Chapter 5: Commercial and Recreational Fisheries

Table of Contents

Appendices

Tables

Figures

Section 500. Introduction

1. Commercial and recreational fisheries are among the oldest and most widespread human uses of the Ocean SAMP area and are of great economic, historic and cultural value to the state of Rhode Island. Commercial fisheries sustain Rhode Island coastal communities by providing jobs to fishermen and supporting businesses and industries, as well as food for local consumption or export throughout the United States and overseas. Recreational fisheries, which here includes recreational fishing that takes place aboard for-hire party and charter boats as well as recreational anglers fishing from private boats, also support businesses and families throughout Rhode Island and are a key element of the region's recreation and tourism economy. All Rhode Island fisheries, both within the Ocean SAMP area and inside Narragansett Bay, also have significant non-market value in that they provide Rhode Islanders with a connection to the sea and to New England's rich maritime history.

2. The purpose of the Ocean SAMP is to protect sustainable existing uses, resources, and habitats, and to guide future uses of the Ocean SAMP area. While it is recognized there is a need to restore fish habitat and recover depleted stocks, the goal of the Ocean SAMP is not to engage in fisheries management. Commercial and recreational fisheries in the Ocean SAMP area are already managed by a host of different agencies and regulatory bodies which have jurisdiction over different species and/or different parts of the Ocean SAMP area. In many cases, these entities have overlapping jurisdiction over the state and federal waters of the Ocean SAMP area. Entities involved in managing fish and fisheries within the Ocean SAMP area include, but are not limited to, the Atlantic States Marine Fisheries Commission (ASMFC), the Rhode Island Department of Environmental Management (RIDEM), the New England Fishery Management Council, the Mid-Atlantic Fishery Management Council, and the NOAA National Marine Fisheries Service (NMFS).[1] For further information on fisheries management, see Chapter 10, Existing Statutes, Regulations, and Policies.

3. The objectives of this chapter are to summarize existing information about current commercial and recreational fisheries resources and activities within the Ocean SAMP area; highlight the economic, social, cultural, and historic value of these activities to Rhode Island; and outline policies for managing these activities within the context of other existing and future uses. Accordingly, this chapter focuses primarily on commercially and recreationally important species that are targeted within the Ocean SAMP area by Rhode Island fishermen. The methodology for selecting these species is outlined below in Section 510. This chapter focuses on current baseline conditions based on the best available existing data and information. Per the NMFS Northeast Regional Office Protected Resources Division, this chapter also includes discussion of finfish "Species of Concern" which may occur within the Ocean SAMP area; see Section 510 below for a list of those species included here. Available fisheries dependent and independent data from the past decade are used to establish baseline conditions. Available historic information on fisheries is included to underscore the longstanding economic and cultural importance of these activities to Rhode Island.

[1] In addition, the Rhode Island Marine Fisheries Council acts as an advisory group to the RIDEM Director.

4. This chapter has found that commercial and recreational fisheries are an important activity in the Ocean SAMP area. Twenty-eight finfish, shellfish, and crustacean species are of commercial and recreational fishing importance in the Ocean SAMP area. Commercial fishermen using otter trawls, scallop dredges, gillnets, and lobster pots harvest a diverse variety of species, and squid and lobster are consistently among the most valuable species landed in Rhode Island. Recreational fishermen fish in the Ocean SAMP area aboard both private boats and party and charter boats, and target a variety of species including striped bass, bluefish, summer flounder, and large pelagic fish. At the time of this writing, many of the more popular commercially and recreationally targeted species, including squid and striped bass, are not overfished, nor is overfishing occurring. However, other fisheries are depleted or in decline, and there is a need to rebuild the stocks of some species found in the Ocean SAMP area. There are a variety of state and federal entities and regulatory bodies currently addressing stock levels, largely through the development and implementation of Fishery Management Plans. Fisheries management efforts have had a number of successes in rebuilding previously overfished stocks. Whereas all of these species rely on habitat within the Ocean SAMP area, little fish habitat mapping has been done to date at a resolution that would highlight important habitats within the area. Available qualitative and quantitative data have been used to produce maps that show commercial and recreational fisheries activity throughout the Ocean SAMP area. These maps show that the entire Ocean SAMP area is used by commercial and recreational fishermen over the course of a year, but that these use patterns vary in space and time due to factors including seasonal species migrations, the regulatory environment, and market demand for seafood. Commercial and recreational fisheries have a longstanding history in Rhode Island and are closely tied to Rhode Island's coastal communities and economies; whereas commercial fisheries have an economic impact through the sale and processing of seafood products, recreational fisheries have an economic impact through the sale of fishing vessels and gear and the in-state spending of out-of-state visitors. All of these fisheries activities rely on fisheries resources and habitats, and whereas future uses may impact these resources, existing activities and trends, including fishing and other uses of the area, are already having an impact on fisheries resources in the Ocean SAMP area. Human activities such as fisheries that have been taking place for hundreds of years have influenced Ocean SAMP area resources, and conditions in the area will continue to change due to human uses, such as fishing, as well as longer-term trends such as global climate change.

5. It is acknowledged that future uses of the Ocean SAMP area may have a variety of potential effects on fisheries resources and activities. See Chapter 8, Renewable Energy for a discussion of the potential effects of renewable energy on fish and fisheries, and see Chapter 9, Other Future Uses for a discussion of other future uses and their potential effects on fish and fisheries. In addition it should be noted that future projects will be subject to site- and project-specific regulatory review to evaluate the potential effects; see Section 560, Fisheries Policies and Standards, for further information.

6. While this chapter is focused on commercial and recreational fisheries, it is acknowledged that the finfish, shellfish, and crustacean populations targeted by fishermen are fundamental parts of the Ocean SAMP ecosystem. These species rely on the availability of appropriate habitats and food sources, and the viability of these

fisheries is dependent upon these resources. In addition, there are numerous finfish, shellfish, and crustacean populations within the Ocean SAMP area that are not part of directed fisheries. See Chapter 2, The Ecology of the Ocean SAMP Area for an extensive discussion of the Ocean SAMP ecosystem, including other species, benthic habitat, and a discussion of broader and longer-term regional trends. It is also acknowledged that global climate change is having, and will continue to have, effects on fisheries resources and activities; see Chapter 3, Global Climate Change for further discussion.

7. Commercial and recreational fisheries are discussed together in this chapter, although it is acknowledged that there are significant differences between the commercial and recreational industries. Commercial and recreational fisheries are included together primarily because commercial and recreational fishermen target many of the same species. Recreational fisheries here include recreational anglers as well as recreational fishing that takes place aboard party and charter boats operated by professional captains running businesses. It should be noted that recreational fishing is a significant recreational activity and major contributor to Rhode Island’s tourism economy; see Chapter 6, Recreation and Tourism for further discussion.

8. Aquaculture is an activity that is relevant to seafood production and is currently permitted only in state waters. Offshore aquaculture may be a potential future use of the Ocean SAMP area once a federal permitting process is established. See Chapter 9, Other Future Uses for further discussion.

