stated concern about the late maturity and low fecundity of sharks, the increase in fishing mortality, and the possibility of the resource being overfished.

[89] Ibid.

frequently caught species of Atlantic sharks, separated into three groups for assessment and regulatory purposes (Large Coastal Sharks (LCS), Small Coastal Sharks (SCS), and pelagic sharks, and established commercial quotas for LCS and pelagic sharks, and a recreational retention limit of 5 sharks per vessel. Four years later, the 1997 FMP was developed to revise the initial management measures established in the first shark FMP, including reducing the quotas, prohibiting the possession of certain species, and reducing recreational retention limits.[90] Only two years later, another FMP was developed, although NMFS began working on the 1999 FMP shortly after Congress reauthorized the Magnuson-Stevens Act in 1996.[91] In April 1999, NMFS published its third FMP for Atlantic sharks in commercial and recreational fisheries. Table 2 displays the current regulations. (See Appendix 2 for full summary of current Federal regulations)

[90] Ibid. As a consequence, the Southern Offshore Fishing Association (SOFA) and other commercial fishermen and dealers sued the Secretary of Commerce on the 1997 regulations, which reduced the LCS commercial quota by 50 percent to 1,285 mt dw, limited the recreational retention limit of all sharks to two per trip (with an additional allowance of two Atlantic sharpnose sharks), established an annual commercial quota for SCS of 1,760 mt dw, and prohibited the possession of five species. Judge Steven D. Merryday of the U.S. District Court for the Middle District of Florida, issued an order on February 26, 1998, finding that the Secretary "failed to conduct a proper analysis to determine the 1997 LCS quota's economic effect on small businesses." As a result of this finding, the Judge directed NMFS "to undertake a rational consideration of the economic effects and potential alternatives to the 1997 LCS quotas" on small businesses engaged in the Atlantic shark commercial fishery. The Judge however, allowed NMFS to maintain the 1997 quotas pending further order of the court. In May 1998, NMFS completed its consideration of the economic effects of the 1997 LCS quotas on fishermen and submitted the analysis to the court. NMFS concluded that 1997 LCS quotas may have had a significant economic impact on a substantial number of small entities and that there were no other available alternatives that would both mitigate those economic impacts and ensure the viability of the LCS stocks. On June 25, 1999 SOFA et al. sued NMFS again, this time challenging the Atlantic shark commercial measures implemented in the 1999 HMS FMP. After initially being enjoined from enforcing the regulations, the court eventually issued an order on June 12, 2000 clarifying that NMFS could proceed with implementation and enforcement of the 1999 prohibited species provisions (64 FR 29090, 5/28/99).

[91] Ibid. The 1996 Amendments added new fishery management requirements including requiring NMFS to halt overfishing; rebuild overfished fisheries; minimize bycatch and bycatch mortality, to the extent practicable; and identify and protect essential fish habitat (EFH). These provisions were coupled with the recognition that the management of HMS requires international cooperation and that rebuilding programs must reflect traditional participation in the fisheries by U.S. fishermen, relative to foreign fleets. Besides the Magnuson-Stevens Act, U.S. fisheries management must be consistent with the requirements of other regulations including the Marine Mammal Protection Act, the Endangered Species Act, the Migratory Bird Treaty Act, and several other Federal laws.

PROHIBITED SPECIES

The following sharks cannot be kept commercially or recreationally: Whale, basking, sand tiger, bigeye sand tiger, white, dusky, night, bignose, Galapagos, Caribbean reef, narrowtooth, longfin mako, bigeye thresher, sevengill, sixgill, bigeye sixgill, Caribbean sharpnose, smalltail, and Atlantic angel sharks. *There is a mechanism in place to add or remove species, as needed via rulemaking.*

COMMERCIAL REGULATIONS

Management Unit	Species that can be retained	Quota (mt dw)	Regional Quotas	Authorized Gears
Large Coastal Sharks *directed commercial retention limit of 4,000 lb dw per trip *incidental retention limit	Sandbar, silky, tiger, blacktip, bull, spinner, lemon, nurse, smooth, hammerhead, scalloped hammerhead, great hammerhead	1,017	NA = 4% SA = 54% GM = 42%	Pelagic or Bottom Longline; Gillnet; Rod and Reel; Handline; Bandit Gear
Pelagic Sharks *no directed retention limit *incidental retention limit	Shortfin mako, thresher, oceanic whitetip	488		
	Porbeagle	92		
	Blue	273	None	
Small Coastal Sharks *no directed retention limit *incidental retention limit	Atlantic sharpnose, blacknose, finetooth, bonnethead	454	NA = 13% SA = 83% GM = 4%	

Additional remarks:
* All sharks not retained must be released in a manner that ensures the maximum probability of survival
*Finning is prohibited for all sharks no matter what species
*Fishing seasons: Starting January 1, 2005, the fishing seasons will be January 1 to April 30; May 1 to August 30; September 1 to December 31
*Fishing regions: NA = Maine through Virginia; SA = N. Carolina through East Florida and Caribbean; GM = Gulf of Mexico
*Quota over- and underharvest adjustments will be made for the same season the following year; no reopening that season
*Count state landings after Federal closure against Federal quota
*Time/area closure for vessels with bottom longline gear on board: January through July between 35 41'N to 33 51'N and west of 74 46'W , roughly following the 60 fathom contour line, diagonally south to 76 24'W and north to 74 51'W
*Vessel Monitoring Systems required for all gillnet vessels during right whale calving season and from January through July for all vessels with bottom longline gear on board between 33 00'N and 36 30'N
*Limited access; Exempted Fishing Permit (EFP) requirements; Display permits for collection for public display
*Observer and reporting requirements
*For incidental limited access permit holders: 5 large coastal sharks per trip; a total of 16 pelagic or small coastal sharks (all species combined) per vessel per trip
*Vessel with bottom longline gear on board must: (1) have non-stainless steel corrodible hook; (2) have a dehooking device, linecutters, and a dipnet on board; (3) move 1 nmi after an interaction with a protected species; and (4) post sea turtle handling and release guidelines in the wheelhouse

RECREATIONAL REGULATIONS

Management Unit	Species that can be kept	Retention Limit	Authorized Gears
Large Coastal, Pelagic, and Small Coastal Sharks	Same as commercial.	1 shark per vessel per trip (all species) with a 4.5 feet fork length minimum size; allowance for 1 Atlantic sharpnose and 1 bonnethead per person per trip (no minimum size)	Rod and Reel; Handline

Additional remarks:
*Harvested sharks must have fins, head, and tail attached
*No sale
*HMS Charter boat/headboat permit and/or HMS Angling permit required

The main commercial management measures related to sharks in the 1999 FMP include:[92]

- Maintaining the fishery management unit consisting of 39 frequently caught species of Atlantic sharks, separated into three groups for assessment and regulatory purposes (Large Coastal Sharks (LCS), Small Coastal Sharks (SCS), and pelagic sharks);

[92] Ibid. viii

- Establishing calendar year commercial quotas for the LCS, SCS and pelagic sharks based on region and season;
- Establishing blue shark, porbeagle shark, and other pelagic shark subgroups of the pelagic sharks and establishing a commercial quota for each subgroup;
- Establishing new procedures for counting dead discards and state landings of sharks after Federal fishing season closures against Federal quotas; and
- Prohibiting finning by requiring that the ratio between wet fins/dressed carcass weight not exceed five percent;
- Requiring annual commercial permits for fishermen who harvest and sell shark (meat products and fins);
- Implementing limited access in commercial fisheries, based on either a directed permit (4,000 lbs. shark/trip) or an incidental permit (5 sharks/trip);
- Requiring trip reports by permitted fishermen and persons conducting shark tournaments and requiring fishermen to provide information to NMFS under the Trip Interview Program; and,
- Requiring NMFS observers on selected shark fishing vessels to document mortality of marine mammals and endangered species.

The main recreational management measures related to sharks include:[93]

- Establishing a recreational trip limit of one shark per vessel;
- Establishing a recreational minimum size of 4.5 feet
- Prohibiting the sale by recreational fishermen of sharks or shark products caught in the EEZ;

[93] Ibid.

- Requiring all charterboats/headboats targeting HMS to possess an HMS Charterboat Permit; and,
- Requiring all recreational anglers to possess an HMS Angler Permit.[94]

Some of the non-species specific management measures of the 1999 FMP include:[95]

- Establishing vessel monitoring systems for all pelagic longline vessels; gear and vessel marking requirements;
- Moving pelagic longline gear after an interaction with a protected species;
- a requirement for charter/headboats to obtain an annual vessel permit; tournament registration for all HMS tournaments;
- Establishing a time limit on completing a vessel logbook; and
- Expanding observer coverage.

Sharks are currently managed on a calendar year beginning January 1 that is separated into three equal seasons. In 1994, in order to lengthen the fishing season for large coastal sharks and to reduce the derby fishery, NMFS implemented a 4,000 lb trip limit on LCS. This trip limit has been maintained for directed shark permit holders after implementation of the limited access program in 1999. Incidental shark permit holders have a lower trip limit, which allows for a total of 5 sharks to be landed per fishing trip.[96] The 1999 FMP also established species-specific quotas for pelagic sharks throughout the entire Atlantic, including porbeagle (92 MT dw), blue (273 MT dw), and all other pelagic sharks (488 MT dw), which have been added to the regional quotas already established

[94] This provision was not included/required until 2004.

[95] Amendment I. viii

[96] Some fishermen note that they often exceed the trip limit on one set and need to cut their gear and return to it later.

for LCS (1,017 MT dw) and SCS (454 MT dw). The HMS limited access permit program was established in the 1999 FMP in order to "reduce latent effort and begin the process of rationalizing catch capacity with the available quota."[97] Current regulations allow for the removal of all fins at sea, if the fins are retained with the dressed carcasses and do not exceed 5% of the dressed weight of the carcasses. While curtailing the serious and once widespread practice of finning, the current prohibition fails to correct problems associated with shark species identification[98] as their removal complicates identification and makes data collection and enforcement of trip limits and prohibited species regulations more difficult.

Current HMS regulations allow NMFS to select any vessel that has an Atlantic HMS permit for observer coverage, coverage though, remains dependent upon federal funding and is generally limited.[99] Observer coverage ranges between 2% to 5% of vessels in the Atlantic, depending on available resources.[100] Vessels permitted in the HMS Charter/Headboat and Angling categories can be requested to take observers on a voluntary basis as well, but this program was just implemented in 2003.[101] A number of time/area closures have been implemented to reduce bycatch of protected species, as well as target and non-target HMS in recent years. NMFS has closed some areas to fishermen

[97] Ibid. 4-9

[98] Species identification of sharks, particularly dressed (i.e., headed, gutted, and finned) sharks, can be enhanced by the presence of the 2nd dorsal and anal fins. Because these fins are usually small, they are often referred to as "chips" when removed from the shark itself.

[99] Pers. Comm. HMS Division. M. Clark

[100] Ibid.

[101] Recent biological opinions pertaining to HMS fisheries require NMFS to collect observer information specific to sea turtles and marine mammals on pelagic longline vessels and commercial vessels participating in the Atlantic shark fisheries.

with HMS permits who have pelagic longline gear on board. The Northeastern U.S. closed area (39 to 40^{0}N. lat. and 68 to 74^{0}W long.) is closed during the month of June each year. In terms of Essential Fish Habitat, currently, only one area, for sandbar sharks off of North Carolina, Chesapeake Bay, MD, and Great Bary, NJ, has been identified as a Habitat Area of Particular Concern (HAPC) for sharks.[102]

Recreational anglers targeting sharks are only required to observe the minimum retention limit of one shark per vessel and a minimum size limit of 4.5 feet fork length. Permits have just been required for charterboat operators, as well as any recreational angler beginning in 2004, targeting HMS, and they are not allowed to sell any shark that is caught while fishing recreationally. Alternatives have been proposed which would prohibit the landing of any sharks within the recreational sector. Alternative E6 in Amendment 1 to the 1999 FMP would have implemented catch-and-release fishing for all recreational shark fisheries in Federal waters, inclusive of all LCS, SCS, pelagic species, prohibited species, and deepwater/other species. Under this alternative, no sharks could be retained and all sharks subject to Federal management would have to be released in a manner that maximizes the probability of survival.[103]

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[102] NMFS is conducting the five-year EFH review and update for all Atlantic HMS that were not updated in Amendment 1 to the 1999 FMP. HAPCs are areas within EFH that meet one or more of the following criteria: they are ecologically important, particularly vulnerable to degradation, undergoing stress from development, or they are a rare habitat type. HAPCs can be used to focus conservation efforts on specific habitat types that are particularly important to the managed species.

[103] Amendment 1. 2-11. Alternative E6 would result in the fastest rebuilding to MSY levels by reducing recreational fishing mortality to post-release mortality only. As no quantitative estimates for post-release mortality of sharks caught in recreational fisheries (in general or for individual species) are currently available, only qualitative impacts can be discussed at this time. However, assuming a low post-release mortality, this alternative would be expected to provide for the fastest rebuilding possible with the highest probabilities that LCS stocks will increase from the 2002 levels. This alternative would be expected to meet NS 1 to prevent overfishing and rebuild overfished fisheries for LCS, and would also enhance stock status for the fully fished pelagic and rebuilt small coastal sharks.

Dealers and fishermen provide the foundation for the majority of information that NMFS is dependent on in managing its fisheries. Data on landings and sales provided by dealers and information on catch, landings, location, and effort provided by fishermen are assembled by NMFS and used for biological, social, and economic analyses. Data collection requirements and needs frequently vary from fishery to fishery even within HMS. As a result, dealers and fishermen may be required to report data about different species on different NMFS forms to more than one NMFS office. Different types of information may be collected using different methodologies such as vessel trip reports or vessel logbooks. Most are submitted in hard copies, but some fisheries have instituted electronic reporting. Currently in HMS fisheries, all commercial fishing vessels and charter/headboat vessels are required to submit logbooks for all HMS trip, if they are selected for reporting. Permit holders selected for reporting include all shark and swordfish fishermen and Atlantic tuna's longline category vessels.

Because recreational landings of Atlantic HMS are not marketed through commercial channels it is not possible to monitor anglers' catches through ex-vessel transactions as in the commercial fishery. Instead, NMFS collects data through two primary statistical sampling surveys of the recreational fisheries: the Marine Recreational Fishery Statistics Survey (MRFSS) and the Large Pelagic Survey (LPS), for tunas and other HMS from Virginia to New Hampshire. Both surveys consist of a telephone survey to estimate effort and a dockside intercept program to collect CPUE data or landings. The utility and accuracy of both surveys has been questioned in recent years by both fishermen and environmental groups, and mandatory call-in systems have only been

implemented for bluefin tuna (in 1997), and for Atlantic billfish and swordfish (in 2003), but not for sharks.

MSY and Stock Assessments

Since the first FMP, stock assessments have been performed each year to examine the status of LCS, SCS and pelagic stocks. The basis for determining these stock assessments and for establishing commercial quotas is the concept of maximum sustainable yield (MSY). Maximum sustainable yield (MSY) is defined in the Magnuson-Stevens Act, under the guidelines for National Standard 1, issued in 1998, as "the largest long-term average catch or yield that can be taken from a stock or stock complex under prevailing ecological and environmental conditions."[104] Stated another way, it is the largest long-term average yield/catch that can be taken from a stock of fish without depressing the species' ability to reproduce. Since the 1950s, MSY and the goal of full utilization have been the dominant concepts in fisheries management. The strength of the concept is that it offers a "scientific and objective mode of inquiry" that avoids political, economic, and social issues related to fisheries and focuses on the resource rather than the users.[105] MSY, though, is often difficult to determine because of the complexity of interrelationships of stock, the insufficiency of available data, and the effects of short-term variations in environmental conditions. Fishing at MSY for a particular managed fishery does not take into account the effects on other stocks in the ecosystem, and in mixed stock fisheries, the MSY for each stock will differ from the

[104] 50 C.F.R. §600.310(c)(1) 2004 A typical MSY is about 80% of the total population biomass of the mature fish capable of reproduction. The maximum sustainable yield is usually higher than the optimum sustainable yield.

[105] Scheiber, H.N. and Carr, C. From extended jurisdiction to privatization: International law, biology, and economics in the Marine Fisheries Debates, 1937-1976. 16. Berkeley J. Int'l. L. 10. 1998

MSY of the biomass as a whole. Economists have long asserted that MSY ignores basic fisheries economics principles and role played by density of population.[106] Furthermore, economists have espoused management of public resources that produced a "socially optimum" level of exploitation and found MSY to be a "socially meaningless" objective.[107]

The original criteria in the Magnuson-Stevens Act responded to some of the criticisms of MSY by allowing for adjustment of MSY – higher or lower – in light of social, economic, and ecological factors to achieve an "optimum yield" from the fishery.[108] Because this approach was seen to have been so unsuccessful in maintaining or restoring fish stocks, the 1996 Sustainable Fisheries Act amended Magnuson-Stevens to determine optimum yield (OY) on the "basis of maximum sustainable yield, as reduced by any relevant social, economic, or ecological factor."[109] OY has been interpreted by fisheries managers to be the level of effort that maximizes the difference between total revenue and total cost. Or, where marginal revenue equals marginal cost.[110] Legal scholar and attorney Donna Christie states, in her assessment on marine resource management, that "in the face of continually declining fisheries, the SFA changed the

[106] Knight, G. International fisheries management – a background paper. The Future of International Fisheries Management 16-37. 1975. The failure of MSY to incorporate fisheries economics is said to lead to overfishing and overcapitalization. As available stock is depleted, fishing efforts will tend to increase to inefficient levels; the cost to harvest the last fish is much greater than the cost harvest the first fish and may eventually exceed the value of the fish.

[107] Marine Fisheries Debates, note 177, at 28-29

[108] 16 U.S.C. §1802(28)(A) 2000. Optimum yield is the "amount of fish which will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems."

[109] Ibid. §1802(28)(B) Optimum yield must now also provide for rebuilding of overfished stocks.

[110] This level of effort maximizes the economic profit, or rent, of the resource being utilized. It usually corresponds to an effort level lower than that of maximum sustainable yield.

definition of OY so that MSY is no longer a starting point for adjusting the OY up or down, but a biologically determined ceiling on OY. This change still failed to address many of the fundamental problems in use of MSY as the benchmark for management."[111] Yet, according to the fisheries biologists and managers, Hilborn and Walters, the most widely accepted fundamental purpose of fisheries management is "to ensure the sustainable production over time from fish stocks, preferably through regulatory and enhancement options that promote economic and social well-being of the fishermen and industries that use the production."[112] Clearly, the primary concern in managing the resource is related to effects on the industry and its ability to continue "harvesting the resource", rather than on protecting the fish, thus representing an inherent conflict of interest for those whose job it is to both manage and conserve the resource.

NMFS, despite the weaknesses in MSY and a single-species approach to management, continues to rely on MSY. Additional criteria has been developed to assess when a species is considered overfished and when overfishing is occurring.[113] A species is considered overfished when the current biomass (B) is less than the minimum stock size threshold ($B<B_{MSY}$). The minimum stock size threshold is determined based on the natural mortality of the stock and the biomass at Maximum Sustainable Yield (B_{MSY}). Furthermore, overfishing may also be occurring on a species if the current fishing

[111] Chrisie, D. p.133

[112] Hilborn, R. and C.J. Walters. 1992. Quantitative fisheries stock assessment: Choice, dynamics and uncertainty. Chapman and Hall.

[113] The 1999 FMP established the threshold levels to determine if a stock is overfished, if overfishing is occurring, or if the stock is rebuilt.

mortality (F) is greater than the fishing mortality at MSY (F_{MSY}) ($F<F_{MSY}$).[114] A species is considered rebuilt when B is greater than B_{MSY} and F is less than F_{MSY}. A species is considered healthy when B is greater than or equal to the biomass at optimum yield (B_{OY}) and F is less than or equal to the fishing mortality at optimum yield (F_{OY}). In its' June 1998 LCS stock assessment, NMFS found that LCS were overfished and would not rebuild under 1997 harvest levels. With the exception of sandbar and blacktip sharks, both of which were determined to be experienced overfishing, the entire LCS complex was determined to be overfished with overfishing occurring.[115] NMFS has an annual quota of 1,017 MT dw for the LCS complex, even though the entire complex is considered overfished. (see Policy/Legislation chapter for explanation) The 2002 NMFS stock assessment for SCS, the first conducted in over ten years, established that the SCS complex was not overfished nor was overfishing occurring, however, they indicated that overfishing is occurring with finetooth sharks, and allow for 454 MT dw of SCS to be landed.[116] Table 3 displays the published known maximum sustainable yield and the maximum sustainable catch for the three NMFS management groups for sharks.

Table 3 – MSY and MSC for Atlantic Sharks

Species	Avg. Maximum Sustainable Yield (MSY, mt dw)	Ave. Maximum Sustainable Catch (MSC, numbers of fish)
LCS Complex	N/A	344,000
SCS Complex	2,087	N/A

[114] If a species is declared overfished, action to rebuild the stock and/or prevent further overfishing is needed within one year.

[115] Amendment 1. 1-4

[116] Ibid. 1-6

Pelagics	N/A	N/A

Pelagic sharks, primarily given the transboundary/international nature of their populations have been very difficult to assess, and NMFS has yet to publish its' own stock assessment for pelagic sharks. However, in June 2004, the ICCAT Standing Committee for Research and Statistics (SCRS) conducted a stock assessment for some species of pelagic sharks, with an emphasis on blue and Shortfin mako sharks.[117] The assessment indicated that the current biomass of North and South Atlantic blue shark seems to be above MSY ($B>B_{MSY}$), however, these results are conditional and based on assumptions that were made by the committee. These assumptions indicate that blue sharks are not currently overfished; again, this conclusion is conditional and based on limited landings data.[118] In contrast, the assessment found that the North Atlantic Shortfin mako population has experienced some level of stock depletion as suggested by the historical CPUE trend and model outputs. The current stock may be below MSY ($B<B_{MSY}$), suggesting that the species may be overfished. Overfishing may also be occurring as between 13,000 and 18,000 mt ww (28,660,094 – 39,683,207 lb) of Shortfin mako are harvested in the Atlantic Ocean annually. The Committee stated that, "South Atlantic stocks of Shortfin mako shark are likely fully exploited as well, but depletion

[117] Report of the 2004 Inter-Sessional Meeting of the ICCAT Sub-Committee on bycatches: Shark stock assessment. SCRS/2004/014. Tokyo, Japan. June 14-18, 2004 http://www.iccat.es/Documents/SCRS/DetRep/DET_shk.pdf#search='ICCAT%20mako%20assessment' For assessment purposes the stocks were divided into North and South Atlantic populations.

[118] Ibid. The committee estimates that between 82,000 and 114,000 mt ww (180,779,054 – 251,326,978 lb) of blue shark are harvested from the Atlantic Ocean each year.

rates are less severe than in the North Atlantic."[119] Currently, NMFS has a species-specific quota of 488 MT dw for mako sharks.

In addition to the ICCAT assessment stating that the Shortfin mako is likely overfished and that overfishing is occurring, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) conducted a species report and assessment for porbeagle in 2004, which suggested that significant declines in porbeagle abundance have occurred as a result of overexploitation in fisheries.[120] The model which was employed predicts that populations declined precipitously after the fishery was developed in 1961, recovered slightly in the 1980s, and then declined again to the current level. In 2001, the porbeagle biomass was estimated at 4,409 MT ww, a staggering decline of 89% from the pre-fishing biomass in 1961.[121] Currently, NMFS has a species-specific quota of 46 MT dw for porbeagle.[122] Federal regulations, while imposing commercial quotas and limited entry for fishermen are still able to allow landings of sharks that are considered to be overfished and where overfishing is occurring per Magnuson-Stevens (see Policy chapter).

Serious changes have been implemented since the first FMP for sharks in 1993. At that time, no sharks were listed on the prohibited species list. By 1999, 19 species had been listed. The recreational retention limit in 1993 was five sharks per vessel per trip.

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[119] Ibid. The results of both of these assessments should be considered preliminary in nature due to limitations on quality and quantity of catch data available. The sub-committee stated that catch data currently being reported to ICCAT does not represent the total catch actually landed, and are very limited with regard to size, age, and sex of shark harvested or caught incidentally.

[120] Annual Report to the Minister of the Environment and the Canadian Endangered Species Conservation Council. COSEWIC. 5/7/04. http://www.cosewic.gc.ca/eng/sct7/sct7_3_3_e.cfm

[121] Ibid.

[122] These fish are generally harvested incidentally in the pelagic longline fisheries. Between 2000 and 2003, landings of porbeagle were approximately 3.4 mt dw for the four fishing years combined.

The limit is now one shark per vessel per trip. Commercial quotas have been implemented and have been lowered with each successive FMP, although the commercial fishing industry has sued to block the quotas and has repeatedly sought to raise them. Federal management is forced to grapple with competing interests, intent on exploiting the resource while simultaneously insuring its sustained presence, yet the response appears to be more reactive than proactive and has been conditioned upon acting only after significant declines have been noted.

Part 2:

Rhode Island Shark Landings: Data and Results

CHAPTER 3 – RHODE ISLAND SHARK FISHERY: Profiles and Landings Data

18 of the 39 species managed by NMFS transit or inhabit Rhode Island waters at some point. Table 4 displays the historical status and known life history of those species, managed by NMFS, known to transit or inhabit Rhode Island waters.

Table 4 – Rhode Island Sharks

Taxon	Common Name	NMFS Management Group	Life History	Historical Status[123]	IUCN Listing[124]
Ginglymostoma cirratum	Nurse Shark	LCS	Adventitious Visitor	Historic (1920s)	-
Carcharias Taurus	Sand Tiger	Prohibited	Seasonal Visitor	Recent	Vulnerable
Alopias vulpinus	Thresher Shark	Pelagic	Seasonal Visitor	Recent	Data Deficient
Cetorhinus maximus	Basking Shark	Prohibited	Seasonal Visitor	Recent	Vulnerable
Carcharodon carcharias	White Shark	Prohibited	Seasonal Visitor	Recent	Vulnerable
Isurus oxyrinchus	Shortfin Mako	Pelagic	Seasonal Visitor	Recent	Lower Risk/near threatened
Lamna nasus	Porbeagle	Pelagic	Adventitious Visitor	Recent	Lower Risk/near threatened
Scyliorhinus rotifer	Chain Dogfish	-	Adventitious Visitor	Recent	-
Carcharhinus obscurus	Dusky Shark	Prohibited	Seasonal Visitor	Recent	Lower Risk/near threatened
Carcharhinus plumbeus	Sandbar Shark	LCS	Seasonal Visitor	Recent	Lower Risk/near threatened
Galeocerdo cuvier	Tiger Shark	LCS	Seasonal Visitor	Recent	Lower Risk
Prionace glauca	Blue Shark	Pelagic	Seasonal Visitor	Recent	Lower Risk/near threatened
Mustelus canis	Smooth Dogfish	-	Resident	Recent	Lower Risk/near threatened
Sphyrna lewini	Scalloped Hammerhead	LCS	Seasonal Visitor	Recent	Lower Risk/near threatened

[123] August, P. et al.2001.Vertebrates of Rhode Island. Vol. 2 of The Biota of Rhode Island. The Rhode Island Natural History Survey.

[124] IUCN definitions: http://www.redlist.org/info/categories_criteria2001.html#definitions

Taxon	Common Name	NMFS Management Group	Life History	Historical Status	IUCN Listing
Sphyrna tiburo	Bonnethead	SCS	Adventitious Visitor	Historic (1953)	-
Sphyrna zygaena	Smooth Hammerhead	LCS	Adventitious Visitor	Recent	Lower Risk/near threatened
Squalus acanthias	Spiny Dogfish	-	Seasonal Visitor	Recent	Lower Risk/near threatened
Squatina dumerili	Atl. Angel Shark	Prohibited	Seasonal Visitor	Recent	Vulnerable

Five species, the sand tiger, basking, great white, dusky, and Atlantic angel shark are protected under Federal regulations and are prohibited from being caught. Furthermore, 75% of the species are listed as either vulnerable or near threatened with extinction according to World Conservation's 2002 Red List of Endangered Species.[125] The most common species landed in both the commercial and recreational catch according to fishermen are the blue shark, mako, thresher, sandbar, and the occasional dusky shark.[126] Because dusky sharks are prohibited from being caught, their capture often results in bycatch in the commercial fisheries and/or release in the recreational fisheries. Both the sand tiger and dusky are known to frequent Rhode Island coastal waters in the summer, and because of their resemblance and similar characteristics, they are frequently confused with each other. Several reports of commercial landings of "brown" sharks – a name used for both species – are often called in, compounding the difficulty of determining what species are being landed.[127]

[125] IUCN 2002 Red List.

[126] Pers. Comm. with charterboat capts. also see Amendment 1 to 1999 FMP for HMS. 9-8 After mako, thresher, blue, dusky and sandbar sharks are the most common species caught by anglers, with the most common being mako sharks of 60-100 pounds. Light tackle is the gear preferred for shark fishing by the charter operators and most private boat fishermen, and catch and release is normal in the fishery.

[127] Pers. Comm. with NMFS: W. Anoushian

Commercial Fishery

In 2004 there were 10 commercial vessels in the state with Limited Access Permits fishing for sharks, although the commercial shark fisheries are incidental to other longline fisheries in Rhode Island.[128] All of them were Incidental Shark Permits, which again allows for five sharks to be landed per fishing trip.[129] This is down slightly from 2001, in which there were 12 vessels fishing for sharks, of which 11 held incidental-take permits.[130] New York had the most number of HMS Shark permits with 22 (10 directed) followed by Massachusetts with 18 (4 directed).[131] Table 5 shows the total number of HMS Shark permits within the New England region along with the amount of sharks landed by the commercial sector in 2002.

Table 5 – Distribution of Shark Limited Access Permits for New England[132]

New England Commercial Shark Landings in 2002									Shark lbs/HMS permit
		Pounds	Metric Tons		Shark	HMS Shark permits			
St.	State	Sharks	Sharks	Population	lbs/person	Directed	Incidental	Total	Total
NY	New York	21,880	9.9	18,600,527	0.00	10	12	22	994.55
CT	Connecticut	533	0.2	3,371,241	0.00	0	1	1	533.00
RI	Rhode Island	59,093	26.8	1,037,196	0.06	0	10	10	5,909.30
MA	Massachusetts	34,449	15.6	6,218,773	0.01	4	14	18	1,913.83
NH	New Hampshire	608	0.3	1,251,572	0.00	1	2	3	202.67
ME	Maine	13,829	6.3	1,270,602	0.01	2	5	7	1,975.57
	Total	130,392	59.1	31,749,911	0.00	17	44	61	2,137.57

While Rhode Island had the third most commercial vessels with HMS Shark permits, with ten, in 2002 those vessels landed more sharks than any other state. Rhode Island also

[128] 2005 pre-draft FMP for HMS

[129] Ibid.

[130] Amendment 1 to 1999 FMP for HMS. 9-8

[131] 2005 pre-draft FMP for HMS

[132] NMFS and U.S. Census Bureau

has the smallest population of any New England state[133] and so the total number of sharks landed represents far more per person than any other state as well. (In 2002, six times as many sharks were landed per person in Rhode Island as the next closest states Massachusetts and Maine respectively.)

The main centers involved with the commercial fishery in Rhode Island include Warwick, Little Compton, Newport, Tiverton, Block Island, Narragansett, Peacedale, Point Judith, South Kingstown, Wakefield and West Kingston. There are seven dealers licensed to handle shark in the state, who primarily operate in Little Compton, Newport, Tiverton, Point Judith, and South Kingstown.[134] There are no HMS dealers in Connecticut, but nearby ports in New York and Massachusetts represent the bulk of the remaining shark dealers in the region. (see Table 6)

Table 6 – Number of Shark dealer permits issued in New England – December 2004[135]

State	Shark dealer permits
MA	20
ME	3
NY	10
RI	7
Total	40

Commercial Data[136]

Landings of sharks occur throughout the Atlantic in the U.S. EEZ, but they remain heaviest in the South Atlantic and the Gulf of Mexico. Directed shark fisheries

[133] With a population just above one million, Rhode Island has the smallest population of any U.S. coastal state.

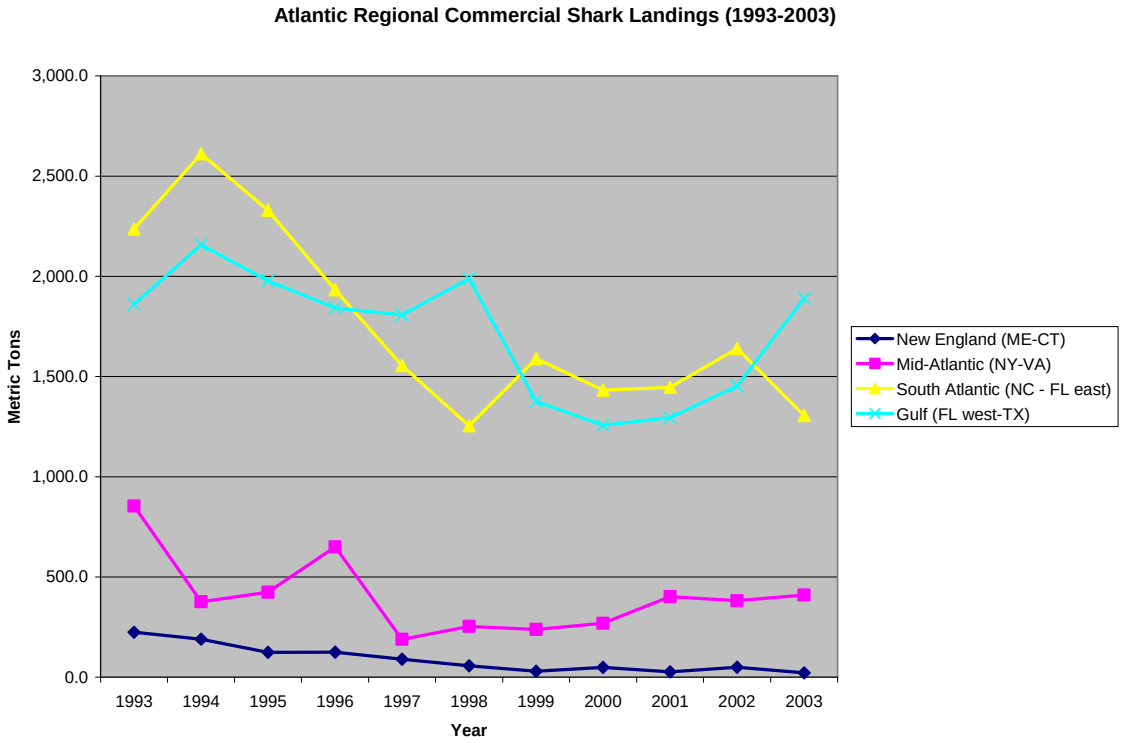
[134] Amendment 1 to 1999 FMP for HMS. 9-8

[135] Ibid.

[136] Data source for all commercial landings data is from the National Marine Fisheries Service, Fisheries Statistics Division, Silver Spring, MD. http://www.st.nmfs.gov/st1/index.html

both within state waters and offshore in these regions, primarily target sandbars, blacktips, and makos, but a significant catch of sharks within the large coastal complex and pelagic shark complex are also landed. Figure 3 shows landings of sharks by region from 1993 to 2003.

Fig. 3 – Regional Atlantic Shark Landings

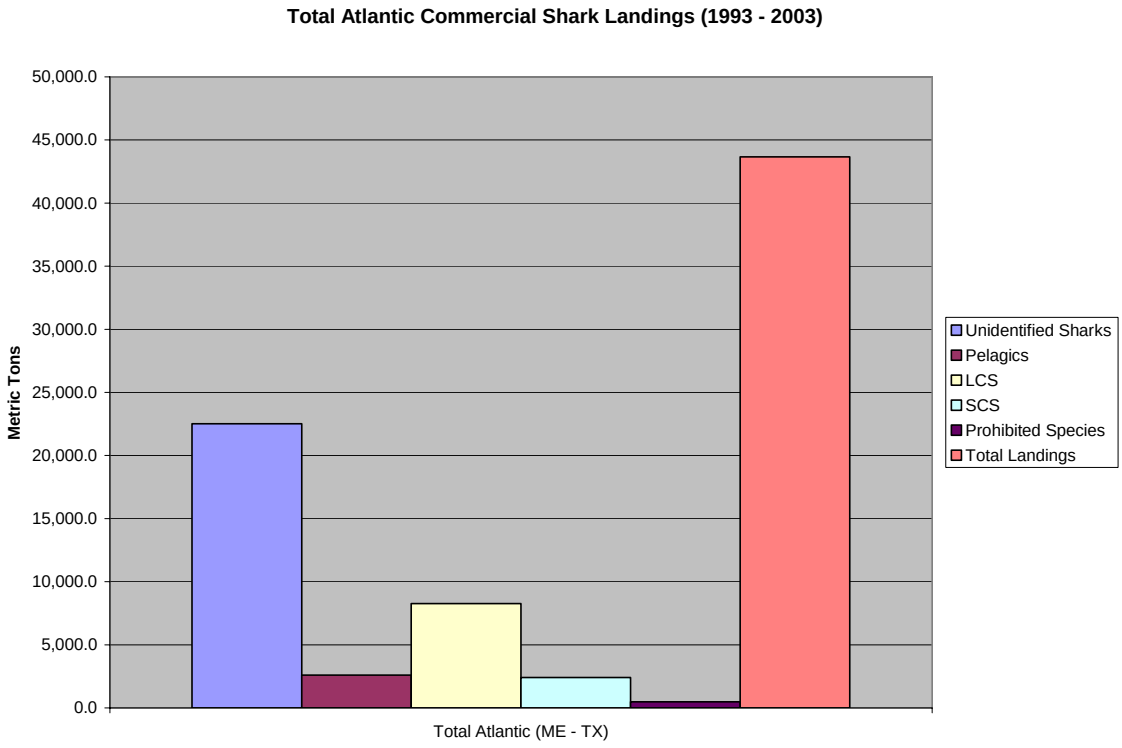


During this period, landings were generally highest from1993 to 1994, before declining throughout all regions. In 1993, NMFS instituted the first FMP for sharks, which may have contributed to the declines seen. Landings in the South Atlantic and Gulf of Mexico (with highs of 2,611 MT in 1994 and 2,157 MT in 1994 respectively) were around ten times as great as those in New England (with a high of 224 MT landed in 1993), while the Mid-Atlantic has landed almost five times as many sharks as New England in recent years, with New England's total shark landings falling from its high of 224 MT in 1993 to 21.6 MT in 2003, versus 409.3 MT of sharks landed in the Mid-Atlantic in 2003. (see

Appendix 3) It should also be noted that the reporting of U.S. shark landings alone in 2002 for the FAO's Northwest Atlantic region (which would include the Mid-Atlantic and the New England regional landings) of 430.6, exceeded that of the FAO's reported total of 414 MT landed.[137] (See Appendix 1)

Overall, the number of large coastal sharks caught in the U.S. Atlantic EEZ remained the highest reported catch for any of the NMFS management groups, although landings of both pelagic sharks and small coastal sharks were also significant. Figure 4 details the total shark landings for the period from 1993-2003 for the entire Atlantic (ME – TX) by NMFS management group.

Fig. 4 – Total Atlantic Commercial Shark Landings



[137] The FAO's Northwest Atlantic region also includes landings from Canada, which reported landing 593 MT of shark in 2002 in the Northwest Atlantic, thus raising the reported total for the U.S. and Canada to over 1,000 MT of shark landed, well above the 414 MT reported by the FAO in that year. Prior to 2002, Canada's shark landings in the Atlantic for the past decade averaged 1,047 MT. http://www.dfo-mpo.gc.ca/COMMUNIC/fish_man/ifmp/shark-requin/index_e.htm

More than half of the almost 44,000 MT landed in the ten-year period, however, remain classified as unidentified sharks, representing the largest totals of sharks landed. (see Appendix 3) Species specific identification for sharks was not required prior to 1986 in the reporting of landings, and many fishermen are unaware of what species they have caught.[138] Additionally, misidentification of species remains a problem. Reporting of "brown" sharks is common, yet this name has been used as a reference for both sandbars, which are often directly targeted in fisheries, and dusky sharks, which are almost identical in appearance to sandbars, are known to co-occur with sandbars, and are of the more vulnerable species and are prohibited from being caught or landed under NMFS regulations.[139] Selected fishermen with a commercial shark permit are required to report fishing activities, including the species caught, in a logbook within 48 hours of each day's fishing for multi-day trips, or before offloading for one-day trips, and they must submit the logbook within seven days of offloading.[140] There is some limited observer coverage, with vessels required to carry an observer if they have been selected by NMFS for monitoring or observer coverage on a fishing trip, however, coverage remains limited and is currently dependent upon federal funding for observers, thus presenting an inherent limitation to adequate coverage without increased funding.[141] Dealers are also required to record what species are purchased at the dock, however, because finning is still practiced (while the carcasses, now, may not be discarded) identification at the dock is often difficult because the fins are often some of the most distinguishing characteristics

[138] Pers. Comm. with W. Anoushian. NMFS. 3/2/05

[139] Pers. Comm. with NMFS and fishermen. Also see Appendix ? for summary of HMS shark regulations.

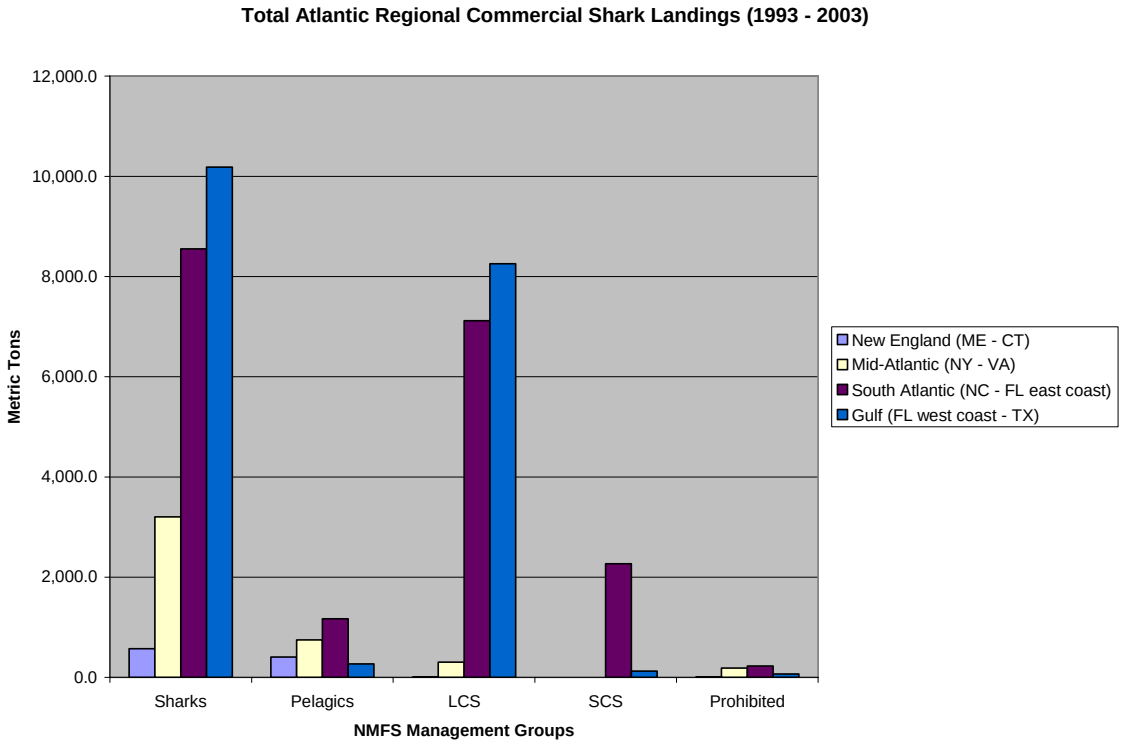
[140] NMFS 1999 HMS FMP. Also see Appendix 2 for summary of HMS shark regulations.

[141] Ibid.

on a species. Thus removal of the fins complicates species identification, as well as enforcement of the landings of prohibited species as a result. The excessive number of unspecified sharks landed additionally complicates any species specific or group assessments of sharks.

Figure 5 displays the commercial shark landings by NMFS management group by region for the period from 1993-2003.

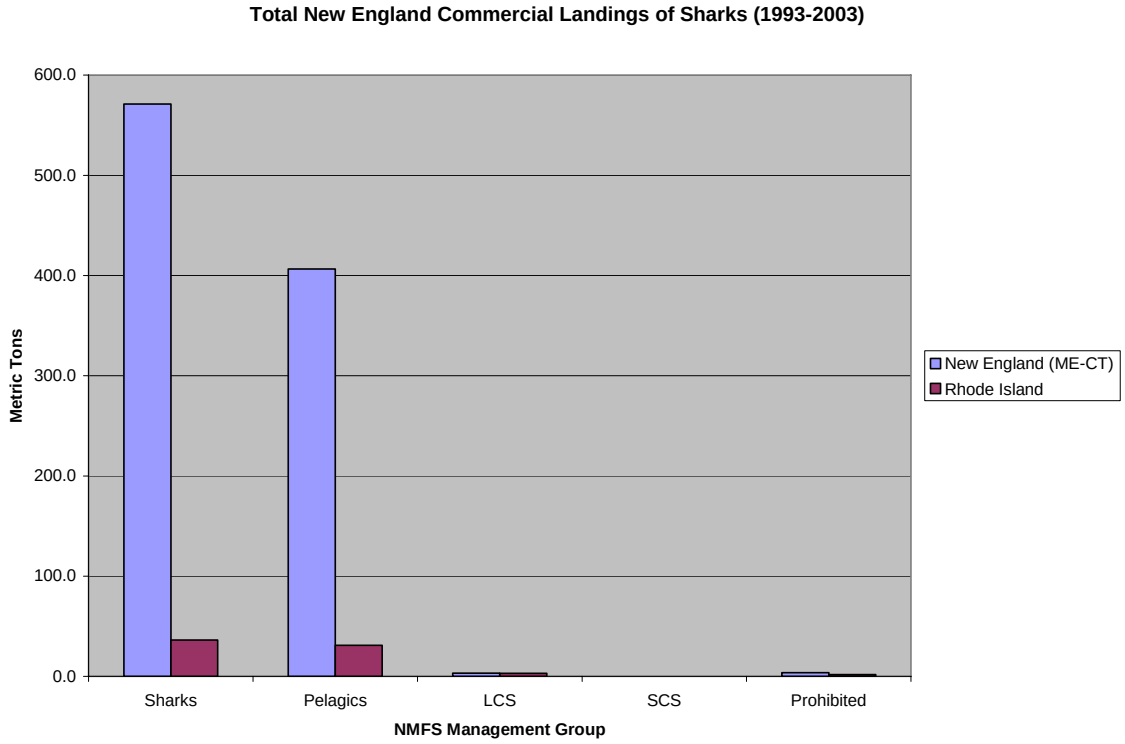
Fig. 5 – NMFS Group Landings



Again, the highest reported commercial landings of sharks in the ten-year period are greatest in the South Atlantic, followed by the Gulf of Mexico. Almost no large or small coastal sharks are identified as caught in New England, however, the New England commercial catch of identified pelagic sharks, is closer to the catch of pelagic sharks in other regions. Overall, more than 400 MT of pelagic sharks were identified as being landed from 1993 to 2003 in New England, compared to 745 MT in the Mid-Atlantic,

1,170 MT in the South Atlantic, and less than 270 MT in the Gulf of Mexico. Within New England and Rhode Island, 98% of identified sharks caught were pelagic sharks, while the remaining 2% were large coastal sharks. (See Fig. 6)

Fig. 6 – New England (CT-ME) and Rhode Island Commercial Landings by NMFS Group



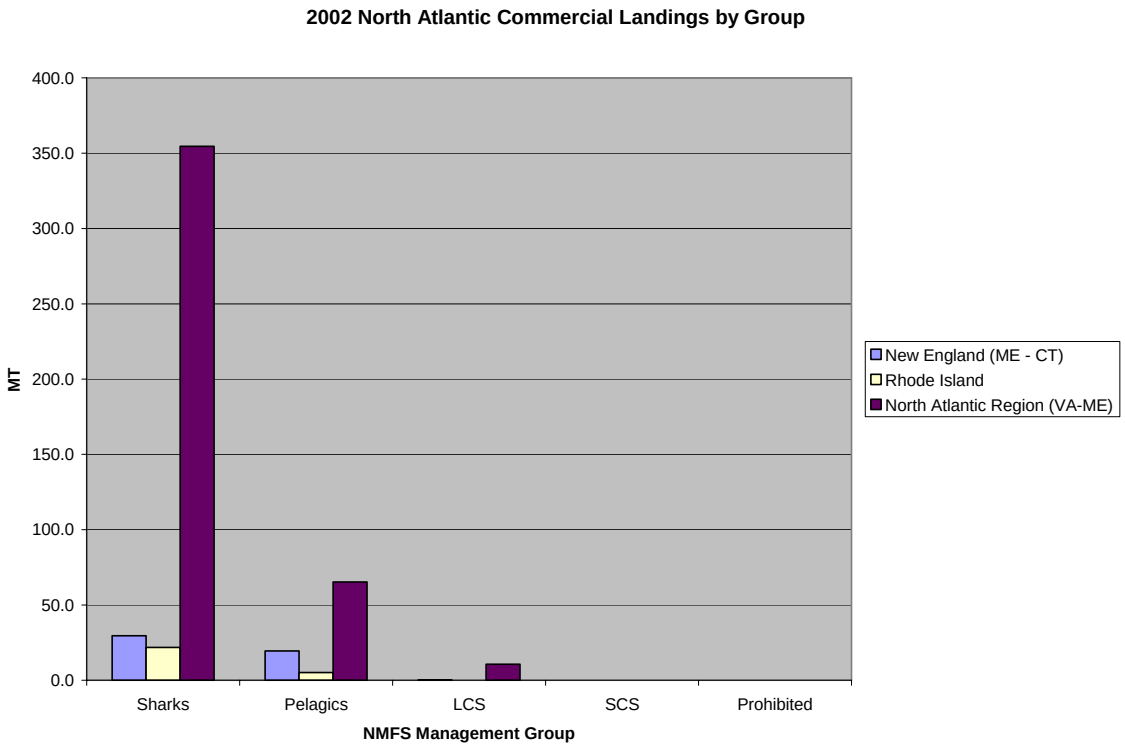
More than 55% of those sharks landed however, were classified as unspecified sharks for all of New England and Rhode Island. Of the 984.4 MT landed in New England from 1993 to 2003, Rhode Island's commercial catch of sharks of 72.4 MT, represents about 7% of the total New England catch during this time period.[142]

As part of the FMP for sharks, commercial quotas were first established in 1993 for large coastal sharks (LCS) because NMFS had identified them as overfished. Subsequent amendments and revisions have established commercial quotas based on

[142] Recent commercial landings of sharks in Rhode Island, particularly in 2002, represent a far greater proportion of New England's overall landings of sharks.

region for both the large coastal shark complex and small coastal sharks (SCS), as well as quotas for pelagic sharks for the entire Atlantic, separated for blue, porbeagle, and other pelagics.[143] In 2002, the commercial quotas for the North Atlantic (defined as Virginia to Maine) for LCS was 40.68 MT (this was 4% of the total quota for LCS), and 59.02 MT for SCS (this was 13% of the total quota for SCS).[144] The total quota for pelagic sharks combined in the Atlantic was 853 MT dw.[145] Figure 7 shows the total landings of sharks by NMFS management group for the North Atlantic region in 2002.