Section 510. Marine Fisheries Resources in the Ocean SAMP Area

510.1. Species Included in this Chapter

510.1.1. Species Important to Commercial and Recreational Fisheries

1. This chapter's focus is on commercial and recreational fisheries, finfish, shellfish, and crustacean species that are considered most important to Rhode Island commercial and recreational fishermen operating in the Ocean SAMP area. Lists of commercially and recreationally important species were developed through the methodology outlined below and resulted in a summary list of species included below in Table 5.1.

2. Species harvested within the Ocean SAMP area that are considered to be most important to Rhode Island's commercial fisheries were identified by reviewing NMFS landings data and then reviewing this draft list with Rhode Island commercial fisheries stakeholders. Ten years (1998 – 2007) of NMFS landings data were reviewed to determine the most valuable finfish, shellfish, and crustacean species landed in Rhode Island (NMFS 2009a). For each year, the top 20 species (ranked by value) were identified. This list was then edited down to those species which occurred in the top 20 (by value) in at least 5 of those 10 years. This list was then reviewed with commercial fishermen to determine which species are actually harvested within the Ocean SAMP area. This review took place during fisheries stakeholder meetings conducted through the Ocean SAMP stakeholder process. Through this process, most shellfish were removed from this list, with the exception of sea scallops, which are harvested within the Ocean SAMP area. It should be noted that while quahogs are well known to be an important and lucrative fishery in Rhode Island, quahogs are currently harvested primarily within Narragansett Bay, not offshore in the Ocean SAMP area, and are therefore not included here. The species identified through this process are: American lobster (*Homarus americanus*); Atlantic cod (*Gadus morhua*); Atlantic herring (*Clupea harengus*); Atlantic mackerel (*Scomber scombrus*); Atlantic sea scallop (*Placopecten magellanicus)*; Black sea bass (*Centropristis striata*); Butterfish (*Peprilus triacanthus)*; Goosefish (monkfish) *(Lophius americanus);* Longfin (loligo) squid (*Loligo pealeii)*; Scup (*Stenotomus chrysops)*; Silver hake (*Merluccius bilinearis)*; Skates (unclassified); Summer flounder (*Paralichthys dentatus)*; Winter flounder (*Pseudopleuronectes americanus)*; and Yellowtail flounder (*Limanda ferruginea).* The above list was then compared with those commercially harvested species managed at the state level with quotas or other daily landing limits (RIDEM 2009), to ensure any significant species managed at the state level were accounted for. Because they appear on this list, and in addition are both found within the Ocean SAMP area, two additional species, menhaden (*Brevoortia tyrannus)* and spiny dogfish (*Squalus acanthias)*, are included in this chapter.

3. Species important to recreational fisheries were identified by reviewing Rhode Island recreational harvest and release data published in *Fisheries Economics of the United States, 2006* (NMFS 2008a).[2] This list was then compared with RI Department of Environmental Management recreational fishing regulations (RIDEM 2009), as well as information on sportfishing tournaments sponsored by the RI Saltwater Anglers

[2] This is the most recent version of this publication available.

Association (RISAA 2010). The resultant draft list of species was then reviewed with both recreational anglers and party and charter boat fishermen with the goal of determining which species are actually targeted within the Ocean SAMP area. This review took place during fisheries stakeholder meetings conducted through the Ocean SAMP stakeholder process. The species identified through this process are: Atlantic bonito (*Sarda sarda)*; Atlantic cod (*Gadus morhua*); Black sea bass (*Centropristis striata*); Bluefish (*Pomatomus saltatrix)*; False albacore (*Euthynnus alletteratus);* Scup (*Stenotomus chrysops)*; Sharks (unspecified); Striped bass (*Morone saxatilis*); Summer flounder (*Paralichthys dentatus)*; Tautog (*Tautoga onitis)*; Tunas (unspecified); and Winter flounder (*Pseudopleuronectes americanus).* Recreationally targeted sharks were further narrowed down to Shortfin mako (*Isurus oxyrinchus*), Blue (*Prionace glauca*), and Thresher (*Alopias vulpinus*), and recreationally targeted tunas were further narrowed down to Bluefin (*Thunnus thynnus*) and Yellowfin (*Thunnus albacares*).

4. Table 5.1 shows the resultant list of commercially and recreationally important species found within the Ocean SAMP area:

Table 5.1. Commercially and recreationally important species.

Common Name	**Scientific Name**
American lobster	*Homarus americanus*
Atlantic bonito	*Sarda sarda*
Atlantic cod	*Gadus morhua*
Atlantic herring	*Clupea harengus*
Atlantic mackerel	*Scomber scombrus*
Atlantic sea scallop	*Placopecten magellanicus*
Black sea bass	*Centropristis striata*
Bluefish	*Pomatomus saltatrix*
Butterfish	*Peprilus triacanthus*
False albacore	*Euthynnus alletteratus*
Goosefish (monkfish)	*Lophius americanus*
Longfin (loligo) squid	*Loligo pealeii*
Menhaden	*Brevoortia tyrannus*
Scup	*Stenotomus chrysops*
Shark, blue	*Prionace glauca*
Shark, shortfin mako	*Isurus oxyrinchus*
Shark, thresher	*Alopias vulpinus*
Silver hake	*Merluccius bilinearis*
Skates (unclassified)[3]	*Raja spp.*
Spiny dogfish	*Squalus acanthias*
Striped bass	*Morone saxatilis*
Summer flounder	*Paralichthys dentatus*
Tautog	*Tautoga onitis*
Tuna, bluefin	*Thunnus thynnus*
Tuna, yellowfin	*Thunnus albacares*
Winter flounder	*Pseudopleuronectes americanus*
Yellowtail flounder	*Limanda ferruginea*

[3] Skates are unspecified here because this is how NMFS reports skate landings.

5. The commercially and recreationally important species identified above are managed by a variety of different federal and state management entities. Table 5.2 below includes a summary of the relevant management entities for each species as well as the current status of each stock as of March 2010. As defined in the Magnuson Stevens Fishery Conservation and Management Act, 16 U.S.C. 1801 *et. seq.* (Magnuson Stevens Act), "the terms 'overfishing' and 'overfished' 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" (NMFS 2007c). This information is summarized from the individual species descriptions that follow below in Section 510.2, which include further details and references for each species.

Table 5.2. Management and status of species/stocks in the Ocean SAMP area.

Common name	**Management entity**	**Status of stock within Ocean SAMP area as of March 2010**
American lobster	Atlantic States Marine Fisheries Commission	Depleted; overfishing not occurring
Atlantic bonito	International Commission for the Conservation of Atlantic Tunas	Not available
Atlantic cod	New England Fishery Management Council	Overfished; overfishing is occurring
Atlantic herring	Atlantic States Marine Fisheries Commission and New England Fishery Management Council	Not overfished; overfishing not occurring
Atlantic mackerel	Mid-Atlantic Fishery Management Council	Not overfished; overfishing not occurring
Atlantic sea scallop	New England Fishery Management Council	Not overfished; overfishing not occurring
Black sea bass	Atlantic States Marine Fisheries Commission and Mid-Atlantic Fishery Management Council	Not overfished; overfishing not occurring
Bluefish	Atlantic States Marine Fisheries Commission and Mid-Atlantic Fishery Management Council	Not overfished; overfishing not occurring
Butterfish	Mid-Atlantic Fishery Management Council	Pending release of 2009 NMFS stock assessment
False albacore	International Commission for the Conservation of Atlantic Tunas	Not available
Goosefish (monkfish)	New England Fishery Management Council; Mid-Atlantic Fishery Management Council	Not overfished; overfishing is occurring
Longfin (loligo) squid	Mid-Atlantic Fishery Management Council	Not overfished; overfishing not occurring
Menhaden	Atlantic States Marine Fisheries Commission	Not overfished; overfishing not occurring
Scup	Atlantic States Marine Fisheries Commission and Mid-Atlantic Fishery Management Council	Not overfished; overfishing not occurring
Shark, blue	National Marine Fisheries Service (Consolidated Atlantic Highly Migratory Species Fishery Management Plan); Atlantic States Marine Fisheries Commission (Interstate Fishery Management Plan for Atlantic Coastal Sharks)	Not available
Shark, shortfin mako	National Marine Fisheries Service (Consolidated Atlantic Highly Migratory Species Fishery Management Plan); Atlantic States Marine	Not overfished; overfishing is occurring

	Fisheries Commission (Interstate Fishery Management Plan for Atlantic Coastal Sharks)	
Shark, thresher	National Marine Fisheries Service (Consolidated Atlantic Highly Migratory Species Fishery Management Plan); Atlantic States Marine Fisheries Commission (Interstate Fishery Management Plan for Atlantic Coastal Sharks)	Not available
Silver hake	New England Fishery Management Council	Not overfished; overfishing not occurring
Skates (unclassified)	New England Fishery Management Council	Overfishing occurring on winter skate only
Spiny dogfish	Atlantic States Marine Fisheries Commission; New England Fishery Management Council; Mid-Atlantic Fishery Management Council	Not overfished; overfishing not occurring
Striped bass	Atlantic States Marine Fisheries Commission	Not overfished; overfishing not occurring
Summer flounder	Atlantic States Marine Fisheries Commission and Mid-Atlantic Fishery Management Council	Not overfished; overfishing not occurring
Tautog	Atlantic States Marine Fisheries Commission	Overfished; overfishing not occurring
Tuna, bluefin	National Marine Fisheries Service (Highly Migratory Species Fishery Management Plan) and International Commission for the Conservation of Atlantic Tunas	Overfished; overfishing is occurring
Tuna, yellowfin	National Marine Fisheries Service (Highly Migratory Species Fishery Management Plan) and International Commission for the Conservation of Atlantic Tunas	Not overfished; overfishing not occurring
Winter flounder	Atlantic States Marine Fisheries Commission and New England Fishery Management Council	Overfished; overfishing is occurring
Yellowtail flounder	New England Fishery Management Council	Overfished; overfishing is occurring

510.1.2. Forage Fish

1. Forage fish are essential to a discussion of commercial and recreational fisheries insofar as they provide food for many of the above-mentioned targeted species. Many forage fish in this region are themselves commercially or recreationally targeted. See Section 510.4 for a brief discussion of forage fish as they relate to the above-mentioned species.

510.1.3. Threatened and Endangered Species and Species of Concern

1. This chapter also includes discussion of Threatened and Endangered finfish per the Endangered Species Act (16 U.S.C. 1531 *et. seq.*) as well as finfish listed as “Species of Concern” by the NMFS Office of Protected Resources. According to the NMFS Northeast Regional Office Protected Resources Division, based on the best available information, no finfish currently listed as threatened or endangered are likely to occur within the Ocean SAMP area (J. Crocker, pers. comm., a). However, according to the NMFS Northeast Regional Offices Protected Resources Division (J. Crocker, pers. comm., b), the following species currently listed as “Species of Concern” could be

present in the Ocean SAMP area: Alewife (*Alosa pseudoharengus)*; Atlantic halibut (*Hippoglossus hippoglossus)*; Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*); Atlantic wolffish (*Anarhichas lupus)*; Blueback herring (*Alosa aestivalis*); Dusky shark (*Carcharhinus obscurus)*; Porbeagle shark (*Lamna nasus)*; Rainbow smelt (*Osmerus mordax)*; Sand tiger shark *(Carcharias taurus)*; and Thorny skate (*Amblyraja radiate)*.[4] It should also be noted that Atlantic sturgeon are currently a candidate species for listing under the Endangered Species Act (NMFS 2010a). Accordingly, these species are included in this chapter and are discussed in detail in Section 510.5.

[4] See the NOAA NMFS Office of Protected Resources for a complete list of designated "Species of Concern": http://www.nmfs.noaa.gov/pr/species/concern/.

510.2. Life History, Habitat, and Fishery of Commercially and Recreationally Important Species

510.2.1. American Lobster (*Homarus americanus*)

1. The American lobster is a bottom-dwelling crustacean widely distributed over the North American continental shelf, occurring inshore in the U.S. from Maine through New Jersey, and offshore from Labrador, Canada through North Carolina (ASMFC 2008a). In the Ocean SAMP area, American lobsters are targeted by commercial fishermen.

Life History

2. Lobsters are long-lived, and grow incrementally through molting. During the first two years of their lives, lobsters will molt several times each year, and once or twice per year thereafter, depending on food availability and water temperature (ASMFC 2008a). Most lobsters molt in July or August; with each molt the lobster increases 14% in length and 50% in weight. Lobsters reach legal size in about five to seven years, depending on water temperature (ASMFC 2008a). In Rhode Island, minimum legal size is currently $3^{3/8}$ inches in carapace length.

3. Lobsters become sexually mature between their fifth and eighth year, and may molt as many as 25 times before reaching adulthood (Lobster Conservancy 2004). Female lobsters mate immediately after molting, and store the sperm for up to two years until they extrude their eggs, which are then fertilized. Females carry eggs on their underside for nine to eleven months before hatching. Eggs hatch from mid-May through mid-June (ASMFC 2008a). For the first two months of their lives, lobsters are planktonic, floating at the surface before they sink to the bottom. During their planktonic stage, lobsters sometimes travel great distances and may settle far from their source. Studies of lobster populations have found in some cases only a small percentage of new recruits have come from within the population, and in some cases the percentage of self-recruitment (larvae settling back into the same population) is more than 90 percent. Sources and sinks of larvae will vary from year to year depending on factors such as wind and currents (e.g. Incze et al. 2010). During the first year of their lives, lobsters remain within a meter (3.3 feet) of the spot where they settled (Wahle 1992).