Fig. 7 – North Atlantic (VA-ME) Shark Landings by Group



Clearly, the overwhelming majority of sharks landed, at more than 350 MT, is unidentified and represents about 70% of the total catch. However, 86% of the

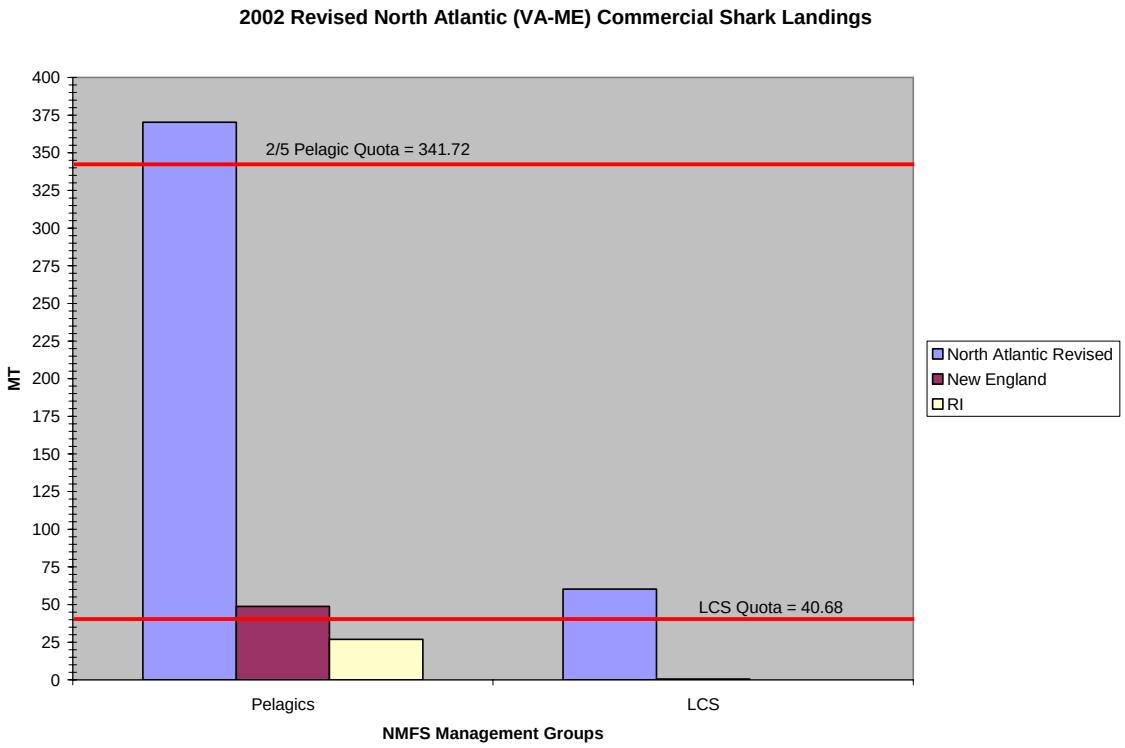
[143] See Appendix 2 for summary of Federal rules. The three remaining pelagics are the Shortfin mako, the thresher shark, and the oceanic whitetip.

[144] Amendment 1 to the FMP for HMS. 2003. viii

[145] Ibid. Quota breakdown for pelagic sharks is as follows: Shortfin mako, thresher, oceanic whitetip – 488 MT; porbeagle – 92 MT; blue – 273 MT.

commercial landings of identified sharks were pelagics, and 14% were LCS. Within RI and NE, 98% of the identified sharks were pelagics and the remaining 2% were LCS. Because so much of the landed sharks are unidentified this poses a problem in attempting to see whether or not the region is exceeding the commercial quotas established. When the proportion of the catch that is identified is applied to the overall landings, that is, if 86% of the total landings are considered to be pelagic sharks and 14% are considered to be LCS, it appears that shark landings in the North Atlantic do exceed the NMFS commercial quotas. (See Figure 8)

Fig. 8 – 2002 Revised North Atlantic Landings

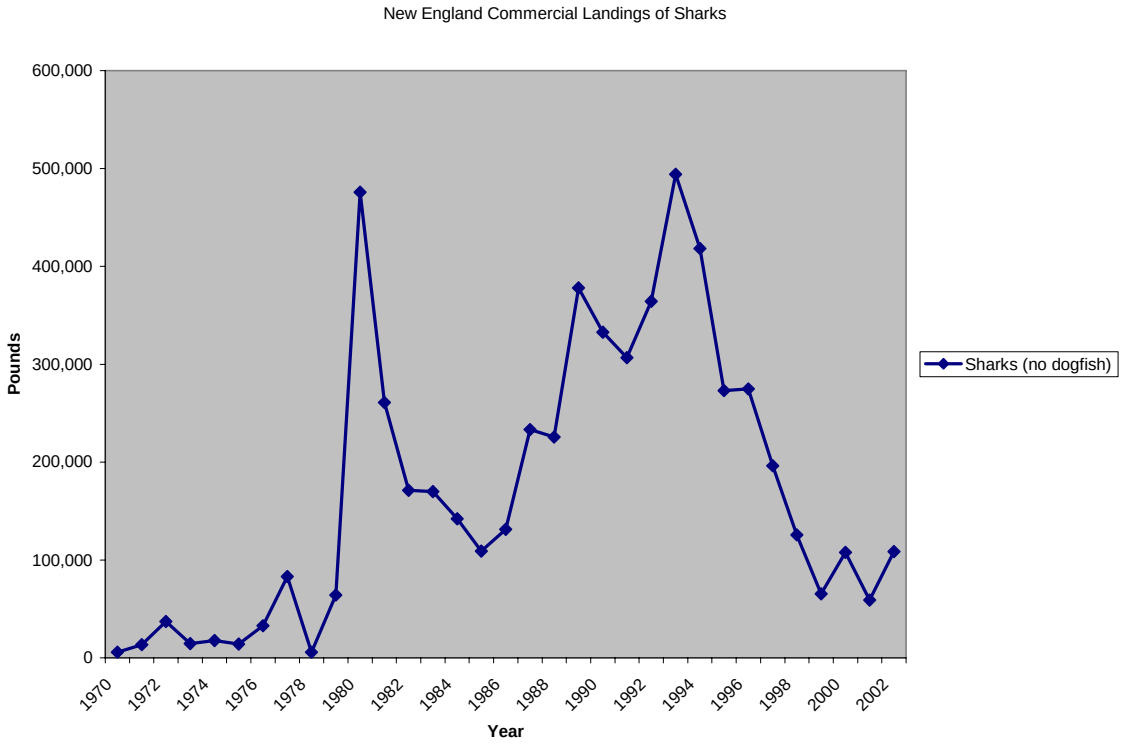


When this proportion is applied to the overall landings of sharks for 2002, it appears that almost 375 MT of pelagic sharks were landed, which is greater than 40% of the Federal

quota for pelagic sharks (341.72 MT) when all are combined.[146] Almost 60 MT of LCS were landed which exceeds the Regional quota of 40.68 MT. VA landed the most sharks within the region, but RI was 2nd that year representing about 7% of the total catch, and was followed by MA. (see Appendix 4) The revised commercial landings appear to suggest that the North Atlantic region is exceeding the regional quotas established for LCS and is landing almost 45% of the quota for pelagic sharks in the entire Atlantic.

Overall, New England's commercial landings of sharks remained relatively low with the exception of an abnormal high in 1980 with more than 215 MT of sharks landed (~475,000 lbs.), before taking off in the late 1980s and early 1990s. (See Figure 9)

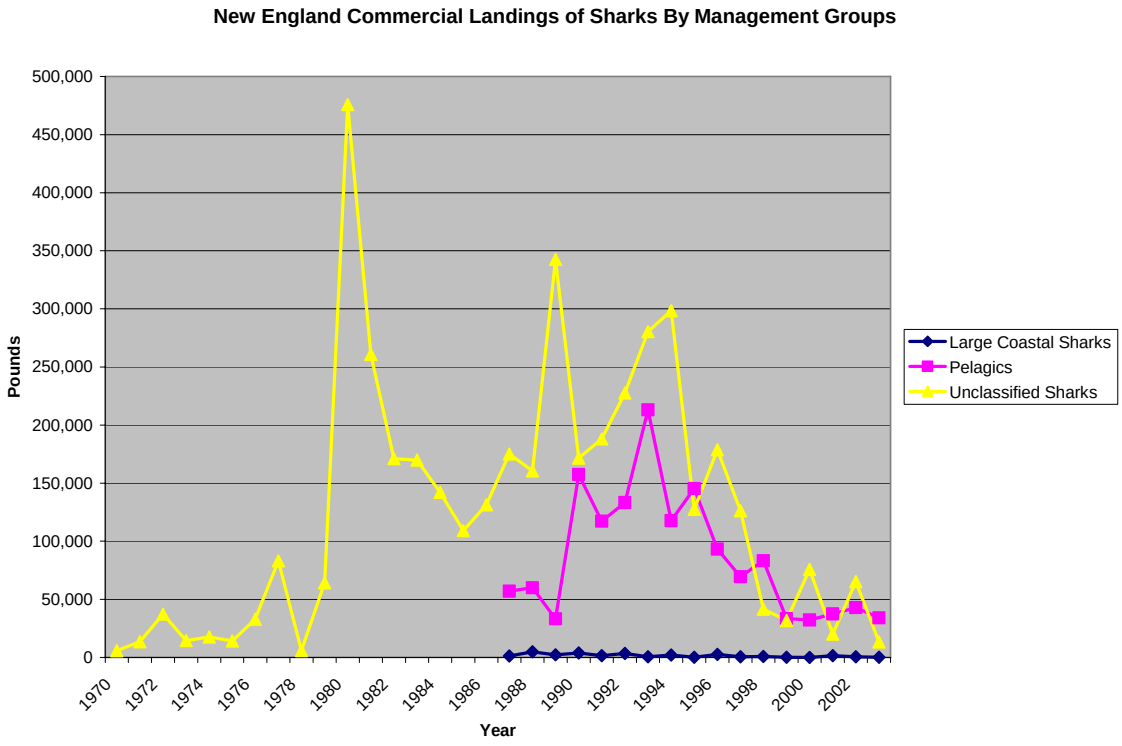
Fig. 9 – New England Commercial Landings



[146] Because the North Atlantic landed 40% of identified pelagic sharks, while the South Atlantic landed 55% of identified pelagic shark, and the Gulf landed 5%, I applied this percentage to the region as the limit for a revised regional quota based on an aggregate of the pelagic shark NMFS management group. (see Appendix 4)

The high in 1992 of almost 227 MT of sharks landed (~500,000 lbs.) occurs just prior to the implementation of the first FMP for sharks. (See Appendix 5) The resultant declines in catch may be attributed to quotas that were established in 1993 for the commercial fisheries, however, the more restrictive regulations, which include restricting access to only those vessels containing limited access permits and the establishment of commercial retention limits, limiting catches to 4,000 lbs. of dressed weight per trip for a directed shark permit, or 5 sharks landed per trip for an incidental shark permit, were not implemented until the 1999 FMP.[147] Recent commercial landings of sharks are between 80 to 90% less than landing highs in the early 1990s. Figure 10 shows New England commercial landings since 1970 based on NMFS management groups.

Fig. 10 – New England Commercial Landings by Group

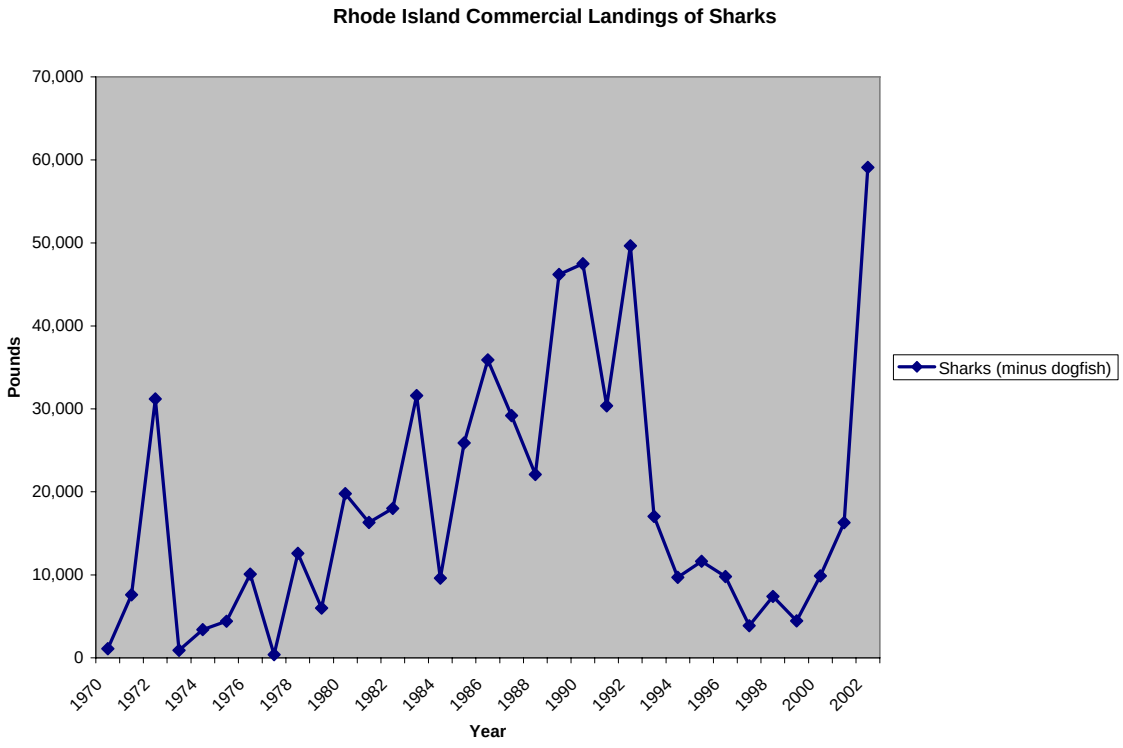


[147] NMFS 1999 HMS FMP. Also see Appendix 2 for summary of HMS shark regulations.

Makos account for the greatest number of identified sharks caught, followed by threshers and blues, and overall, identified pelagic sharks landed represent 98% of the total number of identified sharks landed. (See Appendix 6) However, as was mentioned earlier, the number of unidentified sharks landed in New England represents more than half of the total sharks landed.

Rhode Island's commercial landings of sharks, in general, rose steadily from 1970 to the early 1990s, before declining significantly after 1992. However, as Figure 11 shows, the highest reported commercial landings of sharks in Rhode Island occurred more recently in 2002.

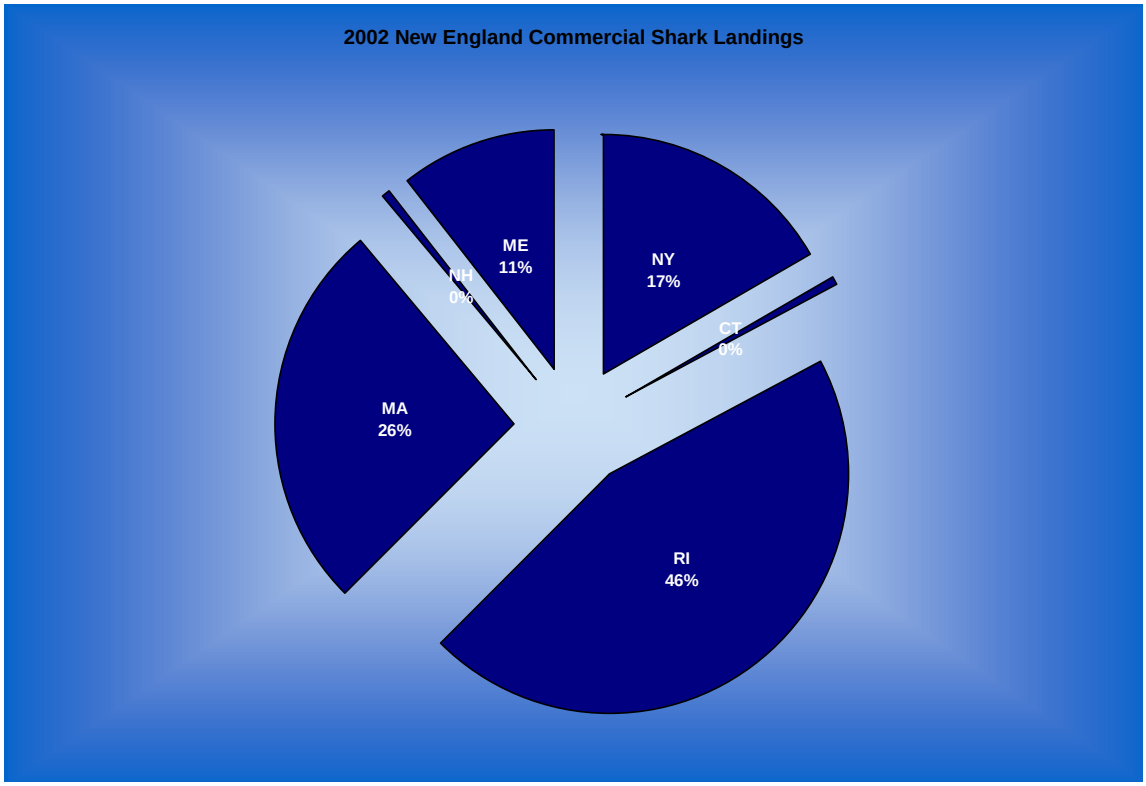
Fig. 11 – Rhode Island Commercial Landings



Prior to the 2002 landings high of almost 27 MT landed (~60,000 lbs.), shark landings had peaked in 1992 with more than 22 MT of shark landed (~48,500 lbs.). (See Appendix 7) In 2002, Rhode Island's commercial landings of sharks also represented the most of

any state in New England. Figure 12 depicts the proportion of shark landings by state for the year, in which a total of 49.3 MT of shark were landed in the region.

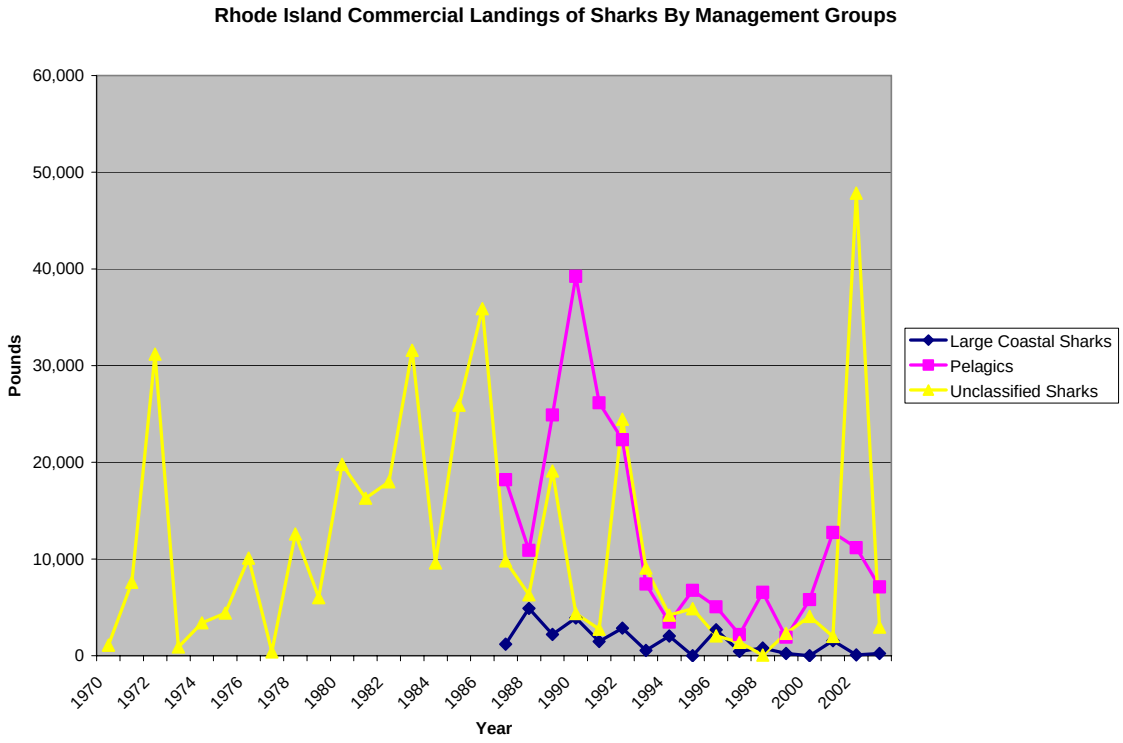
Fig. 12 – 2002 New England Commercial Landings



This is unusual given that Rhode Island landed almost twice as many sharks as the next state Massachusetts at basically half the effort. (Rhode Island has 10 vessels with incidental shark permits compared to Massachusetts 14 plus an additional four vessels with directed shark permits.) Rhode Island ports, especially Point Judith and Newport with 7 HMS dealers, may have served as an easy depot for vessels operating nearby in Connecticut, New York, or Massachusetts, thus contributing to the shark landings in the state. It's also possible however, that reporting of landings, rather than actual landings, is what has changed more significantly, especially since reporting requirements have only

recently been implemented (since the 1999 FMP), and observer coverage is minimal.[148] Rhode Island's reported commercial landings of sharks, has been somewhat better than New England's in terms of proportion of sharks caught by NMFS management group. (See Figure 13)

Fig. 13 – Rhode Island Commercial Landings by Group



However, despite the majority of sharks being identified throughout most of the 1990s, more than 80% of the shark landings in 2002 were reported as unidentified species. For those species that were identified (with species-specific reporting beginning in 1986), the majority have been pelagic sharks, although large coastal sharks were caught in similar amounts to pelagic sharks during the mid-1990s. (See Appendix 8) Overall commercial landings of sharks in 2002, represented about 0.05% of total commercial landings, yet despite this minimal amount, it is clear that any fishing pressure poses significant

[148] 2001 Amendment 1 to the 1999 FMP for Atlantic HMS. Pers. Comm. with NMFS.

problems for sharks because of their low intrinsic rates of increase and low resilience to fishing mortality. Additionally, while commercial landings in Rhode Island and New England may appear small overall, there is a significant amount of bycatch of sharks that occurs in the various fisheries.

Bycatch

Each year, fisheries in the U.S. discard vast numbers of unintentional catch. Roughly 25 percent of catch is discarded[149], and it is estimated that in 2000, U.S. fisheries discarded a gargantuan 2.3 billion pounds (1.05 million metric tons) of marine animals.[150] Yet the validity of many estimates (or underestimates) of bycatch, are complicated by the fact that some are based on fishers' logbooks, and it is doubtful that they always report bycatch accurately.[151] More often, bycatch is estimated from reports by onboard observers; however, observer coverage is usually reserved for the fisheries with very large vessels, and is, as a result, rather limited.[152] Additionally, observer reports are often confidential and rarely published, so the lack of transparency makes any assessment by the public difficult. Bycatch of species protected under the Marine Mammal Protection Act of 1972 or the Endangered Species Act of 1973 can cause

[149] Alverson, D.L. et al. 1994. A global assessment of fisheries bycatch and discards. FAO Fisheries Technical Paper 339. Rome: FAO

[150] Dayton, P.K. et al. 2002. Ecological effects of fishing in marine ecosystems of the United States. Arlington, VA. Pew Oceans Commission

[151] Ibid.

[152] Ibid. Many factors influence the severity of bycatch, including the species' pattern of distribution (e.g., patchiness or concentration in one area, seasonality), predictability of behavior, and associations with other species, as well as the degree to which fishers can control deployment of the gear. With the possible exception of harpooning, spearfishing, and hand-picking, all classes of fishing gears result in some level of unintended catch.

fisheries to be closed.[153] In addition, regulatory bycatch – discards that occur because management regimes limit the types of fish a particular fisher can land – leads to discarding of marketable species. In the U.S. in 2001, the federal government proposed listing the smalltooth sawfish as endangered under the Endangered Species Act solely because of bycatch mortality.[154] Other species imperiled as a result of bycatch include the barndoor skate, once prevalent throughout Rhode Island and New England.[155]

In 2003 the Pew Science Center conducted a survey of individuals who represented the fishing industry, fisheries management, and academia to assess the severity of bycatch[156] on marine life.[157] Their findings with respect to sharks indicate that midwater gillnets and pelagic longlines represented the highest impact on sharks, with bottom and midwater gillnets reflecting a higher priority for management because of the abundance of other species also caught incidentally. (See Table 7)

Table 7 – Fishing Gears with Impacts on Sharks[158]

Gear Class	Bycatch – Sharks	Management Category (Policy Responses)
Gillnets-midwater	4/High Impact	High Impact (Very

[153] Federal Register: April 1, 2003. Endangered and Threatened Species; Final Endangered Status for a Distinct Population Segment of Smalltooth Sawfish (Pristis pectinata) in the United States. (Volume 68, Number 62)] http://www.epa.gov/fedrgstr/EPA-SPECIES/2003/April/Day-01/e7786.htm

[154] Ibid.

[155] Impacts to many other species, especially non-target species, are not known, and even more problematic is the assessment of the ecosystem-wide consequences of bycatch.

[156] Bycatch is divided by management into 3 classes: 1. economic - species discarded because they are of little or no economic value (e.g., in poor condition or nonmarketable); 2. regulatory - marketable species discarded because of management regulations (e.g., size limits, allocations, seasons); and, 3. collateral mortality - species killed in encounters with fishing gears that are not brought on board the vessel.

[157] Morgan, L. and R. Chuenpagdee. 2003. Bycatch: from Shifting Gears – Addressing the Collateral Impacts of Fishing Methods in U.S. Waters. Pew Science Series

[158] Experts' Impact Rating(5/very high impact; 4/high impact; 3/medium impact; 2/low impact; 1/very low impact), Survey Severity Ranking, and Policy Implications for Bycatch of Sharks.

		Stringent)
Longlines-pelagic	4/High Impact	Medium Impact (Moderately Stringent)
Gillnets-bottom	3/Medium Impact	High Impact (Very Stringent)
Longlines-bottom	3/Medium Impact	Medium Impact (Moderately Stringent)
Hook and line	3/Medium Impact	Low Impact (Least Stringent)
Trawls-bottom	2/Low Impact	High Impact (Very Stringent)
Trawls-midwater	2/Low Impact	Low Impact (Least Stringent)
Purse seines	2/Low Impact	Low Impact (Least Stringent)
Dredges	1/Very Low Impact	High Impact (Very Stringent)
Pots and traps	1/Very Low Impact	Medium Impact (Moderately Stringent)

The majority of bycatch on sharks is from pelagic longlines, particularly in the eastern Pacific, and midwater gillnets. Tuna eaten fresh as steaks, sushi or sashimi comes from the long-line fleets, which have long been a cause of significant by-catch of albatrosses, endangered turtles, and sharks.[159] Purse-seiners usually catch tuna by setting nets around naturally floating objects or man-made flotation area devices (FADs). Setting on FADs tends to be highly indiscriminate in terms of the size of tuna killed and the number of other fish species caught.[160] Sets on floating objects in the eastern Pacific, used so as not to catch dolphins, show that some 237 tons of sharks and rays and 15,500 tons of other fish are caught in order to catch 15,721 tons of tuna, a by-catch rate of over

[159] Joseph, J. 2003. Managing fishing capacity of the world tuna fleet. Fisheries Circular. No. 982. FAO

[160] The use of FADs was largely a result of public outrage related to the bycatch of dolphins (they tend to run with yellowfin – or the other way around) from nets set on them in the 1980s and a campaign by the Earth Island Institute (EII) to stop the method. As a result, fishermen no longer set their nets on dolphins, and so many use FADs, which produce up to 50 times the bycatch of 'other fish', including potentially vulnerable species, such as sharks and endangered turtles. Greenpeace and the WWF, no longer support the dolphin-friendly scheme as a result and endorse a much cleaner fishing method, monitored by an observer program, which sets on dolphins but allows them to escape.

50%.[161] In other words, sets on floating objects killed on average 2.6 million other fish and 42,325 sharks and rays a year.[162] Bycatch of sharks that associate with targeted fish schools occurs throughout U.S. waters. Within New England, the majority of commercial fishing is done by trawls, both midwater and bottom trawls. The following table shows the percentage landings by weight, total dollar value for gear class in millions, and highest value species for each gear class.

Table 8 – New England (ME-CT) Landings by Gear Class in 2001[163]

7% Dredges – ($109; sea scallops)	15% Pots and traps – ($244; American lobster)	33% Trawls-bottom – ($147; goosefish)	26% Trawls-midwater – ($9; Atlantic herring)	19% Other – ($130; quahog clams)
Total – 286 MT ($639)				

The Atlantic pelagic longline fleets present perhaps one of the greatest sources of bycatch for sharks. The fishery primarily targets swordfish, yellowfin tuna, and bigeye tuna in various areas and seasons.[164] Secondary target species include dolphin, albacore tuna, pelagic sharks (including mako, thresher, and porbeagle sharks), as well as several species of large coastal sharks. Although this gear can be modified (i.e., depth of set, hook type, etc.) to target swordfish, tunas, or sharks, it is generally a multi-species fishery. NMFS states that, "vessel operators tend to be opportunistic, switching gear style and making subtle changes to target the best available economic opportunity of each

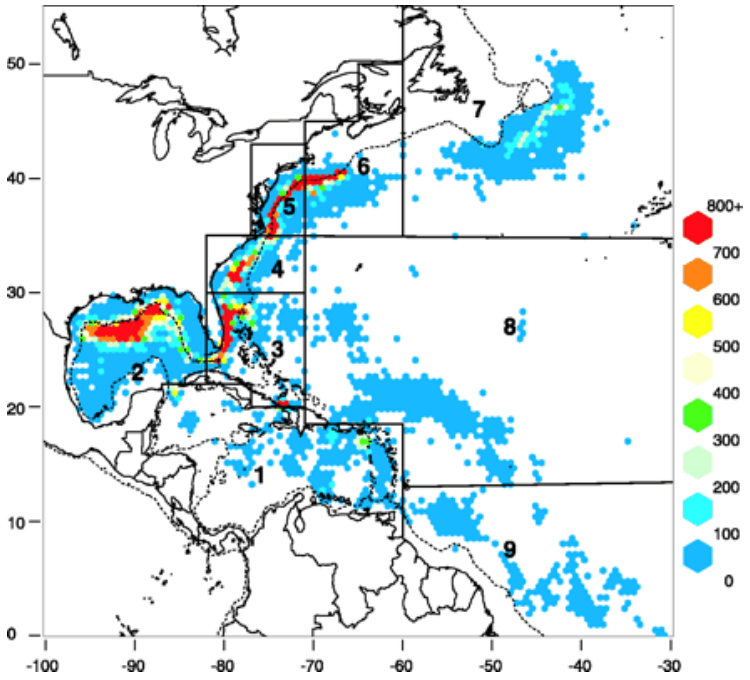
[161] E. V. Romanov. Bycatch in the purse seine tuna fisheries in the western Indian Ocean. Seventh Expert Consultation on Indian Ocean Tunas. Victoria, Seychelles. 11/14/98. In contrast, sets on dolphins, killed only 18 dolphins in seven years, with an additional by-catch of 34 tons of sharks and 295 tons of other fish.

[162] Ibid.

[163] Commercial fish landings in thousand metric tons (MT) and value (millions of dollars).

[164] 2005 Pre-draft to FMP for Atlantic HMS. P. 330

individual trip."[165] As a result, pelagic longline gear often attracts and hooks non-target finfish with no commercial value, as well as species that cannot be retained by commercial fishermen due to regulations.[166] Any species (or undersized catch of permitted species) that cannot be landed due to fishery regulations is required to be released, whether dead or alive.[167] Figure 14 shows the distribution of effort in the U.S. pelagic longline fishery between 1986 and 2000, categorized by the number of sets (0 to 800+), within the nine areas assessed: 1, Caribbean; 2, Gulf of Mexico; 3, Florida East Coast; 4, South Atlantic Bight; 5, Mid-Atlantic Bight; 6, Northeast Coastal; 7, Northeast Distant; 8, Sargasso/North Central Atlantic; 9, Tuna North/Tuna South.[168]



[165] Ibid.

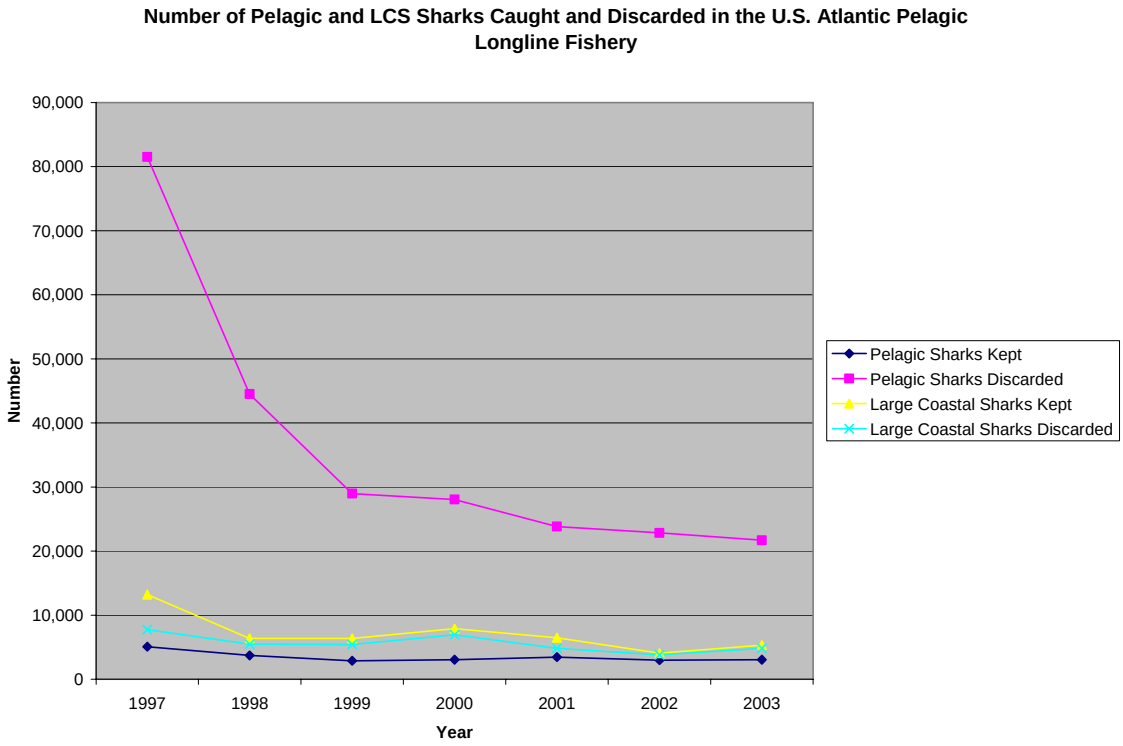
[166] Ibid. Pelagic longlines may also interact with protected species and the gear has been classified as a Category I fishery with respect to the MMPA.

[167] 1999 HMS FMP.

[168] Myers, R. and J. Baum. 2003. These areas were modified from the U.S. NMFS classification for longline fisheries by the fisheries biologists, Ransom Myers and Julia Baum. The 1000 m coastal isobath (dotted line) is given for reference.

The overall bycatch of sharks from Atlantic pelagic longline sets from 1997 to 2003 is shown in figure 15.

Fig. 15 – Atlantic Shark Bycatch: 1997-2003



With almost 34,000 sharks caught from the pelagic longlines in the Atlantic in 2003, more than 75% of the total sharks caught were discarded. (See Appendix 9) While the number of discards has declined[169], the total number of sharks discarded is still more than three times as many as those kept. Pelagic sharks represent far more of the discards (>80%), and in 2003 pelagic discards, while still lower than in previous years, were more than the total number of pelagic sharks kept, large coastal sharks kept and large coastal sharks discarded combined. In general, blue sharks, as well as other species, are discarded because of limited markets (resulting in low prices) and perishability of the

[169] NMFS has implemented several time/area closures in the Atlantic to reduce discards and bycatch during the past several years. NMFS examined the cumulative effects of the individual area closures by comparing 2001-2003 catch and discards to the average for 1997-1999 throughout the entire U.S. Atlantic fishery. Overall effort, expressed as the number of hooks set, declined by 15%. Declines were noted for both the numbers of kept and discards of all species. (see Appendix ?)

product.[170] Large coastal sharks are discarded during times when the shark season is closed.[171]

Rhode Island (there are 5 vessels with HMS permits targeting tunas and swordfish)[172] and New England vessels (there are 26 total vessels with HMS permits targeting tunas and swordfish)[173] engaged in pelagic longlining, set their hooks primarily in the Mid-Atlantic Bight (5) and the Northeast Coastal region (6).[174] Fishing in this area has evolved during recent years to focus almost year-round on directed tuna trips, with substantial numbers of swordfish trips as well. Some vessels participate in directed bigeye/yellowfin tuna fishing during the summer and fall months and then switch to bottom longline and/or shark fishing during the winter when the large coastal shark season is open.[175] Figure 16 shows the total numbers of sharks kept and discarded in these two regions (Mid-Atlantic Bight – MAB, and Northeast Coastal – NEC) from the pelagic longline fisheries from 1995 to 2003.

[170] 2005 Pre-draft to FMP for Atlantic HMS. P. 348

[171] Ibid. NMFS has implemented regulations to close areas to longline fishing in order to minimize bycatch and bycatch mortality. ICCAT recommends an allowance for dead discards of HMS species (tunas, swordfish, and sharks). The U.S. annual dead discard allowance for all species combined is 68 MT ww. The estimate for the 2003 calendar year of U.S. dead discards, as reported per the longline discards calculated from logbook tallies totaled 52.4 MT ww.

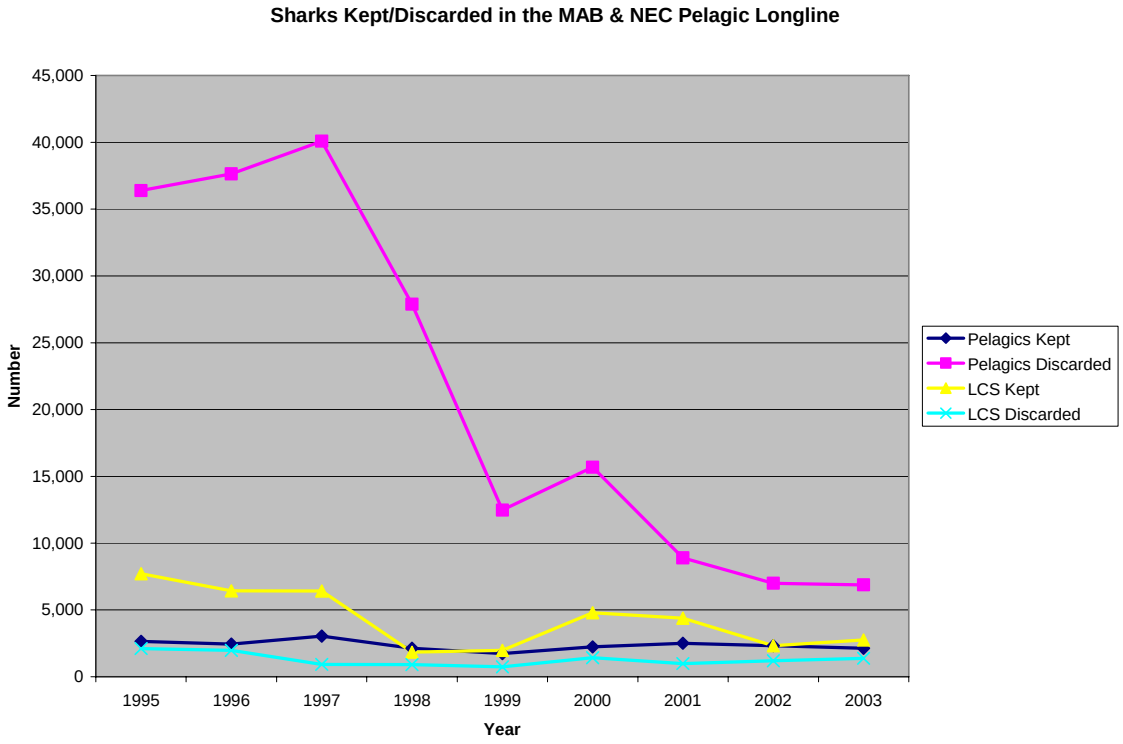
[172] Ibid.

[173] Ibid.

[174] Pers. Comm. with NMFS (W. Anoushian)

[175] 2005 Pre-draft to FMP for Atlantic HMS. Fishing trips in this fishery sector average 12 sets over 18 days. During the season vessels primarily offload in the ports of New Bedford, MA; Barnegat Light, NJ; Ocean City, MD; and Wanchese, NC.

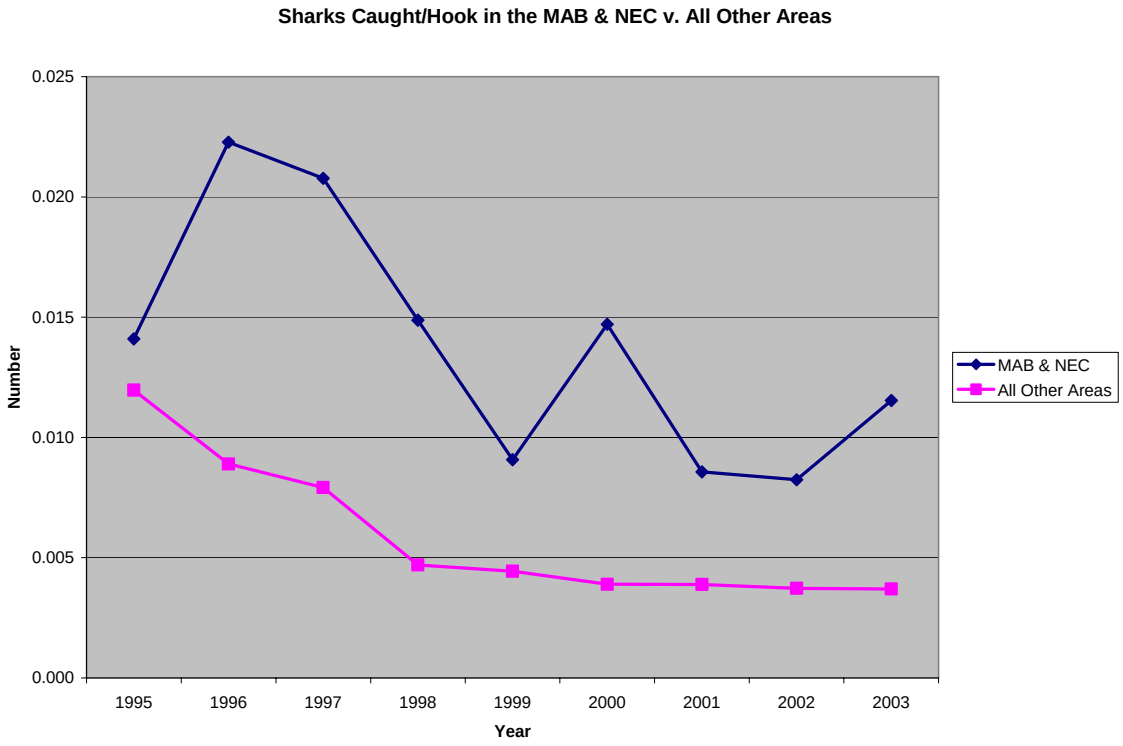
Fig. 16 – Shark Bycatch in the MAB and NEC Pelagic Longline



Total shark discards in 2003 for these two regions represents more than 1/3rd of the total discards of sharks for the entire U.S. Atlantic EEZ. (See Appendix 10) This is down from a high in 1997 when more than 40,000 sharks (pelagic and large coastals) were discarded, representing about 45% of the total shark discards. Pelagic sharks, again, represent the greatest number of discards, and with almost 7,000 discarded in 2003, was more than half of the total sharks caught. In general the number of hooks set in the Mid-Atlantic Bight was greater than those set in the Northeast Coastal Areas, and was generally 50% to 55% more than the number of hooks set in the Northeast Coastal Areas. While the number of hooks set in these two regions (1,140,634 in 2003) was only about 15% of the total number of hooks set (7,008,134 in 2003) in the U.S. Atlantic pelagic longline fisheries, the number of sharks caught per hook was much greater in these two

regions. Figure 17 shows the number of sharks caught per hook in the MAB and the NEC areas combined versus all the other areas from 1995 to 2003.

Fig. 17 – Sharks Caught per Hook in the MAB and NEC



In 2003, about 1 shark (pelagic and LCS combined) was caught for about every 87 hooks set in the MAB and NEC areas, versus about 1 shark for every 270 hooks set in all the other areas combined. This is in contrast to 1996, when about 1 shark for every 45 hooks set were caught in the MAB and NEC areas combined, versus a high of 1 shark for every 84 hooks set in 1995 for all other areas combined. (See Appendix 10)

The Atlantic Pelagic Longline fisheries clearly present a large source of the mortality for sharks in the amount of bycatch that is discarded. However, bycatch of sharks occurs in various fisheries and while discards may be greatest from both the pelagic and the bottom longline fisheries the diversity of sharks caught is also significant in the gillnet fisheries. ICCAT assessments of bycatch have detailed the total number of

species caught in the various fisheries operating in the Atlantic Ocean (see Table 9), and while longlining accounts for the catch of almost all species, gillnets, purse seining, and harpoons also catch a fair diversity of shark species.

Table 9 - ICCAT Bycatch Table of Species Diversity Caught by Various Gears[176]

Total Species	Group	Longline	Gillnets	Purse Seine	Baitboat	Harpoon	Trap	Other
46	Coastal Sharks	45	19	6	1	7	2	9
11	Pelagic Sharks	10	7	5	0	5	2	4

Additionally, while NMFS has the authority to use observers to collect bycatch information from commercial vessels fishing for tunas and voluntarily, from vessels with HMS charter/headboat or angling permits, only a few selected Federal permit holders in the Gulf of Mexico and South Atlantic fisheries are required to report all species and quantities of discarded species to NMFS.[177] Of the 3,359 vessels with Federal permits in 2003, a total of only 453 vessels were selected to report (~13% of total vessels) bycatch data on a supplemental discard form.[178] So, while the amount of known bycatch is significant, arguably much of what is discarded is not even known or at least recorded.

Recreational Fishery

The recreational fishery for sharks in Rhode Island is, like that in the other New England states, largely incidental to the recreational offshore bluefin tuna fishery. In 2003, some 397,000 anglers took 1,496,000 saltwater fishing trips in Rhode Island for all species of fish. Of these marine anglers, some 65% were from out-of-state. Table 10

[176] ICCAT. Standing Committee for Research and Statistics. 2004

[177] 2005 pre-draft FMP for HMS. P. 210

[178] Ibid. Many of these vessels complete Federal and/or state logbooks (i.e., the NMFS Northeast Region Vessel Trip Report (VTR) Program), in which they are required to report all fishing information, including that for HMS.

displays the total numbers of recreational anglers and fishing trips for each state in New England in 2003.[179]

Table 10 – New England Recreational Anglers, 2003

New England States	Population	Out-of-State Anglers	In-State Anglers			Total Anglers (In-State and Out)	Number of Angler Trips	In-State Anglers/ Population
			From Coastal Counties	From Non-Coastal Counties	Total			
Connecticut	3371241	112,000	361,000		361,000	473,000	1,564,000	11%
Maine	1,270,602	170,000	165,000	23,000	188,000	358,000	919,000	15%
Massachusetts	6,218,773	306,000	434,000	112,000	546,000	852,000	4,085,000	9%
New Hampshire	1,251,572	75,000	91,000	16,000	107,000	182,000	416,000	9%
New York	18,600,527	82,000	599,000	19,000	618,000	700,000	5,525,000	3%
Rhode Island	1,037,196	253,000	147,000		147,000	400,000	1,595,000	14%
Total	**31,749,911**	**998,000**	**1,797,000**	**170,000**	**1,967,000**	**2,965,000**	**14,104,000**	**6%**

There are about 147,000 in-state anglers in Rhode Island, which represents about 14% of the total population. Only Maine with 15% of the population identified as recreational anglers has a higher proportion of the population involved in the recreational sector within New England. Because permits were just required for HMS anglers per Federal regulations, it's not clear how many actually have targeted or target sharks. In 2004, there were 133 charterboats/headboats with HMS permits, of which 17 advertise shark fishing, while only one advertises shark diving as an alternative. (See Appendix 11) Charter operators offering shark fishing trips are based in Block Island, Point Judith, Little Compton, Warwick, West Greenwich, Newport and Westerly. The trips for sharks are usually to the deep waters south of Rhode Island and the eastern tip of Long Island, last at least 10 hours and, in August, are often overnight trips.[180] Of the ten-hour trips, five anglers are usually carried, and the charter fee is of the order of $900. Table 11

[179]Dept. of Commerce. Fisheries of the U.S., 2003. Oct. 2004

[180] Amendment 1 to 1999 FMP for HMS. 9-8

shows the total number of charterboats/headboats with HMS permits and the average daily rates for all New England states.

Table 11 – 2004 New England CHB Permits & Avg. Rates for Day Trips[181]

State	No. of Charter Boat Operators	2004 Avg. Daily Charter Rate	
ME	48	$900	
NH	52		
MA	494	$777	
RI	133	$917	
CT	85	$1,500	
NY	342	$1,113	
Total	**1,154**	**Avg.**	**$1,041**

In 1998, a NMFS survey of charterboats indicated that 65% of party boat operators reported targeting sharks at least once and that shark trips represented 5% of the total effort by party boat operators.[182] In addition to the normal fishing trips, there are several tournaments which target sharks. Many shark tournaments occur in New England, New York and New Jersey, although other regions hold shark tournaments as well.[183] In 2003, there were 232 HMS tournaments[184] registered in the Atlantic and Gulf of Mexico. Of those approximately 80 targeted or awarded points for the landing of sharks: 50 – pelagic

[181] 2005 pre-draft FMP for HMS

[182] Sutton, et al. 1999. A cross-sectional study and longitudinal perspective on the social and economic characteristics of the charter and party boat fishing industry of Alabama, Mississippi, Louisiana, and Texas. Dept. of Wildlife and Fisheries Sciences, Texas A&M University, College Station, TX Report #HD-612. MARFIN grant number NA77FF0551. 198pp.

[183] Amendment 1 to 1999 FMP for HMS. In 2004, the 24th Annual South Jersey Shark Tournament hosted over 200 boats and awarded over $220,000 in prize money, with an entry fee of $450 per boat. The "Mako Fever" tournament, sponsored by the Jersey Coast Shark Anglers, in 2004 awarded over $55,000 in prizes, with the first place vessel receiving $25,000. In 2004, the 18th Annual Monster Shark Tournament in Martha's Vineyard, MA was broadcast on ESPN, and featured a new fishing boat valued at over $130,000 awarded to the winner.

[184] A tournament is defined in the HMS regulations as any fishing competition involving Atlantic HMS in which participants must register or otherwise enter or in which a prize or award is offered for catching or landing such fish. Since 1999, Federal regulations have required that each HMS tournament operator register their tournament with the HMS Management Division at least four weeks prior to the commencement of tournament fishing activities. Within one week after the tournament concludes operators may be selected to report tournament results to the SEFSC.

sharks; 23 – large coastal sharks; 7 – small coastal sharks. Table 12 shows the total number of HMS tournaments targeting sharks in the Atlantic or Gulf in 2003.