Habitat

4. Lobsters are solitary and territorial. They are most abundant in shallow coastal areas, and are concentrated in rocky habitat where shelter is available, particularly among cobbles and boulders, but also occur in offshore waters. In Rhode Island, lobsters are most often found close to shore among rocks, but they will also frequently burrow in featureless mud, particularly when shelter is not available (Cobb and Wahle 1994). Offshore lobsters are most commonly found along submarine canyons on the edge of the continental shelf. Inshore lobsters typically remain within a home range of about five to ten square kilometers, although large, mature lobsters living in offshore areas will migrate inshore seasonally in the spring and summer to reproduce (ASMFC 2008a). Lobsters in Rhode Island will migrate into Narragansett Bay and other inshore areas during the summer, and return to the Sounds during the fall, traveling as much as 136 nautical miles (252 km) (Saila and Flowers 1968). Pelagic lobster larvae feed primarily on copepods and diatoms. Adults are opportunistic feeders, feeding on fish, crabs, clams, mussels, and sea urchins,

among other species. They are also cannibalistic, and will sometimes eat other lobsters (Lobster Conservancy 2004).

Fishery

5. Three separate stocks of lobsters have been recognized: the Gulf of Maine, Georges Bank, and Southern New England stocks. Lobsters are further divided into seven management areas; Rhode Island waters fall within Management Area 2. Lobsters in both state and federal waters are managed under the Interstate Fisheries Management Program administered by the Atlantic States Marine Fisheries Commission. The fishery is managed through size limits, trap limits, and the practice of cutting a notch in the tail (v-notching) of egg-bearing females. Management measures also include regulations dictating minimum wire gauge and escape vent sizes on the traps. The 2009 peer-reviewed stock assessment report by the Atlantic States Marine Fisheries Commission found overall record high stock abundance in the Gulf of Maine and Georges Bank stocks. For the Southern New England stock, however, abundance is the lowest observed since the 1980s, and recruitment is also very low, although exploitation rates have also declined (ASMFC 2009a). The stock is listed as depleted but overfishing is not occurring. There was a rebuilding program for Southern New England lobster established in 2007; the stock is expected to be rebuilt by 2022 (ASMFC 2009a).[5] According to the University of Maine Lobster Stock Assessment model used by the Atlantic States Marine Fisheries Commission technical committee, the recent abundance for Southern New England lobster from 2005-2007 averaged 14.7 million, and the abundance threshold for the stock is 25.4 million, making the stock overfished (ASMFC 2009a). The average size of lobsters taken within the Southern New England area has been declining for both males and females. NMFS reports there is an excess of effort in the lobster fishery for Southern New England. States report a number of latent licenses which, if used, would exacerbate the excess of effort (NOAA NMFS Northeast Fisheries Science Center [NEFSC] 2006a). It is not well understood what the sources of new settlers to lobster populations in the Ocean SAMP area might be, but it is important to note that this may vary depending on climatic and oceanographic factors, and lobster populations in the Ocean SAMP area may be determined somewhat by spawning and thus population trends elsewhere.

Table 5.3. Habitat characteristics of American lobster. (ASMFC 2008a; ASMFC 2009a; Cobb and Wahle 1994)

Life Stage	*Habitat*	*Substrate*	*Temperature*
Eggs	Carried on underside of females for 9 to 11 months	N/A	N/A
Larvae	Larvae go through five stages, the first four of which are planktonic. They sink to the floor in the fifth stage	Mostly pelagic	N/A
Juveniles	Shallow, rocky habitats; areas with small	Cobble, boulders,	N/A

[5] In this and all subsequent species descriptions, the terms “overfished” and “overfishing” are used to describe species’ stock status. “Overfishing” is defined in the Magnuson-Stevens Act as fishing at a rate or rate or level of mortality that jeopardizes the capacity of a fishery to produce the maximum sustainable yield on a continuing basis. A stock is deemed “overfished” when the population size is determined to be less that that needed to sustain the fishery. For further information see NMFS 2010b.

	shelter-providing spaces; less than 20m in depth. Small juveniles and larvae may use salt marsh peat reefs	subtidal peat, rocky habitats	
Adults	Coastal lobsters found in rocky areas, sometimes burrow in mud substrates; offshore lobsters found along edge of continental shelf near submarine canyons	Cobble, sometimes mud or sand	-2 – 24^{o}C; generally inactive below 4^{o}C

510.2.2. Atlantic Bonito (*Sarda sarda*)

1. The Atlantic bonito, also called the skip jack, is an open-ocean fish found in temperate and tropical waters on both sides of the Atlantic. It is common along the east coast of the United States north to Cape Cod. The bonito is in the family *Scombridae* with tunas and mackerels, and is shaped like a small tuna. In the Ocean SAMP area, bonito are targeted by recreational fishermen.

Life History

2. Most bonito reach sexual maturity at two years of age, although some become sexually mature after their first year. Fecundity for females increases with age and size; large females can produce as many as three to six million eggs. Spawning usually occurs to the south of New England during the summer. Juveniles grow nearly a tenth of an inch (0.3 cm) per day in their first summer. Bonito are generally daytime feeders, feeding mostly in the morning and the evening, and sometimes leaping out of the water in large numbers while chasing prey. They can swim up to 30 or 40 miles (48 to 64 km) per hour in pursuit of prey (Ross 1991).

Habitat

3. The bonito is a schooling fish found in the open waters off the continental shelf, normally at depths of less than 200 meters (656 feet). Bonito prefer temperatures between 54 and 77 degrees Fahrenheit (12 and 25 degrees Celsius), and are most abundant at temperatures between 59 and 72 degrees (15 and 22 degrees Celsius). Bonito are found offshore off southern New England in the summer and fall, and migrate south for the rest of the year. Although they are usually an open-ocean species, they are sometimes found near the coast. Larval bonito feed on copepods and small fish larvae, while juveniles and adults eat squid and a number of fish including mackerel, alewives, menhaden, sand lance, silversides, and smaller bonito (Ross 1991).

Fishery

4. Bonito are targeted primarily as a recreational species, and are known for being fast and powerful. They are managed internationally through the International Commission for the Conservation of Atlantic Tunas (ICCAT). At present, there is no Fishery Management Plan in place for bonito; recreational anglers are not required to have a permit to fish for bonito. There are no size or bag limits for bonito.

Table 5.4. Habitat characteristics of Atlantic bonito. (Ross 1991)

Life Stage	*Habitat*	*Substrate*	*Temperature*
Juveniles/Adults	Open ocean species, usually in waters less than 200 m deep.	Open ocean	From 12 to 25ºC, most abundant between 15 and

			22ºC.

510.2.3. Atlantic Cod (*Gadus morhua*)

1. Cod are found on both sides of the Atlantic, and range from Greenland to North Carolina in the Northwest Atlantic. Cod are assessed by NMFS as two separate stocks; one in the Gulf of Maine, and the other found on Georges Bank and Southward. Cod are targeted in the Ocean SAMP area by both commercial and recreational fishermen.

Life History

2. Cod typically move south and into deeper water in the winter and spring. The cod found in southern New England waters are probably part of a stock that migrates from Nantucket Shoals in the summer to waters off New Jersey and North Carolina in the winter where they spawn. The cod’s eggs and larvae are pelagic for the first three or four months. In 1972, the median age of maturity on Georges Bank was found to be 2.9 years for females and 2.6 years for males, with the median size of both being around 50 cm (20 inches) at maturity. Studies have found significant declines in the median age and size at maturity resulting from declining stock abundance and changes in temperature (Collette and Klein-MacPhee 2002). The fecundity of females increases with age and size. The largest codfish ever recorded was caught off Massachusetts in 1895, weighing 96 kg (211.6 pounds) and measuring 183 cm (72 inches) in length. Cod weighing between 23-27 kg (51 - 60 pounds) are not unusual, but most commercially taken cod weigh only between 2.5 and 4.0 kg (5.5 and 9 pounds) (Collette and Klein-MacPhee 2002). Cod can reach a maximum of 26 to 29 years of age (Collette and Klein-MacPhee 2002).

Habitat

3. Cod are a bottom-dwelling fish, preferring rocky, pebbly, or sandy bottoms, and prefer temperatures between 32 and 50 degrees Fahrenheit (0 to 10 degrees Celsius), although they are often found on Nantucket Shoals in water temperatures as high as 59 degrees Fahrenheit (15 degrees Celsius) (Collette and Klein-MacPhee 2002). They can be found at depths of up to 1200 feet (366 meters), but more typically are found at depths between 200 to 360 feet (60 to 110 meters) (Ross 1991). In Rhode Island waters, cod can be found in shallow coastal waters from October through mid-May, and year-round on Cox Ledge. Cod spawn in the Gulf of Maine, Georges Bank, and southern New England. During their first year, cod are often found in shallow waters close to shore or on Nantucket Shoals and other shallow banks (Collette and Klein-MacPhee 2002).

4. Cod will feed on many different kinds of fish and invertebrates, but especially herring, sand lance, Atlantic mackerel, squids, silver hake, and rock crabs (Collette and Klein-MacPhee 2002). Juveniles eat mostly small crustaceans, while larvae feed on copepods and phytoplankton (Collette and Klein-MacPhee 2002). Juvenile cod are themselves prey for pollock, squid, spiny dogfish, sea ravens, and larger cod (Ross 1991), while adults are preyed upon by large sharks and dogfish (Collette and Klein-MacPhee 2002), as well as seals (Ross 1991).

Fishery

5. The Georges Bank and Southward stock supports a commercial fishery year round, and a recreational fishery from late autumn to early spring. Cod are managed by the New

England Fishery Management Council as part of the fifteen species Northeast Multispecies Fishery Management Plan, through a combination of time/area closures, gear restrictions, and minimum size limits, as well as moratoriums on permits and days-at-sea restrictions. Commercial landings of the Georges Bank and Southward stock hit a record low in 2005, and the stock remains below the long-term average. Fishing mortality has been declining since 1997, but spawning stock biomass (SSB) has also been declining since 2001. The National Marine Fisheries Service defines spawning stock biomass as: "the total weight of all sexually mature fish in the population. This quantity depends on year class abundance, the exploitation pattern, the rate of growth, fishing and natural mortality rates, the onset of sexual maturity and environmental conditions." (NEFSC n.d.). The 2004 SSB was at 10% of the SSB needed for maximum sustainable yield. The stock is thus considered overfished, and overfishing is currently occurring, meaning fishing is occurring at a rate that jeopardizes the ability of the stock to produce maximum sustainable yield (NEFSC 2006a). However, the Georges Bank and Southward stock is currently in the process of being rebuilt, and as of 2009 the Gulf of Maine stock is no longer considered overfished (NMFS 2010b).

Table 5.5. Habitat characteristics of Atlantic cod. (Northeast Fisheries Science Center [NEFSC] 2004a)

Life Stage	*Habitat*	*Substrate*	*Temperature*
Eggs	Bays, harbors, offshore banks. Usually < 70 m.	Pelagic	Most 2.0-8.5ºC for incubation.
Larvae	Most over Georges Bank, perimeter of Gulf of Maine, southern New England, continental shelf. Densest in spring. Youngest from surface to 75 m. Move deeper with age. Migrate vertically in reaction to light.	Pelagic	Most 4-8ºC in winter - spring, 7-12ºC in summer-fall.
Juveniles	Mostly in shallow waters, coastal or offshore banks, during summer. Deeper water in winter.	'Cobble' preferred over finer grains. Uses vegetation for predator avoidance.	6 - 20ºC. More tolerant of extremes than adults.
Adults	Seasonal migrations except in Gulf of Maine. Most dense Massachusetts Bay, northeast Georges Bank, Nantucket Shoals. Usually on bottom during day, may move up into water column at night. Most found between 60 and 110 meters.	Rocky, pebbly, gravelly. Avoid finer sediments.	Generally < 10ºC, varies seasonally.

510.2.4. Atlantic Herring (*Clupea harengus*)

1. Atlantic herring are pelagic species that occur in large schools, and inhabit coastal and continental shelf waters from Labrador to Virginia. The commercial fishery for herring in New England developed in the late 19^{th} century as the canning industry was developing. An extensive foreign fishery developed on Georges Bank in the 1960s, leading to a collapse of the offshore herring stock. Today, the herring stock is completely rebuilt. Herring are often canned, or sometimes processed as frozen or salted fish by foreign ships that purchase the fish from U.S. fishermen and processing plants. Herring are also commonly used as bait in the lobster fishery, as well as the blue crab and tuna fisheries. Because of their importance as a forage species, they also have an important indirect

value for whale watching and other ecotourism industries (ASMFC 2008a). In the Ocean SAMP area, herring are targeted primarily by commercial fishermen.

Life History

2. Herring usually spawn during the fall months, producing anywhere from 30,000 to 200,000 eggs each. Eggs will hatch in ten to twelve days depending on the water temperature, and the hatchlings are about a quarter inch (0.6 cm) long. In the spring, the larvae will transform into juveniles, about an inch and a half long (4 cm). They will grow three to five inches (7 to 13 cm) the next fall, reaching ten inches (25 cm) and sexual maturity by their fourth year, and can grow up to about fifteen inches (38 cm) in fifteen to eighteen years (ASMFC 2008a). Herring may live twenty years or longer (Collette and Klein-MacPhee 2002).

Habitat

3. Juvenile herring, which are commonly called sardines, migrate from shallow, inshore waters during the summer to deeper, offshore waters during the winter months. Adult fish older than three years will migrate from their spawning grounds in the Gulf of Maine and Georges Bank to spend the winter months in southern New England and the Mid-Atlantic. Herring will spawn during October and November in the southern Gulf of Maine, Georges Bank, and Nantucket Shoals. They prefer rock, gravel, or sand bottoms between 50 feet and 150 feet (15 and 45 m) in depth for spawning (ASMFC 2008a).