Table 12 – Number of Registered HMS Shark Tournaments by State - 2003[185]

State	Shark Tourn. #s
MA	3
RI	1
NY	11
NJ	8
MD	3
NC	6
GA	1
FL	26
MS	4
LA	16
TX	1
Total	80

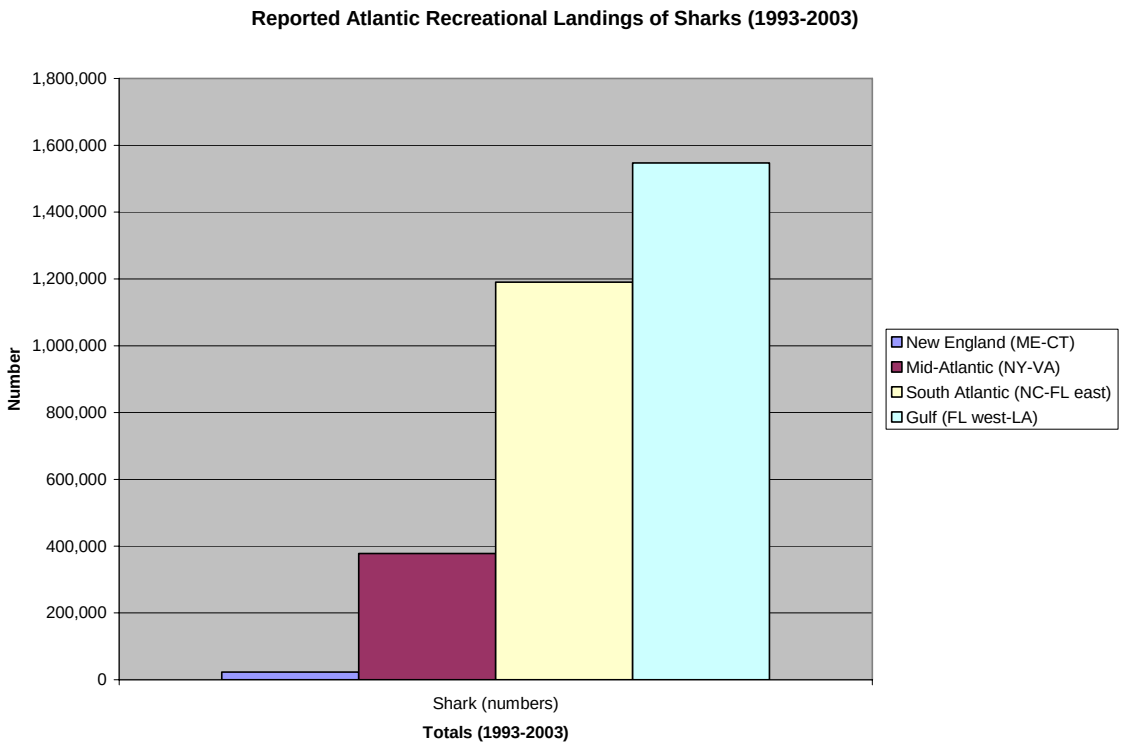
There is one shark tournament in Rhode Island run out of the Snug Harbor Marina. The tournament, which has run annually since 1982, has grown significantly in the number of registered entrants. Occurring the second weekend in July, the tournament attracts around 200 anglers or about 50 vessels and lands an average of 10 to 15 sharks, with three to five times as many usually released after capture. (See Appendix 12) Makos, threshers, and blue sharks are the most common species caught, however, tiger sharks, sandbar sharks, and dusky sharks have been landed in the tournament. (See Appendix 13) Most of the fishing for the offshore trips occurs only 20-40 miles from the edge of deep water and Gulf Stream eddies, which for most vessels leaving Rhode Island ports, is at least 60-100 miles from the primary identified waters for sharks.

[185] NMFS Atlantic HMS Tournament Registration Database

Recreational Landings[186]

Recreational landings of sharks in the Atlantic are similar to the commercial landings in terms of where the heaviest concentrations of landings occur. Figure 18 displays a breakdown by region of where the most recreational landings of sharks have occurred from 1993 to 2003.

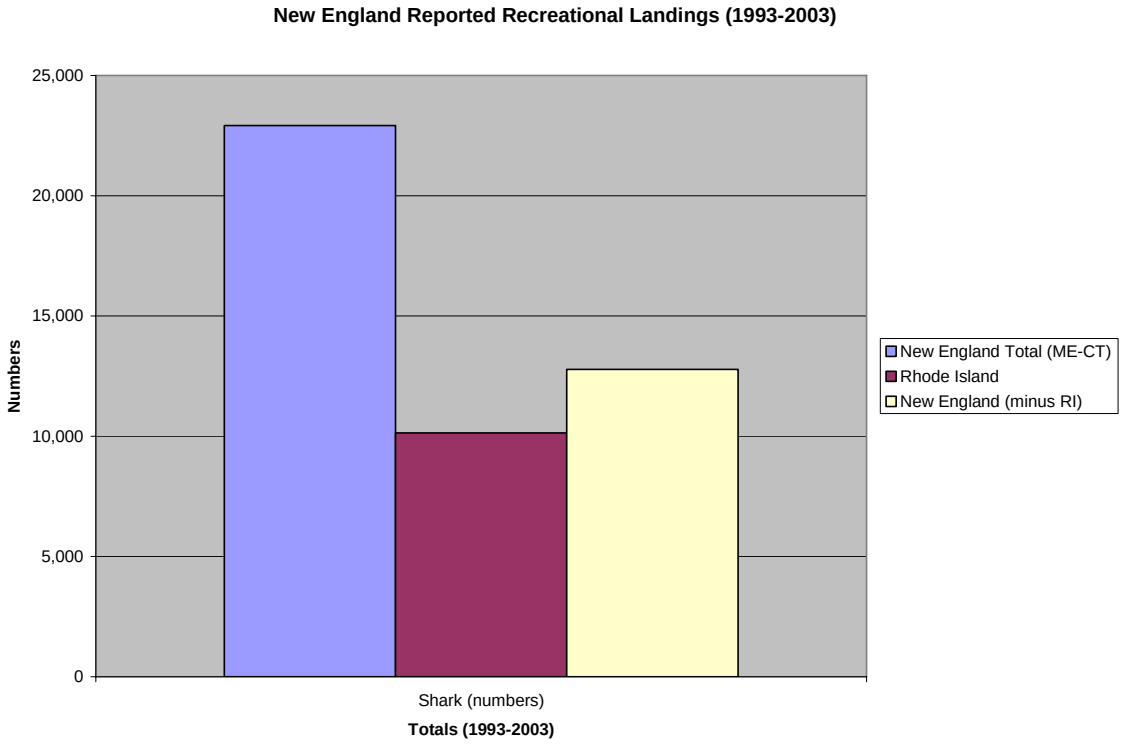
Fig. 18 – Atlantic Recreational Landings of Sharks



The South Atlantic and the Gulf of Mexico, again, represent the greatest landings of sharks followed by the Mid-Atlantic and lastly New England. (See Appendix 14) In the ten year period, more than 1,500,000 sharks were landed in the South Atlantic compared to 23,000 sharks reported landed in New England. Within New England, Figure 19 shows total shark landings for this same period.

[186] Data source for all recreational landings data is from the Marine Recreational Fisheries Statistic Survey (MRFSS), NMFS, Fisheries Statistics Division, Silver Spring, MD. http://www.st.nmfs.gov/st1/index.html

Fig. 19 – New England Recreational Landings



Rhode Island with about 10,000 sharks landed, accounted for just under half of the total for the whole region. (See Appendix 15) Reporting of sharks, however, is often sporadic as it is conducted by random telephone call-ins.[187] Additionally, species specific records are only separated out for dogfish, Atlantic angel sharks, with all other sharks aggregated.[188] This complicates any assessment for species or species' groups, as it is unclear what sharks exactly are being caught.

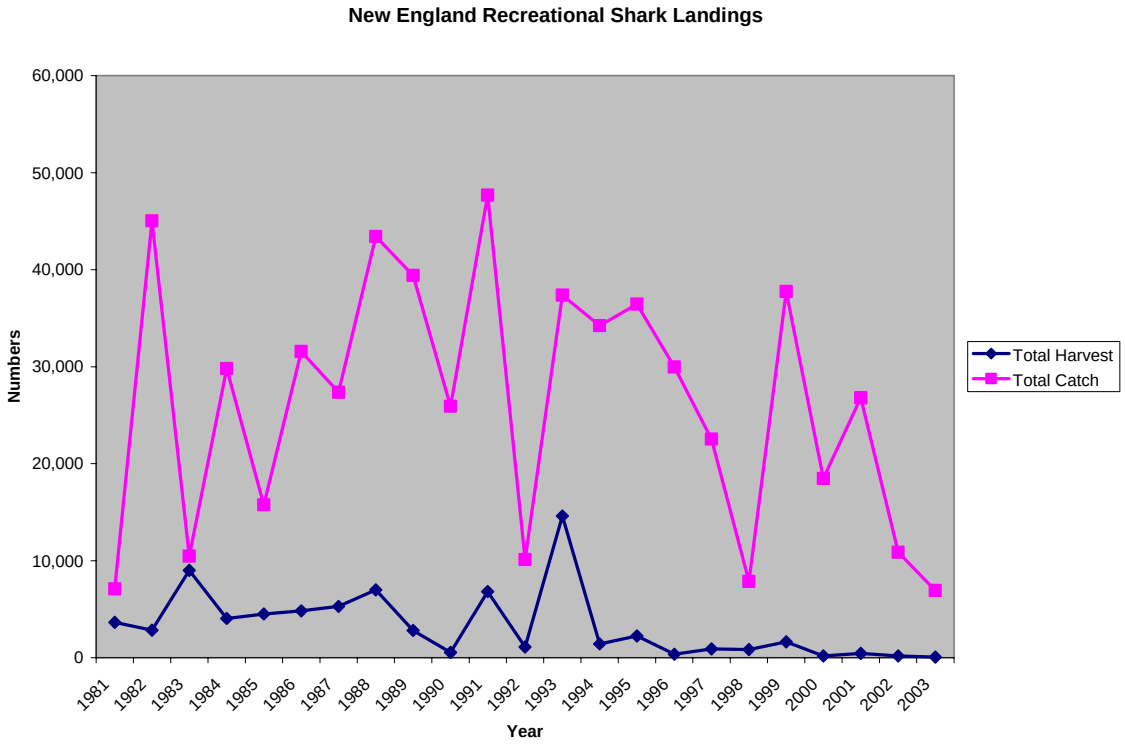
New England's recreational landings have reflected the sporadic nature of its reporting. Figure 20 displays the total numbers of sharks caught and landed[189] since 1981.

[187] MRFSS is often criticized by fishermen and environmentalists as inadequate in proper accounting of sharks caught. See Appendix ? for description of how MRFSS is conducted.

[188] MRFSS database and NMFS-Fisheries Statistics Division.

[189] MRFSS refers to sharks that are landed as harvested.

Fig. 20 – New England Recreational Catch-and-Release



Catch-and-release of sharks is commonly practiced by many fishermen, and overall the number of sharks released has been from 60% to 80% of the total sharks caught. (See Appendix 16) However, post-release mortality estimates vary for certain species, and generally the duration and exertion of the shark in the struggle on the line often determines whether or not the shark survives after being released.[190] Veterinary pathologist Joanna Borucinska has observed that many sharks when cut loose (90% of them) have the hooks still in their mouths, or in their stomachs, and this "can create rupture lesions which could be pretty lethal."[191] So, while catch-and-release is the common practice by recreational fishermen, its contribution to the mortality of sharks has not been quantified, so its effects can not be considered benign as they may in fact

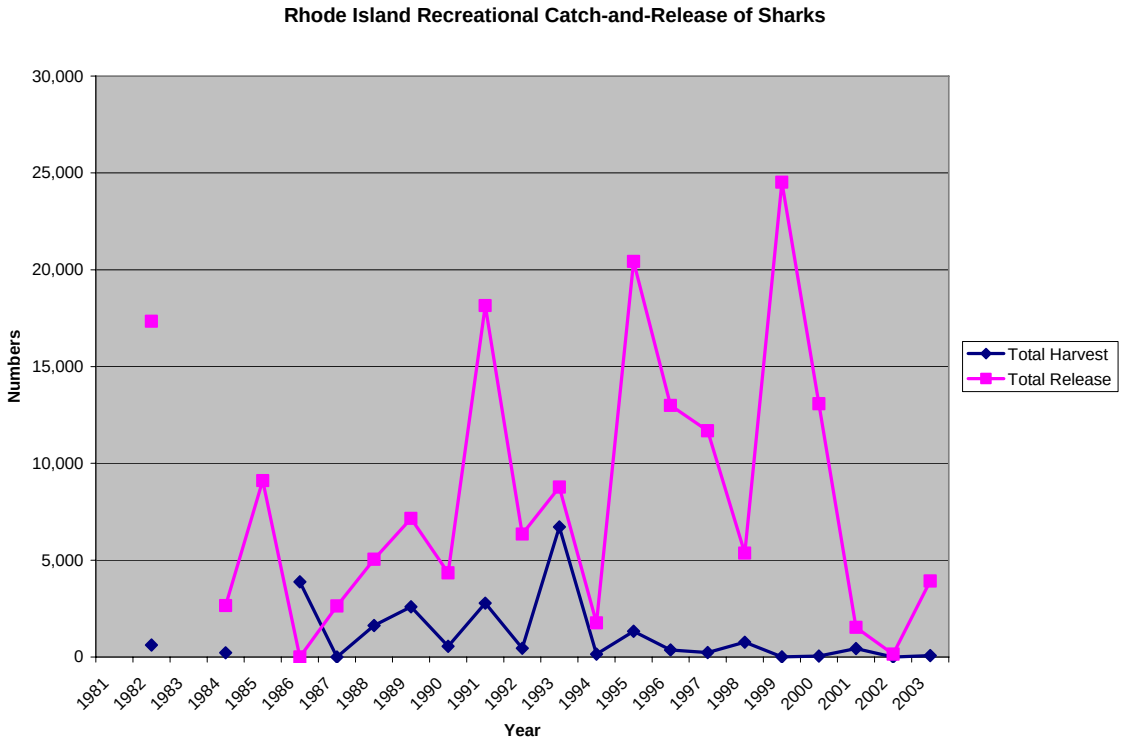
[190] Skomal, G. and B. Chase. 2002. The physiological effects of angling on post-release survivorship in large pelagic gamefish. Massachusetts Division of Marine Fisheries. Suggests that upwards of 30% of sharks released may perish afterwards.

[191] Pers. Comm.. Joanna Borucinska. University of Hartford. 7/15/04

present an additional source of mortality for sharks. Landings of sharks in New England remained fairly steady throughout the 1980s, averaging about 5,000 sharks landed. A high of 14,600 sharks was reported landed in 1993, following a brief period of up-and-down catches. The total number of sharks landed or harvested and those caught decreased significantly after this year, falling to only 70 reported landings in 2003 out of a total of 6,865 caught. This represents a drop of 85% less than the high of over 47,000 sharks caught in 1991.

Rhode Island's recreational catch of sharks, as was noted earlier, represents almost half of the total catch of sharks for the region. Figure 21 shows the total number of sharks caught and landed in Rhode Island since 1981 (the date when data was first recorded for recreational shark landings).

Fig. 21 – Rhode Island Recreational Catch-and-Release



As is the case for the whole of New England, more sharks are generally released than are landed in Rhode Island. However, in 1986 more sharks were reported landed than released, and in 1993, almost half of the total sharks caught were landed. (See Appendix 17) Apart from these two years, in general, between 75% to 90% of the total sharks caught were released. Landings of sharks dropped after a high of almost 7,000 were landed in 1993 to 70 in 2003, and the total catch of sharks dropped from a high of 24,531 in 1999 to a low of 146 reported catch in 2002. The sporadic nature of the MRFSS reporting makes any catch data problematic (the total landings in New England for 2003 were equal to the total landings in Rhode Island for the same year), yet there appears to be a boom-and-bust cycle, with a periodic high of reported catch every four to five years followed by a steep decline.

Recreational Landings vs. Commercial Landings

The recreational data, unlike the commercial data, has not been used with respect to sharks in determining how quotas are set, yet the recreational catch may be significant in comparison to the commercial catch. I wanted to do a comparison of the relative contributions to the mortality of sharks from these two sectors based on the landings of sharks only. However, the data for recreational landings of sharks that is collected by MRFSS is defined in terms of "numbers" of sharks caught or landed, while the commercial data is based on the dressed weight of the shark that is landed at the dock. To do a comparison then, I chose to create a low and a high weight estimate for the recreational catch based on NMFS length-weight relationships of 13 identified species of sharks. While the recreational data does not have species specific information on what sharks are caught, recreational fishermen have noted that the blue shark, the mako, and

the thresher are the most common sharks caught offshore or in New England waters that may be retained.[192] Blue sharks were the most commonly caught shark, followed by makos and then threshers.[193] According to these conversations with charterboat captains, therefore, in creating a low and a high weight estimate for the recreational landings, I assumed that 50% of the catch was blue sharks, 25% were makos, and 25% were threshers. Additionally, almost all captains stated that the majority of sharks landed were in the 6 to 7 foot range in length, so in creating a low and a high weight estimate, I set the high weight estimate on a fork length of 6.5 feet and the low weight estimate was based on the minimum legal catch size of 4.5 feet. Table 13 shows the length-weight relationships for the three species of sharks used in determining the weight estimates for the recreational catch.

Table 13 – Estimated Weights for 3 Most Common Shark Species In the Recreational Catch[194]

Fork Length (Feet)	Common Thresher	Mako	Blue	Fork Length (Feet)
6.5	253	189	109	6.5
4.5	77	60	35	4.5

The low estimate, then, using the average weights for a 4.5 foot shark of these species and based on the 2:1:1 ratio established yields a weight of 44.05 lbs./shark. The high estimate based on a fork length of 6.5 feet for these sharks yields a weight of 165

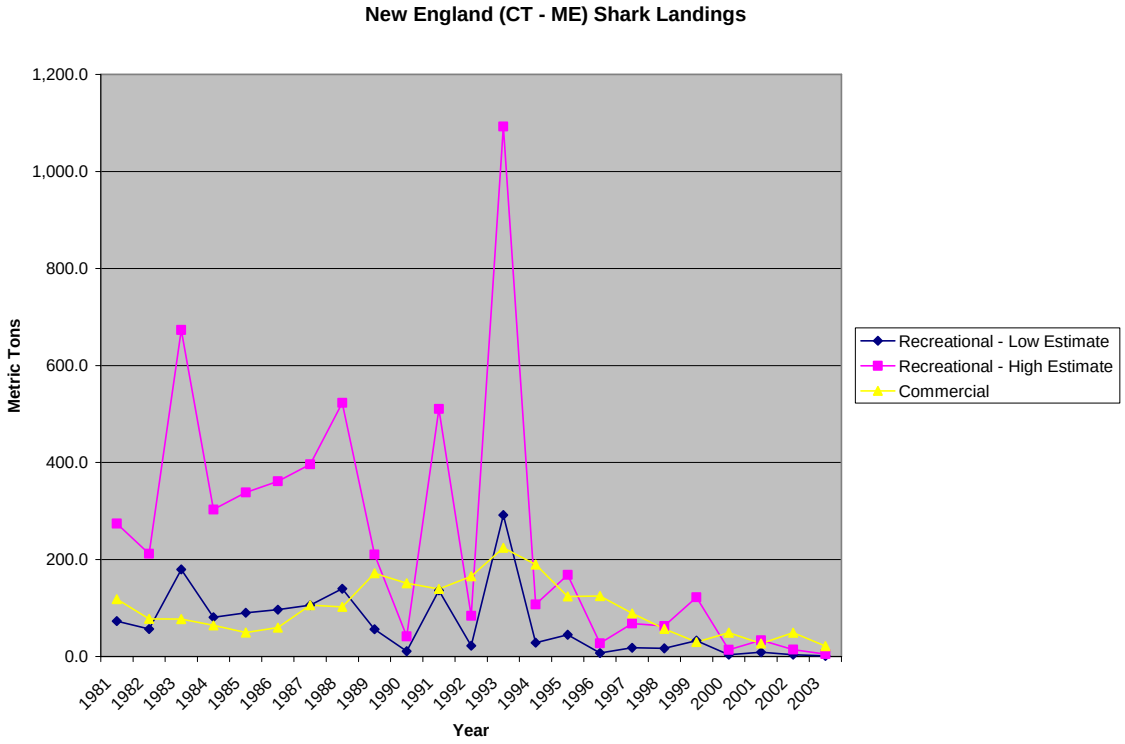
[192] Pers. Comm. w/charterboat capts.

[193] Ibid. Blue sharks are released more often however, as they are not considered as tasty as makos or threshers.

[194] Kohler, N. et al. Length-Length and Length-Weight Relationships for 13 Shark Species from the Western North Atlantic. NOAA Technical Memorandum NMFS-NE-110, May 1996

lbs./shark.[195] Based on these estimates then, Figure 22 shows the recreational landings of sharks in New England compared to the commercial landings of sharks by weight from 1981 to 2003.

Fig. 22 – New England Total Shark Landings



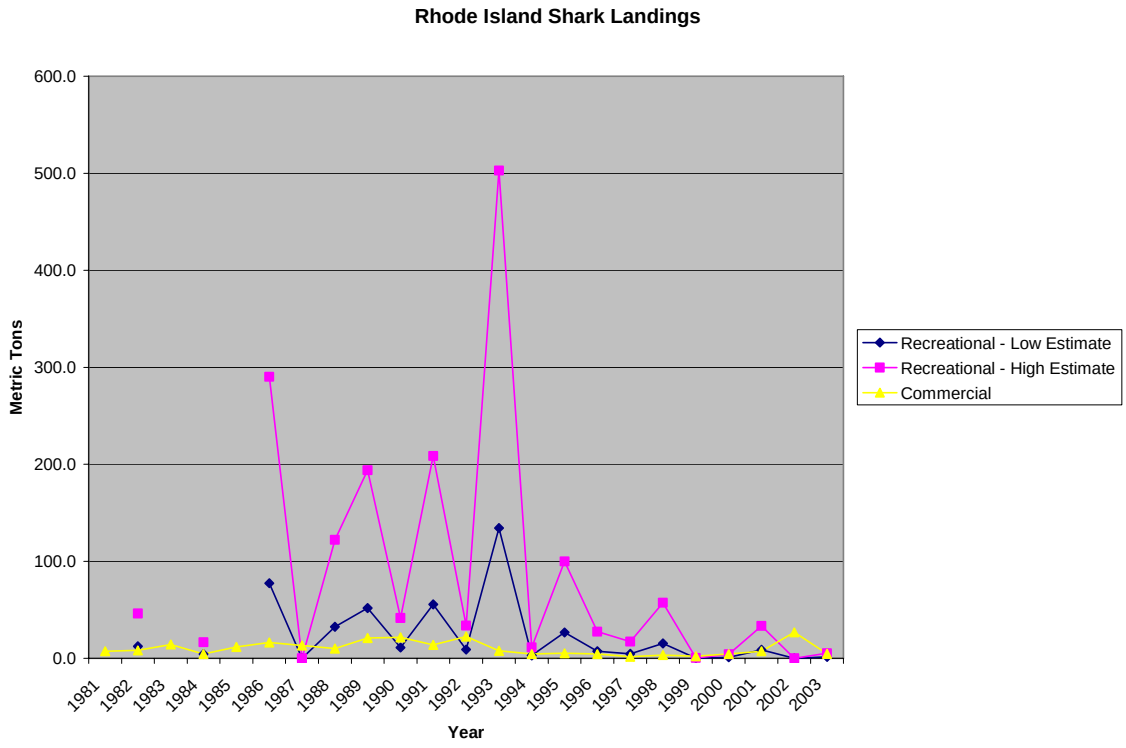
The recreational landings within New England based on both the low and the high weight estimates appear greater than the commercial landings throughout most of the 1980s. (See Appendix 18) From 1990 to 2003, however, the commercial landings were greater than both the low and the high weight estimates in eight of the thirteen years, and were greater than the low weight estimates in all but two of those years. Prior to 1993 the high weight estimate for the recreational landings was far greater than the commercial landings, averaging more than 3 times the commercial landings. The low estimate for the

[195] Both estimates should be considered fairly conservative given that the weight of the blue shark is significantly less than the other two pelagic species at the same length, and the fact that blues are more often released than landed. Additionally, all three species may grow to lengths over 12 feet, and 6 feet is often referred to by recreational anglers as the minimum size that is landed/kept.

recreational landings averaged an identical amount to the commercial landings for this same period. The commercial high for shark landings occurred in 1993 with about 225 MT landed, which is almost 80% less than the recreational high in 1993 of an estimated 1,092.6 MT landed (14,599 sharks), and about 20% less than the low estimate of 292 MT. The recreational landings appear to have fallen much more drastically from this point, for both estimates, than the commercial landings. From 2000 to 2003, between 165 MT (low estimate) and 213 MT (high estimate) total sharks were landed (recreational and commercial combined) – less than commercial landings of sharks alone in the one year of 1993.

Rhode Island, however, generally had far greater recreational landings of sharks than the commercial landings. (See Figure 23)

Fig. 23 – RI Shark Landings 1981- 2003.



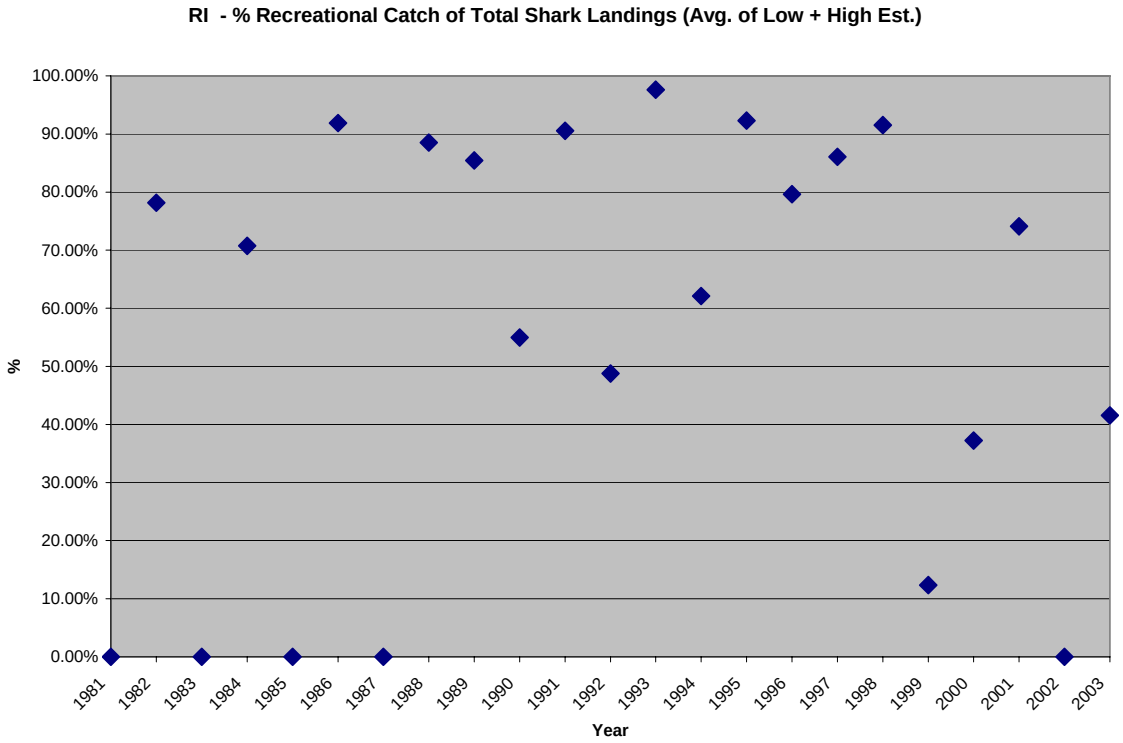
Commercial landings of sharks have generally been rather low compared to the recreational landings, averaging about 12 MT of shark landed/year compared to 22 MT (low estimate) and 85 MT (high estimate) of shark landed/year for the recreational sector. (See Appendix 19) The commercial high in 2002 of almost 27 MT landed is five times less than the recreational low estimate in 1993 of 134.3 MT of shark were landed (6,719 sharks) and almost twenty times less than the recreational high estimate of 503 MT. In other words, for the commercial fishery in 2002, representing the most sharks landed in RI for that sector, about 1 shark for every 1,000 people in the state was killed, compared to the recreational high in 1993, when almost 7,000 sharks were landed, meaning that about 1 shark was killed for every 150 people in the state.[196]

Similar to the whole of New England, the recreational landings have fallen much more dramatically after 1993 than the commercial landings. Yet because the recreational landings were so high prior to this point, the decline in recreational landings appears to now equal or follow more closely what the commercial landings are, at least for the high weight estimate of the recreational catch. Between 2000 to 2003, in which 572 total sharks were reported landed in Rhode Island, the average recreational weight estimates were between 2.9 MT of shark landed/year (low estimate) and 10.7 MT of shark landed/year (high estimate). In contrast, the commercial landings for this same period averaged 10.9 MT of shark landed/year. Recreational landings therefore appear to have historically exceeded that of commercial landings in Rhode Island even though they currently correspond more closely to the commercial catch. Overall, recreational landings of sharks have exceeded commercial landings of sharks in thirteen of the past

[196] This is based on U.S. census figures for the state, which listed 1,037,196 residents in 2002. http://quickfacts.census.gov/qfd/states/44000.html

twenty years for both the low and the high weight estimates, and have exceeded commercial landings in all but four of those years for the high weight estimates.[197] Figure 24 displays the percent of the total landings that the recreational catch composed (as an average of the weight estimates).

Fig. 24 – Recreational Landings as Percent of Total



In almost all of those years the recreational catch was between 50% to 98% of the total shark landings in the state.

Rhode Island's total catch of sharks also appears to average close to 40% of the total catch of sharks for all of New England from 1981 to 2003. Figures 25 and 26 depict the total shark landings (recreational and commercial combined) for Rhode Island compared to the rest of New England (aggregated) and the region as a whole from 1981 to 2003.

[197] 1999-2002

Fig. 25 – Regional Shark Catch

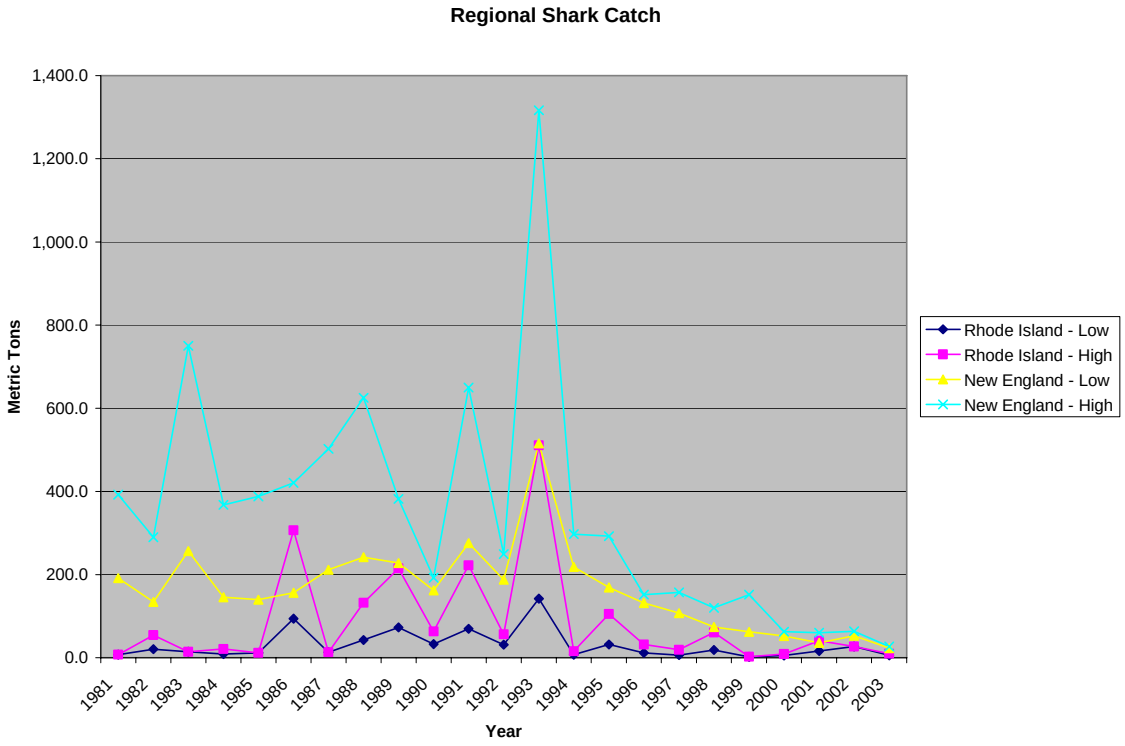
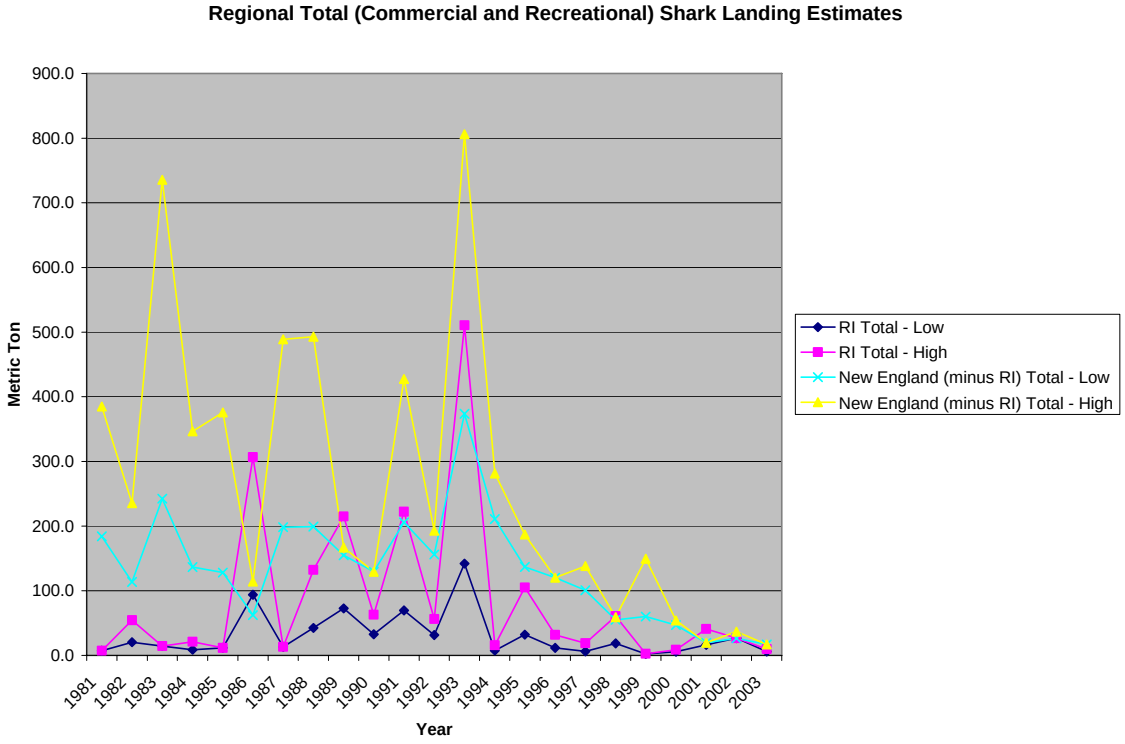


Fig. 26 – RI vs. All Other New England States



From 1998 to 2003, however, the high weight estimate[198] for Rhode Island has surpassed the total for all other New England states (CT, MA, NH, ME) in three of those years. (See Appendix 20) Throughout most of the 1980s and 1990s though, Rhode Island's total shark landings remained around 40% of the remaining New England shark landings' total. The total shark landings for Rhode Island in 1993 ranged between 142 MT of shark landed (low estimate) and 510 MT of shark landed (high estimate). This is in contrast to between 374 MT (low estimate) and 806 MT (high estimate) of shark landed for the other New England states. Overall, when the recreational landings estimates are combined with the commercial landings, the total amount of sharks landed in both Rhode Island and the whole of New England represents between two to five times as many sharks killed as that of commercial landings alone.

Snug Harbor Shark Tournament

Recreational fishermen have identified several grounds where they target sharks offshore of New England and Rhode Island. The Dump, the Acid Barge, Little Tails, the Mud Hole, Shark's Edge, Suffolk wreck, the Fingers, and the Gully have all been identified as prime areas for shark fishing by several fishermen.[199] The site known as the Acid Barge, about 10 miles southeast of Block Island is the closest site to Rhode Island waters that have been identified as shark fishing grounds. While most of the identified fishing grounds are 60 to 100 miles offshore, sharks have been landed closer to state waters. (See Appendix 21) In 1991, a 2,900-lb. great white shark was landed 5 miles

[198] Recreational high weight estimate for shark landings + commercial shark landings

[199] Pers. Comm. w/Capt. Bill Brown, Capt. Charlie Donilon, Capt. Al Anderson.

south of Pt. Judith[200], and in June 2004 a juvenile sand tiger shark was landed from the shore of East Beach in Charlestown, RI.[201] In general, several charterboat captains have noted that when the water temperature reaches 57 degrees F offshore, generally around the beginning of June, more blue sharks begin to appear.[202] As the temperature continues to rise, other species begin to appear and remain throughout the Summer months until around mid-October, with a peak abundance of sharks occurring in August.[203] Water currents, particularly the Gulf Stream, in large part influence the distributions of the pelagic life stages of most species.[204]

The Snug Harbor Shark Tournament, which has run annually out of the Snug Harbor Marina in Rhode Island since 1982, is an event which has grown in popularity with recreational fishermen during the summer months of peak abundance. Generally run the second weekend in July, the tournament attracts around 200 anglers or about 50 vessels and lands an average of 10 to 15 sharks, with three to five times as many usually released after capture. (See Appendix 12 and 13) As was mentioned earlier, makos, threshers, and blue sharks are the most common species caught, however, tiger sharks,

[200] Parker, P. A. Providence Journal. "Stalking the great white shark 3 fishermen tow 2,909-pounder to shore after it dines on whale." 7/30/91. The act caused some controversy at the time, because the fishermen ended up discarding more than 1,100 lbs. of the animal by throwing it into a dumpster at the dock. Several letters decrying the act were submitted to the Providence Journal.

[201] Westerly This Week. Fishing Report. June 17 through June 23, 2004. p. 17

[202] Pers. Comm. Capt. Brown, Donilon, Anderson

[203] Ibid.

[204] Casey, J.G., and N.E. Kohler. 1990 "Long distance movements of Atlantic sharks from the NMFS Cooperative Shark Tagging Program." Discovering Sharks. S.H. Gruber ed. American Littoral Society, Highlands, NJ. 19(4):87-91. The distribution of marine species along the Atlantic seaboard is strongly affected by the cold Labrador Current in the northern part, the warmer Gulf Stream in the middle and southern portions of the region, and generally by the combination of high summer and low winter temperatures. For many species Cape Hatteras forms a strong zoogeographic boundary between the Mid- and South Atlantic areas, while the Cape Cod/Nantucket Island area is a somewhat weaker zoogeographic boundary in the north.

sandbar sharks, and dusky sharks have been landed in the tournament. Points are awarded for the largest sharks landed, and minimum size limits were imposed in 1995. Figures 27, 28, and 29 display the winning weights landed for the three main species caught in the Tournament since 1986 based on published reports from the Providence Journal. (See Appendix 12 and 13)

Fig. 27 – Snug Harbor Blue Shark Winning Catches (1986-2004)

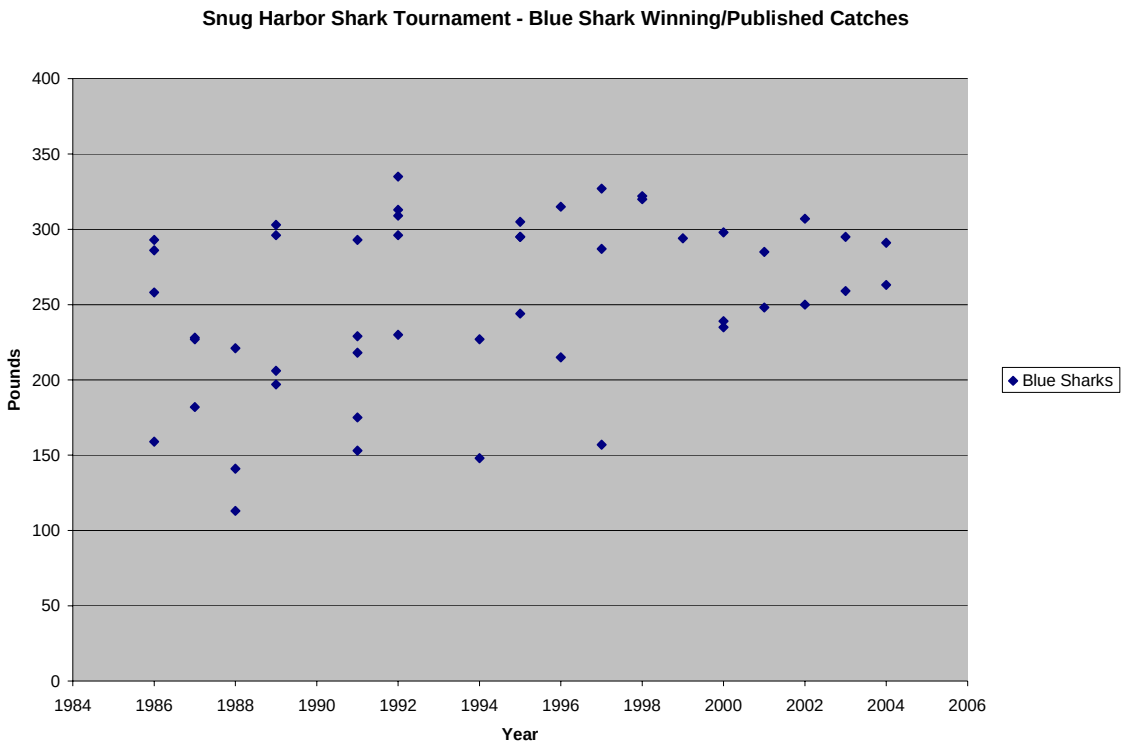


Fig. 28 – Snug Harbor Mako Winning Catches (1986-2004)

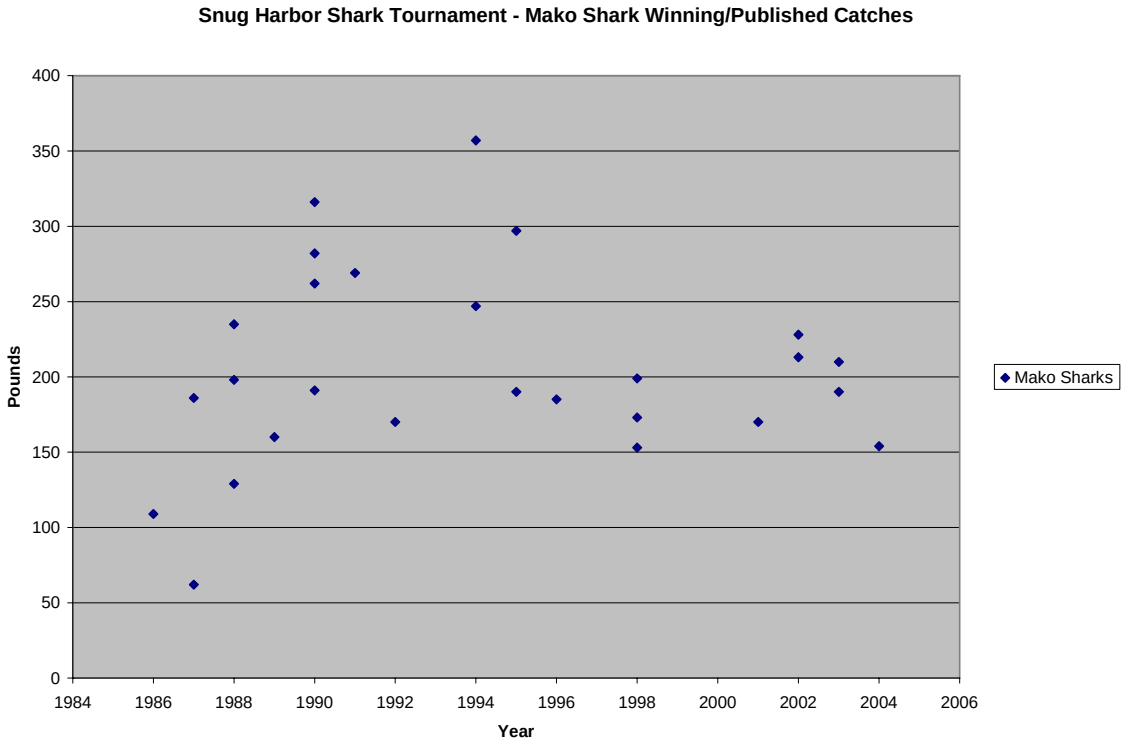
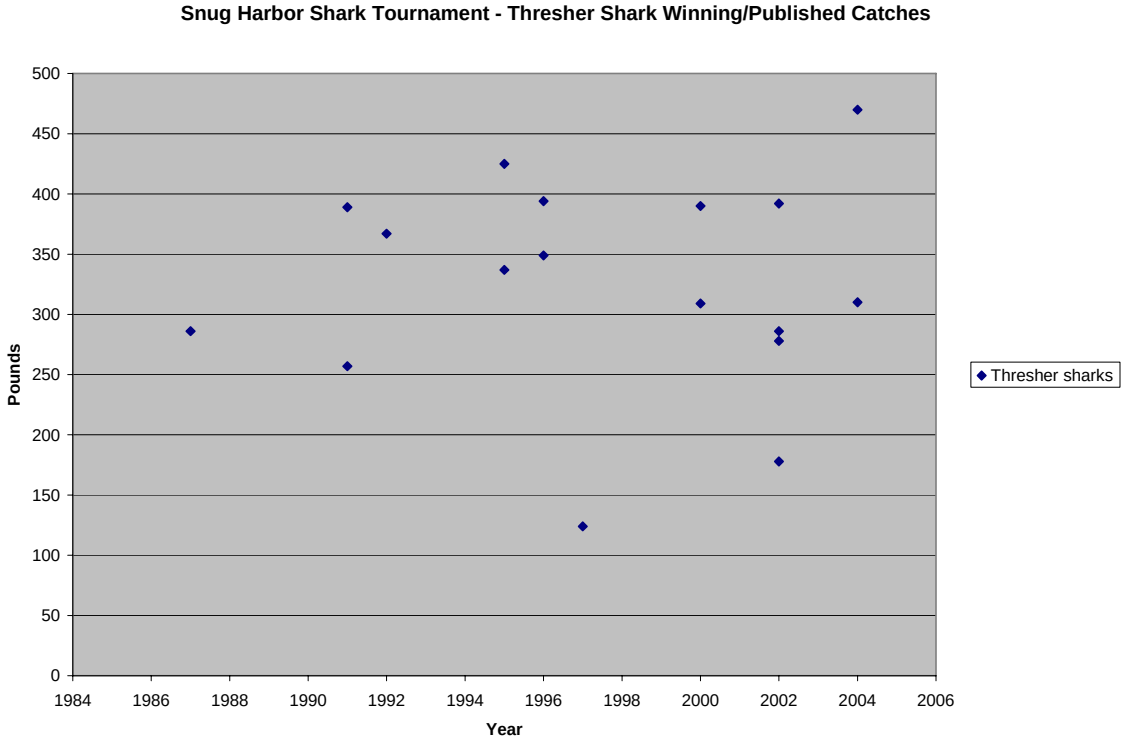


Fig. 29 – Snug Harbor Thresher Shark Winning Catches (1986-2004)



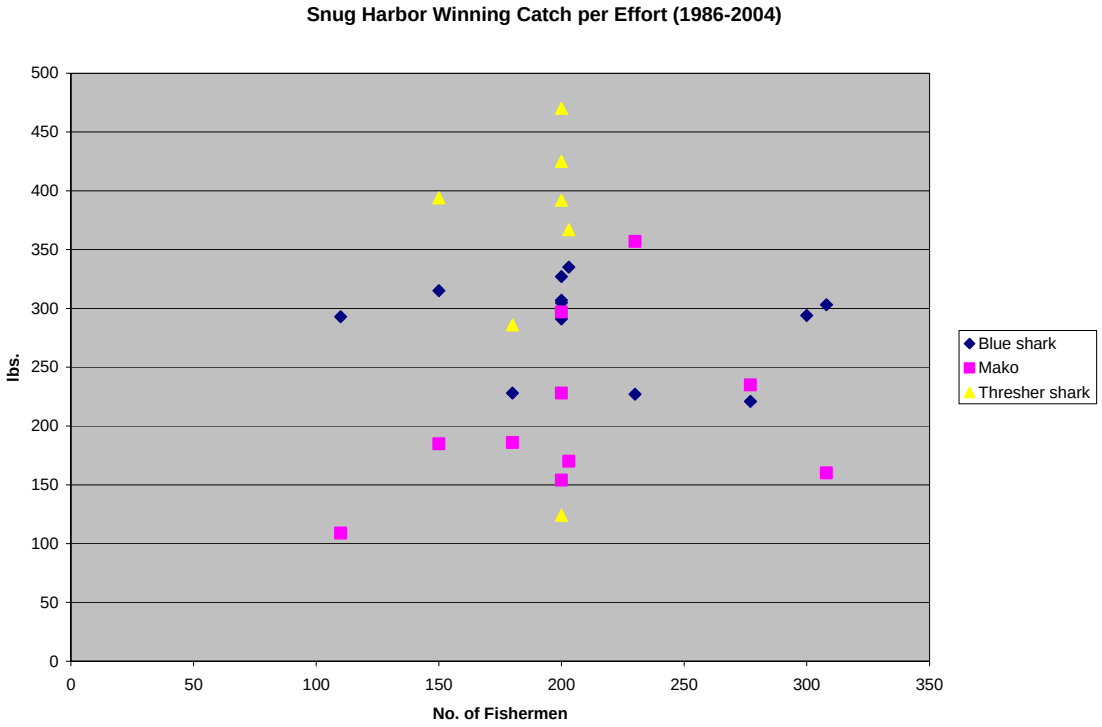
The winning catches for makos at around 200 lbs./shark and threshers at around 325 lbs./shark have remained fairly consistent overall, while the winning catches for blue sharks has actually increased from around 225 lbs./shark to over 275 lbs./shark. In the 2004 tournament however, tournament operator Al Conti commenting on the number of mako sharks remarked that "the number of makos under 150 pounds was amazing."[205] It is not clear, however, whether there is a corresponding absence of larger makos, though only three makos over 200 lbs. have been caught in the tournament since 1996.[206] With the recent ICCAT assessment[207] of blue sharks and makos indicating that makos were overfished and that overfishing is occurring, the continued landing of makos, especially juveniles that have yet to reach their reproductive potential, is alarming. Figure 30 displays the winning catch for blue sharks, makos, and threshers for the number of fishermen who participated in the tournament from 1986 to 2004.

[205] Meade, T. Outdoor Notes. "Cumberland man hooks 470-pound shark to win tourney." Providence Journal. 7/18/04

[206] The shortfin mako can grow up to 1,000 lbs. and about 13 ft. Juveniles are usually around 6 to 6.5 feet and typically weigh just under 200 lbs.

[207] Report of the 2004 Inter-Sessional Meeting of the ICCAT Sub-Committee on bycatches: Shark stock assessment. SCRS/2004/014. Tokyo, Japan. June 14-18, 2004 http://www.iccat.es/Documents/SCRS/DetRep/DET_shk.pdf#search='ICCAT%20mako%20assessment'

Fig. 30 – Snug Harbor Winning Catch per Effort



There do not appear to be any conclusive trends from the catch per effort with the limited amount of data. Moreover, it is difficult to have a high degree of confidence overall in the Snug Harbor data, given that only the winning catches, which were published in newspaper articles, were able to be analyzed. More complete data for the tournament, including the catch size, weight, species, and total numbers of sharks caught are compiled by both the Snug Harbor Marina and by the NMFS Apex Predator Program. Attempts to review this data were denied by both the Snug Harbor Marina and by the Apex Predator Program. The explained rationale for denying the data was that it was "proprietary" information and could not be released without the consent of the tournament operator (Al

Conti).[208] Currently NMFS regulations do not require mandatory reporting for shark fishing tournaments, even though there is mandatory reporting for all other HMS species.

[208] Pers. Comm. with Lisa Natanson, Marine Biologist. 11/04. NMFS: Apex Predator Program. Narragansett, RI.

CHAPTER 4: MARKET DATA AND RHODE ISLAND'S TAKE

The declining status of sharks, particularly in the Northwest Atlantic Ocean, is a direct result of direct and incidental commercial harvesting and recreational fishing. The bycatch of sharks, however, has been shown to be almost three times greater than that which is landed. Perhaps the greatest reason for the vast amount of discards is the relatively low commercial value of sharks compared to other highly migratory species, such as tuna and swordfish, which are the main targets of the fisheries.