4. Herring are filter feeders and feed on plankton, primarily copepods. They usually feed at night, following the zooplankton that inhabit deeper waters during the day and traveling to the surface to feed at night (ASMFC 2008a). Herring themselves play a very important role in the ecosystem, as they are a significant source of food for many species of fish, including cod, haddock, silver hake, striped bass, bluefish, monkfish, mackerel, tuna, and spiny dogfish, as well as birds and marine mammals (Collette and Klein-MacPhee 2002).

Fishery

5. Atlantic herring are managed by the Atlantic States Marine Fisheries Commission in state waters, and by the New England Fishery Management Council in federal waters. Herring is not currently considered overfished, and overfishing is not occurring at present. Fishing mortality has been low since the early 1990s. In 2007, the New England Fishery Management Council implemented a mid-water trawl ban on herring between June 1 and September 30, but no ban exists in state waters. Herring are managed based on a Total Allowable Catch (ASMFC 2008a). Read and Brownstein (2003) found the rate of consumption of herring by marine mammals to greatly exceed the total estimated rates of natural mortality of the species within the Gulf of Maine currently used in stock assessments, and predicted that as marine mammal populations increase, the consumption of herring will likewise increase. These trophic interactions may have not been sufficiently considered in stock assessment models for this species.

Table 5.6. Habitat characteristics of Atlantic herring. (NEFSC 2005a)

Life Stage	*Habitat*	*Substrate*	*Temperature*
Eggs	Discrete, demersal, egg “beds” in coastal waters and on offshore banks and ledges in the Gulf of Maine and on Georges	Boulders, rocks, gravel, coarse sand, shell	Bottom temperatures over egg beds ranged from 7-15ºC; egg

	Bank with strong bottom currents and coarse substrate, depths of 5-90 m	fragments, macrophytes, and on a variety of benthic organisms and man-made structures (e.g., lobster traps); not on mud or fine sand.	development normal 1-22ºC; development rates/ incubation times inversely related to temperature
Larvae	Estuaries, coastal, and offshore waters between Bay of Fundy and New Jersey; remain on or near bottom for first few days after hatching, then rise to surface and are dispersed by currents. Depths from very shallow waters to 200 m; most 50-90 m	Pelagic	Lab study shows larvae tolerate wide temperature range (-1.8 to 24ºC).
Juveniles	One-year-olds in nearshore waters during summer and fall, overwinter in deeper, coastal waters; two-year-olds in inshore/offshore continental shelf waters of Gulf of Maine, deeper waters of Georges Bank in summer and fall, Cape Hatteras to deeper parts of Georges Bank in winter, widespread from Cape Hatteras to Bay of Fundy in spring. Mostly < 100 m in spring; migrate up in water column at dusk and down at dawn.	Pelagic	Prefer 8-12ºC
Adults	Pelagic, but spawn on bottom; inshore/offshore continental shelf waters of the Gulf of Maine and deeper parts of Georges Bank in summer and fall, Cape Hatteras to deeper parts of Georges Bank in winter, distributed across shelf in mid-Atlantic, southern New England, deeper waters of Georges Bank, and the southwest portion of the Gulf of Maine in spring.	Pre-spawning aggregations more abundant over gravel/sand.	Field observations suggest adults prefer 5-9ºC on Georges Bank in summer/ fall; most caught 4-7ºC in spring and 6-10ºC in fall NEFSC trawl surveys

510.2.5. Atlantic mackerel (*Scomber scombrus*)

1. The Atlantic mackerel is a pelagic fish found from the Gulf of St. Lawrence to Cape Hatteras. There are two separate stocks of mackerel, one of which spends winters between the Chesapeake Bay and Long Island, and moves northward along the New England coast in June and July, and the other which moves inshore to southern New England in late May, and migrates north toward Nova Scotia (Ross 1991). In the Ocean SAMP area, mackerel are targeted both by commercial and recreational fishermen.

Life History

2. Adult mackerel usually measure about fourteen to eighteen inches (35 to 46 cm) in length and weigh about a pound (0.5 kg). They are generally found in Rhode Island waters from

May through September, and migrate offshore to the edge of the continental shelf in winter. They spawn in the Mid-Atlantic Bight and in the Gulf of Maine in spring and early summer, once the water is warmer than 46 degrees Fahrenheit (8 degrees Celsius) (Collette and Klein-MacPhee 2002). The fish will form schools when they are about 40 days old, and are about two inches long (5 cm). The mortality rates of young mackerel are very high (Ross 1991). Mackerel grow to about eight inches (20 cm) by the end of their first year, and are sexually mature by their second year (Collette and Klein-MacPhee 2002).

Habitat

3. Mackerel are found in dense schools between 100 fathoms (183 meters) and the surface. They are an open-ocean fish often found over the edge of the continental shelf, but will also inhabit brackish coastal waters. They prefer to spawn near the surface. Mackerel are opportunistic feeders, and feed largely on zooplankters, including copepods, shrimps, and fish larvae. Larger mackerel will feed on larger prey such as squid, silver hake, sand lance, herring, and sculpins (Collette and Klein-MacPhee 2002). They are an important prey species for whales, porpoises, sharks, cod, tunas, bluefish, striped bass, birds, and squid, which eat small mackerel (Ross 1991).

Fishery

4. Mackerel are an important species for both commercial and recreational fisheries. The Atlantic mackerel stocks are currently managed by the Mid-Atlantic Fishery Management Council under the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan. Spawning stock biomass for mackerel has increased steadily since 1976, and fishing mortality has been low since 1992 (NEFSC 2006a). Spawning biomass reached a record high in 2004, and population estimates put biomass of Atlantic mackerel at 257% above what is needed to support maximum sustainable yield (NMFS 2010b). Thus, the stock is not overfished and overfishing is not considered to be occurring (NEFSC 2006a).

Table 5.7. Habitat characteristics of Atlantic mackerel. (NEFSC 1999a)

Life Stage	*Habitat*	*Substrate*	*Temperature*
Eggs	Highest abundances in May/June in southern New England - Mid-Atlantic region. Eggs pelagic, distributed at depths ranging from 10-325 m, majority from 30-70 m.	Pelagic	Eggs collected at 5-23ºC, highest abundance from ~ 7-16ºC with range related to season.
Larvae	Highest abundance ranges from Hudson Canyon north to southern New England and north of Cape Cod. Most distributed at depths from 10-130 m, usually at < 50 m.	Pelagic	Larvae collected at 6-22ºC; highest abundance at 8-13ºC.
Juveniles	Late summer/fall primarily along western shores of Gulf of Maine, inshore areas of New England (includes estuaries in Rhode Island, Connecticut, eastern Long Island). Depth varies seasonally. Offshore in fall, most abundant at ~ 20-40 m, range from 0-320 m. In winter, 50-70 m.	Pelagic	Temperature distribution offshore changes seasonally as average temperature ranges increase: in Rhode Island, 19ºC in summer, 11 and 15ºC in fall.