Price and Revenue of Shark Fisheries

In general, the three most valuable shark species sold in the Atlantic are the blacktip, the mako, and the thresher shark. Table 14 displays the trend in the average wholesale price of these species as well as their change in value since 1996 (the first record available for sharks).

Table 14 – Overall Avg. Wholesale Price/lb. of 3 Shark Species Sold in Atlantic and Gulf of Mexico[209]

Species	1996 Price/lb.	1999 Price/lb.	2000 Price/lb.	2001 Price/lb.	2002 Price/lb.	2003 Price/lb.	Percent Change 1996 to 2003
Blacktip	$1.05	$1.04	$1.04	$1.05	$1.00	$1.33	27%
Mako	$2.77	$2.74	$3.18	$3.00	$2.00	$2.37	-14%
Thresher	$1.00	$0.91	$0.82	$1.25	$1.25	$0.78	-22%

While blacktips are primarily found in the South Atlantic and Gulf, makos and threshers are found offshore of Rhode Island waters and are landed and sold at Rhode Island ports. Overall, the wholesale price of mako shark decreased 14% from 1996 to 2003, however, 2003 wholesale prices were up from 2002, while the wholesale price of

[209] Fulton Fish Market, 2004

thresher shark has decreased 22% from 1996 to 2003.[210] The changes in price are probably a result of many confounding market factors, and the signal does not appear strong enough – the fluctuations are not that great – to suggest that changes are necessarily caused by decreases or increases in abundance.

The animal is usually de-headed, gutted, and finned prior to sale at the dock.[211] Some shark meat is sold directly by a fisherman to a restaurant, although dealers in Rhode Island have stated that this is not common.[212] The utilization of sharks, however, is not well known since trade statistics frequently do not indicate product forms such as skins and leather, jaws, fishmeal and fertilizer, liver oil, and cartilage.[213] In general, domestically-landed sandbar, blacktip, mako, and/or thresher meat are sold to supermarkets and processors of frozen fish products. Individuals involved in the processing and wholesale sectors buy the seafood, cut it into pieces that transform it into a consumer product, and then sell it to restaurants or retail outlets. Many restaurants may not know what type of shark they are buying or are able to verify whether the type of shark purchased is indeed what it was labeled.[214]

The value of sharks, particularly their fins, continues to be the driving factor in the landing of sharks, either through directed fisheries or when they are caught as bycatch, especially in the North Atlantic. The price of shark meat, however, varies

[210] The wholesale price of blacktip shark increased 27% from 1996 to 2003, with most of the increase occurring in 2003.

[211] Sharks may contain high levels of mercury, and shark meat generally requires careful handling due to the high concentrations of urea in the body of the shark.

[212] Pers. Comm. w/M. Vincent. Providence Bay Fish Company. 3/10/05 Some shark may be exported from the U.S., processed overseas, and imported in a final product form.

[213] Rose, D. An Overview of World Trade in Sharks and Other Cartilaginous Fishes. Traffic Publications. December 1996.

[214] Pers. Conv. with Martin. Providence Bay Fish Co. 4/2/05

slightly by region, largely dependent on the composition of the catch. For all LCS shark species prices declined in the North Atlantic in 2003, as well as in the South Atlantic, despite increases in the average ex-vessel price for LCS in the Gulf of Mexico and Mid-Atlantic, while the average ex-vessel prices for pelagic sharks increased in all regions in 2003. [215] (See Table 15)

Table 15 – Avg. ex-vessel Prices per lb. for Atlantic Sharks by Area[216]

Species	Area	1996	1999	2000	2001	2002	2003
Large Coastal Sharks	Gulf of Mexico	$0.21	$0.56	$0.43	$0.44	$0.36	$0.38
	South Atlantic	$1.02	$1.10	$0.78	$1.12	$1.27	$0.39
	Mid-Atlantic	$0.55	$0.59	$0.53	$1.09	$1.56	$1.62
	North Atlantic	$0.88	$0.77	$1.01	$1.02	$0.77	$0.72
Pelagic Sharks	Gulf of Mexico		$1.36	$1.31	$1.42	$1.11	$1.13
	South Atlantic	$0.62	$0.83	$0.76	$0.68	$0.67	$0.71
	Mid-Atlantic	$1.21	$1.23	$1.20	$1.09	$1.17	$1.21
	North Atlantic	$1.31	$0.81	$1.10	$1.23	$1.00	$1.12
Small Coastal Sharks	Gulf of Mexico		$0.55	$0.52	$0.58	$0.48	$0.40
	South Atlantic	$0.25	$0.50	$0.48	$0.52	$0.53	$0.51
	Mid-Atlantic	$0.25	$0.47	$0.38	$0.55	$0.48	$0.38
	North Atlantic				$1.51	$0.58	
Shark Fins	Gulf of Mexico		$14.01	$15.99	$20.90	$22.64	$18.12
	South Atlantic	$10.74	$11.10	$14.16	$18.43	$17.10	$15.85
	Mid-Atlantic	$4.60	$3.41	$4.90			
	North Atlantic	$2.69	$1.19	$6.83			

Despite the absence of market data for shark fins in the New England region, it should be noted, that the price per pound for shark fins in the Gulf and South Atlantic was fourteen to fifteen times the price per pound for pelagic sharks sold in the North Atlantic in 2003. While, the trade in shark fins is more prevalent in the South Atlantic and Pacific[217] their

[215] The 2003 prices for pelagic sharks are not significantly different than 1996 prices and are actually lower than 1996 when adjusting for inflation.

[216] Dealer weigh out slips from the Southeast and Northeast Fisheries Science Centers

[217] The tope or soupfin shark found off the coast of CA and other parts of the Pacific is the most prized shark for the Chinese sharkfin soup.

value insures that larger species of sharks will always be landed if allowed, no matter where they are caught.

The ex-vessel price of a shark also varies depending on the gear type used. In 2003, the average ex-vessel prices per pound dressed weight (dw) for Atlantic sharks in the North Atlantic (RI – ME) were highest for pelagic sharks caught from pelagic longlines and gillnets at $1.30/pound. This was followed by the price for large coastal sharks caught by handline, which sold for $0.74/pound. In general, the price per pound for all sharks has either declined or remained steady for every gear type since 1996, with the exception of an increase in the price for pelagic sharks caught by gillnets (See Table 16).

Table 16 – Avg. ex-vessel Prices per lb. dw for Atlantic Sharks by Gear in the North Atlantic (RI – ME)[218]

Species	Gear	1996	1999	2000	2001	2002	2003
Large Coastal Sharks	Handline		$0.74		$0.50	$0.45	$0.74
	Pelagic Longline	$1.03		$1.00	$1.21	$0.29	$0.28
	Bottom Longline	$0.99	$1.03	$0.65	$1.43	$1.00	
	Gillnet	$0.83	$0.64	$1.06	$0.99	$0.89	$0.89
	Trawl	$0.80	$1.00	$1.08	$0.93	$0.86	$0.66
	Pots and Traps					$0.28	$0.22
Pelagic Sharks	Handline	$1.60			$1.38	$1.71	
	Pelagic Longline	$1.26	$3.30	$1.38	$1.37	$1.31	$1.30
	Bottom Longline	$1.85	$0.89	$1.50		$0.65	
	Gillnet	$1.12	$0.70	$0.82	$0.98	$0.60	$1.30
	Trawl	$0.96	$0.77	$0.97	$1.19	$0.81	$0.63
	Pots and Traps					$0.69	$0.68
Small Coastal Sharks	Gillnet				$1.51		
	Trawl					$0.58	
Shark Fins	Pelagic Longline	$4.25		$5.54			
	Bottom Longline	$3.00	$0.33	$25.19			
	Gillnet	$1.96	$2.79	$2.41			

[218] Dealer weigh out slips from the Northeast Fisheries Science Center

	Trawl	$2.32	$0.49	$3.00			

Again, prices for shark fins are generally lacking in the North Atlantic since the passage of the Shark Finning Prohibition Act in 2000. The price per pound of shark meat, outside of the fins, is considerably less than that of other HMS species that are the primary targets of commercial fishing in the North Atlantic. The most valuable HMS species, the Bluefin tuna, earned between $5 to $6 per pound, depending on the gear type used to catch it, while bigeye tuna, yellowfin tuna, and swordfish all sold for between $3 to $4, compared to roughly $2 per pound for the most valuable shark species.[219] Given the current lucrative status of theses species, so long as they remain marketable and allowable for catch for all gear types, the incidental catch of sharks is certain.

The estimated total annual revenue of Atlantic HMS fisheries has also increased 11 percent from approximately $66.4 million in 1996 to approximately $73.7 million in 2003.[220] Tuna accounted for approximately $50 million, swordfish $14.6 million, and the shark fishery accounted for the remaining $9 million, with more than half of the revenue ($4.7 million) generated from the sale of shark fins. Table 17 displays estimates for the total annual revenues for the shark fisheries in the Atlantic for 1996 and 1999 to 2003 (the only data available for review).

Table 17 – Estimates of the Total ex-vessel Annual Revenues of Atlantic Shark Fisheries[221]

Species	Description	1996	1999	2000	2001	2002	2003
Large Coastal Sharks	Ex-vessel $/lb dw	$0.67	$0.76	$0.68	$0.91	$0.99	$0.78
	Weight lb dw	5,262,314	3,919,570	3,762,000	3,562,546	4,097,363	4,421,249
	Fishery Revenue	$3,525,750	$2,950,102	$2,560,307	$3,256,955	$4,040,977	$3,437,521

[219] Ibid.

[220] NMFS, 2004. Bluefin tuna dealer reports from the Northeast Regional Office.

[221] Northeast Regional Office

Pelagic Sharks	Ex-vessel $/lb dw	$1.05	$1.06	$1.09	$1.11	$0.99	$1.04
	Weight lb dw	695,531	400,821	215,005	362,925	303,666	616,967
	Fishery Revenue	$730,308	$424,273	$233,650	$401,430	$299,487	$643,188
Small Coastal Sharks	Ex-vessel $/lb dw	$0.25	$0.51	$0.46	$0.79	$0.52	$0.43
	Weight lb dw	460,667	672,245	672,245	719,484	579,441	549,799
	Fishery Revenue	$115,167	$340,890	$309,926	$568,441	$299,023	$236,414
Shark Fins (weight = 5% of all sharks landed)	Ex-vessel $/lb dw	$6.01	$7.43	$10.47	$19.67	$19.87	$17.09
	Weight lb dw	320,926	249,632	232,462	232,248	249,024	279,401
	Fishery Revenue	$218,561	$1,854,313	$2,434,344	$4,568,937	$4,949,056	$4,774,959
Total Sharks	**Fishery Revenue**	**$4,589,786**	**$5,569,578**	**$5,538,227**	**$8,795,763**	**$9,588,545**	**$9,092,082**

Increasing almost 200 percent since 1996, from $4.5 million/year to more than $9 million, the Atlantic shark fishery nevertheless, experienced a decrease in annual revenues of five percent from 2002 to 2003. A majority of that decrease may be attributed to reduced commercial landings and an overall decline in abundance. Additionally, declines were also noted for both tuna and swordfish, with tuna fishery revenues having decreased by 16 percent from 2002 to 2003, and swordfish having decreased by 24 percent for the same period.[222] This roughly corresponds to the same time period in which new Federal HMS regulations were implemented limiting access to fishermen as part of the required permit process and lowering the allowable catch through reduced quotas. (See Ch. 2 for HMS regulatory history)

Rhode Island's Proportion

Rhode Island has contributed to the commercial and recreational take of sharks in both the commercial and recreational sectors and its continued efforts exacerbate the declines of sharks. As was noted earlier, Rhode Island's commercial take of sharks in 2002, with only ten vessels possessing Incidental Shark Permits, represented the second most of any state in the North Atlantic for the U.S. (Virginia was first). However, shark landings for the state were almost negligible in terms of dollar value compared to all

[222] Ibid.

other fisheries. Table 18 displays the proportion of the Rhode Island commercial fishery for sharks and all other species and the value of the fishery for 2002.

Table 18 – 2002 Commercial Fishery Landings in Rhode Island.[223]

Species	Landings (MT)	Landings Value ($)	Percent Weight	Percent Value
All Species	46,950.5	$64,660,885	100	100
Sharks	26.9	$27,039	0.05	0.04

At less than $30,000 the value of the Rhode Island shark fishery represented less than four-hundredths of a percent of the value of total landings.[224] The value of sharks caught by commercial fishermen targeting HMS represents about 12% of their total revenues, so total revenues for commercial fishermen targeting HMS was approximately $225,325 in 2002, or about $22,500/vessel. It is thus reasonable to suggest that any restrictions placed on the landing of sharks would not place an economic hardship on the commercial fishery in Rhode Island as a whole, particularly since there is no direct targeting of sharks by commercial vessels registered in the state and their capture is mainly a result of the bycatch from other fisheries (i.e., tuna, swordfish).

Within the recreational sector, landings of sharks in 2002 were negligible compared to total recreational landings of all species (See Table 19), even though the take of sharks remains a threat to their recovery and survival.

[223] National Marine Fisheries Service, Fisheries Statistics Division, Silver Spring, MD. http://www.st.nmfs.gov/st1/index.html

[224] Appendix 23 displays the Average ex-vessel Prices per lb. dw for Atlantic Sharks by Gear in the North Atlantic (RI – ME); Average ex-vessel Prices per lb. for Atlantic Sharks by Area; Estimates of the Total ex-vessel Annual Revenues of Atlantic Shark Fisheries; and, Overall Average Wholesale Price/lb. of 3 Most Valuable Shark Species Sold in Atlantic and Gulf of Mexico.

Table 19 – 2002 Recreational Fishery Landings in Rhode Island.[225]

Species	Landings (Numbers)	Percent Numbers
All Species	2,198,041	100
Sharks	70	0.003

There are approximately 400,000 anglers fishing in the state (only ~150,000 are in-state residents), although it is difficult to estimate the 'real' number of marine anglers since Rhode Island does not have a marine recreational license. However, NMFS estimates that approximately 1,594,608 recreational angling trips were taken in Rhode Island in 2003[226] generating retail sales estimated to total $86.2 million.[227]

Recreational shark fishing is primarily conducted via private or charter boats in Rhode Island. Of the estimated annual angling trips in Rhode Island, about 60% (952,329) represented fishing from the shore, with some 35% (581,909) of fishing trips coming from private or rental boats.[228] The remaining trips, some 60,371 represented those of the charter/headboat industry.[229] Recreational anglers, in total, averaged about four trips per fisherman. If one assumes that all of the targeted recreational shark fishing was done by either private/rental boats or charter/headboats, and one uses Fisher and Ditton's figure showing that recreational shark trips represent some 5% of the total effort, than more than 32,000 recreational trips targeted sharks in 2003, or about 8,000 fishermen targeted sharks. This is almost 90 trips a day that anglers leaving from Rhode

[225] NMFS, Fisheries Statistics Division, Silver Spring, MD. http://www.st.nmfs.gov/st1/index.html

[226] U.S. Dept. of Commerce. NOAA. Fisheries of the U.S., 2003. October 2004. p.49

[227] ASA, 2002. 1,382 jobs were generated in the marine recreational fishing industry. This is the most recent data available.

[228] NMFS, Fisheries Statistics Division, Silver Spring, MD. 2003 http://www.st.nmfs.gov/pls/webpls/MR_EFFORT_TIME_SERIES.RESULTS

[229] Ibid.

Island took in their attempts to catch a shark. It seems remarkable that only 70 sharks would be reported as being landed, 22 of which were landed during the two-day Snug Harbor Shark Tournament, and only 146 total as being caught, when almost 100 trips a day are taken to catch a shark by recreational anglers.[230] Even though most shark fishing occurs some 60 to 100 miles outside of state waters, fishing for sharks, or rather their capture, also takes place on the shore or from piers. In fact, in June 2004, an undersized juvenile sand tiger shark was caught by an angler fishing from the beach in Charlestown.[231] (See photo, Figure 31)

Fig. 31 – Protected Species Caught in State Waters

Westerly This WEEK

Westerly FISHING REPORT This WEEK

Courtesy of Capt'n Don Of Capt'n Don's Bait & Tackle Shop in Charlestown, RI

It's been an amazing week of fishing! First off, some credits are due: Charles Carlo age 9 caught a nice 8 lb., Tautog in Quonnie Breachway. Bridgett and Patrick McGrath age 12 & 13 caught keeper Bass to 15 lbs., on Tube & Worm at Quonnie. Bass every 30 inches at East Beach. Last but not least, two old-timers Frank Russel & Chris Florentino caught 53 Bass and 2 Blues in Quonnie, on the Tube & Worm one day this week.

Pictured above is Erick Feuerstein and the shark that he caught.

Erick Feuerstein caught this shark in the Surf on East Beach. Can anyone identify it? Fluking has been outstanding. Mario's Drift Rigs and Woody's lures have been making people Highliners.

Tautog are still hitting well off Charlestown Breachway and Quonnie. Scup are out in good numbers, but the bite is still a little slow.

[230] See Ch. 4. In the Oak Bluffs Monster Shark Tournament off of Martha's Vineyard, more than 2,500 sharks were caught in the two-day event in 2004. "Big Shark Contest set for Oak Bluffs." Vineyard Gazette. 7/15/05

[231] "The Fishing Report." Westerly This Week. 6/23/04. The article does not identify what shark is caught, however, unless the man is 9-ft. tall, the animal clearly looks to be an undersized juvenile, and it appears to be a sand tiger shark b/c its distinguishing characteristics include: first dorsal fin far back on body, closer to pelvic fins than to pectoral fins; first and second dorsal and anal fins nearly equal in size; snout flattened with long mouth extending behind eyes.

Sand tigers of course, are prohibited from being caught and are one of the most vulnerable species in the entire Atlantic. This example highlights the lack of species specific information that both recreational and commercial fishermen face when a shark is landed. The problem of accurate data collection is magnified by the popularity and profitability that shark fishing holds for the charter/headboat industry especially.

Rhode Island's charter/headboat service is a multimillion dollar industry within the recreational fishing sector and big game fishing remains an attractive draw. With 65% of charterboats believed to target sharks at least once, the "race to fish" extends far beyond the initial commercial analogy. If one assumes, as Fisher and Ditton do, that 5% of total charterboat trips represented shark fishing, than 3,018 charter/headboat fishing trips from Rhode Island targeted sharks in 2003. The average daily rate for a charterboat in Rhode Island is $917, so if the duration of these trips was between one and two days than annual revenues generated by charter/headboats targeting sharks was between $2.7 million to $5.5 million.[232] Revenues such as these divided evenly amongst the 133 charterboats with HMS permits in the state (only 17 of which advertise "shark fishing") yield annual earnings from $20,800 to $41,600.[233] The exact numbers of recreational fishermen targeting sharks is still unknown (HMS Angler Permits were just instituted in 2004), yet with more than 8,000 anglers targeting sharks at least once a year, the cumulative fishing effort expressed by the recreational fishing sector's take of sharks represents a significant source of mortality for the animals.

[232] Using these figures as an estimate, annual revenues for the charter/headboat industry in 2003 ranged between $55 million to $110 million.

[233] The earnings expectedly are much greater if divided evenly among the 17 advertised charterboats: between $163,800 to $325,600 annually.

Part 3:

Rhode Island Management and Jurisdiction

CHAPTER 5 – RHODE ISLAND'S JURISDICTION AND CONSERVATION MEASURES

The primary laws governing management of living marine resources were developed independently of each other and reflect differing management goals, ranging from maximum sustainable exploitation to preservation. The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act or MSA)[234] requires management of fisheries to conserve the resource to optimized yield. (This is in contrast to the Endangered Species Act (ESA)[235], which attempts to protect imperiled species and recover them from the brink of extinction, and the Marine Mammal Protection Act (MMPA)[236], which protects marine mammals that are in danger of extinction or depletion, but also controls the taking of healthy populations to keep them at optimum sustainable levels. With respect to marine life, all these laws are administered by the same agency – NOAA Fisheries, or the National Marine Fisheries Service (NMFS) in the Department of Commerce.)

The failures of the management regimes for numerous fisheries have been widely documented as have a number of causes, including: mismanagement by regional fisheries councils and NMFS; overexploitation of unregulated fisheries as fishermen have fished "down the food web," and; uncontrolled bycatch which can decimate populations of nontargeted stocks. One of the most well known management disasters is that of the New England groundfish fishery.[237] Stocks of cod, yellowtail flounder, and haddock

[234] 16 U.S.C. §§1801-1883 (2000).

[235] 16 U.S.C. §§1531-1544 (2000).

[236] 16 U.S.C. §§1361-1421h (2000).

[237] Shelley, Peter et al. 1996. The New England Fisheries Crisis: What have we learned?. 9 Tulane Envtl. Law Review 221. As stocks of cod, haddock, and yellowtail flounder collapsed between 1982 and 1994,

decreased about 85% after 1976, which severely affected the balance of the ecosystem, and as they did, unutilized and unregulated species, like the spiny dogfish, became dominant in the ecosystem.[238] Fishermen found markets for the spiny dogfish in England for fish and chips, and as depleted stocks and increased regulation limited groundfish catch, unregulated commercial fishing for spiny dogfish increased tenfold, and by 2000, the targeted female population had decreased by eighty percent.[239] At that point the fishery was in danger of collapse, but it was 2002 before an FMP was put in place to begin rebuilding the stock.[240] This phenomenon of "fishing down the food web" is a common practice as traditional fisheries become depleted. Although fishing down the food web has provided an economic "prop" for struggling fishermen, the practice further disrupts the ecosystem, making recovery of the traditionally fished stocks even more difficult to achieve.[241] (For more complete *Historical Overview*, including use of *Best Scientific Evidence and the Precautionary Approach*, and *Management to Prevent Overexploitation and to Restore Depleted Species* see Appendix 22).

General Powers of the State

Until reduced to a fortunate fisherman's possession, free-swimming fish within a sovereign's territorial waters remain public property. As Justice Marshall wrote in *Douglas v. Seacoast Products*, "It is pure fantasy to talk of 'owning' wild fish, birds, or

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the New England Regional FMC implemented conservative and generally ineffectual measures to "manage" the fisheries. By the time the SFA called for the end of overfishing and the rebuilding of overfished stocks, the biomass of some groundfish stocks had reached levels that could require more than a decade to rebuild.

[238] Ibid.

[239] Pew Oceans Commission. 2003. America's Living Oceans: Charting a course for sea change. http://www.pewoceans.org/oceans/downloads/oceans_report.pdf

[240] Ibid. note 9 at 38.

[241] Ibid. at 40.

animals. Neither the States nor the Federal Government, any more than a hopeful fisherman or hunter, has title to these creatures until they are reduced to possession by skillful capture."[242] As legal scholar Alexandra Renard notes, "the decision removed much of the confusion surrounding the 'ownership' rationale prevalent in earlier cases, which Justice Marshall characterized as 'no more than a 19th century legal fiction' expressing the 'importance to its people that a State have power to preserve and regulate the exploitation of an important resource.'"[243]

The state, often by constitutional mandate, shoulders the responsibility of preserving its resources for the benefit of all its citizens. Indeed, Rhode Island's own Legislative Findings declares that "the establishment of conservation policies should be pursued utilizing modern scientific techniques, having regard for the fluctuations of species populations, the effect of management practices on fish and wildlife, and the conservation and perpetuation of all species of fish and wildlife."[244] Some of this responsibility is legislatively delegated to the State Marine Fisheries Council and the Department of Environmental Management (DEM), which possesses the rule-making authority with respect to Rhode Island's marine life.[245] Rhode Island Statute § 20-1-2 states that the director of the DEM is "authorized to promulgate, adopt, and enforce any and rules and regulations deemed necessary" to "preserve and maintain" the natural

[242] 431 U.S. 265 (1977) at 284

[243] Renard, Alexandra M. Will Florida's new net ban sink or swim? Journal of Land Use and Environmental Law. 1996

[244] RI § 20-1-1

[245] RI § 20-1-2

resources of the state.[246] The Rhode Island Marine Fisheries Council serves in an advisory capacity "only to the state and agencies of the state regarding marine fisheries issues."[247] Additionally, Rhode Island's Freedom to Fish Act, while designed to insure continued access for fishermen, in fact states that "protecting fish, shellfish, crustaceans, essential marine habitats, and the right to fish in Rhode Island's marine waters must be managed together,"[248] and that "various management measures, including the closure of marine waters or portions thereof to fishing, can be utilized to manage marine fish…"[249]

State Regulations and their Promulgation

The appropriate alternative in employing the precautionary approach for rare, large predators, should be to prohibit their take/landings. However, the State is limited in prohibiting the landings of all sharks, because certain species are allowed for catch under the federally designed FMP (rather than by the arguably non-binding Fishery Management Councils). Rhode Island, apart from not having any shark-specific regulations, does not even reference the Federal regulations in its' State Regulations or in its abstract of Marine Fisheries Laws and Regulations.[250] Several states along the Atlantic coast do have specific regulations related to sharks, a number of which (NY, SC, FL, MS) also provide reference to the Federal regulations. (See Appendix 23 for full list of regulatory details by state.) Figure 32 displays those Atlantic states with and without

[246] RI § 20-1-2

[247] RI § 20-3-2

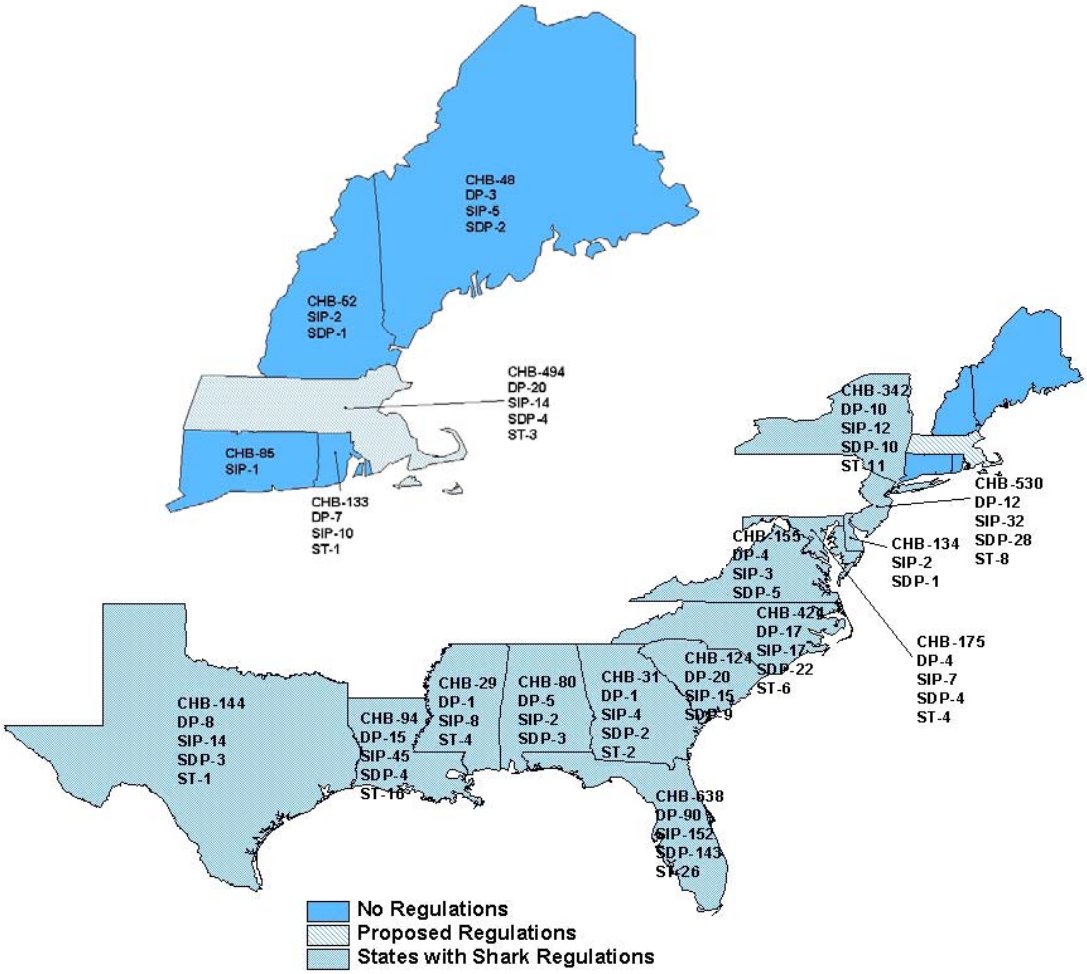
[248] RI § 20-3.2-2 (f)

[249] RI § 20-3.2-2 (g)

[250] 2004. Rhode Island Division of Marine Fisheries. Abstract of Fishing Regulations. http://www.dem.ri.gov/programs/bnatres/fishwild/pdf/saltabs.pdf (notwithstanding those for spiny dogfish.)

regulations as well as their respective number of recreational and commercial permits for HMS and sharks.

From 1996 to 1998, Maryland, Delaware, South Carolina, Virginia, and North



Carolina implemented relatively comprehensive shark fishing regulations, and Georgia has some regulations in the proposal stage.[251] Florida maintains the most progressive

[251] Camhi, M. 1999. Sharks on the line.

shark fishing regulations. Moreover, Florida implements more restrictive shark management measures in its waters than exist in federal waters, even for federally permitted commercial fishers.[252] Florida, North Carolina, and Maryland essentially have closed their state waters to commercial shark fishing.[253] Other states have taken their first steps: Alabama now closes its waters to shark fishing when federal waters are closed, and Mississippi prohibits the taking of five species and has minimum size regulations for anglers to protect juvenile sharks.[254] Notably, New York, Texas, Maine, Delaware, Florida, Maryland, North Carolina, South Carolina, and Virginia prohibit finning in their waters.[255] New England states generally lack shark fishery management except those for spiny dogfish.

With the exception of Massachusetts, none of the New England states currently have any shark-specific regulations, despite the fact that the region as a whole has 40 commercial vessels permitted to land sharks, over 800 charterboat vessels with HMS permits, and an untold number of private recreational anglers with HMS permits. (See Ch. 3 and 4). Massachusetts, which only has temporary legislation prohibiting the landing of great whites[256], has recently proposed making this a permanent ban along with two other species, the basking shark and the sand tiger shark, all of which are currently prohibited from being landed under Federal regulations. Massachusetts marine fisheries biologist Greg Skomal stated that the State's recent move to conform with federal shark

[252] Florida Rec. Fishing Regs. http://myfwc.com/marine/Regulations/SaltwaterRegsSummary_200401.pdf

[253] Ibid. North Carolina Recreational Fishing Regulations. http://www.ncdmf.net/recgide.htm; MD Recreational Fishing Regulations. http://www.amsa-sportfishermen.org/fishing_regulations.htm

[254] Camhi, M. 1999. Sharks on the Line.

[255] Ibid.

[256] MA 322 CMR Section 6.37. M.G.L. c. 130, §§ 2, 17A, 80, 100A and 104.

regulations was prompted by several factors including the presence of a great white off of the Nashuon Inlet on Cape Cod in late September 2004.[257] "To protect the shark at that time, the Director issued an emergency regulation."[258] Skomal also stated that, "in the absence of ASMFC regional management, it is not unusual for the state to adopt fisheries regulations that complement federal regulations."[259] The perceived need for regulations thus was borne out of both from the recent presence of a protected species as well as the lack of management from the Atlantic States Marine Fisheries Commission (ASMFC).

In Rhode Island, as is the case in Massachusetts, the Director of the Marine Fisheries Division has the power to issue emergency regulations and can act on its own to close a fishery once a quota has been exceeded.[260] However, any regulation executed in this fashion is temporary and expires in 90 days unless subsequent legislation is enacted or the Director promulgates the regulation. Maintaining the regulation or making one permanent requires the agency to set-up a public hearing[261] and the measure must be approved by the Rhode Island Marine Fisheries Council.[262] The Rhode Island Marine Fisheries Council, which serves as the advisory board for the DEM and the Division of Marine Fisheries, will also accept proposals from individuals or groups for regulations to

[257] Pers. Comm. with Greg Skomal, Marine Biologist, Massachusetts Marine Fisheries Division. 5/17/05

[258] Ibid.

[259] Ibid. Skomal also stated that, "The shark issue presents an unusual situation because the Atlantic States Marine Fisheries Commission, the east coast regional management body, has yet to address shark management. Once the ASMFC takes action, all the east coast states will be singing off the same song sheet. Such is the case for species like fluke, striped bass, and spiny dogfish. In the absence of ASMFC management, states like Virginia, Florida, and now Massachusetts have implemented measures that complement federal regs."

[260] RI § 20-1-5.1. Quotas are established for all fisheries other than HMS by the ASMFC.

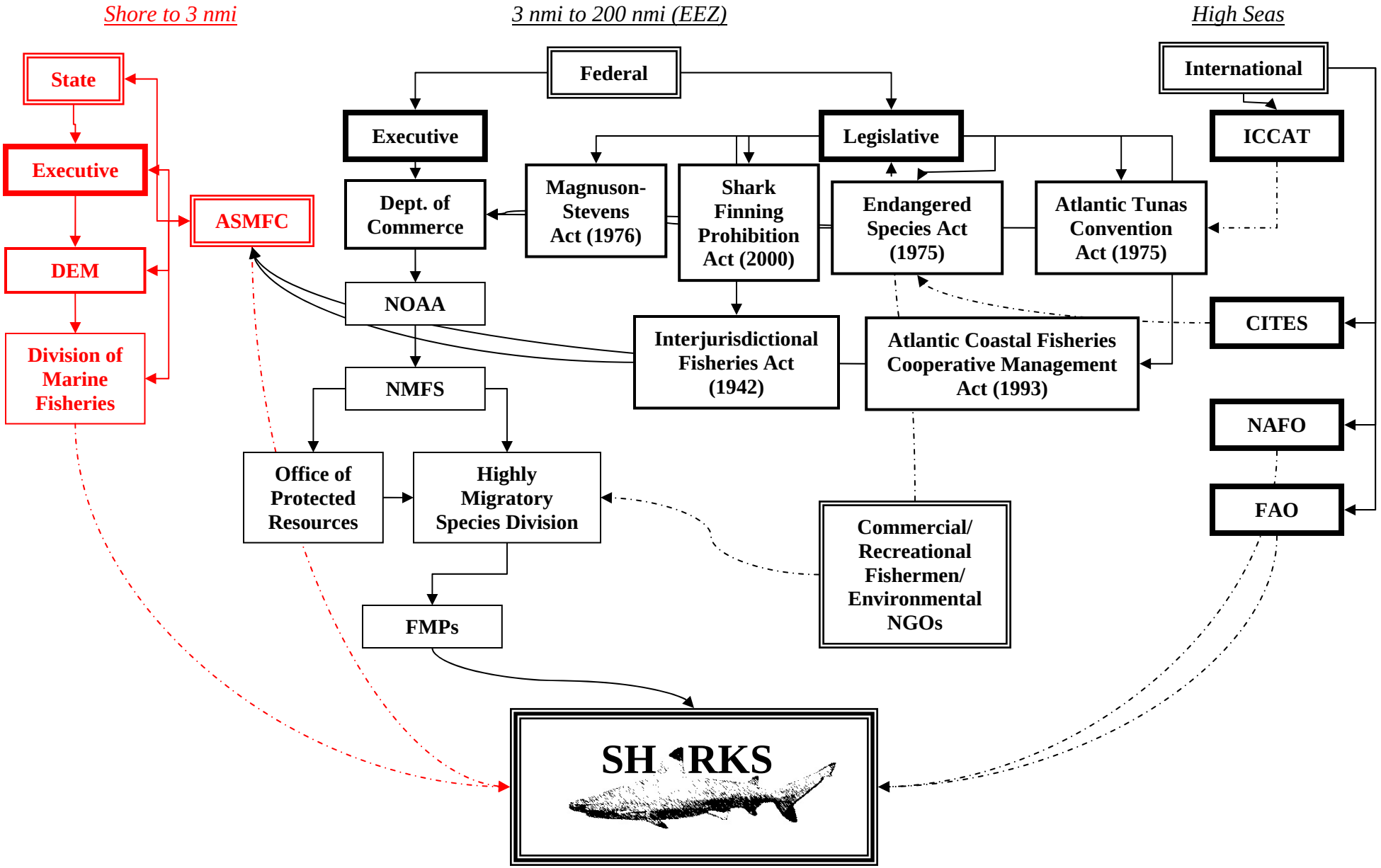
[261] Notice of 30 days is required.

[262] RI § 20-3-2

be made. If the Council disregards the proposal or refuses it, the individual may petition the DEM by gathering at least 25 signatures.[263] The Director of the DEM is then required to hold a public hearing for any proposed new regulations. (Again a Notice of Public Hearing is scheduled 30 days after a proposal has been submitted.) At the hearing, members of the DEM and the Marine Fisheries Council will convene to make a motion to either hold additional hearings, or to rule in favor or against the proposed recommendation/regulation. Almost all proposals, however, come from fishing interests, and rarely if ever originate from the general public. The problem of developing conservation-backed regulations by proposal, is perhaps then, a systemic problem in that there is a reluctance to antagonize commercial or recreational interests too aggressively, and it is these same interests that are most engaged.

The Director of the DEM, however, and not the Division of Marine Fisheries, has sole power, to promulgate regulations pursuant to state law. The Division of Marine Fisheries does, however, provide technical recommendations and advice to the Director and the Council. If the State, were to act to manage sharks, in a similar manner as Massachusetts, the RIDEM Division of Marine Fisheries would be the responsible agency for enforcing and monitoring any regulations within state waters and possibly over any vessels registered in the State. Figure 33 displays the political divisions governing the management of sharks across all boundaries for Rhode Island fishermen if the State were to act to regulate shark fishing.

[263] RI § 20-3-2. This is the threshold needed to bring a proposal for new regulations to the DEM


Shore to 3 nmi
3 nmi to 200 nmi (EEZ)
High Seas
State
Executive
DEM
Division of Marine Fisheries
ASMFC
Federal
Executive
Dept. of Commerce
NOAA
NMFS
Office of Protected Resources
Highly Migratory Species Division
FMPs
Legislative
Magnuson-Stevens Act (1976)
Shark Finning Prohibition Act (2000)
Endangered Species Act (1975)
Atlantic Tunas Convention Act (1975)
Interjurisdictional Fisheries Act (1942)
Atlantic Coastal Fisheries Cooperative Management Act (1993)
Commercial/ Recreational Fishermen/ Environmental NGOs
International
ICCAT
CITES
NAFO
FAO
SHARKS

U.S. participation in international management initiatives for sharks is guided by the Atlantic Tunas Convention Act which is used to implement ICCAT recommendations, and the Endangered Species Act, which is used to enforce CITES listings of species. The Magnuson-Stevens Fishery Conservation and Management Act delegates the responsibility for conservation and management of marine fisheries within the Exclusive Economic Zone (EEZ) to the Secretary of Commerce, who in turn, delegates that day-to-day responsibility to NMFS. Management of sharks is then carried out at the Federal level by NMFS through Fishery Management Plans (FMPs) by its' Highly Migratory Species (HMS) Division, which includes management of tuna, swordfish, and billfish, as well as sharks. Rhode Island retains jurisdiction over the management of sharks from the shore to 3 nmi, thus possessing the ability to regulate sharks within this boundary, as well as over vessels registered within the state. While the majority of sharks landed are caught some 60 to 100 nmi offshore in Federal waters, there is direct evidence of landings within state waters of some of the most vulnerable shark species. Furthermore, the U.S. National Plan of Action (NPOA) recommends that the Interstate Marine Fisheries Commissions and appropriate State agencies analyze the fisheries under their jurisdiction to determine if their elasmobranch catches are sustainable. To date, neither the Atlantic States Marine Fisheries Commission (ASMFC) nor Rhode Island (or any of the New England states) have done so.

Rhode Island and the ASMFC

The Atlantic States Marine Fisheries Commission (ASMFC) was formed by the 15 Atlantic coast states in 1942. The Commission serves as a deliberative body, coordinating the conservation and management of the states shared near shore (from the

shore to 3 nmi) fishery resources – marine, shell, and anadromous – for sustainable use. The Commission is currently responsible for managing 22 species, including large coastal sharks. Member states are Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, and Florida. Rhode Island's participation is implemented as part of the Interjurisdictional Fisheries Management Act and Rhode Island Statute §20-3-2. Each state is represented by three Commissioners: the director for the state's marine fisheries management agency, a state legislator, and an individual appointed by the governor. Commissioners participate in the deliberations in the Commission's five main policy arenas: interstate fisheries management, research and statistics, fisheries science, habitat conservation, and law enforcement. The ASMFC states that the one-state one-vote concept "allows Commissioners to address stakeholder-resource balance issues at the state level."[264] Rhode Island's current commissioners include: Mark Gibson (State Administrator – RI DEM); Everett A. Petronio, Jr. (Governor's Appointee) an attorney who is an avid recreational sport fishermen[265]; and Rep. Eileen Naughton (State Legislator), who boasts support for "an environment which preserves Narragansett Bay and Rhode Island's rich waters," but also supports "Rhode Island's seafood – fisheries and aquaculture – industry (which) has historically been at the core of our state economy."[266]

[264] ASMFC. www.asmfc.org

[265] Migliaccio, F. 8/3/02. "Two fishing events here this month." Block Island Times. http://www.blockislandtimes.com/News/2002/0803/News/034.html

[266] Eileen Naughton. Rhode Island House of Representatives, District 21, Warwick. http://www.eileennaughton.com/environment.asp. She also developed legislation in 2004 that would "create a special House commission to develop, promote and stimulate a comprehensive system of

Article III of the ASMFC compact allows for the Governor of each state to appoint 2 of the 3 positions, even possibly all 3.[267] The current membership of the ASMFC council is weighted most heavily in favor of commercial and recreational interests.[268] Potentially, then only one-third of the Council's make-up represents any conservation-minded interests. Furthermore, despite the presence of State representatives there is arguably limited representation from the public, especially in the form of independent NGO's, who might represent the interests of both the species' being managed and the wider public. There have been some real jurisdictional problems in the past with NMFS in attempting to negotiate agreements with foreign states because of ASMFC management undermining Federal goals, especially with spiny dogfish.[269] State-federal quota discrepancies also remain a problem. Quotas are often set at state jurisdictional boundaries, such as south of Rhode Island waters or south of Virginia/Maryland waters.[270]

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aquaculture and seafood commerce." H 8703. http://www.rilin.state.ri.us/billtext/billtext04/housetext04/h8703.htm

[267] http://www.asmfc.org/

[268] Ibid.

[269] Fordham, S. 8/29/02. Proceedings of the ASMFC spiny dogfish and coastal shark management board. http://www.asmfc.org/speciesDocuments/dogfish/minutesandmeetings/board/2002/aug02bdminutes.pdf#search='sonja%20fordham%20spiny%20dogfish%20canada%20asmfc' "NMFS attempted to negotiate with Canada to bring their growing dogfish fishery in line with scientific advice. A bilateral meeting was then set up. However, the U.S. government was put in a difficult and embarrassing situation at this meeting as they had to end their dogfish presentation with the news that the ASMFC commission had doubled the quota. The Canadian fishermen in the meeting reacted by requesting a comparable doubling of their quota, and the Canadian fishery managers told NGOs present that the United States had a real jurisdictional problem, and they were obviously hesitant to engage in joint management if plans could be undermined by the states."

[270] There does not seem to be a distinction made on how or where a species schools or remains at certain periods. The ASMFC sometimes sees a split in the perception of management benefits for southern states versus northern states, i.e. Massachusetts benefits at the expense of Virginia or North Carolina fishermen in the dogfish management proposals.

Despite past conflicts, in May 2005, the ASMFC received a letter from NMFS requesting the ASMFC to initiate the development of an interstate fishery management plan (FMP) for Atlantic coastal sharks.[271] ASMFC Fishery Management Plan Coordinator Ruth Christiansen stated, "From this letter, it was clear that NMFS believes coordinated state management is a vital step towards establishing healthy self-sustaining populations of Atlantic coastal sharks and that eliminating inconsistencies in shark management will address enforcement concerns and strengthen shark rebuilding efforts at the Federal and states' levels."[272] As a result in August 2005, the Spiny Dogfish and Coastal Shark Management Board of the ASMFC approved initiating the development of a coastal shark Fishery Management Plan (FMP) to complement current federal actions on coastal sharks.[273] Only two states voted against moving forward with the development of the FMP, Maryland and Rhode Island.[274]

RIDEM Fish and Wildlife Capacity

The August 2005 ASMFC meeting recognized that the Commission had previously indicated it would develop an interstate coastal shark FMP after the successful completion and adoption of the interstate FMP for spiny dogfish.[275] Rhode Island and Maryland, however, raised several concerns, including: splitting the Spiny Dogfish and Coastal Sharks Management Board into two separate management boards; Commission

[271] Pers. Corresp. 9/6/05. Ruth Christiansen. Fishery Management Plan Coordinator. ASMFC

[272] Ibid.

[273] Ibid. The ASMFC is currently in the preliminary stages of FMP development concentrating at the moment on assigning members for the new Technical Committee, Plan Development Team and Advisory Panel.

[274] Ibid.

[275] Ibid.

workload and priorities; rushing to implement a new FMP without full and careful consideration of all issues; potential partnership with and support from the NOAA Fisheries HMS Division; and fairness amongst states. Rhode Island Commissioner and RIDEM Fish and Wildlife administrator Mark Gibson, opposed the motion to establish a FMP for large coastal sharks because of the stated concerns as well as the perception that "coastal sharks will indeed compete with other managed species efforts and require Rhode Island participation if we expect to advance our fishery interests."[276] Gibson reiterated his fear that the proposal will drain resources away from the State and remarked that his vote was "purely pragmatic" and that allowing the states "to implement complementary measures to the evolving federal plan…is the most cost effective approach and will provide the necessary conservation."[277] Despite this vote, the RIDEM Division of Fish and Wildlife has stated that they will of course work with the ASMFC to achieve the development of a FMP and that "there was never any doubt about the need for management of these stocks…It was just a question of how to do it most effectively."[278]

The Division of Fish and Wildlife, tasked with the protection, restoration, and management of the fish and wildlife resources of the state, has a staff of 57 employees, including biologists, technicians, fish culturists, heavy equipment operators, and skilled workers.[279] The Division is responsible for setting seasons, size limits, methods of

[276] Pers. Corresp. 9/8/05. M. Gibson. Principal Marine Biologist. RIDEM Fish and Wildlife.

[277] Ibid.

[278] Ibid.

[279] RI DEM FY 2004-2007 Work Plan. Division of Fish and Wildlife. http://www.dem.ri.gov/pubs/plan2003/pdf/fishwild.pdf. The division also operates over 100 boat launching ramps and shore fishing areas located throughout the state.

taking, and daily limits for the harvest of all wildlife as well as all recreational and commercial fisheries in the state. Apart from managing the State's marine resources, the division is also responsible for operating and managing twenty-four wildlife management areas totaling over 47,000 acres.[280] The division is divided into three separate sections: Marine Fisheries, Freshwater Fisheries, and Wildlife. Each section is responsible for specific program activities.[281] These activities include fisheries and wildlife research, fish hatchery and fish stocking programs, habitat restoration, public access, land acquisition, education and information, public angling and hunting programs, and commercial fisheries management.[282]

In Fiscal Year 1999 (subsequent FY figures are not available but are similar to FY1999) the total division program costs were $5.45 million. [283] These costs were distributed among 35 separate accounts corresponding to individual projects. Approximately 90% of these costs were covered by dedicated resources including USFWS Sportfish Restoration Program (special federal excise taxes on fishing, hunting, and boating equipment), NMFS, and Rhode Island hunting and freshwater fishing license receipts.[284] The Division states that "these funding sources provide the foundation for a user-pay user-benefit relationship with the hunting, fishing, and boating public of Rhode Island. Limited funding, as authorized through a cooperative agreement under the Endangered Species Act, assists with recovery program for several species of flora and

[280] Ibid.

[281] Ibid.

[282] Ibid.

[283] RI DEM FY 2004-2007 Work Plan. Division of Fish and Wildlife. http://www.dem.ri.gov/pubs/plan2003/pdf/fishwild.pdf

[284] Ibid.

fauna, as well as monitoring programs for rare species, including reptiles and amphibians." The Division has identified five key objectives in attempting to execute its' mission: 1) maintain healthy and sustainable populations of fish and wildlife; 2) protect and restore habitat and promote biodiversity; 3) improve recreational fishing and hunting; 4) promote the fisheries and wildlife resources as a key element in Rhode Island's economy; and, 5) asset protection - improve Division facilities to increase program effectiveness.[285] The Division has also assessed trends and problems affecting each objective and has proposed a series of initiatives to address identified issues.

The majority of the proposed initiatives are aimed at promoting access, increased training for staff, and gathering further data[286] despite the State's own assessment that "marine fisheries are in flux with some stocks depleted and over fished while others have seen significant rebuilding… (and) several key fishery resources have either failed to recover or have undergone dramatic declines in recent years."[287] (See Appendix 24 for list of RIDEM Fish and Wildlife FY 2004 – 2007 Initiatives) Rhode Island's population of 1,076,164,[288] means that the cost per person annually for all Division programs, initiatives, and other expenses is about $5. Rhode Island's total budget for all state

[285] Ibid.

[286] Only 5 of the 20 proposed initiatives for Fish contain management proposals for essential fish habitat, marine surveys, or strengthening citizen's advisory panels. None deal with restricting access or limiting fishing. RI DEM FY 2004-2007 Work Plan. Division of Fish and Wildlife. http://www.dem.ri.gov/pubs/plan2003/pdf/fishwild.pdf

[287] Ibid.

[288] U.S. Census Bureau. 2004. Rhode Island Quick Facts. http://quickfacts.census.gov/qfd/states/44000.html

government services and programs is $6.35 billion.[289] This means that only 0.09% of the budget is allocated for Fish and Wildlife programs and initiatives, or less than one cent for every $100 that is spent goes to maintaining the health of the Ocean State's marine resources. Yet, if only an additional dollar per person were spent on the Division, an additional $1 million dollars would be available for the sustained use, enjoyment, and health of one of the state's most important assets.

Direct leadership from the executive branch in providing additional support and resources for the maintenance, health, and restoration of the state's marine resources, particularly with respect to the overextraction of marine resources or excess capacity in the fishing sector, is generally lacking. Furthermore, the current Governor's view to promote tax cuts, claiming it will entice business growth in the state, directly cuts into necessary funds for many of its services and undermines the social contract that the State has in protecting the public and its resources. While Governor Carcieri has taken efforts to address some marine issues[290] (most notably in coastal pollution), he has simultaneously proposed the expansion of tax cuts in the state,[291] which arguably prevents the Ocean State from adequately preserving, restoring, and managing its' marine resources. The Division of Marine Fisheries is limited in its ability to act, however, without significant executive and legislative support, so the scope of any proactive management rests upon direct action from the legislature. However, action on the part of

[289] FY 2006. Budget at a glance. http://www.rilin.state.ri.us/gen_assembly/HouseFinance/BudgetGlance.pdf

[290] The Governor encouraged the President's Committee on Ocean Policy to double the nation's current $650 million annual investment in ocean research and he has proposed the creation of a New England Ocean's Council to examine policies on ocean exploration and research and to coordinate plans to reduce coastal pollution. 9/1/05. http://www.turnto10.com/news/4926916/detail.html?rss=pro&psp=news

[291] 9/12/05. "Carcieri targets tax cuts with new research office. Providence Business News. http://www.pbn.com/contentmgr/showdetails.php/id/116685

the legislature is often constrained by special interests, particularly by both the recreational and commercial fishing sector when questions of fisheries management are debated and decided.