	Spring, although dispersed through water column, concentrated 30-90 m. Move higher in summer to 20-50 m, range from 0-210 m.		
Adults	Fall: concentrated at 60-80 m. Winter: ~ 50% at 20-30 m. Spring: down to 380 m. Summer: > 60% at 50-70 m. Larger fish deeper than smaller ones. Distribution may also be correlated with downwelling events and onshore advection of warm surface water. Found on edge of continental shelf, but will also inhabit brackish waters. Most spawning in shoreward half of continental shelf, some on shelf edge and beyond.	Pelagic	Offshore distribution varies with seasonal temperature changes. Most found between 5-14ºC. Spawning begins when temperatures are ~ 7ºC (peak 9-14ºC) and progresses from southern to northern waters during adult migration.

510.2.6. Atlantic Sea Scallop (*Placopecten magellenicus*)

1. The Atlantic sea scallop is found from the Gulf of St. Lawrence to Cape Hatteras. In the Ocean SAMP area, sea scallop are harvested by commercial fishermen. The scallop fishery is presently the most lucrative fishery in New England.

Life History

2. Sea scallops become sexually mature at age two, but those less than four years of age probably contribute little to egg production. Fertilization takes place externally, and sea scallops usually spawn in late summer and early autumn. A single female may release hundreds of millions of eggs annually (NEFSC 2006a). Larvae remain in the water column as part of the plankton for over one month after hatching (Pogsay 1979), during which time eggs and larvae are subjected to currents. The spat, or juvenile larvae, eventually sink and seek out hard substrate, such as shell fragments, on which to settle. Young adults are exceptionally vulnerable to smothering by moving sands and loose bottom substrates (Mullen and Moring 1986). Sea scallops grow rapidly, increasing their shell height by 50 to 80 percent between ages three and five, and quadrupling their meat weight. They reach commercial size at about four or five years of age. Sea scallops can live up to 20 years. A combination of low mobility, rapid growth, and low natural mortality means sea scallop populations grow rapidly in areas which are closed to fishing activity (NEFSC 2006a).

Habitat

3. Sea scallops are found from mean low water to depths of several hundred feet. They are found on a variety of bottom types, including firm sand, gravel, shells, and rocks (NEFSC 2004b). They prefer sand and gravel sediments, and water temperatures below 68 degrees Fahrenheit (20 degrees Celsius). South of Cape Cod and on Georges Bank, sea scallops are usually found at depths between 25 and 200 meters (82 and 656 feet), with most commercial concentrations found between 35 and 100 meters (115 and 328 feet) of depth. Sea scallops are filter feeders, feeding mainly on phytoplankton, but also on microzooplankton and detritus (NEFSC 2006a). Large adults do not migrate, but can escape predators by clapping the two halves of their shells together in a rudimentary form of swimming.

Fishery

4. The fishery for sea scallops is conducted year-round, usually with scallop dredges. The sea scallop fishery is managed by the New England Fishery Management Council. Most sea scallop fishing in the United States is done by vessels with limited access permits, which provide them with days-at-sea and a limited number of trips to former closed areas. Some sea scallop vessels have open access general category permits, allowing them to take up to 400 pounds of meats per day; these are the vessels operating within the Ocean SAMP waters. The biomass of sea scallops on Georges Bank was low from 1982 through 1994, but then increased, and has been at a high, stable level since 2000. Surveys for Georges Bank and Mid-Atlantic sea scallops indicated the species was near its historical maximum biomass in 2005 (NEFSC 2006a). The biomass of Atlantic sea scallops in 2006 was estimated at 166,000 metric tons of meats, about 52% above the amount needed to produce maximum sustainable yield (NMFS 2010b). They are not considered to be overfished, nor is overfishing occurring (NEFSC 2006a).

Table 5.8. Habitat characteristics of Atlantic sea scallop. (NEFSC 2004b)

Life Stage	*Habitat*	*Substrate*	*Temperature*
Eggs	Remain on sea floor	N/A	N/A
Larvae	In mixed areas, larvae distributed evenly through water column; in stratified areas, larvae aggregated above pycnocline. Migrate vertically in response to tidal, solar cues.	Larvae settle in areas of gravelly sand, shell fragments or on hydroids, bryozoans and sponges; select substrates covered with a biofilm.	N/A
Juveniles	N/A	Mainly found on gravel, small rocks, shells, and among branching animals and plants that permit attachment of juveniles.	N/A
Adults	Wide distribution on offshore banks and coastal waters from Newfoundland to Cape Hatteras; from low tide level to ~100 m line; generally shallower in northern populations.	Generally found in seabed areas with firm sand, gravel, shells and cobble substrate. Typically abundant in areas with low levels of inorganic suspended particulates (fine clay size particles).	Prefer water temperatures below 20ºC

510.2.7. Black Sea Bass (*Centropristis striata*)

1. Black sea bass are concentrated from Cape Cod to Cape Canaveral, Florida. There are two distinct and overlapping stocks of black sea bass along the Atlantic coast. In the Ocean SAMP area, black sea bass are targeted by both commercial and recreational fishermen.

Life History

2. Black sea bass are hermaphroditic, beginning life as females and then changing to males when they reach about nine to thirteen inches (23 to 33 cm) in length. In the Mid-Atlantic, 38% of females will change sex between August and April, after most of the fish have already spawned. Most black sea bass will produce eggs when they first

mature, although some are already males at this stage, and then the ovaries eventually stop functioning as sperm production begins. Most fish will reverse sex before they reach the age of six (ASMFC 2008a). In populations where the larger, older males are heavily fished, females may change sex at an earlier age than they would in populations unaffected by fishing (Ross 1991).

3. The northern stock of black sea bass spawns off New England from mid-May until the end of June (Ross 1991), and an average sized fish will produce roughly 280,000 eggs. The eggs float in the water column, hatching a few days after fertilization. The larvae will drift offshore until they grow to a half an inch (one cm) in length, at which point the young sea bass will migrate inshore into estuaries, bays, and sounds (ASMFC 2008a).

Habitat

4. Black sea bass are a temperate reef fish, preferring water about 48 degrees Fahrenheit (9 degrees Celsius), and they prefer to inhabit rock bottoms near pilings, wrecks, and jetties. They are found in inshore waters at depths of less than 120 feet (37 meters) in the summer, and move offshore to deeper waters to the south during the winter (ASMFC 2008a). Larger adults are usually found in deeper waters than smaller individuals, and larger adults typically begin their migration earlier than the younger adults and juveniles, starting in August (Ross 1991). Juvenile sea bass migrate inshore and prefer sheltered habitats such as submerged aquatic vegetation, oyster reefs, and man-made structures. Juveniles feed primarily on benthic invertebrates such as shrimp, isopods, and amphipods, while adults feed on rock and hermit crabs, squid, fish, and mollusks (Ross 1991).