Economic interests always remain a high priority, and give an elevated platform to the industry doing the most harm to the resource. As a result, the opponents of attempts at restraint are often disproportionately represented at the expense of the species or ecosystem in question, and at the expense of future generations.[292] The state is thus often unwilling to act to take significant proactive precautionary steps in conservation without vocal public support, yet, in a catch-22, vocal public support is often difficult to mobilize in the absence of a crisis, or some other imminent threat to the viability of a species. Yet, the limited nature of our scientific understanding of sharks and their populations means that we may well be in a "crisis" situation before one can ever be shown scientifically that an ecological collapse or local extirpation is imminent. Indeed, the RIDEM Division of Fish and Wildlife has stated that:

> Resource scientists need training in facilitation that is increasingly required as stakeholders are more active in making environmental decisions. Co-management of resources with stakeholders engenders considerable disputes over the extent of recovery and the sustainability of expanded exploitation. In addition, staff is needed to coordinate volunteer information from recreational anglers that is an untapped source of information for stock assessment.[293]

"Stakeholders", more often than not, are the fishermen. In recent years, fishermen have dealt several setbacks to fisheries management proposals made by the state, including blocking a potential recreational license, lowering quotas on winter flounder and spiny

[292] The State has numerous fishing associations representing various recreational sportfishing, charterboat, and commercial sectors. http://www.sportsmansresource.com/flocalxrhodeisland.htm

[293] RI DEM FY 2004-2007 Work Plan. Division of Fish and Wildlife. http://www.dem.ri.gov/pubs/plan2003/pdf/fishwild.pdf

dogfish, as well as several other species.[294] The Division is thus often forced to play an unwelcome role as adversary to user-groups rather than as advocate for the marine resource.

[294] Pers. Corresp. 6/25/05. Jason McNamee. Principal Marine Biologist. RIDEM Division of Fish and Wildlife.

CHAPTER 6 – POLICY IMPLICATIONS AND CONSTITUTIONAL CHALLENGES:
Barriers, Obstacles and Directives

Given the potential for misuse, waste or eradication of a state's fisheries and wildlife, regulation by the state is critical. A state's regulatory power, however, is by no means absolute. Measures chosen by a state legislature when fostering socially, environmentally and economically-desirable goals are still governed by constitutional principles.[295] Not surprisingly, then, courts have entertained a host of constitutional assaults on fishery regulations: takings claims, equal protection challenges and alleged Commerce Clause violations are among the notable few.[296] Scarce commodities like sharks and other marine resources are not sufficiently abundant to survive unrestricted taking by all competing users. Consequently, part of fishery conservation necessarily implies a system of allocation among competing users. Allocation is often preferably accomplished by identifying who or what is responsible for the decline in fisheries (i.e., anglers, commercial fishermen, pollution, or coastal development), but the difficulty in assessing the causes and effects of the decline inevitably compels a no-fault approach toward fishery restoration and management.[297]

[295] RI § 20-1-1

[296] Individuals bringing fishery legislation under the judicial microscope have been largely unsuccessful when trying to invalidate such legislation on constitutional grounds. Courts consistently uphold fishery regulations, recognizing a state's superseding interest in protecting and preserving its dwindling supply of marine resources.

[297] Fishery regulations, often because of their perception among both commercial and recreational fishermen,, remain a prime target for equal protection claims.

Equal Protection Claims

Challenges grounded on the Fourteenth Amendment[298]of the United States Constitution proceed under the three-tier analysis established by the United States Supreme Court.[299] However, the status of fishermen and the rights they assert are not sufficient to warrant strict scrutiny under the "rational basis" test established by the Court. Legal scholar Jonathan Adler states that, "first, unlike recognized suspect classes, commercial fishermen have not experienced a 'history of purposeful unequal treatment,' nor have they been 'politically powerless as to command extraordinary protection from the majoritarian political process.'"[300] In fact, through persistent lobbying, organized fishermen associations have secured a very powerful voice in the political process. Second, the asserted right to earn a livelihood is merely an economic privilege that falls outside the company of fundamental rights which exact judicial scrutiny.[301] Accordingly, the next step where the courts begin their inquiry is review under the "rational basis" test.

The first question is whether a state has a legitimate objective in regulating its fishery resources, and whether the conservation, protection and preservation of its marine

[298] U.S. Const. amend. XIV, § 1, cl. 3

[299] Where legislation addresses a suspect class (i.e., those based on race, national origin or alienage) or interferes with a fundamental right (i.e., voting or exercising personal choices), strict scrutiny requires a compelling state interest, and the legislation must be narrowly tailored to serve that interest. Classifications based on gender or illegitimacy invoke an inter mediate level of review that will uphold legislation if it is fairly and substantially related to an important governmental interest. Finally, if the classification calls for neither strict nor immediate scrutiny, then review proceeds under the "rational basis" test, requiring the legitimate state interest to be rationally related to the legislation's enactment.

[300] Adler, Jonathan H. Legal Obstacles to Private Ordering in Marine Fisheries. Roger Williams University Law Review. Vol. 8, No. 1. Fall 2002

[301] Dandridge v. Williams, 397 U.S. 471 (1970) (the right to pursue employment opportunities is not sufficiently fundamental as to warrant strict scrutiny); Williamson v. Lee Optical, 348 U.S. 483 (1955) (the right to pursue a particular occupation is not fundamental for equal protection purposes); LaBauve v. Louisiana Wildlife & Fisheries Comm'n, 444 F. Supp. 1376 (E.D. La. 1978) (a fisherman's interest in the pursuit of livelihood is economic and is not fundamental within scope of the Equal Protection Clause.

life is such an objective? The answer is invariably yes. Courts have announced time and time again that a state does possess a legitimate interest in regulating its fisheries, and the protection and preservation of this valuable resource is an appropriate subject for legislative enactment.[302] "We consider the States' interests in conservation and protection of wild animals as legitimate local purposes similar to States' interests in protecting the health and safety of their citizens."[303] Commercial fishing practices today yield higher landings to meet increased market demands, so concerns as to the long term consequences of overfishing provide the catalyst for many fishery management schemes. The alarming pace at which shark populations have declined in the Northwest Atlantic illustrates the devouring effects of commercial overharvesting and recreational sport fishing. An added shortcoming of commercial practices is the incidental capture and bycatch of sharks and other unintended fish species and wildlife, such as sea turtles and dolphins. Despite claims by commercial fishermen that pelagic longlines, drift nets, and gill nets are highly selective gear able to precisely earmark specific species, the data and other empirical evidence suggests otherwise.

When a state announces its interest in guarding against the waste of bycatch and the exploitation of its marine resources, controversy may arise as to whether sufficient biological evidence exists to support conservation measures. Opponents may maintain that until comprehensive scientific studies are conducted legislation cannot be adequately

[302] New York State Trawlers Ass'n v. Jorling, 16 F.3d 1303 (2d Cir. 1994); Louisiana *ex rel.* Guste v. Verity, 853 F.2d 322 (5th Cir. 1988); Burns Harbor Fish Co. v. Ralston, 800 F. Supp. 722 (S.D. Ind. 1992); State v. Raffield, 515 So. 2d 283 (Fla. Dist. Ct. App. 1987), *approved*, 565 So. 2d 704 (Fla. 1990), *cert. denied*, 498 U.S. 1025 (1991); State v. Perkins, 436 So. 2d 150 (Fla. Dist. Ct. App. 1983); Fulford v. Graham, 418 So. 2d 1204 (Fla. Dist. Ct. App. 1982); Anthony v. Veatch, 220 P.2d 493 (Or. 1950); Morgan v. State, 470 S.W.2d 877 (Tex. Crim. App. 1971); Washington Kelpers Ass'n v. State, 502 P.2d 1170 (Wash. 1972), *cert. denied*, 411 U.S. 982 (1973); State v. Moses, 483 P.2d 832 (Wash. 1971), *cert. denied*, 406 U.S. 910 (1972)

[303] Hughes v. Oklahoma, 441 U.S. 322, 337 (1979)

designed to tackle the causes of endangered, threatened or overexploited fisheries. Collecting sufficient evidence to corroborate conservation efforts, however, is somewhat troublesome.[304] Notwithstanding the difficulties in securing reliable evidence, a state should not be required to sit idly by and watch the killing of its fisheries until there reaches a point where the state can unequivocally be concerned about fishery destruction. A state should be permitted to take preventive measures or a precautionary approach even before its natural resources appear threatened with extinction or before the state incurs substantial costs in maintaining or rehabilitating the resource.[305]

A government may not have marine preservation as its ultimate intention in enacting fishery regulations. As is the case with Rhode Island's Freedom to Fish Act, encouraging public and private recreation, other objectives may also include promoting tourism, enhancing the public welfare, or maximizing the economic benefits that states typically enjoy from both the sports fishing and commercial fishing industries. A state may be guided exclusively by economic policy and enact legislation that regulates its fish stocks in a manner yielding the greatest dollars for the state. Under an economically-driven model, the significance of marine resources is simply reduced to a cash value, and management and allocation of those resources are structured to favor the industry whose activities surrender the highest cash value. Where a law has as its sole underpinning an economic objective, the concern is that its enforcement inequitably favors one economic group to the detriment of a less resourceful economic group. Such economic favoritism, it

[304] State and federal marine research dollars are minimal and actual research operations require the support and cooperation from commercial net fishermen. Moreover, the accuracy of scientific evidence, particularly with respect to incidents of bycatch, is potentially skewed given the possibility that fishermen will alter their behavior when aware that their activities are being observed and recorded.

[305] Burns Harbor Fish Co. v. Ralston, 800 F. Supp. 722, 732 (S.D. Ind. 1992) (noting that even if the Indiana legislature relied upon erroneous information when enacting its gill net ban, this fact would not transform the legislature's otherwise rational decision into an irrational one).

is often argued, runs afoul of the constitution.[306] Congress has already announced its position on the issue of economic favoritism in the very language of the Magnuson-Stevens Act. The Act declares that "conservation and management measures shall, where practicable, promote efficiency in the utilization of fishery resources, *except that no such measure shall have economic allocation as its sole purpose.*"[307] If economic concerns are to be paramount, environmental concerns necessarily take a backseat. Under an economically-motivated policy, commercial fishermen are encouraged to maximize their intake of a state's fisheries in order to maximize economies to the state. They do so, however, at the expense of an environmental policy which urges the protection and conservation of those very same fisheries.

Deprivation of Property Rights

Restrictions on access to marine resources may also precipitate legal challenges from a property standpoint, the grievance being that such restrictions impermissibly interfere with the right to pursue an occupation and deflate property values in fishing boats, licenses and fish-snaring devices.[308] These "property" rights, it is argued are given protection by the Fifth Amendment, prohibiting governmental takings without just compensation, and by the Fourteenth Amendment, providing that no person shall be deprived of life, liberty or property without due process of law. However, as Adler

[306] Most recently, in New York State Trawlers Ass'n v. Jorling, 16 F.3d 1303 (2d Cir. 1994), a group of fishermen attacked a New York conservation law which altogether prohibited trawlers from taking, landing or possessing lobsters in state waters. The Trawlers Association argued that New York was constitutionally restrained from enacting legislation that simply promotes one economic interest or group over another, citing for support Department of Agriculture v. Moreno, 413 U.S. 528 (1973). The Second Circuit disagreed with the fishermen's reliance on *Moreno*, and instead recognized *Moreno* as standing for the proposition that "'a bare [legislative] desire to harm a politically unpopular group cannot constitute a legitimate governmental interest.'" 16 F.3d at 1310 (citations omitted). The record in *Jorling* made no indication that harming the trawler fishermen was the sole legislative purpose behind the amendment.

[307] 16 U.S.C. § 1851(a)(5)(1988)

[308] Burns Harbor Fish Co. v. Ralston, 800 F. Supp. 722 (S.D. Ind. 1992)

explains "the property interests afforded protections by the Takings Clause are not necessarily co-extensive with those protected by the Due Process Clause. As a result, courts entertain a dual inquiry into whether the asserted right is a protectible property interest—one for takings purposes and a second for purposes of due process."[309]

Certain restrictions have the undeniable effect of unraveling the small bundle of rights that commercial fishermen typically enjoy in their vessels, snaring devices and fishing licenses.[310] Fishermen can pursue alternative uses of the regulated property provided such uses are not censured by the state. Legal challenges under the Takings Clause typically pivot then not upon any actual confiscation of property but upon the drastic diminution of the property's economic value. Despite the financial hardships that may emerge from such regulations, economic restraints do not necessarily rise to an unconstitutional taking. In *Andrus v. Allard,* the United States Supreme Court noted that loss of future profits, absent any physical restriction, is a weak foundation upon which to rest a takings claim.[311] Moreover, anticipated gains are traditionally viewed as less compelling than other property-related interests.[312] The "bundle of rights" that fishermen possess is by no means impervious to state interference. Personal property, in particular (as opposed to land), has historically been subject to rigorous state control and regulations which strip all economically viable use of that property are not presumably

[309] Adler, J. p.22

[310] Many prohibitions, such as those banning certain gear types or nets, however, do not compel fishermen to actually relinquish their property to the state.

[311] 444 U.S. 51 (1979) at 66

[312] Ibid.

inharmonious with the Takings Clause.[313] The fisherman who purchases property to pursue a commercial livelihood necessarily assumes a risk that uses of his property may be abruptly restricted by a state exercising its legitimate police powers, as well as a risk that regulations enacted pursuant to that exercise may significantly diminish the worth of that property.[314] With society's growing concern for the environment, the risk is particularly high where use of the property, such as pelagic longlines or gillnets, poses significant environmental hazards.

In line with this "assumption of the risk" approach is that a fisherman securing a license to engage in certain activities in state owned waters does not thereby acquire "property" that is protectible under the Takings Clause. As the Eleventh Circuit Court illuminated in *Marine One, Inc. v. Manatee County,* "permits to perform activities on public land—whether the activity be building, grazing, prospecting, mining or traversing—are mere licenses whose revocation cannot rise to the level of a Fifth Amendment taking."[315] Individuals possess no proprietary right in free-swimming fish, nor do they possess an unfettered right to commercially harvest a state's waters for fish. However, a state may decide, pursuant to its inherent right to regulate its public resources, to grant individuals the licensed privilege of capturing fish, subject to such limitations as the state may legitimately exact.[316] Accordingly, any license for which the state has the power to "issue" is subject to the state's concomitant power to "revoke" or,

[313] Lucas v. South Carolina Coastal Council, 112 S.Ct. 2886, 2899 (1992)

[314] *Andrus*, 444 U.S. at 66-67

[315] 898 F.2d 1490, 1492-93 (11th Cir. 1990)

[316] Rhode Island Chapter 20-2 Licensing. §20-2-1

alternatively, to limit in a manner just short of wholesale prohibition.[317] When a state acts upon these powers, any economic losses the licensee may incur do not amount to a taking which requires just compensation; the losses simply illustrate the expectant costs of doing business in the community.[318]

Limitations of the Commerce Clause

As free-swimming fish migrate their way into the stream of commerce, state fishery regulations dictating how, when and where these fish may be accessed pose important considerations in the context of the Commerce Clause, Article I, Section 8 of the U.S. Constitution. The Constitution reminds the states, when enacting fishing legislation, to be cognizant of the constraints imposed on them by both the Supremacy and Commerce Clauses. A state cannot enforce local fishery restrictions which conflict with federal laws or which impermissibly burden interstate commerce. *Douglas v. Seacoast Products* emphasized that "the business of commercial fishing must be conducted by peripatetic entrepreneurs moving, like their quarry, without regard for state boundary lines."[319] Nevertheless, the limitations imposed by the Commerce Clause are by no means absolute; a state still retains some authority under its general police powers to regulate its fresh and saltwater boundaries in matters of legitimate local concern.[320] Socially, politically, and judicially, it is recognized that the environmental protection and

[317] Burns Harbor Fish Co. v. Ralston, 800 F. Supp. 728 (S.D. Ind. 1992)

[318] *Andrus*, 444 U.S. at 67; *Burns Harbor*, 800 F. Supp at 729

[319] 43 U.S. 285 (1977)

[320] Maine v. Taylor, 477 U.S. 131 (1986) (Maine's ban on importation of live baitfish did not violate Commerce Clause where ban served legitimate state interest in protecting indigenous fish population from parasites in out-of-state baitfish); *see also* Hughes v. Oklahoma, 441 U.S. 322, 337 (1979) ("We consider the States' interests in conservation and protection of wild animals as legitimate local purposes similar to the States' interests in protecting the health and safety of their citizens.")

conservation of our marine resources meets that concern. In part demonstrated in Hughes v. Oklahoma, fishery statutes that affirmatively discriminate against interstate transactions, either facially or in practical effect, exact high judicial scrutiny, i.e., they must serve a legitimate local purpose that cannot be equally served by other available nondiscriminatory means.[321] Conversely, statutes that only incidentally burden interstate transactions violate the Commerce Clause if the burdens they impose are "clearly excessive in relation to the putative local benefits."[322]

A number of discriminatory statutes have been adjudicated which detail and further define some of the powers entailed in the Commerce Clause. In 1948, the United States Supreme Court confronted a South Carolina statute which required owners of shrimp boats fishing in the state's maritime belt to dock at state ports and unload, pack and stamp their catch before transporting it to a fellow state.[323] In deciding the case of *Toomer v. Witsell*, the Supreme Court studied South Carolina's eagerness to stimulate employment and income within its own shrimp industry by diverting business which would have otherwise gone to neighboring states.[324] Sensitive to the familiar practice of economic protectionism—shielding instate economies from out-of-state competition—the Court struck down the statute as an impermissible burden on interstate commerce.

Another discriminatory state statute arose in the 1979 case of *Hughes v. Oklahoma*, in which the state of Oklahoma forbade the out-of-state transportation of its

[321] 441 U.S. 322 (1979)

[322] Pike v. Bruce Church, Inc., 397 U.S. 137, 142 (1970)

[323] Toomer v. Witsell, 334 U.S. 385 (1948)

[324] Ibid. at 403-4 Costs to foreign fishermen were materially increased by the requirement of having their shrimp unloaded and packed in South Carolina ports rather than at their home bases in Georgia where they maintained their own docking, warehousing and packing facilities.

natural minnows.[325] Oklahoma maintained that the statute served the legitimate local purpose of preserving the ecological balance of its waters that would otherwise be jeopardized by the removal of inordinate numbers of natural minnows for sale in other states. In response, the Supreme Court concluded that while Oklahoma's interest possibly qualified as a legitimate local purpose, the state nonetheless chose to "'conserve' its minnows in the way that most overtly discriminated against interstate commerce."[326] Oklahoma imposed no limits on the numbers of minnows which could be taken by licensed minnow dealers and similarly placed no limits on the means by which minnows could be disposed of within the state. In invalidating the statute, the *Hughes* court underscored the principle that "when a wild animal 'becomes an article of commerce . . . its use cannot be limited to the citizens of one State to the exclusion of citizens of another State.'"[327]

A few years later, the Supreme Court took a surprising turn in *Maine v. Taylor* when it declared as constitutional a Maine statute which prohibited the importation of live baitfish into the state.[328] The Court characterized the statute as restricting interstate trade "in the most direct manner possible."[329] In exacting the highest scrutiny, the Court held that Maine's ban on the importation of live baitfish served legitimate concerns given the potentially damaging effects that baitfish parasites would have on the state's population of wild fish. Additionally, the Court concluded that Maine's ecology concerns

[325] 441 U.S. 322 (1979)

[326] Ibid at 338

[327] Ibid at 339

[328] 477 U.S. 131 (1986)

[329] Ibid at 137

could not be adequately served by any available nondiscriminatory alternatives, particularly since screening procedures for baitfish parasites were largely unreliable.[330]

Most regulatory schemes aimed at preserving marine resources, however, are upheld as incidental burdens on interstate commerce. For example, conservation laws prohibiting trawlers from taking, landing or possessing lobsters, [331] forbidding the taking of food fish with the use of certain fishnets,[332] or banning the importation of undersized shrimp taken outside of territorial waters[333] have all been declared consistent with the Commerce Clause. Courts consistently have held that whatever incidental impacts such regulatory schemes may have on interstate transactions, they fall outside the purpose of, and are insufficient to invalidate, conservation laws. State fishery conservation and management plans (by their very name) steer for the protection of the aquatic ecosystem against the devouring effects of commercial fishing operations. Such plans do not profess to interfere with navigation; fishing vessels may, with considerable impunity, cross in and out of state waters. Nor does economic protectionism occur; conservation measures are evenhandedly directed and enforced against all fishermen, residents and nonresidents alike, who overexploit or otherwise destroy a state's precious fisheries. In conclusion, as Renard states, "the trend in affording states considerable latitude under the Commerce Clause reflects the judiciary's awareness of the dangers that may unfold if coastal waters

[330] Ibid at 151-2. In a dissenting opinion, Justice Stevens, noting "something fishy about this case," took issue over the finding that alternative nondiscriminatory procedures were unavailable. Maine was the only state flatly prohibiting imported baitfish; other states, sharing Maine's interest in the health of their fish and ecology, had developed far less restrictive procedures. Stevens remarked, in closing, that Maine had engaged in obvious discrimination against out-of-state commerce, and accordingly should have been put to its proof.

[331] New York State Trawlers Ass'n. v. Jorling, 16 F.3d 1303 (2d. Cir. 1994)

[332] Florida v. Raffield, 515 So. 2d 283 (Fla. Dist. Ct. App. 1987)

[333] Florida v. Millington, 377 So. 2d 685, 688 (Fla. 1979)

were to go wholly unregulated. Tying the hands of states in this respect would eventually lead to a total depletion of our fishery resources. Commerce would surely feel that effect."[334]

Pre-Emption and the Supremacy Clause

In addition to the Commerce Clause, attacks on fishery legislation frequently harkens to the pronouncements of the Supremacy Clause as well. Embodied in Article VI, clause 2, the Supremacy Clause states that the laws of the United States (including properly enacted federal regulations) are the supreme law of the land, and accordingly take precedence over state laws.[335] The Supremacy Clause is potentially a virile source for invalidating state restraints on fishing activities—particularly with the enactment of Magnuson-Stevens, which as a federal decree, preempts state fishery schemes. Again Renard explains that "pre-emption of state law by federal law can occur in several ways: when Congress expressly defines the extent to which it intends to preempt state law; when it evidences an intent to occupy an entire field of regulation; or when state and federal laws are in actual conflict. Actual conflict arises when it is impossible to comply with both federal and state law or similarly when state law impedes the accomplishment of congressional purposes."[336] Despite these guidelines, the issue of federal preemption in and outside of state territorial waters continues to generate considerable confusion.

States were at first reticent to relinquish authority for fisheries management because they historically had managed fisheries both within and outside state waters, because a significant proportion of fisheries resources occur within state waters, and

[334] Renard, A. 1996

[335] U.S. Const. art. VI, cl. 2

[336] Renard, A. at 15

because management decisions can have serious local economic and social impacts. The Magnuson-Stevens Act retained the jurisdiction of states to regulate fisheries within their state waters (state waters extend 3 nautical miles offshore), allowing for federal intervention only if the Secretary finds that state action or inaction with regard to a fishery within state waters will "substantially and adversely affect" and FMP covering a fishery that is predominantly within the EEZ, as is the case with sharks.[337]

States also continued to have jurisdiction over vessels "registered under the laws of such state," even in the EEZ beyond state waters.[338] Magnuson-Stevens prohibited the direct or indirect regulation in the EEZ by the state of a vessel not registered in that state[339], but the provision lacked important definitions and "left major questions about preemption and the continuing scope of state authority after Councils began developing and implementing FMPs."[340] The SFA amended the section, but it still left some major issues unresolved. Because the original provisions of the Act did not define the term "registered", states were left with apparent discretion concerning its meaning. Several courts have rejected the interpretation that the term refers to federal licensing and enrollment. In *People v. Weeren*, the Court stated that being "registered" was not limited to carrying U.S. documentation or state registration and identification, but included California permits for commercial swordfishing purposes.[341] Christie explains that "states have applied creative interpretations that substantially expanded the definition

[337] 16 U.S.C. §1856(b)

[338] Pub. L. No. 94-265, § 306(a), 90 Stat. 331, 335 (1976)

[339] Ibid.

[340] Christie, D. p.165

[341] 607 P.2d 1279, 1286 (Cal. 1980)

beyond citizens of the state and vessels which are home ported or principally used in that state."[342] What is considered perhaps the biggest problem with this result is that a vessel fishing in the EEZ might be concurrently "registered" under the definitions of several states with different, possibly conflicting, regulations. The SFA amended the section to provide:

> (3) A State may regulate a fishing vessel outside the boundaries of the State in the following circumstances:
> (A) The fishing vessel is registered under the laws of that State, and
> (i) there is no fishery management plan or other applicable Federal fishing regulations for the fishery in which the vessel is operating; or
> (ii) the State's laws and regulations are consistent with the fishery management plan and applicable Federal fishing regulations for the fishery in which the vessel is operating.[343]

Several commentators have noted that while Congress introduced language to define "registered", no definition was included in the SFA as enacted. Law Professor Jonathan Adler explains that, "the 1996 provisions attempted to address the question of when states would be preempted by federal fishery management plans from regulating registered vessels in the EEZ. The SFA continued to allow substantial confusion though by not entirely preempting state regulation when a federal plan and regulation were in place."[344] States can still regulate state-registered vessels if no federal FMP is in place or if their laws and regulations are "consistent" with "the fishery management plan and applicable Federal fishing regulations."[345] Further, the state can regulate other fishing

[342] Christie, D. p.165

[343] 16 U.S.C. §1856(a)(3)(A).

[344] Adler, J. H. 6/28/02. "Legal Obstacles to Private ordering in Marine Fisheries." Roger Williams University Law Review, Vol. 8, #1. 2002. p. 15

[345] 16 U.S.C. §1856(a)(3)(A)(i).

vessels beyond state waters if the Secretary delegates management to a state with laws and regulations consistent with the applicable federal FMP.[346]

In both cases however, Congress failed to define the term "consistent". Adler contends that "while it is clear that less restrictive regulation would not be consistent with the conservation regime of FMPs, it is not entirely clear that more restrictive state regulations are inconsistent."[347] Several courts have held that because the purposes of the Magnuson-Stevens Act include developing the fishing industry, state regulations that restrict fishing in the EEZ beyond the level allowed in federal FMPs are inconsistent. In *Southeastern Fisheries Association, Inc. v. Chiles*, the Court held that the state of Florida's daily landing limits for Spanish mackerel conflicts with the federal annual quota.[348] Furthermore, in *State v. Sterling*[349], the Court held that the state of Rhode Island's landing limits for yellowtail flounder restricting the allowable catch without regard to area of capture conflicts with the federal limit; and in *Vietnamese Fishermen Association of America v. CA Dept. of Fish & Game*[350], the Court issued a finding of conflict when state law prohibited the use of gillnets below a certain latitude and federal law permitted gill nets in the same area.

Some questions have arisen however, about whether state laws that prohibit landings of fish which can be legally harvested in the EEZ under the FMP are consistent. In *Southeastern Fisheries Association, Inc. v. Mosbacher*, for example, four out of five

[346] 16 U.S.C. §1856(a)(3)(B).

[347] Adler, J. p. 19

[348] 979 F.2d 1504, 1510 (11th Cir. 1992)

[349] 448 A.2d 785, 757 (R.I. 1982)

[350] 816 F. Supp. 1468, 1475 (N.D. Cal. 1993)

Gulf states prohibited or restricted landing of redfish even though the fish could be harvested in the Gulf of Mexico under the FMP.[351] Professor Adler states "the language in the original Act concerning 'no indirect regulation' in the EEZ of vessels not registered in the state called into question the use of landing laws, the most effective and efficient state enforcement mechanism. Although these laws operate indirectly to regulate vessels beyond state jurisdictions, courts have long held them to be both necessary for enforcement and constitutional."[352] In *Bayside Fish Flour Co. v. Gentry*, the U.S. Supreme Court upheld a California law that prohibited commercial use of sardines for animal feed, even if the sardines had been taken in international waters outside California, thus upholding the state act to the extent the act deals with fish brought into the state from outside state waters.[353] Most states made the issue moot, however, by defining "registered" for purposes of the Act to include vessels owned by parties who have landing or wholesale licenses.[354] The 1996 SFA removed the language concerning direct or indirect regulation and instead, included provisions where the state will have jurisdiction and authority to regulate vessels not registered in the state in the EEZ beyond state waters.[355] While the Act is the foundation for many shark regulations, NMFS and state governments are both needed to lead the shark conservation endeavor, and states may regulate their residents'

[351] 773 F. Supp. 435, 440 (D.D.C. 1991)

[352] Adler, J. p. 22

[353] 297 U.S. 422, 426-27 (1936)

[354] 16 U.S.C. §1856(a)(3)(B)

[355] 16 U.S.C. §1856(a)(3)(C) These include several specifically designated areas and instances in which the FMP for a fishery delegates management of the fishery to a state and the state's management plan is consistent with the FMP. However, the term "consistent" is still not defined.

shark fishing under the Act, even in the EEZ, in the absence of a conflict with Federal regulations.[356]

[356] Scoping Document for a Combined Environmental Impact Statement and Fishery Management Plan for the Fisheries for Highly Migratory Species of the West Coast, Pac. Fishery Management Council, Sept. 1999.

Part 4:

Conserving Sharks in Rhode Island

CHAPTER 7 – FINDINGS

Thesis Question:

What is the status of shark landings and cause of declines in Rhode Island? Given the trans-boundary migratory nature of sharks, swimming in and out of political jurisdictions and protection, how can the State of Rhode Island manage sharks to better protect or conserve them?

There are 39 species of sharks which are managed by the Federal government, of which 19, just under half, have either been so fully exploited or are either so locally rare that they are prohibited from being caught by fishermen. The declines in shark species, however, are growing, and several sharks which are still allowed for catch are now severely depleted. Federal assessments have determined that overfishing is occurring for pelagic sharks and large coastal sharks, and the entire large coastal shark complex has been determined to be overfished. Furthermore, independent assessments by the fisheries biologists Ransom Myers and Julia Baum, in 2004, documented declines of more than 50% for all species in the Northwest Atlantic Ocean in the past 15 years, with the exception of makos, which they determined had declined by approximately 39%. (See Ch. 2 for background) ICCAT assessments have recently determined, however, that makos are overfished, and overfishing is occurring. (See Ch. 2 for stock assessments)

Of the 39 federally managed species of sharks, eighteen transit or inhabit Rhode Island waters at some point. Three of these species, the mako, the thresher and the sandbar, are routinely landed and another five, the great white, the sand-tiger, the basking, the Atlantic angel, and the dusky are protected species under the Federal government's HMS regulations. Furthermore, fourteen of those species are considered to

be near threatened with extinction by the IUCN, and the remainder lack sufficient data for an assessment.

Commercial and recreational catches of sharks in federal waters (from 3 miles out to the boundary of the 200 nautical mile limit) are governed under the Magnuson-Stevens Fishery and Conservation Act and the resulting NMFS regulations in its' HMS FMP. The U.S. regulates the direct and indirect shark fishery via limited access permits, quotas, finning prohibitions, and other landing limits and species prohibitions. There are ten commercial vessels in the State which have incidental shark permits (allowing them to land 5,000 lbs. dw of shark), and there are no vessels with directed shark permits. 27 MT of shark were landed in 2002, the most for any state in New England, and the most landed in the State since records were kept in 1970. Despite the relatively low amount compared to recreational landings, bycatch from commercial fisheries remains a significant source of mortality for sharks. The total number of sharks discarded is still more than three times as many as those kept. Pelagic sharks represent far more of the discards and were more than the total number of pelagic sharks kept, large coastal sharks kept and large coastal sharks discarded combined. (See Ch. 3) Commercial shark landings for the state were almost negligible in terms of dollar value compared to all other fisheries in 2002, the year the greatest numbers of sharks were landed by that sector. Additionally, the value of sharks caught by commercial fishermen targeting HMS represents about 12% of their total revenues. Yet, for the commercial fishery in 2002, representing the most sharks landed in RI for that sector, about 1 shark for every 1,000 people in the state was killed, compared to the recreational high in 1993, when almost

7,000 sharks were landed, meaning that about 1 shark was killed for every 150 people in the state.

The recreational sector's take of sharks more recently represents less than three-thousandths of a percent of total fishery landings, even though landings of sharks in the past have surpassed commercial landings of sharks within the state. Indeed, recreational landings of sharks appear far more significant than the commercial fisheries in the State. Almost 32,000 recreational trips targeted sharks in 2003, or about 8,000 fishermen targeted sharks. This is represents virtually 90 trips a day that anglers leaving from Rhode Island took in their attempts to catch a shark. Additionally, approximately 3,018 charter/headboat fishing trips from Rhode Island targeted sharks in 2003. Most of the recreational fishing targeting sharks occurs from these charter/headboats or from private boats or rentals. There are 133 charter/headboats in the state which possess HMS permits which allow them to target sharks. Many of these charters and private/rental boats directly target pelagic sharks, particularly makos, threshers, and sometime blues. The demand for sportfishing opportunities to catch sharks has sustained one shark fishing tournament in the State, which is run out of Snug Harbor, and lands roughly 25 sharks annually (usually depending on weather conditions). While NMFS officials monitor the tournament, the NMFS Apex Predator Program has declined to release historic information on recreational landings of sharks at the Snug Harbor Shark Tournament, citing the data as the "property" of the parties hosting the tournaments.

Endangered and over-exploited sharks are not protected from commercial and recreational fishers in Rhode Island and Rhode Island fishermen are contributing to the decline in sharks and other apex predators. Rhode Island currently has no regulations in

place for sharks, other than those for spiny dogfish, despite the fact that both pelagic sharks and large coastal sharks were landed at a greater rate than any other state in New England in 2002. No other New England state has any regulations pertaining to the management of sharks with the exception of those for spiny dogfish, yet every other Atlantic state has some form of regulation for its' commercial and recreational shark fishery. Massachusetts is the first and only New England state to propose regulations to prohibit the landings of federally protected species. Rhode Island does have subject and geographic jurisdiction over the management of sharks from the shore to 3 nmi, thus possessing the ability to regulate sharks within this boundary, as well as over vessels registered within the state. RI Statute §20-1-4 allows the director of the DEM to manage and safeguard the marine resources within the State's jurisdiction and to "promulgate, adopt, and enforce any all rules and regulations" necessary to "preserve and maintain the beauty and mystery that wild animals bring to our environment."[357] While the majority of sharks landed are caught some 60 to 100 offshore in Federal waters, there is direct evidence of landings within state waters of some of the most vulnerable shark species. Furthermore, the lack of species specific data for what sharks are caught make biomass assessments incredibly difficult and thus complicate effective management.

The Ocean State has a prime opportunity to become engaged in affording protection to these vulnerable species through several means. The following chapter presents several recommendations, which include: having the State adopt federal regulations within it's jurisdictional waters; improving data collection, including catch report cards for all HMS fishermen, possession of species ID guide, workshops for HMS fishermen which discuss the importance of catch-and-release for the recreational sector as

[357] RI §20-1-1

well as the function and vulnerability of sharks in the ecosystem, transparency between State and Federal agencies and independent requests for data, and additional observer coverage on commercial vessels. More proactive measures which should be considered, but may be less likely to be adopted immediately because of opposition from both the commercial and recreational sectors, include: restricting the take of overfished sharks within state waters; a recreational shark license; and a bycatch quota and shark repellant technology to limit bycatch. Fishermen are often opposed to increased regulation, but may in fact be driven to act when shown that the resource has been severely depleted. Scientific data however, is not always enough to convince opponents of adopting a more conservative approach. Recent collapses, however, of several groundfish stocks in the Northwest Atlantic have highlighted both the reality that, locally, fish may be seriously overexploited and that there is a need for more restrictive control to ensure continued access to the resource for fishermen. Beyond the proposed recommendations for the State, the Federal government should also consider the broader development of Marine Protected Areas as well as market-based tools, including eco-labeling schemes which could assist and influence the purchasing habits of concerned citizens.

The threat to shark populations is part of an immense problem confronting world fisheries. Most seas have been fished to the limits of their productivity. Advances in fishing technologies, along with rising demands by a growing human population, have led to heightened efforts to catch sharks, in addition to most other fish. As a result, the stability of marine ecosystems is in serious danger, and it is incumbent on states, as well as the Federal government, to act to protect and restore the populations of these sea creatures.

CHAPTER 8 – RECOMMENDATIONS

Federal regulations in recent years have evolved to address some of the most pressing concerns of fishing for sharks. Management can be viewed as an assemblage of certain restrictions on fishing (minimum size limits, prohibited species, commercial quotas, etc.) as well as bestowing use rights for harvesting fish. Some of these are market proposals which include limited entry; quantitative input rights (effort rights), gear regulations, and a suite of other tools detailed earlier in Chapter 2. These regulations and use rights, while dramatically limiting the take of sharks since their inception by Federal FMPs in 1993 and 1997, have not stemmed the overfishing of most species and indeed have allowed for continued fishing despite a paucity of data, and the devastating effects of bycatch continue to be an enormous source of mortality posing an undeniable and untenable threat to sharks.

Rhode Island is limited in its response because of legal restrictions preventing the State from issuing regulations where the Federal government has already ruled. The state, as explained in Chapter 5, is legally prevented from prohibiting the catch or landing of all sharks or mandating their release, because the Federal government has ruled on the issue in its HMS FMP.[358] While such proposals may in the future come about, NMFS is currently the only entity able to alter such regulations. Despite the State's limited jurisdiction and pre-existing Federal regulations, as well as the relative size of the shark fishery in the region, Rhode Island can, however, take several actions to prevent sharks from disappearing in the North Atlantic and insure their continued presence for future generations.

[358] This is considered "inconsistent" under section 3(a)(ii) of the Sustainable Fisheries Amendments to Magnuson-Stevens. 1996

RHODE ISLAND – State Recommendations

Non-Market

I. Restrict Take in State Waters

Beyond attempting to reduce bycatch, perhaps one of the most proactive and precautionary steps the State could take to restore depleted shark stocks would be to prohibit the catch or take of sharks that are overfished or where overfishing is occurring within its' own territorial waters. This act of conservation and preservation should be informed or based on the precedent set by the Marine Mammal Protection Act (MMPA), which is perhaps the paradigmatic regulation for the preservation of a group of living marine resources. The preservationist philosophy of the Act is reflected in several ways, including MMPA management principles that focus on the health of the populations, rather than yield, and the Act's fundamental approach of establishing a "moratorium" on the taking of all marine mammals in U.S. waters and by U.S. citizens on the high seas. (This moratorium, however, does contain a waiver provision, an exemption for Alaskan Natives, and a number of other exceptions.)[359] The starting point for MMPA protection is a moratorium on the taking and importation of marine mammals and marine mammal products based on the concept of optimum sustainable population (OSP).[360]

The Marine Mammal Protection Act (MMPA) defines OSP as "the number of animals which will result in the maximum productivity of the population or the species,

[359] 16 U.S.C §1371 (b). The exemption from the moratorium for takings by Native Alaskans is allowed if the taking is for subsistence purposes or creating native crafts, and is not accomplished in a wasteful manner.

[360] 16 U.S.C §1371(a) "The term 'take' means to harass, hunt, capture, or kill…or to attempt to engage in any such conduct."

keeping in mind the carrying capacity of the habitat and the health of the ecosystem of which they form a constituent element."[361] NMFS regulations define OSP as:

> Optimum sustainable population is a population size which falls within a range from the population level of a given species or stock which is the largest supportable within the ecosystem to the population level that results in maximum net productivity. Maximum net productivity is the greatest net annual increment in population numbers or biomass resulting from additions to the population due to reproduction and/or growth less losses due to natural mortality.[362]

OSP does not base management on the optimum utilization of marine mammals. Rather the "take" or "yield" of marine mammals is relevant in establishing the circumstances in which any incidental depletion of the resource will be allowed, and not in the context of harvesting a resource. Sharks therefore, would no longer be seen as product waiting to get to market, or as "trash fish" needing disposal. Additionally, the potential biological removal (PBR) is the concept developed to establish the limits of such depletion. PBR is defined generally in the MMPA as the "maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain is (OSP)."[363] Actual calculation of PBR, however, has been difficult to determine and is often controversial.[364] If a population is below OSP or the species is listed as endangered or threatened under the

[361] 16 U.S.C. §1362(9) 2000.

[362] 50 C.F.R. §216.3. 2003

[363] 16 U.S.C. §1362(20) 2000.

[364] Bean, M.J. et al. The evolution of national wildlife law 114. 1997 Some critics find the current definition ambiguous in attempting to factor in both the maximization of a particular population in the ecosystem. Additionally, NMFS has been criticized as inconsistent with the legislative intent in that it favors maximizing population over health of the ecosystem. Others speculate that the lower limit of OSP is nothing more than MSY. Finally, the variable nature of populations in marine ecosystems contributes to the difficulty of determining the OSP of any given population.

ESA, a stock is classified as "depleted."[365] A finding that a stock is depleted has significant consequences. The moratorium generally cannot be waived, nor can a permit be granted, to take or import a depleted species or stock, except for the limited purposes of scientific research, photography, or enhancing the survival or recovery of a species or stock.[366]

The MMPA along with the Endangered Species Act are perhaps the two most progressive pieces of legislation which reconceive how we interact and use living marine resources. The animals are no longer seen as commodities waiting to be exploited, but rather as valuable species deserving of protection. As such, Rhode Island should adopt the goals established in the MMPA to reduce "to insignificant levels approaching a zero mortality and serious injury rate," [367] the incidental take or bycatch of sharks that have been recognized as overfished or where overfishing is occurring, based on OSP, within its' own territorial waters to improve the species' likelihood of survival and recovery in the wild. While the majority of sharks are caught outside of state waters, and enforcement would be difficult[368] because sharks could still be landed in the State per Federal regulations, this would send a clear signal that the Ocean State is committed to the preservation of its living marine resources.

Furthermore, in recent years the growing popularity of recreational shark fishing has also coincided with an increase in the numbers of anglers who choose to release their

[365] 16 U.S.C. §1362(1)(A) 2000.

[366] Ibid. §1371(a)(3) Native taking of a depleted species or stock may also be restricted.

[367] 16 U.S.C. § 1387.

[368] A fisherman could claim the shark was caught outside state waters.

catches often after tagging them.[369] The value of recreational fishing to local communities may be huge considering the costs to fishers of food, accommodation, bait, tackle, charter/headboat, etc. Therefore, the value of an individual shark in a recreational fishery even where harvest is practiced is several-fold greater than its value in a commercial fishery. Catch and release hence provides even greater value because individuals may be caught multiple times by several anglers, and even with some post-release mortality[370] catch and release fishing clearly contributes to the sustainability of the shark stocks, and if fishermen are involved in the surveying of stocks then they may respect the scientific process.

II. Incorporate Federal Standards by Reference

The RI DEM should incorporate Federal HMS regulations regarding sharks by reference in its Marine Fisheries Rules and Regulations. One of the easiest and most important steps that the State can make, without promulgating any new regulations, is the adoption of the Federal regulations via reference in their own Marine Regulations. Regulations are adopted pursuant to Chapters 42-17.1, 42-17.6, 20-4 through 20-10, and sections 20-1-2, 20-1-4, and 20-3-2 through 20-3-6, in accordance with Chapter 42-35 of the Rhode Island General Laws of 1956, as amended.[371] Rhode Island should amend Part XI – Commercial Fisheries (would become regulation 11.21), and Part VII – Minimum Sizes of Fish/Shellfish (would become regulation 7.20) to incorporate via reference

[369] Casey, J.G. and N. Kohler. 1992. Tagging studies on the Shortfin mako shark in the western North Atlantic. Aust. J. Mar. Freshwater. Res. 43:45-60

[370] Skomal, G. and B. Chase. 1996. Release mortality studies in Massachusetts. Shark News (Newsletter of the IUCN Shark Specialist Group) 7:8-9 Post-release survivorship may be increased through the use of circle hooks, and care in handling the animals when landing and releasing.

[371] RI-DEM. Division of Fish and Wildlife. Marine Fisheries Statutes and Regulations. http://www.dem.ri.gov/pubs/regs/regs/fishwild/rimftoc.htm

Federal regulations regarding sharks (50 CFR part 635).[372] This would ensure that there is no confusion as to what laws apply in fishing for sharks. The incorporation of Federal regulations into the State Marine Regulations, moreover, is important, regardless of whether sharks are landed in state waters or not, because their absence allows for anglers to potentially poach without penalty. While the Federal laws apply regardless of their publication, notice does prevent an argument of negligence on the part of a fisherman if, for example, an undersized shark or protected species (dusky or sand tiger) is caught. Anglers could no longer claim ignorance of the law (even though this holds no legal weight) and official State recognition of the shark's vulnerability within the Atlantic is an important first step in raising awareness. This is a much needed initial step to protect some of the more vulnerable species, such as the sand tiger and the dusky shark, which are prohibited from being caught, but which have been shown to have been landed in state waters in the past year alone.

III. Data Collection

A. Catch Report Cards (CRC)to Monitor the Status of Shark Distribution and Abundance in RI waters

Rhode Island Senior Fisheries Biologist Mark Gibson, in a report directed to the DEM, recently stated that the State's current funding and staffing requirements are inadequate to achieve even minimum management standards, especially because the management of living marine resources is a data-intensive activity.[373] One of the central problems for fisheries science is counting fish – one cannot see how many fish there are

[372] The new rules/regulations could simply state: *Rhode Island incorporates Federal rules and regulations pertaining to Small Coastal Sharks, Large Coastal Sharks, and Pelagic Sharks pursuant to 50 CFR part 635.*

[373] Gibson, M. RI Div. of Marine Fisheries. 2003. Future Needs of the Marine Program. http://www.state.ri.us/dem/topics/mftopics.htm

in the sea. The entire basis of monitoring the changing status of sharks and other marine resources is intimately linked to certain basic data gathering programs. Statistical models used to calculate MSY are based on landings data, but the data is inevitably limited and even the landings' data is almost always incomplete. Furthermore, there is a serious lack of species specific data with respect to what sharks are landed in both the commercial and recreational sector, but especially in the recreational sector. Complicated telephone call-in systems and sophisticated electronic dockside reporting by dealers has proven to yield fairly little information on the composition of the catch. The State of Rhode Island, in assessing the future needs of its' own marine program, has stated that, "although staff members do a very commendable job with limited financial and personnel commitments, continued management and monitoring of our fisheries resources in the face of increasingly stringent management practices demands additional data to permit more precise analysis. Given the importance of the marine environment to the state, creative ways must be found to finance an expansion of certain fundamental programs."[374] Given that a large percentage of staff time is devoted to stock assessment and participation in the fisheries regulatory process at both the state and federal level, the Division has stated a need to provide data to support management decisions and to demonstrate changes which occur in the health of the stocks.[375]

In attempting to deal with its own inefficiencies in estimating the recreational catch of several species[376], the State of Washington has devised a rather simple, cost

[374] Ibid.

[375] Ibid.

[376] Washington's CRC are used for salmon, sturgeon, steelhead, halibut, and Dungeness crab.

efficient and effective method for estimating its' recreational harvest.[377] The system known as the Catch Report Card (CRC) is used to track the more vulnerable fisheries.[378] Catch estimates generated by the CRC system are then used to manage fisheries and to "provide the greatest recreational opportunities while preserving the resource for future generations."[379] The cards are provided free with the purchase of a license and must be used by recreational fishers to report each fish caught, the type of fish caught, the location of the catch, the length of the fish, and what type of vessel was used to catch the fish. The cards are submitted annually to the Department of Fish and Wildlife each April 30.

Rhode Island could borrow this model and use it to more accurately track the landings of sharks and all HMS caught by both recreational and commercial fishermen. Essentially the State should require Catch Report Cards for all HMS permit holders. While Vessel Trip Reports (VTRs) or logbooks are used by some commercial fishermen with HMS permits, their use is not mandatory and is governed by random selection.[380] The CRC system would require all fishermen, both commercial and recreational, to provide the same information requested in the Washington CRC, identifying the species caught, length, location of the catch as well as what gear type was used. (See Appendix 25 for proposed legislation detailing the Catch Report Card Rule.) Additionally, catch-and-release information for recreational anglers and discard or bycatch data for

[377] WAC 220-56-175. Catch record cards. http://www.leg.wa.gov/wac/index.cfm?fuseaction=section&section=220-56-175.

[378] The system was first implemented to estimate sport steelhead harvest in the late 1940's. Salmon was added in 1964; sturgeon was added in 1988; and halibut in 1990.

[379] http://www.wdfw.wa.gov/com/lic_proposals/catch_record.htm "Fish and Wildlife Commission" Catch Record Card Reform.

[380] NMFS. 2005 HMS SAFE Report.

commercial fishermen with the same information would also be required, although length data would thus not be required. Commercial fishermen could aggregate the total number of a species caught and discarded on each trip and would not be required to keep length data. Charterboat operators would be responsible for tracking any catch or release of species by individuals fishing. The cards would then be submitted annually by the fishermen to the Division of Marine Fisheries at a specific date, preferably before the beginning of the Federal Shark Season, June 1st. Annual data could then be compiled to more accurately assess what and how many of a species are caught, as well as discarded, and then a composite of that information could be forwarded to the Federal NMFS HMS Data and Statistics Division.

In Washington, the expense of collecting and processing these cards is split between two accounts.[381] Their Department of Fish and Wildlife's general fund supports 60% of the total expense and their Fish Program carries the other 40%.[382] Rhode Island, however, because it does not have a recreational license or a separate commercial license could cover the marginal cost of the cards by charging a one-time fee to all HMS permit holders. The fee could also be modeled after the charge for duplicate fees of a CRC in Washington which is $10. The funds received from the sale of catch record cards must then be deposited into the State Wildlife Fund or into a separate HMS Fund, and could then be used for running the CRC system, as well as sampling, monitoring, and managing the catch associated with HMS fisheries, both recreational and commercial.

B. NMFS Species Identification Guide

[381] Pers. Comm. w/Frank J. Hawley, Manager License Division. WA Dept. of Fish and Wildlife. 7/1/05

[382] Ibid.

Many fishermen's stated lack of familiarity with some of the species that they land also needs to be addressed for a CRC program to be successful and for more accurate assessments of a species' relative health and abundance. To assist with the identification of species, the State should require all HMS permit holders to purchase the NOAA Fisheries and Rhode Island SeaGrant HMS species identification guide.[383] The Guide, a 7" x 9" color-photo flipbook, provides a clear and concise analysis of the distinguishing characteristics of all 39 shark species managed in the Atlantic Ocean, as well as a complete list of the tunas, swordfish, and billfish that are managed under the HMS FMP. HMS permit holders would be required to pay the $25 cost of the guide, and the funds received from the sale, as with the CRC, must then be deposited into the State Wildlife Fund and could then be used for the management of HMS fisheries.

C. HMS Workshop

The HMS ID guides and the CRC could be made available for distribution and collection at an annual workshop which could be jointly hosted by the State Division of Marine Fisheries, the NMFS Apex Predator Program located in Narragansett, and the Rhode Island SeaGrant. The workshop would be an opportunity for managers to assist fishermen in the identification process, aid in the collection of information and could serve as an opportunity to teach techniques and the benefits of catch-and-release, gear type modifications for limiting bycatch, and the vulnerability of large marine predators. Additionally, a workshop could serve as a constructive venue for Federal and State managers and fishermen to interact in an attempt to understand the fish first and would be a forum for open communication and dialogue between those who manage and those

[383] Kohler, N. et al. 2004. A Guide to Tunas, Sharks, Swordfish, and Billfish of the Atlantic. HMS and Rhode Island SeaGrant.

being managed. URI's Coastal Institute in Narragansett could serve as an appropriate space for the workshop, although if the workshop were held just prior to the deadline for CRC submissions in late May or early June, outdoor space at the Division of Marine Fisheries in Jamestown, might also offer a comfortable and relaxed environment for the exchange of information. The workshop would be mandatory for all HMS permit holders in the State and could also be an important regional event for HMS permit holders throughout New England. A fee of $20 to $30 could be imposed on participants and would be in addition to the CRC fee and the cost of the HMS Guide. Again all funds would then be deposited into the State Wildlife Fund and/or a separate fund for the management of HMS fisheries.

D. Observer Coverage

Observer coverage is an incredibly effective and necessary tool in monitoring the take of living marine resources. The abundant bycatch and discarding of sharks makes the need all the more apparent in attempting to quantify the waste that occurs on commercial vessels, particularly amongst the pelagic longline fleet. Trained observers are needed to ride aboard commercial fishing vessels to observe fishing practices, estimate discarded catch, and to take biological samples. Presently, observer coverage on pelagic longlines in the Atlantic Ocean ranges from between 2.5% to >5% of commercial vessels depending on the resources available.[384] The longline fleet consists of 250 to 300 vessels with 150 to 200 vessels active all year, with between six to fifteen observers on

[384] NOAA Fisheries. Office of Science and Technology. National Observer Program. Pelagic Longline Observer Program. http://www.st.nmfs.gov/st4/nop/regions/pelagic_longline.html

those vessels at different times.[385] NMFS has a goal of five percent coverage by set effort as its sampling target.[386]

Rhode Island has expressed an acute need to develop a sea sampling program in state waters similar to that now required by law in federal waters,[387] and observer coverage could be seen as both a complement to a CRC system as well as an independent monitoring system necessary to verify the catch and discards on commercial vessels. With between ten to twenty commercial vessels registered in the State operating longlines, one additional observer would meet both state and Federal goals. Rhode Island has called for two additional fishery technicians in its own assessments for observer coverage, and has listed the budget requirements for the personnel at $80,000/annually.[388] Budget requirements for one additional technician dedicated solely to observing the pelagic longline vessels operating from the state would be approximately $40,000/annually. Funds to pay for the observer coverage could be split by both the revenues from the CRC system and from the commercial vessels themselves, so that each commercial vessel would contribute $2,000/annually for the right to continue pelagic longline fishing.

E. Transparency

Transparency and access to data collected by public agencies is also key to allowing scientists, fisheries managers, and the public an opportunity to independently evaluate and assess both the management and the science. Records of shark tournament

[385] Ibid.

[386] Ibid. The sampling fraction has varied from 1992 to 1998 from 2.5% to >5%, depending on available resources.

[387] RI Future Needs.

[388] Ibid.

landings kept by NMFS are not disclosed[389], bycatch data from commercial vessels may be obtained only after a lengthy process of bureaucratic requests[390], and observer reports are often confidential and rarely published[391], so the lack of transparency makes any assessment by the public difficult. The Society of Environmental Journalists recently released a report, which shows that government compliance with FOIA has worsened considerably since the Sept. 11 terrorist attacks.[392] The reporters surveyed, all members of the journalism trade group, reported significant delays – some up to a year – before receiving the information they requested under FOIA.[393] Many reported that the information was of poor or incomplete quality, with paragraphs or entire pages blacked out, and they reported difficulty monitoring the status of their requests and delays due to waffling over fees.[394] Ideally the data, particularly the Snug Harbor Shark Tournament data, should be made available to anyone in the public, but at the least, NMFS should share data that it has gathered with the State. This can only enhance the level of information that is disseminated in forming assessments and keeping track of stocks.

[389] I was denied the ability to review the Snug Harbor Tournament data both by NMFS (the Apex Predator Program) as well as by the tournament operator (Al Conti).

[390] Pers. Conv. A. Van Atten. 5/13/05. NMFS Northeast Center.

[391] Ibid.

[392] Society of Environmental Journalists. FOIA Tip Sheet. http://www.sej.org/foia/index7.htm

[393] Ibid.

[394] Ibid.

Market

IV. Shark Conservation Stamp

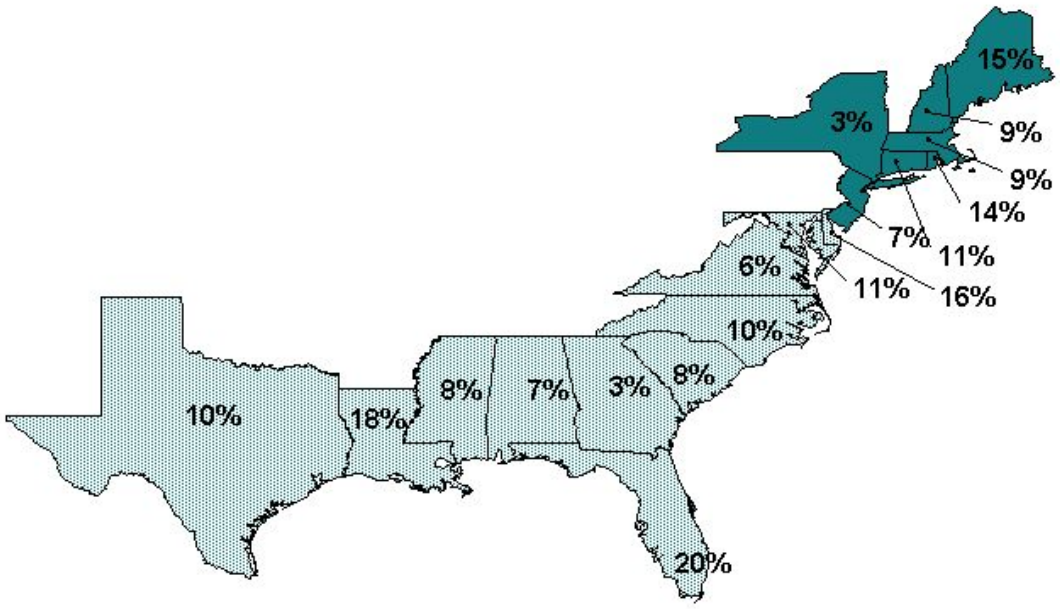
Recreational anglers who fish for sharks in Rhode Island, however, are still partially responsible for the depletion of shark populations and should bear their requisite burden of paying for the privilege of targeting that resource through a license. Rhode Island, the Ocean State, however, is one of ten coastal states in the entire U.S., without a requirement for any type of recreational saltwater license. Of the eighteen coastal Atlantic states, eleven have a recreational saltwater license. The fees vary from $33.50 annually for a resident in Virginia[395] to $4 annually in Mississippi[396], and in all states non-resident fees are greater than resident fees. Freshwater anglers in Rhode Island are required to purchase a license as well as an additional conservation stamp to fish for trout, and commercial vessels in the state are required to purchase a license.[397] Figure 34 shows those states with recreational saltwater licenses (in shaded green), those without (in green), as well as the percentage of each state's population that identifies itself as a recreational angler.

[395] VA Saltwater Recreational Fishing License. http://www.mrc.state.va.us/mrc_license_boundaries.htm

[396] MS Fishing License. https://www.ms.gov/gf/hunting/index.jsp

[397] RI § 20-11-1, RI § 20-2-40, and RI § 20-2.1, respectively.

Fig. 34 – Atlantic States With Recreational Licenses (shaded) and Without (in green), and Percent of Population Identified as Recreational Angler



Furthermore, figure 34 shows that all the coastal states from Texas to Delaware require saltwater recreational licenses, while, the Northeast, representing roughly one quarter of the Atlantic coastline, does not. While RI's percentage of fisherman in the state ranks 5th overall in Atlantic states, the three states with the largest percentages (FL, LA, and DE) all have recreational saltwater licenses. Because the recreational sector is so

large in the state, there would be undoubtedly be some opposition to the idea, yet every other Atlantic state outside of New England has some form of recreational license fee. In 2001, Rhode Island's DEM as well as URI's Coastal Institute established an intergovernmental panel to evaluate the prospects for a marine recreational fishing license among other options.[398] Many recreational anglers, many of whom were from out of state, opposed the idea because of the historical freedom they have enjoyed without having to pay.[399] Of the State's 400,000 estimated anglers, more than 63% are from out-of-state.[400] With such an overwhelming majority attempting to dictate the direction the State takes on recreational license issues, the proposal undoubtedly becomes contentious. However, surveys conducted by the Federal government have shown and quantified a willingness to pay for Atlantic shark by recreational anglers.

The most recent data NMFS has regarding the *willingness to pay* to fish for Atlantic sharks caught recreationally, comes from a 1994 survey of anglers in New England and the Mid-Atlantic.[401] The data collected was used to estimate expenditures and economic value of the various groups of recreational fisheries in this area. One category of fishing, dubbed "Big Game" consisted primarily of HMS, including sharks, billfish, and tunas. Overall *average willingness to pay* (WTP) for a one-day fishing trip

[398] Borden, D. Et al. Intergovernmental Working Group on the RI Marine Fisheries Modernization Act. 2001. http://www.ci.uri.edu/rifish/Recreational_Licensing

[399] Pers. Comm. w/C. Powell. RI Div. of Marine Fisheries. 6/10/05

[400] NMFS. Fisheries of the U.S., 2003. Oct. 2004. There are 253,000 out-of-state anglers and 147,000 in-state anglers taking an estimated total of 1,595,000 angler trips.

[401] Hicks, R., et al. 1999. Volume II: The economic value of New England and mid-Atlantic sportfishing in 1994. NOAA Technical Memorandum NOAA Fisheries –F/SPO-38.

ranged from a low of less than a dollar in New Hampshire to a high of $42 in Virginia.[402] The highest average value was attributed to big game fish, ranging from $5 to $7 per trip (about $5.40 on average), in addition to the value of the trip.[403] Additionally, researchers Fisher and Ditton, in their economic characterization of the recreational shark fishery, found that anglers were willing to pay an additional $105 per trip rather than stop fishing for sharks, and those anglers spent an average of $197 per trip.[404] Fisher and Ditton also found that 32% of shark anglers said that no other species would be an acceptable substitute for sharks.[405]

If one assumes that each angler takes about four trips annually (see previous Chapter), and the average range of $5 to $7 per trip for "big game" fishing is used, than a cost of $20 to $28 could be imposed as a fee for a recreational license to fish for sharks.[406] The fee would also increase for out-of-state anglers, and could represent the higher end of the range. A separate fee could also be imposed on charter/headboats which target sharks, rather than requiring each individual fisherman on one to possess a license. This would conform to the data collection recommendations for the charter/headboats associated with the catch report cards, and would prevent confusion as

[402] Ibid. The study found that aggregate WTP (average WTP times the number of trips) ranged from $18,000 in New Hampshire to nearly $1 million in Virginia.

[403] Ibid. Using model results, it was possible to estimate the WTP for a one fish increase in the expected catch rate across all sites in the choice set. The marginal value of an increase in catch per trip was highest for big game fish, and lowest for bottom fish.

[404] Fisher and Ditton. 1992. A social and economic characterization of the U.S. Gulf of Mexico recreational shark fishery. Marine Fisheries Review 55(3): pp. 21-27. The 1994 survey results also indicated that boat fees were responsible for the greatest percentage of expenditures. Roughly 70% and 53% of total expenditures went for private/rental boats and charter/party boats, respectively. Travel expenses were the smallest portion of expenditures, although travel costs for those fishing on party/charter vessels were about twice as high as for those fishing on private/rental boats ($28 vs. $16).

[405] Ibid.

[406] Using the full range ($1 to $42), fees could be between $4 to $168.

to who is required to possess a license when fishing from a charter/headboat. Again, if one assumes that the 133 charter/headboats in the state with HMS permits took an estimated 3,000 trips annually (See previous chapter), then the range of fees for a charter/headboat shark license would be between $112 and $158 annually. With an estimated 32,000 angler trips taken annually by roughly 8,000 recreational fishermen to target sharks, some 5,000 of whom may be from out-of-state, revenues would be between $175,000 and $245,000. The funds would be deposited in the State Wildlife Fund and could also be used to establish a separate HMS Management Fund. (See Appendix 26 for Legislation detailing Shark Conservation Stamp.)

V. Shark Deterrent

In the North Atlantic, perhaps the most profound threat to sharks comes from incidental and regulatory bycatch from commercial vessels. Bycatch increases the uncertainty concerning fishing-related mortality and consequently increases the difficulty of assessment and regulation, and of achieving goals related to preventing overfishing and rebuilding stocks. Because bycatch is by definition random and discarded, determining the level and kinds of bycatch is difficult. This uncertainty makes it difficult to determine optimum yield or when total mortality in a fishery (as opposed to only landings) has surpassed optimum or sustainable yield and is contributing to overfishing. Mortality of juvenile fish as bycatch also creates serious uncertainties in projecting the growth and recovery of fish stocks.[407] The goal of commercial fishermen documenting their bycatch and discards in a catch report card system is one manner in which the waste of bycatch may be better understood. In addition to this, however, there are promising

[407] NMFS. 1998. Managing the Nation's bycatch.

new technologies which may actually deter sharks from going after bait and prevent needless bycatch.

An existing device, called the Shark Shield[408], is a small battery-operated device fitted to a board which has metallic electrodes built into the sides and a shorter antenna. The electrodes emit a strong electrical pulse four or five meters into the water, which is picked up by receptors in the shark's snout.[409] Once detected by the sharks' sensors, the field causes muscular spasms that result in the shark being deterred from the area.[410] Apart from this however, the technology is not known to affect any other marine life, and it has no known harmful effects on the shark. The *Shark Shield Mariner*© unit can be used by trawlers as well as longliners. The manufacturer claims that by attaching several units to the upper side of a trawl net opening (depending on the opening size), commercial fishermen "should reduce or eliminate shark bycatch" and for pelagic longlining, "a series of protective zones needs to be established in the ocean by attaching several units to a drop line at appropriate intervals."[411] A handful of commercial fishing trawlers in the Gulf of Carpentaria and off Western Australia's Pilbara coast have begun dangling Shark Shields off the back of their boats to stop sharks being caught as bycatch

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[408] *Shark Shield*©: manufactured by Sea Change Technology. http://www.sharkshield.com/index.php

[409] The *Shark Shield*© generates an electrical field that is detected by the shark through its sensory receptors, known as the Ampullae of Lorenzini, found on the snouts of many sharks. The field is projected from the unit by two electrodes, which create an elliptical field that surrounds the user. Both electrodes must be immersed in the water for the field to be created.

[410] *Shark Shield*©. http://www.sharkshield.com/index.php. Field testing involves attracting sharks using blood and offal, under stringently controlled conditions. The unit is turned on and placed into the water with fish bait attached, to attract the shark. The shark's behavior is then observed and recorded as it investigates the food source. The testing conducted to date proves conclusively that sharks detest the effect the field has on them, and will keep a safe distance between themselves and the Shark Shield. Natal Sharks Board test program. South Africa. 1995. Shark Shield has recently gained credibility by being issued with a NATO stock number. This involved a testing regime by the Australian military.

[411] Ibid.

in their nets.[412] Thus far, none of the prawn trawlers employing the electronic repellant have captured any sawfish and the number of sharks caught as bycatch has decreased significantly.[413] The cost of one unit of the Shark Shield Mariner is $955.00.[414]

Commercial fishermen with HMS permits should be encouraged to trial the device as a way to reduce the unnecessary bycatch of sharks. Because the device is so new on the market and relatively unproven, mandating its use is more difficult to justify. However, an incentive system could be employed, whereby the fees associated with the expense of paying for observer coverage are offset by the purchase of a Shark Shield unit, up to $1,000. In this way, the experimental use of the device would be encouraged without unnecessarily requiring commercial vessels to pay for a relatively unknown commodity. The potential to vastly reduce bycatch, however, should not be understated, and should the devices prove to be effective at significantly lowering the amount of bycatch of sharks, their mandatory acquisition by commercial vessels should be considered.

NMFS should also consider revising its' quotas to reflect the amount of discarded bycatch and should require all catch to be landed. In this way, a bycatch quota would be the standard which a fishery must meet and must close after a designated quota of bycatch has been met. Additionally, in both the commercial and the recreational sector, Legal maximum sizes should be used to avoid recruitment overfishing. The maximum size limit protects larger fish in such a way that those caught at or above stated size must be released. This is potentially useful for those species of sharks where the proportion of

[412] Laurie, V. "Device saves humans ... and sharks" MATP. The Australian. November 13, 2004
[413] Ibid. Exact data/figures were not available though.

[414] *Shark Shield*©. http://www.sharkshield.com/index.php. There are U.S. distributors in San Diego, CA.

the females in breeding condition each year increases with size and fecundity increases with maternal size. Where reproductive rates increase with size, the contribution to recruitment is likely to be much higher for large animals than for small animals. Hence, there can be stock benefits in releasing large animals alive.[415]

Table 20 displays a brief summary of the recommendations for the State, while Table 21 is a breakdown of the estimated costs and revenues associated with the various programs.

Table 20 – Rhode Island Recommendations Summary

	Direct	**Indirect**
Non-Market	Regulation (*Oblige, Prohibit*) • Prohibit catch/take in State waters • Reference Fed. Regulations in State Regulations. • Catch Report Cards • Observer Coverage • Transparency/Data Sharing	Knowledge (*Inform, Implore*) • NOAA species guide for all HMS permit holders • Workshops with Apex Predator Program for all HMS permit holders
Market	Trade (*Make, Buy*) • Experimental use of shark deterrent, Shark Shield, for commercial vessels to limit bycatch of sharks	Transfer (*Tax, Subsidize*) • Shark conservation stamp/license for recreational anglers

[415] Walker, Terence I. 2004. "Management Measures." Elasmobranch Fisheries Management Techniques. APEC Fisheries Working Group. p. 315 A legal maximum size is likely to be of higher value for females than for male. Additionally, there is usually a strong correlation between mercury concentrations in shark meat and size of shark.

Table 21 – Rhode Island Recommendations: Cost and Revenue

Annual Commercial Revenues from Sharks (10 Vessels)	Annual Charter Boat Revenues from Sharks (133 Vessels)	Program	Annual Program Cost	Annual Program Revenues
>$30,000 or >$3,000/vessel from sharks ~$225,325 or ~$22,500/vessel from all HMS	$2.7 - $5.5 million total $20,000 - $40,000 individual	CRC - $10 annually	Minimal	$1,500 - $3,000
		NOAA ID Guide - $25	$0	$3,750 - $7,500
		HMS Workshop - $20 - $30 annually	Minimal ~ $5,000 - $10,000 (personnel, advertising/mailings, venue, etc.)	$3,000 - $9,000
		Observer Coverage - $2,000 annually	$40,000	$20,000
		Shark Conservation Stamp - $20 - $28 per angler, $112 - $158 per charter	Minimal	$175,000 - $245,000
		Shark Deterrent - $955 per unit	Incentives would offset up to half the annual fees required for observer coverage.	$0

NGO and FEDERAL/NMFS Recommendations

Rhode Island, of the 22 U.S. coastal states, is the smallest and its ability to significantly prevent the declines in shark populations caused by overharvesting, bycatch, and recreational fishing is limited. Given the transboundary nature of many of the protected species, the ability of Rhode Island to protect and conserve sharks is always going to be dependent on the management and policies of other bodies, including those outside of the jurisdiction of U.S. management. There is a wealth of ideas and proposals which the Federal government and NGOs should consider in attempting to more successfully prevent the precipitous declines seen in shark populations, two of which, eco-labeling and marine protected areas, could be pivotal in the successful stewardship of sharks and all living marine resources . These following recommendations, primarily aimed at NMFS and NGOs working with the conservation of marine resources, are less defined, but nevertheless, represent tools, which, if further developed and adopted, would aid in the conservation and preservation of sharks.

I. NGOs like The Ocean Conservancy, Oceana, SeaWeb should promote ECO-LABELLING

One of the increasingly popular tactics employed by some NGOs has been the development of eco-labels on goods to aid a growing, conscientious consumer movement demanding more information. U.S. NGOs have often used boycotts, rather than eco-labels, as a method of resolving and/or reducing fishing pressures.[416] Product certification and eco-labeling, however, can be applied as a means to both provide consumers information and aid in support of fisheries management. Product certification is a measure mandated by governments to ensure that only legally harvested and reported

[416] SeaWeb and the NRDC organized a successful boycott of Atlantic swordfish, the National Environmental Trust organized a campaign to “Take a Pass on Chilean Sea Bass”.

landings can be traded and sold on domestic and international markets. Where there are problems regulating access, such as on the high seas, product certification schemes provide a means of reducing illegal, unreported, and unregulated fishing. While, eco-labeling programs can create market-based incentives for better management of fisheries by creating consumer demand for seafood products from well-managed stocks by tapping the growing public demand for environmentally preferable products.[417]

Tuna, for example, whether caught on a line or in a net, are a huge problem for the bycatch of vulnerable shark, turtle, and mammalian species in addition to the viability of the tuna stock itself. Current labeling, such as dolphin-friendly tuna, belies the environmental impact these fishing practices may have. Why not shark-friendly tuna, or tuna-friendly tuna (so that it is caught in a sustainable way)? The American consumer has limited influence over the Asian long-line fleets, and the increasing bait-boats and illegal long-liners, but they can influence the purse-seine fleets through the canneries in the Indian, Pacific and Atlantic oceans by eating different fish until the canners come up with answers about what they are doing about the bycatch and the purse-seine fishery in general.

Two of the most prominent eco-labels, distributed by Eco-Fish[418] and the Marine Stewardship Council (MSC)[419], give an independent certification of sustainability to fisheries, thus giving the consumer the power to choose fish from well-managed stocks.

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[417] Wessells, C. et al. 2001. Product certification and ecolabelling for fisheries sustainability. FAO Fisheries Technical Paper 422. FAO, Rome. Criteria used for the accreditation process are a compromise between the demands of consumers and the capabilities and willingness of the producers to meet those demands.

[418] Eco-Fish. http://ecofish.org

[419] Marine Stewardship Council. http://msc.org

The MSC label is generally accepted as the most rigorous among competing labels.[420] MSC certification is based on three principles, and a fishery needs to score 80% or more under each of the following principles: 1) A fishery must be conducted in a manner that does not lead to overfishing or depletion of the exploited populations, and for those populations that are depleted must be conducted in a way that demonstrably leads to their recovery. 2) Fishing operations should allow for the maintenance of the structure, productivity, function and diversity of the ecosystem (including the habitat and associated dependant ecologically related species) on which the fishery depends. 3) The fishery is subject to an effective management system that respects local, national and international laws and standards, and incorporates institutional and operational frameworks that require use of the resource to be responsible and sustainable.[421] Only eight stocks worldwide carry the label though a number have petitioned for assessment.[422] Those who have achieved certification have been seen to benefit financially. New Zealand hoki, for example, increased its sales in Europe 13-fold following certification.[423] Even if all the fish awaiting certification do get certified, though, only 4% of the world's fish supplies would then be certified as sustainably managed.[424]

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[420] Clover, C. 2004

[421] MSC. http://www.msc.org

[422] Ibid. Western Australian rock lobster; Thames herring; Alaskan salmon; New Zealand hoki; Burry Inlet cockles; southwest UK hand-lined mackerel; Loch Torridon nephrops (also known as scampi or langoustines); and the, South Georgia toothfish (sea bass). Several other fisheries are undergoing assessment, including Alaskan Pollock, the largest fishery for human consumption in the world, with catches of 2 million tons a year.

[423] Clover, C. 2004. p. 176

[424] Ibid. p. 182

The U.S. FDA is currently convening a panel to discuss the establishment of consistent standards for the application of "organic" labels on food products.[425] A similar effort should be convened to discuss how to set benchmarks based on consistent standards as well. A simple eco-labeling scheme could be implemented prior to the establishment of sustainable fishing standards by requiring that fish sold be labeled with its commercial name (i.e. tuna would have to be labeled as skipjack, bluefin, yellowtail, etc.), whether the species was caught or farmed, and the area where it was caught, to be provided at retail sale. This then, at the very least, would provide concerned and informed customers a basis for determining what products are least harmful without requiring much effort from industry at all. Indeed, several NGOs[426] provide seafood guidelines detailing what species are the "best choices" and which species consumers should use "caution" when purchasing, or "avoid" altogether, that have grown in publication and distribution in the past five years.

Competition between unsustainable supplies and sustainable ones is exactly what the MSC was supposed to create, and a legal, sustainably managed fishery, provided its fish can be clearly identified by a 'chain of custody', should in time squeeze out illegal supplies in major markets at least. Eco-labeling is therefore less of a blunt instrument than a boycott.[427] A lack of curiosity about how fish are caught and whether there are enough of them to justify eating them seems endemic, certainly amongst most restaurants, as well as amongst retailers. At the very least, it must be said that some

[425] National Organic Program. Proposed rule. http://www.ams.usda.gov/nop/indexIE.htm

[426] Environmental Defense, Audubon, Sierra Club, and the Monterey Bay Aquarium all provide seafood guides with similar criteria for sustainability and guidelines for consumers.

[427] Of course what matters is that the fishery is well run, well policed and that the stock is discrete, i.e. not part of a wider stock that is being poached.

obvious opportunities to inform customers about the effect fisheries are having on the world and to shape the path of sustainable consumption are being missed. Any civilized society concerned for future generations must pay attention to sustainability and attempt to favor the 'right' fish, namely, those caught without causing them, or any other species, irrevocable harm. To choose fish caught less wastefully, the consumer is going to need much more information. Additionally, the whole seafood industry – the sellers, the buyers in supermarkets and processing firms as well as the fishermen – bear responsibility for what has been going on in the sea whether or not they are aware of it. Given the scale of illegal catches, it is virtually impossible for anyone to say they have not, inadvertently, bought, sold, or eaten, illegally caught fish. Eco-labeling then, is one way consumers may face up to the numbers of great white sharks, manta rays, as well as whales and endangered turtles that are killed to produce the tuna, swordfish, and other more commercially valuable species that are eaten.

II. MPAs

Many of the management solutions are controversial and complicated, and will always be vulnerable to an over-generous assessment of the stocks. One solution that is controversial with fishermen, which is both simple and totally effective, is preventing fish from being exposed to any kind of fishing gear at all. Marine protected areas (MPAs) or marine reserves, with specific areas of no-take zones, are a key component in protecting against overharvesting and in rebuilding of all fish stocks, including sharks. One of the main advantages of reserves is that they enable people to look below the waves and see fish as wild animals, not just as fillets or food. Additionally, there appears to be growing

evidence that there is the potential for exporting larvae to supplement and replenish the sea elsewhere, thus benefiting fisheries, if only enough large reserves are created.

Whether reserves would help fisheries, however, is not the point. There should be areas of the sea where nature is observed, studied, and appreciated in the absence of human transformation. The reality is that the discussion of sustainable fisheries occurs in the absence of really knowing at what level the ecosystem should be sustained. Marine biologist Bill Ballantine of Auckland University Marine Laboratory states that, "one possibility is that you are merely sustaining the wreckage. It could be twice as good, or ten times as good. Without reserves, the check is not possible."[428] He goes on to state that, "we're still assuming that you have one management plan for the whole sea. There is no biological, economic or social theory that supports this. At no time did anyone say it is a good idea to let everybody fish everywhere. People talk about fishermen being 'stakeholders' in the sea, but that ignores the fact that fishermen may be foreclosing all sorts of options for future generations."[429] Fishermen like to think they own the sea – especially when they have been given or sold property rights to exploit a sustainable proportion of the stocks. But the answer is that everyone and no one owns the sea. If there is an owner of a common resource in a democracy, it is the people. Citizens have, until now, had few ways of exercising any influence over what happens in the sea. The voice of the citizen is seldom heard over the voices of the 'user groups' – commercial fishermen, sport fishermen, fishing associations and lobbyists – and establishment fisheries scientists, another interest group without, necessarily, the same interests as the

[428] Ballantine, B. Marine reserves in New Zealand: The development of the concept and the principles. Proceedings of an International Workshop on Marine Conservation for the New Millenium. P 3-38. Korean Ocean Research and Development Institute. Cheju Island. November 1999.

[429] Ibid.

public. Yet, the public, however slowly, has steadily begun to declare their desire to preserve and protect parts of nature despite the economic potential a living thing may have.[430] It may be that a marine reserve would be unpopular with 500 fishermen, but it may be conversely popular with a million potential voters. Politicians and managers responding to the lobbying efforts of the fishing industry should recognize that public sentiment is probably overwhelmingly in favor of the establishment of marine reserves.

While some conservationists believe that reserves that cover vast areas, including entire migration routes, are needed, recent studies suggest that the usefulness of reserves much smaller that a species' range in conserving its general population has been demonstrated for over 100 years on land.[431] Scientists Ransom Myers and Boris Worm have recently described global 'diversity hotspots' where migratory species, such as sharks, tuna, turtles, and marlin and congregate.[432] While none of the 'hotspots' are currently believed to occur in Narragansett Bay or Rhode Island state waters, these would make ideal marine reserves. Additionally, the marine biologists Michelle Heupel and Colin Simpfendorfer of the Center for Shark Research, recently published data on the use of small and large reserve designs in affording protection for blacktip sharks.[433] They concluded that "the small reserve (c. 1.5 km2) provided consistent levels of protection across years with sharks receiving good protection early in the summer season, but with

[430] Ibid.

[431] The first reserves, established around the 1850s, were for birds. These generally protect only one stopping-off point of a bird's migration, but there are few complaints that this means they will be ineffective.

[432] Myers, R. and B. Worm. 2003. Rapid worldwide depletion of predatory fish communities. Nature. 423:280-3

[433] Heupel, M. and C. Simpfendorfer. 2005. Can MPAs be effective for managing a mobile shark population? Mote Marine Laboratory, Center for Shark Research. Sarasota, FL. 2005 American Elasmobranch Society Conference.

declining protection thereafter," while "the large reserve (c. 3.5 km2) provided less consistent levels of protection across years, but provided protection for a greater portion of time than the small reserve."[434] Their results were coupled with previously calculated mortality estimates to examine whether the reserve areas provided reliable protection for sharks during their periods of highest mortality. While, the large reserve was found to provide better protection for sharks during this period than the small reserve, suggesting the large reserve design may have provided sufficient protection for young sharks, the small reserve design was shown to provide a level of protection not previously afforded to the sharks.[435] Moreover, directed MPAs may be useful for mobile shark populations during select times of their life history or in select locations along their migratory routes. While there are currently no protected areas directed at shark nurseries, further studies or potential theses could explore the potential for small-vs.-large reserve designs for MPAs.

The fundamental issue is to protect some of the marine environment. Fisheries biologist Daniel Pauly, additionally argues that reserves, probably quite large reserves, are important not only in themselves but also for fishermen.[436] These sanctuaries could potentially become repositories of large, fertile female fish, laying large, healthy eggs that can restock the oceans. There is emerging evidence that reserves can improve

[434] Ibid. Excursions from the small reserve were high early in the season and declined as sharks used this region less through the later portion of the summer. Excursions from the large reserve did not show any consistent pattern, but were also high early in the season and decreased through time as sharks used less of the reserve area.

[435] Ibid. The results also suggest that time-area closures for nursery populations of highly mobile shark species may be of value.

[436] Pauly, D. 2003. Why the international community needs to help create marine reserves. Fourth meeting of the UN Open-ended Informal Consultative Process on Oceans and the Law of the Sea. New York.

fishing (much published by WWF).[437] The Soufriere Marine Management Area in St. Lucia, West Indies, increased local catches by 46% from traps, and by 90% in fishing grounds around four reserves in five years.[438] One of the oldest examples of a reserve that had a tremendous effect in conserving fish is the Merritt Island National Refuge in Florida, established in 1962, when it became the security zone for the Kennedy Space Center in Cape Canaveral.[439] After nine years of protection from fishing, the reserve began to contribute world-record-size fish to the surrounding recreational fishery.[440]

Marine reserves may have to adjust in certain areas to allow for some take to insure that at least part of the marine environment is protected. Absolutism (i.e. no-take or nothing) seems bound to cause trouble because it is often seen as an erosion of ordinary people's rights, namely recreational fishermen. Indeed, this is actually contrary to terrestrial practice. Terrestrial national parks in Africa or India often have buffer zones, where there may be some sustainable logging, some hunting, and some settlement.[441] These buffer zones are now thought to be an essential tool for enlisting the

[437] Gell, F. and C. Roberts. 2003. The fishery effects of marine reserves and fishery closures. WWF-US. Washington, D.C.

[438] Ibid.

[439] Ibid.

[440] Ibid. The evidence of reserves producing fisheries-enhancing effects around New Zealand, however, is equivocal. Goat Island Marine Reserve in Leigh is one of the few reserves to produce a measurable spill-over effect with its spiny lobsters. Experimental fishing around Long Island-Kokomohua Marine Reserve found that blue cod had risen there by 300% over seven years, but they remained constant 1 mile (1.6 km) or more from the boundary. It may be that the species is so sedentary that any effects will be felt as the export of larvae. This is extremely difficult to measure.

[441] See Korup National Park in Cameroon

support of local people.[442] So perhaps, in a few areas where commercial fishing might be banned, the allowance of recreational fishing could buy crucial support for conservation.

The idea of leaving parts of the sea alone is very simple. It cuts across the ideas of traditional scientific fisheries 'management'. Scientific fisheries management has failed almost everywhere, sometimes because of some factor that scientists failed to predict, sometimes because politicians fail to act upon what is known. The beauty of large reserves for biodiversity and fish management is that they are an insurance policy against this kind of failure[443], and a reminder of how marine ecosystems behave in the absence of human transformation. Ultimately, they are perhaps the most effective way to insure that sharks and all living marine resources have some respite from the constant exposure to their removal by fishermen.

In total, while some of the recommendations may be considered with less controversy, many will undoubtedly be challenged and huge difficulties exist in stopping fishermen from fishing in a state where so many of them vote, but it must be changed, or the cycle will go on repeating itself. Our understanding of how to exploit sharks and other living marine resources has moved much faster than our ability to manage it, and fishing technology is outstripping the speed at which most managers can comprehend what fishermen are actually doing. While data collection needs meet universal calls for more information, often the failure to act upon what *is* known remains the problem. Reacting to declines is a game of roulette, in which the drivers of the game, ultimately only may suffer a temporary economic readjustment, while the pieces, unwilling

[442] Clover, C. p. 226

[443] Monitoring reserves with satellite technology is now feasible as fishermen can fit transreceivers to their vessels. If a fishing boat has been in a reserve without any extenuating circumstances, it is possible to revoke the license to fish or imprison the captain.

participants may suffer permanent extirpation. Proactively acting to prevent overharvesting and bycatch is fundamental to insuring that many species of sharks do not go extinct.

CHAPTER 9 – CONCLUSION

Apex predators in the marine realm are perennially the targets of fisheries both because predatory fish are what people like to eat, and because non-target species often prey on similar bait. Consumers prize fish such as tuna and swordfish, while sharks often are relegated as "trash" species and disposed of as bycatch if they are not one of the few marketable species. Many species, however, are important players in ecosystems. At a global scale fisheries are literally fishing down food webs causing tremendous declines in these predatory species.[444] The ecosystem consequences of this systemic loss of apex predators have been profound. Serial extirpations of apex then mesopredators in the marine realm has resulted in increases in lower trophic levels that are entirely consistent with the "green-world" or top-down trophic cascades.[445] There is a growing list of examples of marine apex predator extirpation followed by population flushes of herbivores, resulting in large-scale denuding of all vegetation over expansive areas. [446] Such fishing down of marine food webs is thought by many to be one of the most serious threats to ecosystems of the world.[447]

Large carnivores, of which sharks clearly are, have been going extinct or decreasing in number for millennia, and it seems clear that extinction rates have accelerated after humans arrived on the scene, but declines in abundance continue today. The overexploitation of elasmobranchs (sharks, skates, and rays) is known to have

[444] Pauly, D. et al. 1998. Fishing down marine food webs. Science 279:860-863

[445] Steneck, R.S. 1998. Human influences on coastal ecosystems: does overfishing create trophic cascades? Trends in Ecology and Evolution 13:429-430

[446] Steneck, R.S. et al. 2002. Kelp forest ecosystem: biodiversity, stability, resilience and future. Environmental Conservation 29:436-459

[447] Jackson, J.B.C., et al. 2001. Historical overfishing and the recent collapse of coastal ecosystems. Science 293:629-638

already eliminated two skate species from much of their range. One of the most surprising near-extinctions in recent years, in part off Rhode Island waters, has been that of the barndoor skate (*Raja laevis*), that was not even a targeted species.[448] The cause of the collapse was attributed to the large amount of bycatch of the skate in the cod fisheries in eastern Canada and New England waters in the 1970s , and fisheries biologists, studying the decline of more valuable food fishes more recently, didn't notice the disappearance of the barndoor skates until far later.[449] In fact, Casey and Myers note that "if current population trends continue, the barndoor skate could become the first well-documented example of extinction in a marine fish species."[450]

If predators played important functional roles in the past, then theory suggests today's community structure may be altered at all trophic levels. Thus many ecosystems that had been under strong top-down control may be bottom-up controlled today due to the extirpation of key predators. The ecosystem still functions, but it functions differently than it did in the past. Several studies have shown that the functional loss of apex predators weakens top-down control, and the loss of species at lower trophic levels reduces functional redundancies, thereby reducing stability.[451] The political will to restore ecological function is often difficult because there is little public comprehension about how much the entire community has changed. Ecosystems dominated by abundant

[448] Casey, J. and R. Myers. 1998. Near extinction of a large widely distributed fish. Science 281: 690-92. Like many elasmobranchs, *Raja laevis* is "K-selected": slow to mature, reproduces slowly, and has few offspring at a time. Newborn barndoor skates are already ten inches across, large enough to get caught in trawls from their day of birth.

[449] Ibid. Casey and Myers wrote that: "Forty-five years ago research surveys on the St. Pierre Bank recorded barndoor skates in 10 percent of their tows; in the last 20 years, none has been caught and this pattern of decline is similar throughout the range of the species."

[450] Ibid.

[451] Steneck. 2002

herbivores or mesopredators are commonly perceived as natural because the predators baseline shifted long ago or so slowly that the changes were not noticed.[452]

Adding to the difficulty of taking proactive action, in large part, stems from the negative perception surrounding some predators, particularly sharks, by the public. Wrongly maligned as man-eating monsters, sharks seldom attack humans, but their populations are being rapidly depleted by overfishing and other human activities. Often portrayed as ferocious giants of the sea ripping up helpless swimmers, surfers, and boaters, they have been the subject of numerous films, many of which are some of the most popular and top-grossing of all-time. (see Appendix 27 for list of films depicting sharks and their revenues). The word is even applied to people who engage in extortion, preying on others through deceptive practices. Even so, only certain species are large and powerful enough to be capable of harming a person who ventures into their habitat, while most are inoffensive and harmless. On a worldwide scale, the number of shark attacks on humans amounts to about 100 per year, of which only 5 to 15 are fatal.[453] In most cases, the attack ends after the initial contact and the shark does not kill or eat the victim.[454] By comparison, many more people die each year from water-related activities that do not involve sharks. Even the number of casualties from lightning strikes is much higher.[455]

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[452] Preserving ecological functions such as carnivory is arguably much more difficult to explain than extinctions, because their impacts are diffuse in space and time. In most cases, predators are extant but their population densities have fallen below levels where they limit their prey or effect lower trophic levels. Such "trophic level dysfunction" (sensu Steneck et al. 2004) results when an entire trophic level has so few consumers that their impact to other organisms or lower trophic levels is undetectable. When fishing pressure reduced most herbivorous fishes in the Caribbean, herbivory was maintained by a single sea urchin species without any obvious systemwide change in vegetation. Only when the sea urchin succumbed to a disease did vast areas of the Caribbean phase-shift to a highly vegetated alternate state.

[453] International Shark Attack file. http://www.flmnh.ufl.edu/fish/sharks/isaf/isaf.htm

[454] Ibid.

[455] Ibid.

Unfortunately, each shark attack is sensationalized by the media, and these stories then shape public perception of sharks.

Human activities, however, exert a key influence on shark survival. Humans have entered the marine ecosystem as the ultimate apex predator.[456] In recent years, as fisheries relying on other types of fish have declined, shark landings – both intentional and accidental – have greatly increased. NMFS has estimated that over 100 million sharks are killed each year.[457] Consequently, populations of many species have been dramatically reduced. Despite the reliance on traditional methods to catch sharks by fishermen around the world for centuries (as well as other types of fish), several factors have led to serious depletion of shark populations.

One problem is that large-scale fishing methods have substantially reduced stocks of bony fishes, and commercial fishermen have compensated by vastly increasing the capture of sharks, particularly since the early 1990s. Today, almost all shark species in the North Atlantic are being overfished and have declined in abundance by more than 50% in the past fifteen years.[458] Moreover, an estimated 50 percent of the sharks captured worldwide are bycatch, with more than three times the number of sharks discarded as are landed in the North Atlantic alone. A major factor contributing to this problem is the use of pelagic longlines, generally employed to catch swordfish and tuna. In some areas, the number of sharks caught accidentally in longlines reaches 90 percent

[456] This could have the effect of changing the classic three-level trophic cascade in which plants are abundant, into a four-level cascade in which herbivores dominate the system. In some cases, hyperabundance of herbivores have denuded landscapes. In other cases they have also been prone to epizootic diseases. Such large-scale instabilities appear to have escalated since humans became strong interactors in the ecosystem (Alroy 2001; Steneck and Carlton 2001).

[457] NMFS.

[458] Myers, R. et al. 2004

of total captures, and some species such as the blue shark and shortfin mako are especially vulnerable to this method.[459] Additionally, many sharks are caught by recreational anglers, many of whom consider even young sharks to be "large fishes", and in Rhode Island the number of recreational sharks landed has been greater than the number of commercial sharks landed.

Furthermore, shark populations are being adversely affected by human activities that are less direct but just as harmful. One such factor is overfishing of their prey, such as tunas, mackerels, pilchards, rays, squids, and crustaceans. (see Appendix 28 for list of prey for Rhode Island sharks) Other indirect factors include environmental pollution and habitat destruction. Toxic chemicals bioaccumulate in individuals and are passed up the food web, from prey to predator. Consequently, apex predators such as sharks are at higher risk of receiving concentrated toxins from their prey. Sharks, moreover, are much more vulnerable to overexploitation than bony fishes, for several reasons. Their growth rate is slow, their sexual maturation and gestation periods are long, and they produce small litters of young.[460] As a result, shark populations recover from overexploitation far more slowly. The problem of overfishing of sharks is also exceedingly difficult to quantify. The reported landings of sharks, as reported to NMFS, is surely much lower than the total actual landings because large quantities of catch are not recorded, especially because of the thousands of dead sharks thrown back into the sea. While the spiny dogfish is the leading commercial shark taken in the world, in the Atlantic Ocean, species such as the porbeagle, the shortfin mako, and large coastal sharks (particularly the

[459] De Maddalena, A. 2003. Sharks: Dangerous or Endangered. Italian Great White Shark Data Bank and Mediterranean Shark Research Grp. http://www.worldandi.com/newhome/public/2004/january/nspub.asp

[460] By contrast, bony fishes lay numerous eggs, and they grow and reproduce much faster.

requiem sharks – family *Carcharhinidae*) are heavily exploited and their stocks have dramatically declined. Species that have become sporadic or rare include the great white shark, porbeagle, sand tiger, smooth hammerhead, dusky shark and several others.

Large predators, though, have always been relatively rare. They are vulnerable both because they are usually trophically specialized and because they are large in size. In many places, predators have been absent or rare for so long that managers and scientists have never realized that they were ever important in the ecosystem. There has been a growing realization that the traditional focus on single species with a blind eye to the whole may result in limited, if any, conservation gains.[461] However, a shift to the ecosystem scale may result in lack of sufficient protection for some biodiversity elements.[462] Additionally, both biodiversity and ecosystem conservation remain relatively abstract concepts, especially to the public.[463] Large carnivorous animals are often used as centerpieces of conservation efforts in both terrestrial and marine domains for a variety of reasons. Various life history characteristics, such as their low population densities, space-demanding habits, and position at the top of the food chain, make members of this group potentially useful tools for conserving a broad array of coexisting biodiversity (where they persist or could feasibly be reintroduced).[464] Large carnivores, like the canary in the coal mine, are generally the first elements to disappear in a given

[461] Simberloff, D. 1998. Flagships, umbrellas, and keystones: is single species management passé in the landscape era. Biological Conservation 83:247-257

[462] Furthermore, knowledge of the biology of individual species within a system typically exceeds that of the processes driving that system.

[463] Entwistle, A. and N. Dunstone. 2000. Future priorities for mammalian conservation. P. 369-387 in Priorities for the conservation of mammalian diversity: has the panda had its day? Cambridge University Press, Cambridge, UK.

[464] Australia has just begun a captive breeding program of the grey nurse shark in an effort to reintroduce the species within its known former range.
http://www.cnn.com/2005/TECH/science/07/28/test.tube.sharks.reut/

system,[465] and because of the reliance of large carnivores on large spatial and temporal scales, efforts focused on their conservation may provide a "useful entry to operationalize large-scale long-term conservation."[466] Sharks, in this way, could serve as a focus for protecting ecosystems within a framework of "ecosystem-based" management.

The threat to shark populations is part of an immense problem confronting world fisheries. Most seas have been fished to the limits of their productivity. Advances in fishing technologies, along with rising demands by a growing human population, have led to heightened efforts to catch all fish (as well as mollusks and crustaceans.) As a result, the stability of marine ecosystems is in serious danger, and it is incumbent on us to act to protect and restore the populations of these sea creatures. Conserving biodiversity requires both a scientific understanding of the problem and the political will to act.

Until lions have their historians, tales of the hunt shall always glorify the hunters.
– African proverb

[465] Pauly, D. and J. Maclean. 2003. In a perfect ocean: the state of fisheries and ecosystems in the North Atlantic ocean. Island Press, Washington, D.C. U.S.

[466] Clark, T.W. et al. 1996. Introduction: Special Section: Large carnivore conservation in the Rocky Mountains of the U.S. and Canada. Conservation Biology 10: 936-939

Appendix 1 – FAO Global Landings of Sharks (in MT)

Region	Species	1995	1996	1997	1998	1999	2000	2001	2002
Northwest Atlantic	Sand tiger shark						1		
	Thresher	1					8	11	11
	Shortfin mako	5					29	19	20
	Longfin mako	0					1	0	1
	Mako sharks							47	37
	Porbeagle	1,395	1,069	1,356	1,026	958	930	502	248
	Great white shark						1	0	
	Nurse shark	214					0		0
	Blue Shark						169		
	Sandbar shark	1					41	24	28
	Blacktip shark						21	1	11
	Dusky Shark	0					80	0	3
	Tiger Shark							1	0
	Sharks, rays, skates, etc., nei	415	250	111	107	228	90	124	55
	Total	**2,031**	**1,319**	**1,467**	**1,133**	**1,186**	**1,371**	**729**	**414**
Region	**Species**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Northeast Atlantic	Bluntnose sixgill shark							1	7
	Basking shark	109	1,980	1,161	137	81	294	203	136
	Thresher	13	7	13	7	34	136	140	32
	Shortfin mako				0	162	186	188	108
	Porbeagle	730	410	538	1,024	1,486	1,737	1,501	549
	Blue shark	266	281	214	165	1,185	453	1,287	1,348
	Tiger shark								13
	Smooth hammerhead					8	8	4	5
	Tope shark	380	458	511	427	464	567	559	427
	Greenland shark	55	61	73	87	51	45	58	56
	Little sleeper shark								2
	Gulper shark					73	54	93	160

	Leafscale gulper shark	51	53	58	129	451	478	511	1,173
	Lanternsharks nei					573			99
	Kitefin shark					45	311	189	40
	Angelshark								3
	Angelsharks, sand devils nei	2	1	47	0	1	1	1	
	Angular roughshark					81	33	63	86
	Sailfin roughshark								1
	Various sharks nei	22,679	7,694	36,309	25,294	26,480	33,236	33,219	19,876
	Sharks, rays, skates, etc. nei	400	147	123	211	123	89	141	387
	Total	**24,685**	**11,092**	**39,047**	**27,481**	**31,298**	**37,628**	**38,158**	**24,508**
Region	**Species**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Western Central Atlantic	Bigeye thresher			1					
	Shortfin mako			73	33		5	5	134
	Longfin mako			1	1		3	3	
	Nurse shark						407	89	17
	Blue shark			1,700	435				8
	Blacktip shark		3	9	10	11	580	520	
	Silky shark		5	0	24	49	63	59	56
	Requiem sharks nei	12,209	12,145	9,785	8,588	6,294	6,491	5,907	8,708
	Hammerhead sharks, etc. nei			3	2				
	Sharks, rays, skates, etc. nei	12,518	11,494	12,348	11,404	12,469	9,569	9,393	10,219
	Total	**24,727**	**23,647**	**23,920**	**20,497**	**18,823**	**17,118**	**15,976**	**19,142**
Region	**Species**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Eastern Central Atlantic	Thresher			30	45	151	146	7	1
	Bigeye thresher			148	114				
	Thresher sharks nei			34	55	66			
	Shortfin mako					7	48	43	68
	Mako sharks	12		92	38		116		
	Porbeagle						10	3	8
	Blue shark					76	421	557	5,269
	Silky shark	18		2		110	99		1,355

	Smooth hammerhead						7	1	22
	Scalloped hammerhead	12	12	10	10	10	10	10	267
	Hammerhead sharks, etc. nei	69		995	1,020	147	1,957	1,951	1,538
	Tope shark						2	1	2
	Leafscale gulper shark						28	27	29
	Sharks, rays, skates, etc. nei	16,160	23,088	52,300	36,392	34,922	34,353	32,117	25,399
	Total	**16,271**	**23,100**	**53,611**	**37,674**	**35,489**	**37,197**	**34,717**	**33,958**
Region	**Species**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Mediterranean and Black Sea	Basking shark		2	6	6				4
	Thresher					14	12	21	14
	Shortfin mako						1	6	2
	Porbeagle	0	1	0	0	0	0	1	
	Blackmouth catshark								58
	Small-spotted catshark						30	31	33
	Catsharks, nursehounds nei	48	36	72		262	457	501	324
	Blue shark					3	4	42	16
	Gulper shark								1
	Lanternsharks nei								3
	Angelshark	35	18	34	44	25	20	22	13
	Angelsharks, sand devils nei	31	95	35	171	100	90	36	97
	Sharks, rays, skates, etc. nei	2,445	3,905	3,638	4,913	3,114	2,077	3,383	2,765
	Total	**2,559**	**4,057**	**3,785**	**5,134**	**3,518**	**2,691**	**4,043**	**3,330**
Region	**Species**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Southwest Atlantic	Thresher							3	
	Shortfin mako		83	190		100	135	26	279
	Blue shark		743	1,103		500	636	988	4,233
	Silky shark		502	279		70	80		
	Smooth hammerhead						3		
	Scalloped hammerhead		25	170		30	38	507	541
	Tope shark	104	92	103	92	89	109	87	35
	Argentine angelshark	3,802	4,281	4,410	4,311	3,368	3,123	3,339	2,288

	Angelsharks, sand devils nei	113	1,587						
	Sharks, rays, skates, etc. nei	15,575	13,201	18,144	16,586	18,481	19,726	18,343	15,134
	Total	**19,594**	**20,514**	**24,399**	**20,989**	**22,638**	**23,850**	**23,293**	**22,510**
Region	**Species**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Southeast Atlantic	Shortfin mako	1		587	308	338	764	388	2,078
	Blue shark	21		3,560	1,471	2,251	4,711	3,734	2,514
	Smooth hammerhead			220	103		4	5	3
	Tope shark								19
	Sharks, rays, skates, etc. nei	2,167	1,285	1,187	1,820	2,270	1,895	6,581	4,524
	Total	**2,189**	**1,285**	**5,554**	**3,702**	**4,859**	**7,374**	**10,708**	**9,138**
Region	**Species**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Antarctic Atlantic	Sharks, rays, skates, etc. nei					0			
	Total	**90**	**45**	**32**	**8**	**17**	**0**	**13**	**0**
Region	**Species**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Western Indian Ocean	Shortfin mako				18		58	95	381
	Porbeagle							1	
	Blue shark				60		575	1,123	3,304
	Dusky shark			7	0				
	Requiem sharks nei	32,459	34,483	31,235	36,184	32,573	28,384	26,642	27,201
	Sharks, rays, skates, etc. nei	63,984	121,795	65,579	61,339	59,981	70,445	67,210	84,601
	Total	**96,443**	**156,278**	**96,821**	**97,601**	**92,554**	**99,462**	**95,071**	**115,487**
Region	**Species**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Eastern Indian Ocean	Silky shark	21,400	21,000	15,000	20,875	20,700	14,130	15,870	18,510
	Tope shark						498	325	350
	Angelsharks, sand devils nei		102	129	120	102	98	71	118
	Ghost shark			49	21	14	82	105	102
	Sharks, rays, skates, etc. nei	72,844	73,083	71,306	78,295	76,193	80,745	75,527	70,983
	Total	**94,244**	**94,185**	**86,484**	**99,311**	**97,009**	**95,553**	**91,898**	**90,063**
Region	**Species**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**

Antarctic Indian Ocean	Porbeagle			2					
	Greenland shark								1
	Pacific sleeper shark					1			3
	Sharks, rays, skates, etc. nei			2		1			
	Total	**0**	**0**	**11**	**26**	**38**	**96**	**121**	**347**
Region	**Species**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Northwest Pacific	Sharks, rays, skates, etc. nei	22,635	17,922	25,392	25,425	48,993	46,348	28,994	30,075
	Total	**22,635**	**17,922**	**25,392**	**25,425**	**48,993**	**46,348**	**28,994**	**30,075**
Region	**Species**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Northeast Pacific	Thresher				17	2	48	76	73
	Shortfin mako				3		0	0	0
	Blue shark						1	2	0
	Tope shark				1		3	1	0
	Sharks, rays, skates, etc. nei	10	10	14	20	81	3	36	4
	Total	**10**	**10**	**14**	**41**	**83**	**55**	**115**	**77**
Region	**Species**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Western Central Pacific	Sharks, rays, skates, etc. nei	99,528	89,194	86,559	92,046	82,581	89,048	94,303	96,953
	Total	**99,528**	**89,194**	**86,559**	**92,046**	**82,581**	**89,048**	**94,303**	**96,953**
Region	**Species**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Eastern Central Pacific	Thresher				303	262	249	299	279
	Bigeye thresher				11	5	5	2	
	Shortfin mako		39	32	184	119	114	109	135
	Mako sharks								80
	Great white shark						1	0	
	Blue shark				1		0	0	1
	Silky shark		1,541	1,595	2,097	2,130	1,678	1,031	1,484

	Requiem sharks nei	6,334	5,849	3,482	2,988	2,949	3,320	3,059	2,719
	Hammerhead sharks, etc. nei				1				
	Tope shark				51	73	45	44	32
	Sharks, rays, skates, etc. nei	26,957	25,232	24,887	27,588	27,475	32,597	27,869	26,038
	Total	**33,291**	**32,661**	**29,996**	**33,224**	**33,013**	**38,009**	**32,413**	**30,768**
Region	**Species**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Southwest Pacific	Broadnose sevengill shark				2	3	4	5	4
	Basking shark	14	2	2	49	129	95	84	40
	Thresher	15	13	24	21	32	51	57	54
	Shortfin mako	33	52	40	74	110	208	327	239
	Porbeagle	5	16	21	164	246	188	127	138
	Blue shark	111	246	120	540	593	1,169	1,328	1,186
	Copper shark				15	14	25	38	38
	Smooth hammerhead	12	10	3	6	11	13	17	10
	Tope shark	2,705	3,044	2,864	3,083	3,633	3,100	3,091	3,316
	Leafscale gulper shark				4	1	0	0	1
	Lanternsharks nei	3	0	2				4	25
	Kitefin shark	303	175	352	434	328	317	375	520
	Dark ghost shark	1,593	1,614	2,064	1,956	1,975	1,819	1,572	2,055
	Ghost shark	769	595	913	951	1,260	1,228	1,189	1,086
	Sharks, rays, skates, etc. nei	6,130	4,952	3,562	3,523	3,614	2,274	2,368	2,511
	Total	**11,693**	**10,719**	**9,967**	**10,822**	**11,949**	**10,491**	**10,582**	**11,223**
Region	**Species**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Southeast Pacific	Shortfin mako	475	320	1,218	1,757	379	592	964	1,431
	Porbeagle				7				65
	Blue shark	39	11	114	824	7	262	456	2,491
	Hammerhead sharks, etc. nei				5				2
	Angelsharks, sand devils nei	289	358	189	101	262	406	510	477
	Sharks, rays, skates etc. nei	1,365	2,363	2,735	5,502	4,166	6,521	4,268	4,378
	Total	**2,168**	**3,052**	**4,256**	**8,196**	**4,814**	**7,781**	**6,198**	**8,844**
Region	**Species**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**

Antarctic Pacific	Sharks, rays, skates etc. nei								
	Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Region	**Species**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Global	**Total**	**452,158**	**489,080**	**491,315**	**483,310**	**488,862**	**514,072**	**487,332**	**496,837**

Appendix 2 – Federal HMS Regulations

COMMERCIAL

Gear Types

Commercial gear types that may be used to fish for sharks: pelagic longline, bottom longline, handline, rod and reel, bandit gear, and gillnet.

Longline gear is set horizontally, either anchored, floating, or attached to a vessel, and consists of a mainline with three or more gangions or hooks. This gear can be retrieved by hand or by mechanical means. Any hook and line gear with three or more hooks are considered a longline.

Pelagic longline gear is defined as a longline that is suspended by floats in the water column and that is not fixed to or in contact with the ocean bottom. A vessel has pelagic longline on board when the following equipment is on board:

1. A power-operated longline hauler,
2. A mainline,
3. Floats capable of supporting the mainline, and
4. Leaders (gangions) with hooks.

Removing any one of these four elements from the vessel constitutes removal of pelagic longline gear.

Bottom longline gear is a longline that is not suspended in the water with floats. Bottom longline gear uses weights or anchors to ensure that the gear is placed on or close to the ocean bottom. A vessel has bottom longline onboard when the following equipment is on board:

1. A power-operated longline hauler,
2. A mainline,
3. Weight and/or anchor capable of maintaining contact between midline and ocean bottom, and
4. Leaders (gangions) with hooks.

Removing any one of these four elements from the vessel constitutes removal of pelagic longline gear.

A handline cosists of a mainline to which no more than two gangions or hooks are attached. A handline is retrieved by hand, not by mechanical means.

Rod and reel consists of a handheld fishing rod with a manually or electronically operated reel attached.

Bandit gear is a vertical hook and line with rods that are attached to the vessel when in use. Lines can be retrieved by hand or mechanical means.

A gillnet is a panel of netting suspended vertically in the water with floats at the top and weights along the bottom. Shark gillnets must remain attached to the vessel at one end except when conducting net checks.

General Restrictions

Both the Atlantic Tunas Convention Act (used to implement any provisions agreed to in ICCAT) and the Magnuson-Stevens Fishery Act have provisions that allow NMFS to apply Federal regulations to state waters.

Pelagic and Bottom Longline Gear Restrictions

To fish with pelagic longline gear, a fisherman must possess all three of the HMS permits listed below.

1. A directed or incidental swordfish permit;
2. A directed or incidental shark permit; and,
3. A tuna longline category permit.

All permits must be valid and up-to-date. These permits are administered under a limited access program. To obtain a permit, a fisherman must transfer a permit, within the upgrading restrictions, from another fisherman who is leaving the fishery.

NMFS has closed a number of areas to fishermen with HMS permits who have pelagic longline gear on board. The Northeastern U.S. closed area: this area is closed during the month of June each year. The coordinates are: 39 to 40^0N. lat. and 68 to 74^0W long. The Northeast Distant (NED) closed area: this area is closed year-round, except to vessels fishing with specific longline gear and bait, and complying with other conditions. The coordinates are: 35 to 55^0N. lat. and 20 to 60^0W long.

When fishing in the NED closed area, pelagic longline vessels are limited, at all times, to possessing onboard and/or using only 18/0 or larger circle hooks with an offset not to exceed 10 degrees. Only whole Atlantic mackerel and/or squid baits may be possessed and/or utilized with the allowed hooks. Pelagic longline vessels fishing within the NED must also possess and use sea turtle handling and release gear in compliance with NMFS' careful release protocols.

Generally only commercial shark fisherman use bottom longline gear. These fisherman only need a commercial shark federal limited access permit. Fishermen holding the three permits listed earlier may also use bottom longline gear.

The Mid-Atlantic Shark area is closed for bottom longline gear from January 1 through July 31, effective January 1, 2005. This area includes the Atlantic Ocean area seaward of the inner boundary of the U.S. EEZ at $35^0$41'N. lat. just south of Oregon Inlet, North Carolina, and connecting by straight lines the following coordinates in the order stated: $35^0$41'N. lat., $74^0$51'W. long.; then proceeding southeast to $35^0$30'N. lat., $74^0$46'W. long.; then proceeding southwest, roughly following the 55 fathom mark, to $33^0$51'N. lat., $76^0$24'W. long.; then proceeding due west to intersect the inner boundary of the U.S. EEZ at $33^0$51'N. lat., $77^0$53'W. long. near Cape Fear, North Carolina. This closed area is designed to reduce interactions with juvenile and/or prohibited sharks.

Under the Magnuson-Stevens Act, NMFS is required to minimize bycatch, to the extent practicable. Many gear types, particularly longline gear, catch a number of species as

bycatch. The following closures were implemented to reduce this bycatch by longline gear.

All vessels with pelagic longline gear on board are required to have Vessel Monitoring Systems (VMS) installed and operating.

Fishing Permits
Shark Limited Access Permit: Directed (allows for targeting of sharks) OR Incidental (limited number of shark allowed per trip).

Commercial Shark Fishing
A fisherman who sells sharks needs either a directed or incidental shark permit. These permits are administered under a limited access program. Under the limited access program, NMFS is no longer issuing new shark permits. To obtain a permit, a fisherman must transfer a permit, within the upgrading restrictions, from someone who is leaving the fishery.

An owner may upgrade a vessel with a limited access permit, or transfer the limited access permit to another vessel, only if the upgrade or transfer does not result in an increase in horsepower of more than 20 percent or an increase of more than 10 percent in length overall, gross registered tonnage, or net tonnage from the original qualifying vessel's specifications.

If a fisherman wants to land more sharks than allowed under the recreational bag limit, they still need a commercial shark permit, even if they don't intend to sell them.

Fishermen with a federal limited access permit must sell to a federally permitted dealer.

A directed permit will allow fishermen to retain more sharks than an incidental permit. Generally, directed shark permits allow fishermen to target sharks while incidental permits allow fishermen who normally fish for other species to land a limited number of sharks. There is no difference in the types of gear that may be used.

A fisherman with a directed shark permit has a limit of up to 4,000 lbs. dressed weight of large coastal sharks per trip. There is no directed retention limit for pelagic sharks or small coastal sharks. Additionally, fishermen may not keep any sharks that are prohibited.

A fisherman with an incidental shark permit may keep up to 5 large coastal sharks per vessel per trip. They are also allowed to keep up to a total of 16 pelagic or small coastal sharks (all species combined) per vessel per trip. They many not keep any sharks that are prohibited.

Effective January 1, 2005, all directed shark vessels with Bottom Longline gear on board that are located between 33^0N and $36^0$30'N latitude (roughly SC, NC, and VA) must have a working VMS unit installed and operating. As of November 15, 2004, directed shark

vessels with gillnet gear on board, regardless of location, must have a VMS unit installed and operating.

Fishermen may use pelagic or bottom longline, gillnet, rod and reel, handline, or bandit gear. Bottom longline vessels need to have corrodible (non-stainless steel) hooks, have and use line cutters and dip nets, and move 1 nautical mile after an interaction with a protected species. Pelagic longline vessels need to have corrodible hooks as well as additional release equipment.

Sharks are managed in 3 different species groups: Large Coastal Sharks, Small Coastal Sharks, and Pelagic Sharks. There are 19 prohibited species. Neither commercial or recreational fishermen are allowed to possess these species. If caught, they must be released in the water with minimal injury to the shark in a method that maximizes its survival.

Effective January 1, 2005, the year will be divided between three trimester seasons: the first is from January 1 to April 30; the second is from May 1 to August 31, the third semester is from September 1 to December 31. NMFS announces the closure date for large coastal sharks prior to the start of each fishing season. The closure dates for pelagic and small coastal sharks are announced when these quotas are expected to be met.

The Atlantic commercial shark fishing is managed on a regional basis. The three regions are: the Gulf of Mexico (Texas to West Coast Florida including the Florida Keys), the South Atlantic (East Coast of Florida to North Carolina and Caribbean), and the North Atlantic (Virginia to Maine).

For the 2005 fishing year, the annual quota is 1,017 metric tons (mt) dressed weight (dw) for Large Coastal Sharks. This does not account for any over- or under harvests. The quota is split between the three trimester seasons, and the three regions. NMFS announces the available quota and the length of the fishing seasons before the start of the fishing season.

There are three species sub-groups within the pelagic shark species group. Each sub-group has its own quota. The quotas, not accounting for over or under harvesting are:

1. Pelagic sharks (Shortfin mako, thresher, oceanic whitetip): 488 metric tons (mt) dressed weight (dw);
2. Porbeagle: 92 mt dw
3. Blue: 273 mt dw

As with the large coastal shark quota, these quotas are split between the three trimester fishing seasons and regional areas.

For the 2005 fishing year, the small coastal shark annual quota is 454 metric tons dressed weight not accounting for over- or under harvests. As with the large coastal and the pelagic shark quotas, this quota is split between the three trimester fishing seasons and regional areas.

Finning is prohibited for all fishing vessels under U.S. jurisdiction in the Atlantic Ocean, Gulf of Mexico, Caribbean Sea, and Pacific Ocean. This regulation applies to fishermen with a Federal shark permit in all waters including state waters and the high seas. However, commercial fishermen may remove fins as part of dressing the carcass in the commercial fishery. The wet weight of the fins may not exceed 5 percent of the wet weight of the dressed carcasses. Fins must be offloaded at the first port of landing.

Selected fishermen with a commercial shark permit are required to report fishing activities in an approved logbook within 48 hours of each day's fishing activities for multi-day trips, or before offloading for one-day trips, and must submit the logbook within 7 days of offloading. If a fisherman receives a letter from the observer program coordinator informing them that they have been selected to carry an observer aboard their vessel, they must inform NMFS when they will be taking a trip and if that trip is selected, they must have a NMFS observer aboard in order to go fishing.

There is no commercial minimum size limit for large coastal sharks, pelagic sharks or small coastal sharks.

If a fisherman has a federal limited access permit, they must follow federal regulations regardless of whether they are fishing in State or Federal waters. Additionally, if State regulations are more restrictive, they must follow those.

Sharks may be eviscerated and the fins may be removed but the carcass must remain whole or as a log until landed. Once there is documentation that the sharks were landed, they may be used as bait.

HMS Dealers and Importers/Exporters

Anyone who buys Atlantic sharks must have a Federal Atlantic shark dealer permit. Dealers must report to NMFS all shark purchased from U.S. vessels through biweekly reports that should be submitted within 5 days of the end of each biweekly period. Dealers must only purchase sharks harvested from a vessel that has a valid commercial permit for shark, except that dealers may purchase a shark harvested by a vessel that does not have a commercial permit for shark if that vessel fishes exclusively in state waters. Dealers may not purchase from an owner of a fishing vessel shark fins that are disproportionate to the weight of shark carcasses landed, i.e., the wet fins may not exceed 5 percent of the dressed weight of the carcasses.

RECREATIONAL

Permits

Owners of vessels used to fish recreationally (i.e., no sale of fish) for Atlantic HMS (including sharks), or on which Atlantic HMS are retained or possessed, must obtain an Atlantic HMS Angling permit. For sharks, this permit requirement is applicable only when fishing in Federal waters, although state regulations may also apply. Owners of vessels possessing an Atlantic HMS Angling permit may not sell or transfer any Atlantic HMS for a commercial purpose. Owners of charter or headboats used to fish for Atlantic

HMS must obtain an annual HMS Charter/Headboat permit. Only one type of permit – HMS Angling, Charter/Headboat, or Atlantic tunas permit – may be issued to a vessel.

Gear Type
Recreational anglers are allowed to use rod and reel or handline

Recreational Shark Fishing
Sharks are managed in 3 different species groups: Large Coastal Sharks, Small Coastal Sharks, and Pelagic Sharks. There are 19 prohibited species. Neither commercial or recreational fishermen are allowed to possess these species. If caught, they must be released in the water with minimal injury to the shark in a method that maximizes its survival.

Recreational fishermen must land sharks with the head, fins, and tail attached. They are allowed to gut and bleed the sharks by making an incision at the base of the tail as long as the caudal fin is still attached.

Recreational fishermen are allowed to keep one shark (any of the allowed species) per vessel per trip, subject to the minimum size. In addition, there is an allowance of one Atlantic sharpnose and one Bonnethead per person per trip, with no minimum size.

Except for Atlantic sharpnose or Bonnethead, recreational fishermen may only keep allowed shark species that are larger than 4.5 feet fork length. There is no minimum size for Atlantic sharpnose or Bonnethead sharks.

If contacted on the dock or by phone, recreational anglers are required to operate in the Large Pelagic Survey (LPS) or Marine Recreational Fisheries Statistics Survey (MRFSS) to facilitate scientific research on these species.

HMS Tournaments
A tournament that requires participants to register, or enter, or in which a prize or award is offered for Atlantic HMS and the tournament is conducted from a port in an Atlantic coastal state, the tournament operator must notify NMFS of the tournament name, location, dates, director and contact information of the tournament at least 4 weeks prior to commencement of the tournament.

NMFS will notify HMS tournament operators in writing if a tournament has been selected for reporting. If a tournament is selected, a reporting form will be sent to the operator. The reporting form must be returned to NMFS within 7 days after tournament fishing has been completed.

Tournament registration and reporting is a critical component of the HMS monitoring program. The collected information is used to estimate tournament fishing effort and landings of HMS for stock assessments, national and international reports and other monitoring efforts.

OBSERVER COVERAGE

HMS Observer Coverage

Observers collect biological information on all species that are caught. Often times this information, such as the species, sex and size of a fish, is not required on logbook forms. The observer also records information that is similar to that recorded on logbooks such as the gear used, fishing location, and the number of fish caught and discarded. The information collected is used in stock assessments and to help NMFS verify logbook information. The observer must have access to navigation equipment, logbook records, communication equipment, and other equipment in order to perform their job. The observer is not an enforcement officer, however, data gathered by the observer may be used in support of enforcement investigations.

If a fisherman is notified by NMFS in writing that their vessel is selected for observer coverage, they are required to carry an observer on every trip unless notified otherwise. If a fisherman is selected and continues to fish without an observer or without contacting the observer program office, they may be subjected to fines and penalties. It is illegal to harass an observer or prevent them from carrying out their duties.

Appendix 3 – Atlantic Regional Commercial Shark Landings (in MT)

Region	Species	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Total
New England (ME - CT)	Sharks	127.2	135.4	57.8	81.1	57.3	18.9	14.4	34.3	9.1	29.6	6.0	571.1
	Pelagics	96.5	53.5	65.7	40.9	31.3	37.0	14.9	14.6	17.0	19.5	15.5	406.4
	LCS	0.2	0.9	0.0	0.8	0.1	0.3	0.0	0.0	0.7	0.2	0.0	3.2
	SCS												0.0
	Prohibited	0.1	0.0	0.3	1.8	0.3	0.9	0.2	0.0	0.0	0.0	0.1	3.7
	Total	224.0	189.8	123.8	124.6	89.0	57.1	29.5	48.9	26.8	49.3	21.6	984.4
Region	**Species**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**Total**
Mid-Atlantic (NY - VA)	Sharks	617.0	183.5	243.0	540.9	111.9	166.1	170.8	122.8	341.9	325.0	383.6	3,206.5
	Pelagics	115.9	121.7	87.5	53.4	61.1	66.6	60.3	58.4	52.7	45.8	21.6	745.0
	LCS	92.5	38.5	68.4	42.7	9.8	19.1	5.8	6.8	7.5	10.5	4.0	305.6
	SCS	0.3	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.5
	Prohibited	28.4	32.2	25.1	12.6	5.6	1.5	0.8	80.9	0.0	0.0	0.1	187.2
	Total	854.1	375.9	424.0	649.6	188.4	253.3	237.9	268.9	402.1	381.3	409.3	4,444.8
Region	**Species**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**Total**
South Atlantic (NC - FL east coast)	Sharks	1,714.5	1,894.2	1,277.7	949.3	609.9	307.5	456.0	373.7	485.7	260.6	220.9	8,550.0
	Pelagics	168.6	38.0	102.2	107.0	163.8	118.5	94.2	94.6	104.1	89.8	88.4	1,169.2
	LCS	335.9	636.6	818.6	740.4	441.2	437.7	668.9	635.4	600.9	978.1	825.3	7,119.0
	SCS	0.0	12.2	82.8	93.0	323.5	372.7	334.9	316.7	255.1	311.7	166.1	2,268.7
	Prohibited	17.8	30.3	48.2	43.3	16.8	17.9	34.8	11.4	0.0	0.0	5.1	225.6
	Total	2,236.8	2,611.3	2,329.5	1,933.0	1,555.2	1,254.3	1,588.8	1,431.8	1,445.8	1,640.2	1,305.8	19,332.5
Region	**Species**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**Total**
Gulf (FL west coast - TX)	Sharks	1,457.6	1,445.5	1,133.5	1,231.7	1,406.0	1,494.3	391.1	193.9	269.1	445.7	715.8	10,184.2
	Pelagics	33.3	18.7	43.8	43.2	24.1	44.3	18.0	13.9	13.1	7.9	8.6	268.9
	LCS	369.1	689.2	749.0	530.2	360.9	433.0	951.9	1,035.7	1,001.9	975.8	1,158.9	8,255.6
	SCS	0.0	0.0	36.4	13.1	8.8	11.8	6.6	10.2	8.6	22.7	5.9	124.1
	Prohibited	0.7	3.8	14.7	23.3	7.2	5.0	7.6	2.6	2.5	1.3	1.0	69.7
	Total	1,860.7	2,157.2	1,977.4	1,841.5	1,807.0	1,988.4	1,375.2	1,256.3	1,295.2	1,453.4	1,890.2	18,902.5
Region	**Species**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**Total**

Total Atlantic (ME - TX)	Sharks	3,916.3	3,658.6	2,712.0	2,803.0	2,185.1	1,986.8	1,032.3	724.7	1,105.8	1,060.9	1,326.3	22,511.8
	Pelagics	414.3	231.9	299.2	244.5	280.3	266.4	187.4	181.5	186.9	163.0	134.1	2,589.5
	LCS	797.7	1,365.2	1,636.0	1,314.1	812.0	890.1	1,626.6	1,677.9	1,611.0	1,964.6	1,988.2	15,683.4
	SCS	0.3	12.2	119.2	106.1	332.3	384.5	341.7	326.9	263.7	334.4	172.0	2,393.3
	Prohibited	47.0	66.3	88.3	81.0	29.9	25.3	43.4	94.9	2.5	1.3	6.3	486.2
	Total	5,175.6	5,334.2	4,854.7	4,548.7	3,639.6	3,553.1	3,231.4	3,005.9	3,169.9	3,524.2	3,626.9	43,664.2

Appendix 4 – Revised 2002 North Atlantic Commercial Shark Landings (in MT)

Revised Comm. Landings		
Region	**Species**	**2002**
North Atlantic Revised	Pelagics	370.32
	LCS	60.25
Region	**Species**	**2002**
New England	Pelagics	48.8
	LCS	0.5
Region	**Species**	**2002**
RI	Pelagics	26.9
	LCS	0

Appendix 5 – New England Commercial Shark Landings

Year	Bignose	Blacktip	Blue	Bull	Dusky	Hammerhead	Longfin Mako	Makos	Night	Nurse	Oceanic Whitetip	Porbeagle	Sandbar	Sand Tiger	Shortfin Mako	Silky	Thresher	Tiger	Unspecified Sharks	Total
1970																			5,800	5,800
1971																			13,400	13,400
1972																			37,200	37,200
1973																			14,600	14,600
1974																			17,600	17,600
1975																			14,100	14,100
1976																			32,900	32,900
1977																			83,100	83,100
1978																			5,900	5,900
1979																			64,200	64,200
1980																			475,800	475,800
1981																			260,800	260,800
1982																			171,100	171,100
1983																			169,800	169,800
1984																			142,000	142,000
1985																			109,100	109,100
1986																			131,300	131,300
1987			5,300		100	200						27,300	900		24,100		300		175,100	233,300
1988			1,500			100						53,500	4,800		4,800		200		160,600	225,500
1989			1,100				1,900					7,800	100	2,100	16,100		6,300		342,600	378,000
1990			147		49	931	290	65,836				42,061		2,360	46,368		2,667	556	171,546	332,811
1991			1,479				6,463	11,663				24,260	229	1,351	71,902		1,444		188,000	306,791
1992			570		1,248	97	22,407	7,409		4		20,703		1,744	78,403		3,849	321	227,568	364,323
1993			408		36	519	301	25,398				85,531			99,722		1,674		280,443	494,032
1994			369					24,007				3,295			88,145		2,009	2,033	298,486	418,344
1995			246				418	14,218	229			7,713			121,681		1,176		127,523	273,204
1996			60	1,783	152		3,004	15,580				15,947		742	56,080		2,598		178,854	274,800
1997	13	157					190	12,992	55			3,760	14	280	51,888		579	14	126,381	196,323
1998					183		1,754	13,314				26,199	588	21	40,777		1,229		41,678	125,743
1999			1,543		49		221	2,061				6,638		184	22,582		289		31,850	65,417
2000								6,049				3,425			22,675				75,693	107,842
2001								11,308				360	1,547		25,723				20,122	59,060
2002		414	179					11,943			26	2,280		36	28,333	43	163		65,258	108,675
2003								7,687						223	26,451				13,255	47,616
Total	**13**	**571**	**12,901**	**1,783**	**1,817**	**1,847**	**36,948**	**229,465**	**284**	**4**	**26**	**330,772**	**8,178**	**9,041**	**825,730**	**43**	**24,477**	**2,924**	**4,273,657**	**5,760,481**

Appendix 6 – New England Commercial Shark Landings by NMFS Group

Year	Large Coastal Sharks	Small Coastal Sharks	Pelagics	Unspecified Sharks	Total
1970				5,800	5,800
1971				13,400	13,400
1972				37,200	37,200
1973				14,600	14,600
1974				17,600	17,600
1975				14,100	14,100
1976				32,900	32,900
1977				83,100	83,100
1978				5,900	5,900
1979				64,200	64,200
1980				475,800	475,800
1981				260,800	260,800
1982				171,100	171,100
1983				169,800	169,800
1984				142,000	142,000
1985				109,100	109,100
1986				131,300	131,300
1987	1,200		57,000	175,100	233,300
1988	4,900		60,000	160,600	225,500
1989	2,200		33,200	342,600	378,000
1990	3,896		157,369	171,546	332,811
1991	1,580		117,211	188,000	306,791
1992	3,414		133,341	227,568	364,323
1993	555		213,034	280,443	494,032
1994	2,033		117,825	298,486	418,344
1995	229		145,452	127,523	273,204
1996	2,677		93,269	178,854	274,800
1997	533		69,409	126,381	196,323
1998	792		83,273	41,678	125,743
1999	233		33,334	31,850	65,417
2000	0		32,149	75,693	107,842
2001	1,547		37,391	20,122	59,060
2002	493		42,924	65,258	108,675
2003	223		34,138	13,255	47,616
Total	**26,505**	**0**	**1,460,319**	**4,273,657**	**5,760,481**

Appendix 7 – Rhode Island Commercial Shark Landings

Year	Blacktip	Blue	Bull	Dusky	Hammerhead	Longfin Mako	Makos	Oceanic Whitetip	Porbeagle	Sandbar	Sand Tiger	Shortfin Mako	Silky	Thresher	Tiger	Unspecified Sharks	Total
1970																1,100	1,100
1971																7,600	7,600
1972																31,200	31,200
1973																900	900
1974																3,400	3,400
1975																4,400	4,400
1976																10,100	10,100
1977																400	400
1978																12,600	12,600
1979																6,000	6,000
1980																19,800	19,800
1981																16,300	16,300
1982																18,000	18,000
1983																31,600	31,600
1984																9,600	9,600
1985																25,900	25,900
1986																35,900	35,900
1987		4,000		100	200				100	900		14,100				9,800	29,200
1988		1,300			100				5,400	4,800		4,200				6,300	22,100
1989		900							6,100	100	2,100	16,000		1,900		19,100	46,200
1990		11		49	931		11,273		14,195		2,360	12,801		957	556	4,369	47,502
1991							1,391		10,038	229	1,250	13,436		1,295		2,740	30,379
1992		61		1,248	97		1,089		13,310		1,184	5,416		2,464	321	24,456	49,646
1993		408		36	519	301	184		3,483			2,450		584		9,079	17,044
1994		369					25		1,543			1,134		389	2,033	4,208	9,701
1995						418	1,685		1,975			2,304		385		4,869	11,636
1996		60	1,783	152		296	210		2,194		742	2,194		101		2,058	9,790
1997	157					190	445		707	14	280	847				1,387	3,870
1998				183		830	4,479		177	588	21	560		510		56	7,404
1999		14		49		129	1,518		70		184			182		2,306	4,452
2000							5,803									4,070	9,873
2001							10,271		360	1,547		2,118				2,002	16,298
2002							11,010	26	139		36		43			47,839	59,093
2003							7,108				223					2,953	10,284
Total	**157**	**7,123**	**1,783**	**1,817**	**1,847**	**2,164**	**56,491**	**26**	**59,791**	**8,178**	**8,380**	**77,560**	**43**	**8,767**	**2,910**	**382,392**	**619,272**

Appendix 8 – Rhode Island Commercial Shark Landings by NMFS Group

Year	Large Coastal Sharks	Small Coastal Sharks	Pelagic Sharks	Unspecified Sharks	Total
1970				1,100	1,100
1971				7,600	7,600
1972				31,200	31,200
1973				900	900
1974				3,400	3,400
1975				4,400	4,400
1976				10,100	10,100
1977				400	400
1978				12,600	12,600
1979				6,000	6,000
1980				19,800	19,800
1981				16,300	16,300
1982				18,000	18,000
1983				31,600	31,600
1984				9,600	9,600
1985				25,900	25,900
1986				35,900	35,900
1987	1,200		18,200	9,800	29,200
1988	4,900		10,900	6,300	22,100
1989	2,200		24,900	19,100	46,200
1990	3,896		39,237	4,369	47,502
1991	1,479		26,160	2,740	30,379
1992	2,850		22,340	24,456	49,646
1993	555		7,410	9,079	17,044
1994	2,033		3,460	4,208	9,701
1995	0		6,767	4,869	11,636
1996	2,677		5,055	2,058	9,790
1997	451		2,189	1,387	3,870
1998	792		6,556	56	7,404
1999	233		1,913	2,306	4,452
2000	0		5,803	4,070	9,873
2001	1,547		12,749	2,002	16,298
2002	79		11,175	47,839	59,093
2003	223		7,108	2,953	10,284
Total	**25,115**	**0**	**211,922**	**382,392**	**619,272**

Appendix 9 – Atlantic Bycatch of Sharks from Pelagic Longlines

Species	1997	1998	1999	2000	2001	2002	2003	Avg. 1997-1999	Avg. 2001-2003	% Diff.
Pelagic Sharks Kept	5,078	3,717	2,894	3,065	3,460	2,987	3,037	3,896	3,161	-18.9%
Pelagic Sharks Discarded	81,518	44,516	28,967	28,046	23,813	22,828	21,705	51,667	22,782	-55.9%
Large Coastal Sharks Kept	13,217	6,401	6,382	7,896	6,478	4,077	5,326	8,667	5,294	-38.9%
Large Coastal Sharks Discarded	7,762	5,470	5,442	6,973	4,836	3,815	4,813	6,225	4,488	-27.9%
Total Sharks Kept	18,295	10,118	9,276	10,961	9,938	7,064	8,363	12,563	8,455	-22.7%
Total Sharks Discarded	89,280	49,986	34,409	35,019	28,649	26,643	26,518	57,892	27,270	-52.9%
Total Sharks Caught	107,575	60,104	43,685	45,980	38,587	33,707	34,881	70,455	35,725	-49.3%

Appendix 10 – Atlantic Sharks Kept/Discarded by Area

Area	Year	Hooks Set			Species							
		MAB	NEC	Total	Pelagic Shark Kept	Pelagic Shark Discards	LCS Kept	LCS Discards	Total Shark Kept	Total Shark Discards	Total Shark Caught	Sharks Caught/Hook
MAB & NEC	1995	2,394,364	1,072,433	3,466,797	2,647	36,395	7,717	2,121	10,364	38,516	48,880	0.014
	1996	1,039,594	1,137,229	2,176,823	2,456	37,638	6,433	1,975	8,889	39,613	48,502	0.022
	1997	1,203,832	1,226,406	2,430,238	3,043	40,085	6,423	928	9,466	41,013	50,479	0.021
	1998	1,319,860	883,059	2,202,919	2,136	27,889	1,837	907	3,973	28,796	32,769	0.015
	1999	1,276,008	587,225	1,863,233	1,727	12,468	1,974	746	3,701	13,214	16,915	0.009
	2000	1,032,173	610,103	1,642,276	2,229	15,689	4,796	1,433	7,025	17,122	24,147	0.015
	2001	1,092,030	865,531	1,957,561	2,506	8,903	4,383	991	6,889	9,894	16,783	0.009
	2002	1,011,138	550,096	1,561,234	2,324	7,005	2,331	1,207	4,655	8,212	12,867	0.008
	2003	692,196	448,438	1,140,634	2,135	6,875	2,761	1,384	4,896	8,259	13,155	0.012
Area	**Year**	**Total Hooks Set**			**Pelagic Shark Kept**	**Pelagic Shark Discards**	**LCS Kept**	**LCS Discards**	**Total Shark Kept**	**Total Shark Discards**	**Total Shark Caught**	**Sharks Caught/Hook**
All Other Areas (CAR, GOM, FEC, SAB, NED, SAR, NCA)	1995	6,715,500			3,007	53,787	17,469	6,121	20,476	59,908	80,384	0.012
	1996	8,137,300			2,978	47,388	13,815	8,246	16,793	55,634	72,427	0.009
	1997	7,210,600			2,037	41,433	6,794	6,834	8,831	48,267	57,098	0.008
	1998	5,816,300			1,581	16,627	4,564	4,563	6,145	21,190	27,335	0.005
	1999	6,038,600			1,167	16,499	4,408	4,696	5,575	21,195	26,770	0.004
	2000	6,333,200			970	15,038	3,106	5,563	4,076	20,601	24,677	0.004
	2001	5,606,400			954	14,910	2,095	3,845	3,049	18,755	21,804	0.004
	2002	5,589,000			663	15,823	1,746	2,608	2,409	18,431	20,840	0.004
	2003	5,867,500			902	14,830	2,565	3,429	3,467	18,259	21,726	0.004

Appendix 11 – Charterboat Permits by Atlantic State, 2004

State	CHB Permits
AL	80
CT	85
DC	1
DE	134
FL	638
GA	31
LA	94
MA	494
MD	175
ME	48
MS	29
NC	424
NH	52
NJ	530
NY	342
RI	133
SC	124
TX	144
VA	155
Total	3,713

Appendix 12 – Snug Harbor Shark Landings (data from Providence Journal)

Year	Blue		Year	Mako		Year	Thresher	Year	Total Sharks	# of Fisherman
1982			1982			1982		1982		
1983			1983			1983		1983		
1984			1984			1984		1984		
1985			1985			1985		1985		
1986	293		1986	109		1986		1986	17	110
1986	286		1987	186		1987	286	1987	10	180
1986	258		1987	62		1988		1988	22	277
1986	159		1988	235		1989		1989		308
1987	228		1988	198		1990		1990		
1987	227		1988	129		1991	389	1991		
1987	182		1989	160		1991	257	1992		203
1988	221		1990	316		1992	367	1993		
1988	141		1990	282		1993		1994		230
1988	113		1990	262		1994		1995		200
1989	303		1990	191		1995	425	1996		150
1989	296		1991	269		1995	337	1997		200
1989	206		1992	170		1996	394	1998		
1989	197		1993			1996	349	1999	6	300
1991	293		1994	357		1997	124	2000		
1991	229		1994	247		1998		2001		
1991	218		1995	297		1999		2002		200
1991	175		1995	190		2000	390	2003	9	
1991	153		1996	185		2000	309	2004		200
1992	335		1997			2001				
1992	313		1998	199		2002	392			
1992	309		1998	173		2002	286			
1992	296		1998	153		2002	278			
1992	230		1999			2002	178			
1993			2000			2003				
1994	227		2001	170		2004	470			
1994	148		2002	228		2004	310			
1995	305		2002	213						
1995	295		2003	210						
1995	295		2003	190						
1995	244		2004	154						
1996	315									
1996	215									
1997	327									
1997	287									
1997	157									
1998	322									
1998	320									
1999	294									

2000	298									
2000	239									
2000	235									
2001	285									
2001	248									
2002	307									
2002	250									
2003	295									
2003	259									
2004	291									
2004	263									

Appendix 13 – Snug Harbor Shark Landings: Providence Journal Descriptions

2004
65 boats with more than 200 anglers competed. Most the big fish were caught in the vicinity of the Suffolk wreck or near Ryan's and Jenny's Horns. Al Conti said, "The number of makos under 150 pounds was amazing, and there were more threshers than we've ever had in the tournament." Prizes include savings bonds, boat electronics, and fishing tackle.

Winning/published catches
470 lb. thresher
310 lb. thresher
291 lb. blue
263 lb. blue
154 lb. mako (just 4 lbs. over the minimum acceptable size)

2003
Steve West of Coventry tagged 11 sharks to win the tag-and-release trophy. There were 13 sharks tagged aboard the boat. The tournament fleet tagged more than 150 fish. Nine sharks were brought to the weigh station. Blue sharks, and an occasional mako, have been taking bait at the Gully, the Butterfish Hole, and the wreck of the Suffolk, said Elisa Jackman of Snug Harbor Marina.

Winning/published catches
295 lb. blue
210 lb. mako
190 lb. mako
259 lb. blue

2002
Most of the event's 52 boats fished the waters between The Fingers and The Gully yesterday, said Matt Conti in the marina's tackle shop. Fishermen are catching plenty of sharks, said Elisa Jackman of Snug Harbor Marina. Fishing aboard the charter boat Stuff It, Rick Donahue landed a mako over 130 pounds. Another angler landed a 240-pound thresher this week. The waters near the wreck of the Suffolk and the Butterfish Hole have been hot spots for makos, but there seem to be more blue sharks near The Fingers, Jackman said. More than 200 anglers are expected to compete in the tournament, fishing for blue sharks, makos and threshers. The overall winner receives a $2,000 U.S. Savings Bond and an electronic-navigation package, and tackle is awarded in divisions for the ladies, juniors, and individual shark categories. The fee is $100 for three anglers, and $35 for each additional fisherman.

Winning/published catches
392 lb. thresher
286 lb. thresher
307 lb. blue

250 lb. blue
228 lb. mako
213 lb. mako
278 lb. thresher
178 lb. thresher

2001
Blue sharks have been biting in the waters near the Fingers and the Dump, Al Anderson said. There are more sharks just south of Block Island, said Al Conti of Snug Harbor Marina. Aboard Spindrift, Wakefield anglers Dick Cannon, Dave Connon and Ernest Dunphy won the tagging trophy with 18 blue sharks released.

Winning/published catches
285 lb. blue
248 lb. blue
170 lb. mako

2000
Most of the blue sharks were caught at The Fingers, says Conti. The threshers ranged from The Gully to The Fingers. Looney Tunes won the team tagging division after releasing 15 sharks, and Robert Zuecher, fishing aboard Compromise, was the top individual tagger with 11 sharks released.

Winning/published catches
390 lb. thresher
309 lb. thresher
298 lb. blue
239 lb. blue
235 lb. blue

1999
Anglers from five states battled foul weather to take only six qualifying fish in the event. Most of the fish were caught at the Mud Hole, the Gully or near the Acid Barge, reports Elisa Jackman. The day after the tournament ended, David Gormly, fishing aboard Irish Endeavor, caught a 144-pound mako about five miles from the southeast corner of Cox Ledge.

7/8/99 Advertisement: “Put some bite in your weekend at one of the area's most popular sportfishing events. Fishermen on about 100 boats cast their lines to catch the biggest makos, thrashers and duskies around. The fishing starts at 5 a.m. Saturday and goes through Sunday afternoon - but Sunday's fishermen have to beat Saturday's top catch, so not as many sharks weigh in the second day. The in-the-know crowd gets to the marina between 1 and 5 p.m., when the boats start bringing in their toothy catch, Buffett tunes play overhead, and bragging rights begin.”

Notice how dusky’s are advertised.

Winning/published catches
294 lb. blue

8/1/99 – A week earlier, a Bristol angler landed the largest mako shark ever recorded – 1,324 lbs. (over 200 lbs. heavier than the current all-tackle world record).

1998
"Shark fishing has been terrific this season. Offshore, sharks have been biting all along the 30-fathom line; hot spots include The Gully, the Mud Hole and the wreck of the Suffolk." Aboard Billfish, Dana Cataloni landed a dusky shark.

Winning/published catches
322 lb. blue
320 lb. blue
199 lb. mako
173 lb. mako
153 lb. mako

1997
In its 16th edition, the event has become Rhode Island's largest saltwater big-game tournament. This year's event is scheduled for July 12-13.

"The winning team, which will be the one that brings in the heaviest shark during the two-day competition, will take home a new set of engine gauges from Faria Marine Instruments, plus $ 2,000 in U.S. Savings Bonds. The tournament will offer more than $ 12,000 in U.S. Savings Bonds, merchandise prizes and bonus awards. There will also be two Snug Harbor Super Fish Awards this year. If the winning mako shark establishes a Rhode Island record, the angler catchjing it will receive $ 3,000 in U.S. Savings Bonds. Another $ 2,000 in U.S. Savings Bonds will be awarded if the winning blue shark establishes a Rhode Island record. Additional categories will include prizes for the heaviest and second-heaviest of each eligible shark species, top lady and top junior angler awards, a unique hidden weight prize, as well as both team and club tag-and-release awards. As always, the event will continue to discourage the unnecessary killing of sharks and emphasize the preservation and conservation of this important marine resource. With that in mind, the minimum weights have been set at 225 pounds for blue sharks, 150 pounds for mako and thresher sharks and 125 pounds for dusky or brown sharks. There will be no geographic boundaries for fishing in the tournament, and teams may fish from private, party or charter boats. The only requirement is that all qualifying sharks must be weighed in at the Snug Harbor Marina. The entry fee for the tournament is $100 for each team of one to three anglers. Additional team members may register at a cost of $35 each. All participants will receive special tournament hats. Fishing clubs with at least four members registered in the event will automatically be included in the special inter-club competition."

Notice reference to being conservation-minded, while simultaneously encouraging the catch of duskys, which only 2 years later were listed as a prohibited species.

More than 200 anglers on 56 boats competed in the two-day event and many sharks were caught and released near the Mud Hole, the Suffolk wreck and the Fingers, said Al Conti of the marina. The No Name won the tagging award. Its anglers released 25 sharks after implanting numbered tags in the fish that will allow scientists from NMFS to track their movement, growth and health.

Winning/published catches
327 lb. blue
287 lb. blue
157 lb. blue
124 lb. thresher
218 lb. tiger
Junior Prize – (no weight given) Blue

1996
More than 150 anglers entered the two-day tournament based at Snug Harbor Marina in South Kingstown. The best fishing was in the Mud Hole where blue sharks accounted for most of the action, said Al Conti, the marina's owner. Only three mako sharks were hooked Saturday, and a couple bit yesterday, the calmer of the two days. New Milford Saltwater Anglers club of Connecticut won the tagging trophy for releasing 18 blue sharks over the weekend.

Winning/published catches
394 lb. thresher
349 lb. thresher
315 lb. blue
215 lb. blue
185 lb. mako

1995
More than 44 sharks were tagged in the two-day tournament, according to Patricia Conti of Snug Harbor Marina; she said the New Milford Saltwater Sportsmen's Club of Connecticut won the club trophy for tagging seven sharks. About 200 anglers fished the tournament on smooth seas Saturday. Sunday, however, northerly winds brought slop and chop to the tournament. Most of the fish were taken along the 30-fathom line between the Gully and the wreck of the Suffolk. The entry fee for the tournament is $25 per angler. All species of shark are eligible. The minimum weights are 225 pounds for blue shark; 150 pounds for mako shark; and 125 pounds for all other species. “As always, participants are urged to tag and release all undersized sharks as well as any not intended for consumption.” Each angler may enter only one shark per species on each day of the tournament. However, no limits apply to tag entries.

Winning/published catches
425 lb. thresher
337 lb. thresher

297 lb. mako
190 lb. mako
305 lb. blue
295 lb. blue
295 lb. blue
244 lb. blue
176 lb. dusky

1994
For the second consecutive year, the New Milford Sportfishing Association of Connecticut won the tournament's tagging award after releasing 14 blue sharks with tags that allow scientists to study health and habits of the fish. On the dock at Snug Harbor Marina over the weekend were scientists from NMFS and Duke University who took tissue samples from the mako sharks landed. The Snug Harbor tournament discourages the landing of species which are considered to be unsuitable for eating, such as blues. Early last evening, 19 anglers reported tagging 54 sharks, Fleet said. Keith Aragi, a member of the New Milford Club, was the top tagger after releasing eight blue sharks. Alex Petrucci, Jr., aboard his father's Duck Soup, reported releasing eight blue sharks without tags. More than 230 anglers entered the tournament.

Winning/published catches
357 lb. mako
247 lb. mako
227 lb. blue
148 lb. blue

6/24/94 - Blue-shark fishing should be at its peak, but it's still slow, according to Al Conti of Snug Harbor Marina. The charter boat Billfish out of Westerly tagged an 11-foot blue and a mako estimated at 165 pound near The Horns this week, and the sportfisherman Morning Star out of Snug Harbor landed a mako of more than 400 pounds to take second place in the Star Island shark tournament in Montauk, Long Island, over the weekend.

1993

1992
The Snug Harbor shark tournament is Rhode Island's largest saltwater fishing contest; 203 anglers entered the weekend event. Shark fishing is excellent on The Fingers and to the east where blue sharks are biting. Shark Ledge and the Mud Hole this week also have been producing sharks.

Winning/published catches
367 lb. thresher
335 lb. blue
313 lb. blue
309 lb. blue
296 lb. blue

230 lb. blue
170 lb. mako

1991
Fishing was excellent -- all the way from The Dump to the Butterfish Hole.

Winning/published catches
400 lb. tiger
389 lb. thresher
293 lb. blue
269 lb. mako
257 lb. thresher
153 lb. blue
229 lb. blue
218 lb. blue
175 lb. blue

1990
Most of the shark fishing occurred west of the northwest corner of The Dump and near The Fingers.

7/5/90 – Sharks landed:
316 lb. mako
282 lb. mako
262 lb. mako
191 lb. mako

1989
308 anglers entered in the tournament.

Winning/published catches
303 lb. blue
296 lb. blue
206 lb. blue
197 lb. blue
160 lb. mako

1988
19 fish were landed in the Snug Harbor Shark Tournament and many more were tagged on several traditional shark-fishing spots south and west of Block Island, fishing of The Fingers, fishing the water south of the southwest corner of Cox Ledge. 277 contestants landed 22 sharks; many more were tagged and released during the two-day tournament.

Winning/published catches
235 lb. mako (The shark may have weighed about 300 pounds, but it had been eviscerated before the weigh-in.)

221 lb. blue
198 lb. mako
141 lb. blue
129 lb. mako
113 lb. blue
140 lb. brown???
138 lb. dusky

1987
10 sharks qualified during the weekend tournament that was hampered by fog. More than 180 anglers registered for the two-day event. The majority of the fish caught were blue sharks. Some of the fishing took place in area called The Gully.
Winning/published catches
286 lb. 13-ft. thresher
62 lb. mako
(186 lb. mako was brought to the dock but was not accepted because the angler was not registered.)
228 lb. blue
227 lb. blue
182 lb. blue

1986
Last weekend's storm kept many fishermen off the water, but about 110 shark fishermen competed in the Snug Harbor Shark Tournament. They took a total of 17 sharks.
Winning/published catches
293 lb. blue
286 lb. blue
258 lb. blue
159 lb. blue
109 lb. mako (only mako caught)

Appendix 14 – Atlantic Recreational Landings of Sharks

Region	Year	Shark (numbers)	Region	Year	Shark (numbers)	Region	Year	Shark (numbers)	Region	Year	Shark (numbers)	Region	Year	Shark (numbers)
New England (ME-CT)	1993	14,599	Mid-Atlantic (NY-VA)	1993	41,674	South Atlantic (NC-FL east)	1993	123,522	Gulf (FL west-LA)	1993	151,175	Total Atlantic (ME-LA)	1993	330,970
	1994	1,436		1994	35,982		1994	162,197		1994	130,770		1994	330,385
	1995	2,249		1995	59,327		1995	139,522		1995	168,948		1995	370,046
	1996	366		1996	27,135		1996	138,516		1996	157,125		1996	323,142
	1997	908		1997	47,537		1997	81,471		1997	129,144		1997	259,060
	1998	839		1998	29,219		1998	89,909		1998	139,376		1998	259,343
	1999	1,633		1999	27,884		1999	75,302		1999	80,034		1999	184,853
	2000	185		2000	20,256		2000	94,129		2000	201,310		2000	315,880
	2001	446		2001	48,616		2001	125,720		2001	167,969		2001	342,751
	2002	191		2002	15,418		2002	65,905		2002	126,339		2002	207,853
	2003	70		2003	24,859		2003	93,772		2003	94,998		2003	213,699
	Total	22,922		Total	377,907		Total	1,189,965		Total	1,547,188		Total	3,137,982

Appendix 15 – New England Recreational Shark Landings

Region	Year	Shark (numbers)
New England (ME-CT)	1993	14,599
	1994	1,436
	1995	2,249
	1996	366
	1997	908
	1998	839
	1999	1,633
	2000	185
	2001	446
	2002	191
	2003	70
	Total	22,922
Region	**Year**	**Shark (numbers)**
New England (minus RI)	1993	7,880
	1994	1,284
	1995	914
	1996	0
	1997	679
	1998	74
	1999	1,627
	2000	129
	2001	0
	2002	191
	2003	0
	Total	12,778
Region	**Year**	**Shark (numbers)**
Rhode Island	1993	6,719
	1994	152
	1995	1,335
	1996	366
	1997	229
	1998	765
	1999	6
	2000	56
	2001	446
	2002	0
	2003	70
	Total	10,144

Appendix 16 – New England Recreational Shark Landings and Release

	Sharks		
Year	Total Harvest	Total Release	Total Catch
1981	3,662	3,424	7,086
1982	2,834	42,193	45,027
1983	8,993	1,481	10,474
1984	4,051	25,743	29,794
1985	4,518	11,243	15,761
1986	4,827	26,735	31,562
1987	5,296	22,072	27,368
1988	6,988	36,423	43,411
1989	2,812	36,602	39,414
1990	555	25,366	25,921
1991	6,822	40,857	47,679
1992	1,122	8,984	10,106
1993	14,599	22,775	37,374
1994	1,436	32,794	34,230
1995	2,249	34,202	36,451
1996	366	29,595	29,961
1997	908	21,627	22,535
1998	839	7,031	7,870
1999	1,633	36,129	37,762
2000	185	18,287	18,472
2001	446	26,345	26,791
2002	191	10,684	10,875
2003	70	6,865	6,935
Total	**75,402**	**527,457**	**602,859**

Appendix 17 – Rhode Island Recreational Shark Landings and Release

	Sharks		
Year	Total Harvest	Total Release	Total Catch
1981			0
1982	617	17,341	17,958
1983			0
1984	222	2,659	2,881
1985		9,110	9,110
1986	3,879	0	3,879
1987	0	2,631	2,631
1988	1,632	5,052	6,684
1989	2,592	7,155	9,747
1990	555	4,346	4,901
1991	2,786	18,148	20,934
1992	452	6,350	6,802
1993	6,719	8,776	15,495
1994	152	1,761	1,913
1995	1,335	20,425	21,760
1996	366	12,999	13,365
1997	229	11,682	11,911
1998	765	5,363	6,128
1999	6	24,525	24,531
2000	56	13,079	13,135
2001	446	1,529	1,975
2002	0	146	146
2003	70	3,927	3,997
Total	**22,879**	**177,004**	**199,883**

Appendix 18 – New England Recreational Shark Estimates (in MT)

Recreational				
Region	Year	Numbers Shark	MT (Low) Shark	MT (High) Shark
New England (CT-ME)	1981	3,662	73.2	274.1
	1982	2,834	56.6	212.1
	1983	8,993	179.7	673.1
	1984	4,051	80.9	303.2
	1985	4,518	90.3	338.1
	1986	4,827	96.4	361.3
	1987	5,296	105.8	396.4
	1988	6,988	139.6	523.0
	1989	2,812	56.2	210.5
	1990	555	11.1	41.5
	1991	6,822	136.3	510.6
	1992	1,122	22.4	84.0
	1993	14,599	291.7	1,092.6
	1994	1,436	28.7	107.5
	1995	2,249	44.9	168.3
	1996	366	7.3	27.4
	1997	908	18.1	68.0
	1998	839	16.8	62.8
	1999	1,633	32.6	122.2
	2000	185	3.7	13.8
	2001	446	8.9	33.4
	2002	191	3.8	14.3
	2003	70	1.4	5.2
	Total	75,402	1,506.6	5,643.4

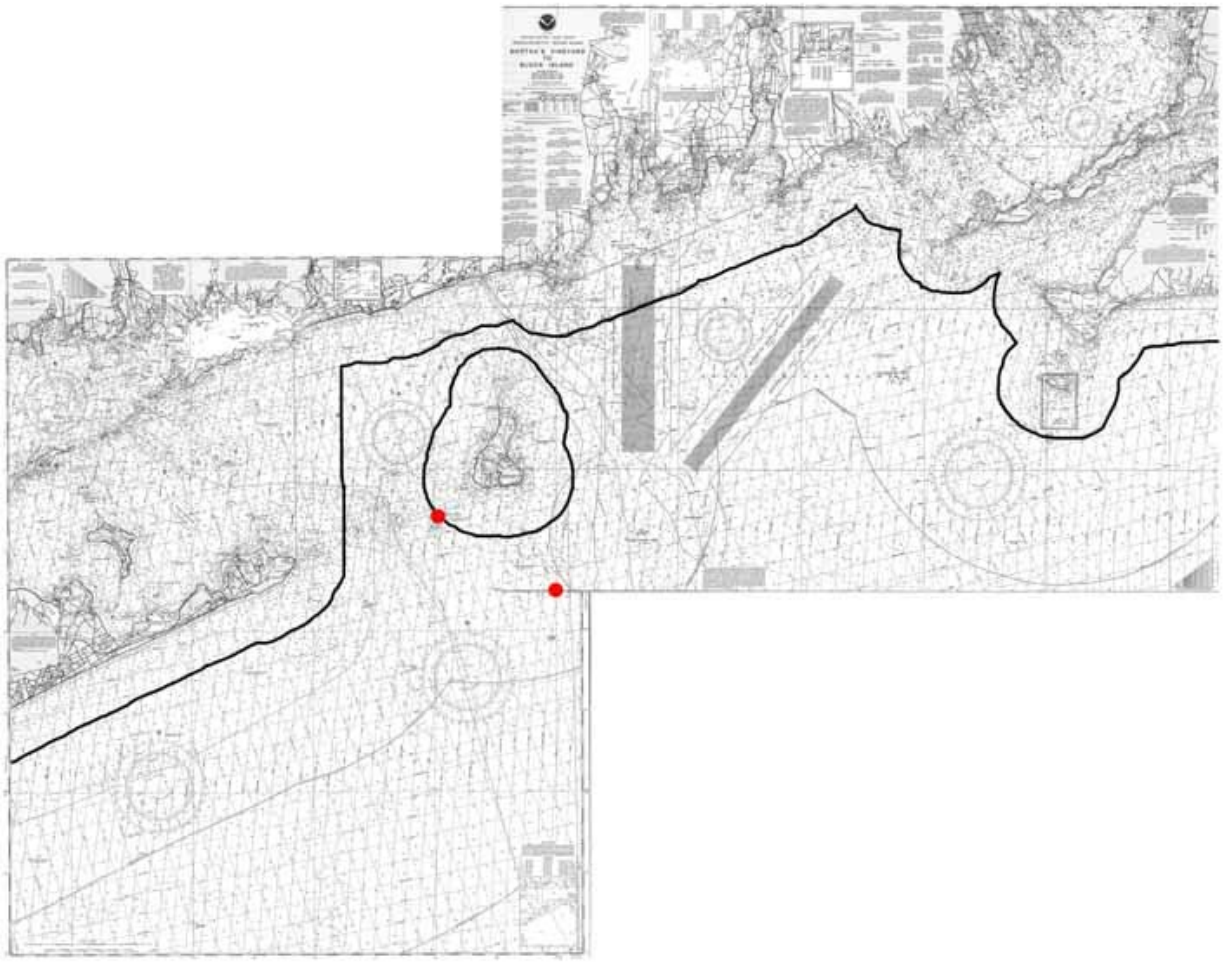
Appendix 19 – Rhode Island Recreational Shark Estimates (in MT)

Recreational				
Region	Year	Numbers Shark	MT (Low) Shark	MT (High) Shark
Rhode Island	1981			
	1982	617	12.3	46.2
	1983			
	1984	222	4.4	16.6
	1985			
	1986	3,879	77.5	290.3
	1987	0	0.0	0.0
	1988	1,632	32.6	122.1
	1989	2,592	51.8	194.0
	1990	555	11.1	41.5
	1991	2,786	55.7	208.5
	1992	452	9.0	33.8
	1993	6,719	134.3	502.9
	1994	152	3.0	11.4
	1995	1,335	26.7	99.9
	1996	366	7.3	27.4
	1997	229	4.6	17.1
	1998	765	15.3	57.3
	1999	6	0.1	0.4
	2000	56	1.1	4.2
	2001	446	8.9	33.4
	2002	0	0.0	0.0
	2003	70	1.4	5.2
	Total	22,879	457.1	1,712.3

Appendix 20 – New England and Rhode Island Shark Landings Estimates (Comm. + Rec.)

Total (Recreational + Commercial)				Total (Recreational + Commercial)				Total (Recreational + Commercial)			
Region	Year	MT (Low) Shark	MT (High) Shark	Region	Year	MT (Low) Shark	MT (High) Shark	Region	Year	MT (Low) Shark	MT (High) Shark
Rhode Island	1981	7.4	7.4	New England (CT-ME)	1981	191.5	392.4	New England (Minus RI)	1981	184.1	385.0
	1982	20.5	54.3		1982	134.2	289.7		1982	113.7	235.4
	1983	14.3	14.3		1983	256.7	750.1		1983	242.4	735.8
	1984	8.8	21.0		1984	145.4	367.6		1984	136.6	346.6
	1985	11.7	11.7		1985	139.8	387.6		1985	128.0	375.9
	1986	93.8	306.6		1986	156.0	420.8		1986	62.2	114.2
	1987	13.2	13.2		1987	211.6	502.2		1987	198.4	489.0
	1988	42.6	132.2		1988	241.9	625.3		1988	199.3	493.1
	1989	72.7	215.0		1989	227.6	381.9		1989	154.9	167.0
	1990	32.6	63.1		1990	162.1	192.5		1990	129.4	129.4
	1991	69.4	222.3		1991	275.5	649.7		1991	206.0	427.4
	1992	31.6	56.3		1992	187.7	249.2		1992	156.1	192.9
	1993	142.0	510.6		1993	515.8	1,316.7		1993	373.8	806.1
	1994	7.4	15.8		1994	218.5	297.2		1994	211.0	281.5
	1995	32.0	105.2		1995	168.9	292.2		1995	136.9	187.1
	1996	11.8	31.8		1996	132.0	152.0		1996	120.2	120.2
	1997	6.3	18.9		1997	107.2	157.0		1997	100.9	138.1
	1998	18.6	60.6		1998	73.8	119.8		1998	55.2	59.2
	1999	2.1	2.5		1999	62.3	151.9		1999	60.2	149.4
	2000	5.6	8.7		2000	52.6	62.8		2000	47.0	54.1
	2001	16.3	40.8		2001	35.7	60.2		2001	19.4	19.4
	2002	26.8	26.8		2002	53.1	63.6		2002	26.3	36.8
	2003	6.1	9.9		2003	23.0	26.8		2003	16.9	16.9
	Total	738.0	1,993.2		Total	4,119.5	8,256.3		Total	3,381.5	6,263.0

Appendix 21 – Rhode Island Shark Fishing Grounds



Appendix 22 – Historical Overview, including use of Best Scientific Evidence and the Precautionary Approach, and Management to Prevent Overexploitation and to Restore Depleted Species

Historical Overview

Historically, states were the primary managers of the United States' fisheries. The states had regulated fisheries in inland waters and the three-mile territorial sea and beyond since colonial times. The Submerged Lands Act of 1953 confirmed this jurisdiction by specifically granting the states "title to and ownership of…natural resources," including the "right and power to manage, administer, lease, develop, and use" marine resources within their boundaries, generally three miles.[467] Citizens of other states were also subject to state regulation within state waters, however, state regulation could not unreasonably discriminate against citizens of other states.[468] The states also had authority to regulate fishing by their citizens beyond territorial waters. In *Skiriotes v. Florida*, the Supreme Court recognized the right of a state to regulate fishing by state citizens beyond state waters, stating:

> If the United States may control the conduct of its citizens upon the high seas, we see no reason why the State of Florida may not likewise govern the conduct of its citizens upon the high seas with respect to matters in which the State has a legitimate interest and where there is no conflict with acts of Congress. Save for the powers committed by the Constitution to the Union, the State of Florida has retained the status of a sovereign….When its action does not conflict with federal legislation, the sovereign authority of the State over the conduct of its citizens upon the high seas is analogous to the sovereign authority of the United States over its citizens in like circumstances.[469]

Some courts had also recognized the authority of states to regulate non-state citizens beyond state waters when the state exhibited a legitimate interest and regulation was necessary for conservation of the fishery.[470]

However, the nature of fisheries exploitation changed significantly, particularly after World War II, and state management was increasingly seen as inadequate to deal with these changes. Foreign fishing in seas off the coasts of the U.S. increased dramatically as new fishing technologies developed and distant water, foreign fishing

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[467] 43 U.S.C. §§1311(a) (2000).

[468] Ibid. Also see Toomer v. Witsell, 334 U.S. 385, 403 (1948), holding that a South Carolina law that charged a $25 fee for a shrimping license for residents and a $2,500 license fee for nonresidents violated the Privileges and Immunities Clause of the Constitution; and Torao Takahashi v. Fish & Game Commission, 334 U.S. 410, 413, 420-21 (1948), holding that a California law prohibiting "any 'person ineligible to citizenship'" from obtaining commercial fishing licenses violated the Equal Protection Clause when applied to discriminate against resident aliens; and Douglas v. Seacoast Products, Inc., 431 U.S. 265, 286-87 (1977), holding that discrimination against vessels not meeting a Virginia statute's citizenship requirements was preempted by federal licensing and enrollment statutes.

[469] 313 U.S. 69, 77-79 (1941)

[470] In Alaska v. Bundrant, 546 P.2d 530, 552, 554-56 (Alaska 1976), the court held that the state had a legitimate interest in regulation of the offshore crab fishery and the regulation was necessary in light of the importance of conservation of the fishery.

fleets proliferated.[471] The U.S. witnessed the resources off its shores being overexploited by growing foreign fishing fleets and found that its relatively small and unsophisticated domestic fleets were at a severe competitive disadvantage.[472] Multilateral treaties and regional fisheries organizations attempted to address the depletion of fish stocks, but neither these attempts at international cooperation nor creation of a twelve-mile fishing zone around the U.S. in 1966 by the Bartlett Act[473] slowed depletion of fish stocks. These concerns, and the perception that negotiations surrounding the Third Conference on the Law of the Sea (UNCLOS III) were proceeding too slowly to prevent the decimation of offshore fisheries, prompted Congress to pass the Magnuson-Stevens Fishery Conservation and Management Act in 1976.[474] The Act extended exclusive U.S. fisheries jurisdiction to 200 miles offshore, and originally designated the management area a fishery conservation zone, but it was later amended to reflect the U.S.'s claim in 1983 to a 200-mile exclusive economic zone (EEZ) that incorporated fishery management jurisdiction.[475] State waters, which are excluded from the EEZ, generally extend from the baseline to three miles offshore.[476]

The policies and purposes of the Act address both the conservation, development, and management of fishery resources and the development of domestic commercial and recreational fishing. The Act, as amended in 1996, provides ten "National Standards" that reflect these purposes and provide overarching principles to guide the entire fisheries management process. National Standards 1, 2, and 9 require fisheries management plans (FMPs) to establish conservation and management measures based on the best scientific information to prevent overfishing, minimize bycatch, and assure optimum yield.[477] National Standards 3 through 7 provide that nondiscriminatory means should used to manage fisheries throughout their range.[478] Measures should be taken to avoid duplication and promote efficiency, but cannot have economic allocation as a sole purpose. National Standards 8 and 10 require management measures to take into account the effects on fishing communities and to promote the safety of life at sea.[479]

The Magnuson-Stevens Act established eight regional fishery management councils to develop FMPs. However, management plans for Atlantic Highly Migratory Species are developed by NOAA/NMFS and are an exception to the council management system.[480] Before 1990, five fishery management councils (New England FC, Mid-Atlantic FC, South Atlantic FC, Gulf of Mexico FC, and the Caribbean FC) had authority to manage Atlantic HMS found in their regions, however, the FMPs that were developed and implemented only related to swordfish and billfish.[481] On November 28, 1990, the Fishery Conservation Amendments of 1990 amended Magnuson-Stevens and gave the

[471] Scheiber, Harry N. 2001. Ocean Governance and the Marine Fisheries Crisis: Two decades of innovation – and frustration. 20 VA Environmental Law Journal 119, 119-21
[472] Ibid.
[473] Pub. L. No. 89-658, §§1-4, 80 Stat. 908, 908 (1966)
[474] Scheiber, H.
[475] 16 U.S.C. §1811. (2000)
[476] Submerged Land Act, 43 U.S.C. §1312 (2000)
[477] 16 U.S.C. §1851 (a)(1), (2), (9).
[478] 16 U.S.C. §1851 (a)(3-7).
[479] 16 U.S.C. §1851 (a)(8), (10).
[480] 16 U.S.C. §1854 (g).
[481] NMFS. 1999. FMP for Atlantic Tunas, Swordfish and Sharks. Vol. 1.

Secretary of Commerce the authority to manage Atlantic tunas, swordfish, billfish, and sharks - what NMFS has termed "highly migratory species" (HMS).[482] The FMPs propose regulations that will generate "optimum yield" (OY) – the amount of fish providing "the greatest overall benefit to the Nation" – from the region's fisheries.[483] The FMPs are then implemented through regulations of the U.S. Department of Commerce and NMFS.

The major overhaul of the Magnuson-Stevens Act was its reauthorization and amendment by the 1996 Sustainable Fisheries Act (SFA).[484] After 20 years, there was a recognition of the inadequacies of the Act to achieve progress toward sustainable fisheries, and this called for serious reconsideration of management principles. The political scientist and attorney Harry Scheiber characterized the original 1976 provisions as exhibiting "ambitious, but ambiguous regulatory design, confusion of scientific and political visions, and a lack of administrative will."[485] The 1996 SFA's goals, time limits, procedural and structural reforms, as well as the Act's clarification and prohibition on overfishing, addressed many of these weaknesses. NMFS has recently pointed to its successes in rebuilding fisheries since enactment of the SFA, noting that in the past five years, "twenty species have been taken off the overfished list and overfishing has been eliminated for twenty-five species."[486] However, this optimistic statistic is somewhat diluted by the fact that in the same period overfishing has begun in 14 cases and in 13 cases a stock has become overfished.[487] 86 stocks are currently overfished, including that of large coastal sharks, and 66 stocks are experiencing overfishing, again including large coastal sharks, finetooth sharks, and pelagic sharks.[488] Furthermore, the overfished status of 695 stocks remains classified as "unknown or not defined," and whether overfishing is occurring cannot be determined in the case of 658 other stocks because the harvest rate is not know or NMFS has not yet defined the threshold for overfishing.[489]

Best Scientific Evidence and the Precautionary Approach

National Standard 2 of the Magnuson-Stevens Act states that "conservation and management measures shall be based on the best scientific evidence available."[490] In general it is argued that this standard recognizes that fisheries research is never going to provide perfect information, but that management must proceed even when critical information may be lacking.[491] This standard highlights the need for more data-

[482] 16 U.S.C. §1854(f)(3)
[483] 16 U.S.C. §1802(28)(A).
[484] Pub. L. No. 104-297, 110 Stat. 3559 (1996)
[485] Scheiber, H. note 16 at 127.
[486] Dept. of Commerce. NOAA marks another year of success in rebuilding America's marine fish stocks; Releases annual report to Congress. 5/13/03. http://www.nmfs.noaa.gov/sfa/sospressrelease.pdf
[487] NOAA Fisheries. Sustaining and Rebuilding, 2002 Report to Congress, The Status of Fisheries. 2003. http://www.nmfs.noaa.gov/sfa/statusoffisheries/cover2_sos.htm
[488] Ibid. NMFS identifies 259 stocks as major, that is, stocks with landings over 200,000 pounds. These stocks account for 99.9% of the nation's landings. Of these major stocks, 41 are subject to overfishing, 129 are not subject to overfishing, and the status of 99 stocks is classified as undefined. 43 are of the major stocks are overfished, 117 are not overfished, and 99 are undefined.
[489] Ibid.
[490] 16 U.S.C. §1851(a)(2).
[491] 50 C.F.R. § 600.315(b). 2002. "The fact that scientific information concerning a fishery is incomplete does not prevent the preparation and implementation of an FMP."

gathering, assessment, and fisheries research. As such, when judgments must be made in the absence of adequate information, the unequivocal mandate in National Standard 1 of the Magnuson-Stevens Act to prevent overfishing necessitates that management should err on the side of conservation.[492] These two standards arguably require the adoption of a precautionary approach in fishery management.[493] Indeed, the Guidelines for National Standard 1 state: "In general, Councils should adopt a precautionary approach to specification of (optimum yield of a fishery)."[494] In the realm of international environmental law, the precautionary approach is embodied in Principle 16 of the Rio Declaration, which provides that "where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."[495] More recently, the United Nations Fish Stocks Agreement, to which the U.S. is a party, set out in more detail the role that the precautionary approach plays in fisheries management.[496] Parties to the Agreement have the duty to "apply the precautionary approach widely to conservation, management and exploitation of straddling fish stocks and highly migratory fish stocks in order to protect the living marine resources and preserve the marine environment."[497] Article 6 discusses the basic premise of the precautionary approach:

> 2. States shall be more cautious when information is uncertain, unreliable or inadequate. The absence of adequate scientific information shall not be used as a reason for postponing or failing to take conservation and management measures.[498]

While the U.S.'s participation in the U.N. Fish Stocks Agreement does not directly obligate the U.S. to apply the precautionary approach to management of all fisheries in the EEZ, there seems to be no justification for adopting an inconsistent approach for fisheries occurring solely within the EEZ, and the Agreement provides important "substance" to the concept of the precautionary approach.[499]

The Endangered Species Act calls for use of "the best scientific and commercial data available" in assessing whether a species should be listed as

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[492] 16 U.S.C. §1851 (a)(1). 2000.

[493] Many commentators state that the 1996 SFA incorporated the precautionary approach into U.S. fishery management law. However, there is no specific reference to the precautionary approach or the precautionary principle in the SFA or implementing regulations. Territo, M. The precautionary approach in marine fisheries conservation and the U.S. Sustainable Fisheries Act of 1996. 24 Vermont Law Review. 1351, 1372. 2000

[494] 50 C.F.R. § 600.310(f)(5). 2002.

[495] Rio Declaration on Environment and Development. 6/14/92. Principle 16, 31 I.L.M. 874, 879.

[496] Agreement for the Implementation of the Provisions of the U.N. 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. U.N. Doc. A/CONF.164/37. 1995

[497] Ibid. Article 6(1), 31 I.L.M. at 1551

[498] Ibid. Article 6(1), 34 I.L.M. at 1551

[499] Restrepo, V.R. et al. Technical guidance on the use of precautionary approaches to implementing national standard 1 of the Magnuson-Stevens Fishery Conservation and Management Act 8-14, NOAA Technical Memorandum NMFS-F/SPO-31. 1998 http://shrimp.ccfhrb.noaa.gov/~mprager/Tech-Guidelines.pdf

endangered or threatened, but apparently NMFS has no duty to do additional research if existing data are insufficient.[500] In *Southwest Center for Biological Diversity v. Babbit*, the court held that the "Secretary has no obligation to conduct independent studies" to improve the available data.[501] The requirement "merely prohibits the Secretary from disregarding available scientific evidence that is in some way better than the evidence he relies on. Even if the available scientific and commercial data were quite inconclusive, he may – indeed must – still rely on it at that stage."[502] However, the fact that data are "not conclusive," does not preclude listing.[503]

Management to Prevent Overexploitation and to Restore Depleted Species

NMFS does have authority to issue regulations to prevent takings and "as…necessary and advisable, to provide for the conservation of (threatened) species."[504] Direct implementation of recovery plans through NMFS is thus, arguably a logical approach for ensuring recovery of the species. One of the Magnuson-Stevens Act's clearest directives is set out in National Standard 1: namely that FMPs must "prevent overfishing." The 1996 SFA defines the terms "overfishing" and "overfished" to mean "a rate or level of fishing mortality that jeopardizes the capacity of a fishery to produce the maximum sustainable yield on a continuing basis."[505] Each FMP must contain measures to prevent overfishing and rebuild overfished stocks, including criteria for determining when a fishery is overfished and, if a fishery is nearing an overfished condition or is already overfished, measures to prevent or end overfishing and to rebuild the fishery.[506]

The Secretary of Commerce must report annually to Congress (and the Councils) on the status of HMS and other fisheries and identify fisheries that are either overfished or are approaching a condition of being overfished. Magnuson-Stevens states that, "A fishery shall be classified as approaching a condition of being overfished if, based on trends in fishing effort, fishery resource size, and other appropriate factors, the Secretary estimates that the fishery will become overfished within two years."[507] Within one year of receiving notice that a highly migratory species' fishery, is overfished, NMFS (or the relevant FMC for other fisheries) must submit a plan amendment or proposed regulations to end or prevent overfishing and to rebuild the affected stocks. NMFS must establish a time period to end overfishing and rebuild the stock that is as "short as possible, taking into account the status and biology (of the stocks), the needs of fishing communities, recommendations of international organizations…and the interaction of the overfished stock of fish within organizations…and the interaction of the overfished stock of fish within the marine ecosystem."[508] The time period is not to exceed ten years except where

[500] 16 U.S.C. §1533(b)(1)(A) 2000
[501] 215 F.3d 58 (D.C. Cir. 2000)
[502] Ibid. 60
[503] Defenders of Wildlife v. Babbitt, 958 F. Supp. 670, 681 (D.D.C. 1997) Holding that Congress clearly intended ESA to provide preventive protection before "conclusive" evidence exists.
[504] 16 U.S.C. § 1538(a)
[505] 16 U.S.C. § 1802(29)
[506] 16 U.S.C. § 1853(a)
[507] 16 U.S.C. § 1854(e)(1)
[508] 16 U.S.C. § 1854(e)(4)(A)(i)

"the biology of the stock, other environmental conditions, or management measures under an international agreement…dictate otherwise."[509] Yet fishing at MSY for one species may result in overfishing of another species, and so the complex interactions of species certainly complicates the implementation of any management. NMFS even permits overfishing, if it will "result in long term benefits, mitigating measures have been considered, and the level of fishing will not cause any species to require protection under the ESA."[510]

Courts have found that NMFS must adopt quotas with at least a 50% probability of reaching targets that will prevent overfishing. In *NRDC v. Daley*, the Court of Appeals found that a quota with an 18% likelihood of meeting targets was insufficient to meet the mandate to prevent overfishing.[511] Furthermore, in *Conservation Law Foundation v. Evans*, the court held that agencies must show at least a 50% likelihood of meeting targets.[512] Given the uncertainties of fisheries management and past historical failures, even a quota that provides a 50% probability of achieving the goal of preventing overfishing may not provide an effective measure to ensure restoration of a deplenished species. Attorney Donna Christie explains that "some courts are finding a tension between the mandate to set quotas at a level that will prevent overfishing and the requirement to alleviate economic impacts on fishing communities."[513] Since the 1990 amendments to the Magnuson-Stevens Act, the contents of a FMP have been required to include a "fishery impact statement" to "assess, specify, and describe the likely effects…(on) participants in the fisheries and fishing communities affected by the plan or amendment…"[514] National Standard 8 was added to the Magnuson-Stevens Act by the SFA in 1996 and provides that to the extent "consistent with the conservation requirements" of the Act, management measures must take into account the importance of the resources to the fishing communities and, "to the extent practicable," to minimize the adverse economic impact on these communities in the fisheries.[515] In *NRDC v. Daley*, however, the Court of Appeals emphasized that the duty to prevent overfishing under Standard 1 takes precedence over Standard 8.[516] Essentially, regulations provide that the effect of Standard 8 is that when two alternatives achieve similar conservation goals, the agency will choose the alternative that better achieves Standard 8 goals as well.[517] Christie, however, contends that "neither Standard 8 nor the RFA[518] (Regulatory

[509] 16 U.S.C. § 1854(e)(4)(A)(ii)
[510] 50 C.F.R. § 600.310(d)(6). NMFS has been criticized by many environmental groups, including Environmental Defense, NRDC, and others, for this very problem of creating regulatory exemptions that permit overfishing in certain circumstances.
[511] 209 F.3d 747 (D.C. Cir. 2000)
[512] 209 F.2d 1, 10 (D.D.C. 2001)
[513] Chrisie, D. Living marine resources management: A proposal for integration of U.S. management regimes. Environmental Law. Vol. 34, No. 1. 2004. p.143
[514] 16 U.S.C. §1853(a)(9)
[515] 16 U.S.C. §1851(a)(8)
[516] 209 F.3d 747 (D.C. Cir. 2000)
[517] 50 C.F.R. § 600.345(b). 2004.
[518] 5 U.S.C. § 601-612 (2000). RFA provides more direct consideration of the effects of fisheries regulation on individual fishermen and businesses, because such a large proportion of U.S. commercial fisheries would fall within the category of "small business", the analysis required under the RFA is directly related to regulations implementing Standard 8, the fishery impact statement (FIS) and individual FMPs. (see D. Christie) The purpose of the RFA is to assure that agencies take into account the disproportionate

Flexibility Act) provide fishermen or fishing communities a great deal of substantive protection, but the provisions ensure their plight continues to be highlighted to the FMCs, NOAA Fisheries (NMFS), and Congress."[519] The bottom line, though, is that fisheries must first have fish. In *A.M.L. Int'l. Inc. v. Daley*, which upheld a management plan for spiny dogfish that would potentially shut down the fishery for five years, Judge Harrington quoted the legislative history of the SFA:

> At the present, efforts to halt overfishing, restore the depleted resource, and conserve habitats will decrease revenues to fishermen and drive some out of business. The industry will have to sustain some losses in the short term if it is to remain viable in the long term.[520]

impacts regulations may have on small businesses and to require agencies to consider less burdensome alternatives if the impact on small businesses is significant. The RFA however, states that it does "not alter in any manner standards otherwise applicable by law to agency action" and is primarily procedural.

[519] Christie, D. p.161

[520] 107 F. Supp. 2d 90, 108 n.29 (5/18/94)

Appendix 23 – Atlantic States' Shark Regulations

State	Cite Reference	Regulatory Details
ME	Code ME R. 13-188 ' 50.02	Regulations apply to Spiny dogfish only.
NH	FIS 603.19	Regulations apply to Spiny dogfish only.
MA	Mass 322 Section 6.35	Regulations apply to Spiny dogfish only. In September 2004 the Director of Marine Fisheries passed emergency regulations to prohibit the landing of white sharks. The agency has recently proposed making this a permanent regulation and including three other species (basking, dusky, sand tiger) to complement federal regulations.
RI	RIMFC Regulations ' 7.15	Regulations apply to Spiny dogfish only.
CT	§26-159a-19	Regulations apply to Spiny dogfish only.
NY	NY Environmental Coservation ' 13-0338; State of New York Codes, Rules and Regulations (Section 40.1)	Shark finning prohibited; Reference to the Federal regulations 50 CFR part 635; Prohibited sharks listed.
NJ	NJ Administrative Code tit. 7, ' ' 25-18.1 - 25-18.2	Commercial/Recreational possession limit - 2 fish/vessel; Finning prohibited; May be eviscerated; Dorsal fin to pre-caudal fin must be at least 23" in length; Total length must be 48" in length.
DE	DE Code Regulations 3541	Creel limit on regulated sharks 1 fish/vessel/day; Creel limit for sharpnose is 2/day; Minimum size on regulated sharks - 54" in FL. Prohibition against possessing fins without them being attached naturally to the body.
MD	Code of Maryland Regulations tit. 8, ' 02.05.17	Minimum size - 54" FL; 31" carcass; Finning prohibition; Recreational catch limit - 1 fish/person/day; Commercial catch limit - 4,000 lbs/day; Reference to 50 CFR 635
VA	4 VA Administrative Code 20-490	Possession limit - 1 fish/person; 1 fish for each person on board boat with common hold; Minimum size - 58" FL (Commercial Only); 31" CL (Commercial Only); 7500 lb/vessel/day/limit; 200 lb limit on shark carcasses less than 31" minimum CL taken within VA state waters; Finning prohibited; Spiny dogfish regulations as well.
NC	NC Administrative Code tit. 15A, r.3M.0505; Proclamation FF-24-2004	Director may impose restrictions for size, seasons, areas, quantity, etc.; Proclamations consistent with closures for LCS, SCS, and Pelagics; Closure to directed shark harvest since 1997; proclamation smooth dogfish may be dressed at sea.
SC	SC Code Ann. ' 50-5-2725	Retention limit - 2 Atlantic sharpnose/per/day and 1 Bonnethead/person/day; No minimum size for recreationally caught bonnethead sharks; No need for Federal recreational angler permit to fish for shark in state waters; Reference to federal commercial regulations and closures.
GA	GA Code Ann. ' 27-4-130.1; OCGA ' 27-4-7(b); GA Comp. R. & Regs. ' 391-2-4-.04	Daily limit 2; Possession limit 2 person/vessel (whichever less); Minimum size 48"; Limit 1 shark less than 84"; Sand tiger sharks - all harvest is prohibited; SCS (including Atlantic sharpnose and bonnethead) - 2/day/person; Minimum size 30" TL; All species must be landed head and fins intact. Sharks may not be landed in Georgia if harvested using gill nets.
FL	FL Administrative Code Ann. r.68B-44, F.A.C.	No size limit; Retention limit (rec. and comm.) - 1 shark/person/day; Maximum of 2 sharks/vessel (with two or more persons on board); Reference to Federal regulations regarding commercial season, closures, and prohibitions on sale; Federal regulatory permits for sale of sharks and swordfish; Finning and Filleting prohibited.
AL	AL Administrative Code r.220-2-.46, r.220-3-.30, r.220-3-.37	Recreational daily bag limit - 2 sharpnose/person/day; all other species - 1 fish/person/day; Recreational minimum size all sharks (except sharpnose) - 54" FL; Reference to shark commercial season and bycatch provisions
MS	MS Code R. 43 000 040, Ord. 7.025	Recreational minimum size - LCS/Pelagics (37 in TL); SCS (25 in TL); Recreational bag limit - LCS/Pelagics (1/person up to 3/vessel); SCS (4/person); Commercial - Reference to Federal regulations.
LA	LA Administrative Code tit. 76, ' 355	Minimum size - 54" except sharpnose; Possession limit - 1 fish/vessel/trip; Trip limit 4,000 lbs dw LCS; Reference to Federal regulations; State waters closed to rec./commercial April 1 through June 30
TX	TX Administrative Code Title 31, Part 2, Parks and Wildlife Code Title 5, Parks and Wildlife Proclamations 65.3 and 65.72	Commercial/Recreational retention limit 1 fish/person/day; Commercial/Recreation possession limit is twice the daily bag limit (i.e., 1 fish/person/day); Commercial/Recreational minimum size 24 in TL.

Appendix 24 – RIDEM Fish and Wildlife FY 2004 – 2007
Objectives and Initiatives

Objective 1 - Maintain Healthy and Sustainable Populations of Fish and Wildlife

Trends

- The fisheries resource of Narragansett Bay and Rhode Island Sound is in transition. Demersel fish populations are in decline while pelagic species populations are increasing. Crab and lobster survey results have shown population increases while quahaugs have declined. This community restructuring is coincident to overfishing of demersal finfish, a long-term increase in water temperature, and predator-prey interactions.
- The commercial fishery has responded by shifting effort to underutilized species and exploring new market opportunities. Recreational anglers have also shifted emphasis to species under recovery such as striped bass and summer flounder. They have become more engaged in the management process, demanding rebuilding of the depressed stock and an equitable share in the harvest.
- Research, assessment, and management of the marine resources have grown exponentially in the past decade. Passage of the Atlantic Coastal Fisheries Cooperative Management Act and the Sustainable Fisheries Act have required state and federal agencies to channel substantial resources into rebuilding depleted stocks.
- Fisheries management has experienced a shift from resource orientation to client orientation.

Problems

- The demands of accelerated resource management have exceeded division resources. Modern management is largely a people issue demanding many interactions with stakeholders. Division scientists are not trained in this area, resulting in ineffective facilitation that does not meet current resource management needs.
- Many populations and in some cases, entire species, are at risk in future years unless adequate advocacy, funding and staffing can be secured.
- Volunteer information from recreational anglers (logbooks, records, surveys etc) is an untapped source of information. Additional staff is needed to coordinate this work so that it may be used as part of the stock assessment process.

Initiatives

Ecosystem/Watershed Management

• The division will begin a survey of the Block Island fisheries resource using a monthly, multi-gear sampling format.

• The division has recognized the importance of essential fish habitat and has delegated the responsibility for this issue to one staff scientist.

• The division will develop a comprehensive wildlife management plan that will focus on species of the greatest conservation need.

Promote Partnerships

• The federal sportfish program will be expanded to include a research partnership with the URI Graduate School of Oceanography. They will study the decline of winter flounder in Narragansett Bay.
• The division will strengthen and restructure the citizens advisory panels which advise the RI Marine Fisheries Council
• With assistance from Senator Chafee's office, a partnership will be formed between the division and NMFS to study fisheries problems in Narragansett Bay. This will provide enhanced port & sea sampling and water quality studies.
• The division will expand its partnership with the EPA to monitor mercury in various trophic levels.

Streamline Processes

• A grant request to streamline and modernize fishery data collection will be submitted to the Atlantic States Cooperative Statistics Program for consideration.

Training

• Staff training in fisheries stock assessment methods, GIS, and general computer skills will continue.

Objective 2 - Protect and Restore Habitat. Promote Biodiversity.

Initiatives

Protect and Restore Critical Resources

• Expand Narragansett Bay survey work to cooperate with EPA and the Coastal Resources Management Council to identify eelgrass and aquatic vegetation.

Ecosystem/Watershed Management

• The division will represent fish and wildlife resource issues in watershed based decision-making.

Objective 3 - Improve Recreational Fishing and Hunting

Trends

• New areas are being developed to increase angler access. The Haines Memorial Park Boat Ramp and the Carbuncle Pond Fishing Pier were finished in 2002. Both facilities were handicap accessible. Funding for these two areas involved a continuing partnership with the
Governor's Commission on Disabilities. Repairs, maintenance, and operations of existing public access continue.
• Marine Recreational Fisheries Statistics show recent increases in marine recreational fishing in Rhode Island. Much of this increase is due to the successful coast wide cooperative (state/federal) restoration of Striped Bass.

Problems

• Increasing the number of public access areas for angling and boating has also increased the maintenance and operation responsibilities (cost) of the division.

Initiatives

Promote Partnerships

• Planned public access improvements include, major repairs to boat ramps at Fort Adams, Gaspee, Longmeadow, Pawtuxet Village, Gull Cove, Prudence Island, and Mt. Hope. These Handicap accessible fishing facilities are planned for Coventry, Stillwater Reservoir, Carolina

Trout Pond, and J. L. Curran Reservoir. The division will cooperate with local communities and the Governors Commission on Disabilities.
• Using the Aquatic Education Program's network of instructors, programs in angling will be scheduled to increase the number of trained students.

Set an Example

• The division's program to make boat ramps, fishing areas, and hunting areas handicap accessible continues. This program will call on partnerships with the Governors Commission on Disabilities and local communities. For example, the Division is working with the Governors Commission on Disabilities to develop a site at Carbuncle Pond and with SCAT to install a handicap accessible trail at Black Point.
• Angling programs for disabled and special needs people will increase because of specialized programming at a disabled fishing training pier at the hatchery.

Objective 4 - Promote the Fisheries and Wildlife Resources as a Key Element in Rhode Islands Economy.

Trends

• Fish and wildlife resources and the business they support make up a significant sector of Rhode Island's economy. Surveys in 1996 estimated that 163,095 resident and non-resident anglers participated in recreational fishing in Rhode Island, spending over $136,000,000.
This total includes both fresh and saltwater angling. These anglers supported over 3000 full time jobs and generated over $11,000,000 in state sales and income tax revenue. This same survey estimated that there were over 16,000 Rhode Island hunters who spent an estimated
$20,785,000. In 1996 over 4,000 commercial fishing licenses were issued and the value of the total commercial landings of fish and shellfish greater than $230,000,000.

Problems

• Fisheries and wildlife resources must be considered and managed as a segment of Rhode Island's economy.
• Lack of support by state and local governments for fisheries and wildlife resources.

Initiatives

Promote Partnerships

• Develop a partnership with the Rhode Island Economic Development Corporation to promote the economic importance of Rhode Island's natural resources.

Improve Communications

• Prepare and publish public access guides to assist the local and state tourist industry.
• Improve and expand the Information and Education Section of DEM to promote all programs available to the general public. Develop a monthly or quarterly magazine that would promote DEM's image and the State Of Rhode Island outdoor activities.

Objective 5 - Asset Protection - Improve Division Facilities to Increase Program Effectiveness

Trends

• Design of the new facility at the Great Swamp is underway.
• The existing marine research vessel (42' T. J. Wright) is too small and inadequate to properly sample Rhode Island Sound and Narragansett Bay. A contract to replace the

existing marine research vessel with a larger vessel (60') capable of multiple sampling techniques has been awarded. Construction will begin in FY 2001.
• Existing base station and mobile radio network lacks ability to communicate within the division and with the Division of Enforcement's EPOs.

Problems

• The division does not have a central facility providing the public with access to information on fish and wildlife resources or outdoor recreational opportunities. There is also a lack of classroom, lab, and storage space for the aquatic education and hunter safety programs.
• The division has a substantial investment in heavy equipment, tractors, trucks, and boats. Storage and workshop capabilities are inadequate.
• The division of Enforcement has changed its radio networking to low band capabilities, while the division remains with high band capabilities resulting in the inabilities to communicate between divisions during potential disaster responses or other emergency situations.

Initiatives

Streamline Processes/Improve Communications

• The division will begin planning a new field headquarters in FY2003 to replace the Great Swamp facility. This new facility will be a center for the Freshwater Fisheries Section, the Wildlife Section, the Aquatic Education Program, and the Hunter Safety Program. This new facility will be equipped with adequate classrooms, meeting areas, and demonstration spaces to accommodate the dissemination of public information and education. The purpose of this facility is to streamline public access to DEM programs and information. These public meeting facilities will be ideal for public hearings, workshops, and community partnerships.
• Purchase low band base station and mobile radio communications.

Appendix 25 – Catch Report Card Legislation

Rhode Island Catch Report Card Rule

RI § 20-38-1. Catch record cards. It is unlawful for any person to fail to comply with the catch record requirements as provided for in this section:

(1) In order to fish for or possess for personal use any HMS/shark an angler or commercial fishermen must obtain and have in personal possession a valid appropriate catch record card as described in RI § ?.

(2) Any angler, after obtaining a catch record card shall validate the catch record card by completely, accurately, and legibly completing all personal identification information in ink on the catch record card prior to detaching the catch record card from the underlying copy of the catch record card. A catch record card remains valid so long as there are one or more unfilled spaces available for the species being fished for.

(3) Immediately upon catching a HMS/shark the angler shall enter in ink in the appropriate space the place, date of catch, species (catch type), length, gear type used, and vessel type.

(4) Every person possessing a catch record card shall by April 30 of the year following the year printed on the card return such card to the Division of Marine Fisheries.

(5) Any person possessing a catch record card shall, upon demand of any law enforcement officer or authorized DEM or Division employee, exhibit said card to such officer or employee for inspection.

(6) A catch record card shall not be transferred, borrowed, altered, or loaned to another person.

RI § 20-38-2. Description of catch record cards and required information. (1) The department shall prepare and distribute a catch record card for the following HMS:

(a) Sharks;

(b) Tunas;

(c) Swordfish;

(d) Billfish.

(2) Each catch record card shall contain space for the following information, which must be recorded prior to the catch record card being separated from the underlying copy of the catch record card:

(a) Name of fisher;

(b) Home address;

(c) City, state, and zip code;

(d) Date of issuance;

(3) Each catch record card shall contain space for the following information:

(a) Month of catch;

(b) Day of catch;

(c) Location of catch;

(d) Identification of the catch;

(e) A space for designating the type of vessel from which the species was taken, either charter or personal boat, as well as the gear type used;

(f) A space for the length of the species;

Appendix 26 – Shark Conservation Stamp Legislation

RI § 20-38-3 Shark Conservation Stamp

No person shall catch any shark without first obtaining a Rhode Island shark conservation stamp for the current year. Each stamp shall be validated by signature of the licensee written in ink across the face of the stamp, shall not be transferable, and shall be in his or her possession while engaged in the activity permitted under the terms of the license and stamp. The stamp year shall run from March 1 to the last day in February. The shark conservation stamp shall be available at all outlets currently used for the issuance of the HMS Recreational fishing license.

RI § 20-38-4 Shark Conservation Stamp - Design, Production, and Distribution

The director of the department of environmental management shall adopt and shall be responsible for the design, production, procurement, distribution, and sale of all shark conservation stamps and all marketable stamp by-products such as posters, artwork, calendars, and other items.

RI § 20-38-5 Shark Conservation Stamp - Fee

Stamps shall be sold at the direction of the director for a fee of twenty-five dollars and fifty cents ($25.50) for recreational anglers and one-hundred and thirty-five dollars and fifty cents ($135.50) for charterboat/headboat operators. The issuing agent may retain a fee of fifty cents ($.50) for each stamp sold, and shall remit the remainder of each fee to the department. The director shall establish uniform sale prices for all categories of by-products.

RI § 20-38-76 Disposition of Shark Conservation Stamp Receipts

All apex predators' conservation stamp receipts and all receipts from the sale of stamp by-products shall be deposited in a special shark conservation fund. All stamp and stamp by-products receipts shall be expended through the appropriations process for operations, shark habitat including acquisition, improvement research, and conservation.

Appendix 27 – Shark Films and Revenues

Shark Films*

YEAR	FILM	STUDIO/PROD. CO.	BOX OFFICE
1975	*Jaws*	Universal	$479,653,000
1977	*Tintorera*	Conacite Uno (Mexico), Hemdale, Productora Filmica Real (Mexico), United Film Distribution Company	
1977	*The Jaws of Death*	Paragon Video Production	
1978	*Jaws 2*	Universal	$187,884,007
1979	*Up From the Depths*	New World Pictures	
1983	*Jaws 3-D*	Universal	$87,987,055
1984	*Devilfish (Shark rosso nell'oceano)*	Filmes International (Italy), Les Films du Griffon (France), National Cinematografica (Italy), Nuova Dania Cinematografica (Italy)	
1987	*Jaws 4 : The Revenge*	Universal	$51,881,013
1987	*Night of the Sharks*	Reel Media International, Miracle Pictures/PMC	
1989	*Deep Blood*	Filmirage S.r.l. (Italy) & Variety (U.S.)	
1995	*Cruel Jaws (TV)*	Production Group	
1996	*Aatank*	(India)	
1999	*Deep Blue Sea*	Warner Bros.	$164,648,142
1999	*Shark Attack*	Nu Image	
2000	*Shark*		
2000	*Shark Attack 2*	Nu Image	
2001	*Shark Hunter*	United Filmakers Organization	
2002	*Shark Attack 3*	Nu Image	
2003	*Shark Zone*	Nu Image	
2003	*Red Water (TV)*	Sony Pictures Television	
2004	*Dark Waters*	United Filmakers Organization	
2004	*Megalodon*	Corbitt Digital Films LLC	
2004	*Open Water*	Plunge Pictures LLC, Lions Gate	$52,561,610
2004	*Shark Tale*	DreamWorks	$340,442,013
2005	*Spring Break Shark Attack (TV)*	CBS Television	
Total	**25 Films**		**$1,365,056,840**

*While sharks have had prominent parts in many other films, such as *Finding Nemo* (2003, Disney/Buena Vista), which grossed over $864,625,978 worldwide, films that did not center around sharks were not included in the list. The list focuses on the most well-known films, and is not exhaustive. Additionally, the box office totals (worldwide) only reflect those known for the highest-grossing films and do not include videocassette rentals or purchases, which are equally substantial. The amount paid for advertisements in those films airing on television is also not included.

Documentaries*

YEAR	DOCUMENTARY	STUDIO/PRODUCTION CO.
1979	Of Sharks & Men	Vci Home Video
1982	The Sharks	National Geographic
1988	Sharks	Vestron
1990	Sharks – Perfect Predators	ABC Home Video
1991	Monster Sharks	Mntex Entertainment
1992	Sharks: Predators in Peril	Fast Forward Marketing
1994	Audubon Video: Sharks	Vestron Video
1995	Sharks of Red Triangle	Discovery Communication
1996	Sharks: Pirates of the Deep	Tapeworm
1996	Ultimate Guide to Sharks	Discovery Home Video
1996	Kratt's Creatures: Sharks	Usa Films
1997	The Living Sea: Encounters with Sharks/Sunset Sea	Global Sourcing
1997	Ramon Bravo's Adventures with Sharks	Moon Glow DVDs
1998	The Man Who Loves Sharks	Discovery Communications
1998	Great White	Discovery Communications
1998	Operation Shark Attack, Vol. 1	Madacy Entertainment
1998	Operation Shark Attack, Vol. 2	Madacy Entertainment
1998	Operation Shark Attack, Vol. 3: Legends of the Killer Sharks	Madacy Entertainment
1999	Island of the Sharks*	Imax Corp.
1999	Search for the Great Sharks	CAV Distribution
1999	Nature: Secret World of Sharks & Rays	Educational Broadcasting Corp.
1999	Visions of the Sea: Sharks of the Deep Blue	Bridgestone
2000	Secrets of the Ocean Realm: The Great Whales/Sharks	PBS Home Video
2001	Air Jaws	Lions Gate Entertainment
2001	Guy Harvey's Underwater Realm Sharks	studio name not given
2001	Great White: The Ultimate Guide	Lions Gate Entertainment

	to Sharks	
2002	How to Catch Sharks	Bennett Marine Video
2002	World of Sharks & Barracudas	Mpi Media Group
2003	Air Jaws 2	Lions Gate Entertainment
2003	The Fascinating Underwater World of: Sharks – Predators or Prey	Diamond Entertainment
2003	The Fascinating Underwater World of: Sharks – Hunters of the Deep	Diamond Entertainment
2003	Jaws of the Pacific	Artisan/Family Home Entertainment
2003	Killer Instinct: Sharks and Killer Whales	Mpi Media Group
2003	Sharks and Little Fish	Beta Film
2003	Sharks and Crocodiles	Goldhil Home Media I
2003	Sharks	Bennett Media Corporation
2004	Rulers of the Ocean, Sharks and Whales	CAV Distribution
2004	Sharks	Questar, Inc.
2005	Sharks 3-D (Imax)	Imax Corp./3D Entertainment Ltd.
	Sierra Club Series – The Sharks	
Total	**39 Documentaries**	

*The 1999 Imax film documentary, Island of the Sharks, has grossed over $10,658,505 to date. Revenues from advertising and videocassette/DVD rentals and purchases are not known, but may be significant. Additionally, the cable network, the Discovery Channel, runs a week-long event in the summers in which documentaries/programs profiling sharks are run during primetime hours. Some of the documentaries the network has produced and others it has purchased from various other sources, including the BBC and National Geographic. Again, this list only reflects some of the more widely-known documentaries that have been produced and is not an exhaustive list.

Appendix 28 – Rhode Island Shark Prey Items and Other Facts

Blue Shark
Diet:
cod, mackerel, herring, sardine, anchovy, squid
Predators:
great white shark
Size:
to 12 ft (3.7 m)
Habitat:
surface and mid waters (0 to 1,150 ft/0 to 350 m)
Facts:
· Blue sharks often form large, all-male or all-female schools, which contain sharks that are about the same size. No one knows why.
· This open ocean resident is known for its long migrations, as long as 3,740 miles (6,020 km.)
· The female gives birth to up to 80 live young.
· The blue shark is among the fastest swimmers - up to 60 mph (97 kmph) in bursts.

Great White Shark
Diet:
bluefin tuna, hammerhead shark, salmon, cod, bonito, spiny dogfish, squid, mackerel, banded rudderfish, blue shark, seal, skate, herring, sardine, anchovy, turtle, white-sided dolphin
Predators:
other great white sharks
Size:
to 24 ft (7.2 m), 7,500 lb (3,400 kg); average 12 to 16 ft (3.7 to 4.9 m)
Habitat:
surface and mid waters (0 to 4,200 ft/0 to 1,280 m)
Facts:
· The great white is considered the world's largest predator with a broad prey spectrum
· The great white shark has 3,000 teeth at one time. They are up to 3 in (7.5 cm) long.
· The great white shark is warm blooded. Its body cavity is several degrees warmer than the water temperature.
· Its swimming is more like an aircraft’s flight, on average 2 mph (3.2 kmph) and up to 15 mph (24 kmph).
· Females migrate to warm waters to give birth to live young. The young must swim away from their mothers immediately after birth - there is no maternal care giving.

Hammerhead Shark
Diet:
salmon, cod, spiny dogfish, mackerel, ocean perch, banded rudderfish, skate, herring, sardine, anchovy, turtle
Size:
to 14 ft (4.3 m), 233 lb (106 kg)

Habitat:
surface and mid waters (0 to 900 ft/0 to 275 m)
Facts:
· The hammerhead shark is a common shark that has a thick, wide head.
· It uses its "hammer" to pin down stingrays and take bites out of the stingray's wings.
· It is a migratory predator with a good sense of smell.
· Females come into shallower water to give birth to live young.
· Hammerhead sharks swim in pairs or form schools of up to 100 sharks.
· Scientists wonder if they group for reproduction, feeding, defense or swimming efficiency.

Mako
Diet:
Their diet includes a variety of fish including anchovies, mackerel, sardines, tuna, and swordfish and billfish. They eat other sharks including the blue sharks. Makos also eat squid.
Predators:
Makos may be eaten by large predators, but are a favorite of many people.
Size:
Mako sharks reach a maximum length up to 12.5 feet and may weigh as much as 1,000 pounds. The average length is more like 7-8 feet.
Habitat:
Mako sharks are usually found further out to sea, but can be found inshore. They are found from the surface down to about 150 m (492 ft).
Facts:

- Makos are the fastest shark, swimming as fast as 30 mph (48 kph). They may use this speed to catch their fast-swimming prey.
- Mako sharks are considered dangerous and have been known to attack swimmers and boats.
- At birth, pups are about 28 inches long. Makos are viviparous.

Thresher Shark
Diet:
Eats schooling fish, primarily herring, mackerel, menhaden
Size:
Threshers can grow up to 20 feet in length. Average length is around 8 feet.
Habitat:
World-wide in temperate and tropical waters ranging from deep to coastal areas
Facts:

- Reproduction is viviparous (live bearing) with litter sizes of up to 4. Size at birth 3.7 to 4.9 ft.