Fishery

5. In Rhode Island, black sea bass are important as both a commercial and recreational species. Both commercial and recreational landings are regulated under a quota system, managed jointly by the Atlantic States Marine Fisheries Commission and the Mid-Atlantic Fishery Management Council under the Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan, in which 51 percent of the quota is given to the recreational fishery, and 49 percent to the commercial fishery. The commercial quota is further divided up by state based on historical landings; Rhode Island fishermen are given eleven percent of the total quota for this species. By contrast the recreational quota is managed under a coastwide plan (ASMFC 2008a). Black sea bass is currently considered rebuilt by the Atlantic States Marine Fisheries Commission and overfishing is not occurring (ASMFC 2009b). Abundance of black sea bass had declined after 2003, but has since increased, and the stock was declared rebuilt in 2009 by NMFS. In 2008, biomass of black sea bass in the Mid-Atlantic was estimated to be 3% above the target level (NMFS 2010b).

Table 5.9. Habitat characteristics of black sea bass. (NEFSC 2007)

Life Stage	*Habitat*	*Substrate*	*Temperature*
Eggs	Mostly at shallow depths; majority around 30m	Pelagic	Mostly between temperatures of about 10-25ºC
Larvae	Reported in high salinity coastal areas of southern New England in August and September, but are rarely reported in	Pelagic	Between temperatures of 11-26ºC. Most larvae found at about 15-19ºC in July, at 15-

	estuaries. Most found at 30-50 m in July – September.		20ºC in August, and in 17-21ºC in September.
Juveniles	Most abundant in oceanic waters of estuaries. High numbers of juveniles in Rhode Island Sound, Buzzards Bay, and the tip of Long Island in the fall. Found in Narragansett Bay. Between 1-35 m, with the majority between 6-15 m. Most nurseries are located at depths < 20 m.	Shellfish beds, seagrass beds, rocky reefs, wrecks, cobble habitats, manmade structures	9-12°C in spring, 10-22°C in fall, with most between 17-21°C.
Adults	Structurally complex habitats with steep depth gradients. Use a variety of man-made habitats. Over wintering habitats in the Mid-Atlantic Bight appear to occur at depths between 60-150 m. Some fish may also over winter in deep water (> 80 m) off southern New England. Depth range in spring from 1 -65 m, with most between 6-25 m, and between depths of 6-20 m in fall. Larger fish found in deeper water.	Structurally complex habitats, including rocky reefs, cobble and rock fields, stone coral patches, exposed stiff clay, and mussel beds.	In spring, temperature range of 3-17°C, with the majority at 10-14°C. In fall, over a range of approximately 8-22°C, with the majority between 16-21°C. In Narragansett Bay, summer temperature range of 15-24ºC, with peaks at 91-20ºC. Potential over wintering habitat may be defined by bottom water temperatures > 7.5ºC.

510.2.8. Bluefish (*Potamomus saltatrix*)

1. Bluefish are a migratory, pelagic species found throughout much of the world's temperate, coastal regions. In the Ocean SAMP area, bluefish are pursued primarily by recreational fishermen.

Life History

2. Bluefish live up to fourteen years, and may weigh upwards of 31 pounds (14 kg) and measure at least 39 inches (one meter) in length. They reach sexual maturity at two years, and spawn offshore between Massachusetts and Florida. Different groups of bluefish spawn at different times of the year, with some spawning in spring, some in summer, and some in fall throughout their range (ASMFC 2008a). Once the larvae hatch, they live in surface waters and are carried by currents along the continental shelf. The survival of the young fish is highly variable from year to year, depending on whether the prevailing circulation patterns carry them inshore to suitable habitats (Ross 1991).

Habitat

3. Bluefish are found between Maine and Cape Hatteras, North Carolina during the summer months, and between Cape Hatteras and Florida in the winter (ASMFC 2008a). Larger fish will migrate further north than younger ones. The fish will begin arriving off the southern New England coast in April and May; smaller fish usually arrive first. Adults will leave the coastal areas again in October, when the water cools to 60 degrees Fahrenheit (16 degrees Celsius) (Ross 1991). They prefer warmer waters of at least 57 to 60 degrees Fahrenheit (14 to 16 degrees Celsius) in summer (Collette and Klein-MacPhee 2002). Bluefish migrate in large schools, each of which may cover tens of square miles of ocean (ASMFC 2008a). They inhabit both inshore and offshore habitats, with young-of-the-year fish often found in estuaries and river mouths (Ross 1991).

4. Bluefish are voracious predators, and will eat almost anything they can catch and swallow. Bigelow and Schroeder (1953) called the bluefish, "the most ferocious and bloodthirsty fish in the sea," although Ross (1991) notes this reputation is somewhat exaggerated. They have very sharp teeth and can take large bites, meaning they can eat larger prey (ASMFC 2008a). Common prey include schooling species such as squid, menhaden, mackerel, herring, alewives, and sand eels, as well as scup and butterfish. They usually feed in schools, pursuing fish into tidal rips or inshore shallows. They are known to force schools of menhaden and other fish up on shore, leading to fish kills. Juvenile bluefish will feed on polychaetes, shrimp, other small crustaceans, small mollusks, and small fish. Bluefish are prey for blue sharks, mako sharks, tuna, and billfish (Ross 1991).

Fishery

5. Bluefish are an important species for recreational fisheries, and are popular with anglers because of their aggressive feeding habits. Recreational harvest averages about 35 million pounds (16 million kilograms) per year. Bluefish are also targeted commercially with trawls, gillnets, haul seines, and pound nets. The species is managed jointly by the Mid-Atlantic Fishery Management Council and the Atlantic States Marine Fisheries Commission. The Atlantic States Marine Fisheries Commission and the Mid-Atlantic Fishery Management Council allocate 83 percent of the resource to recreational fisheries and 17 percent to commercial fisheries. The commercial fishery is managed through state-by-state quotas based on historic landings, and the recreational fishery is managed by a ten-fish bag limit. According to the Atlantic States Marine Fisheries Commission, bluefish are not overfished, nor is overfishing presently occurring. Recent data have shown a decreasing trend in fishing mortality and an increase in stock biomass and population numbers (ASMFC 2008a). Bluefish biomass in the Atlantic Ocean is estimated to be at 5% above the level needed to support maximum sustainable yield, and was estimated at 139,500 metric tons in 2006. A nine-year rebuilding plan was implemented in 2001, and the stock was declared rebuilt in 2009 (NMFS 2010b). Cycles of high and low abundance of bluefish have been observed to be the converse of striped bass abundance patterns, but no explanation for this phenomenon has been found (NEFSC 2006b).

Table 5.10. Habitat characteristics of bluefish. (NEFSC 2006b)

Life Stage	*Habitat*	*Substrate*	*Temperature*
Eggs	Occurs across continental shelf, southern New England to Cape Hatteras. Most in mid-shelf waters.	Pelagic	Most in 18-22ºC.
Larvae	Most 30-70 m depths, May-Sept, peak in July.	Strongly associated with the surface.	18-26ºC in Mid-Atlantic Bight
Juveniles	Mostly estuarine areas and river mouths, including Narragansett Bay. Also coast beaches and surf zones.	Mostly sand, particularly along coast, but some mud, silt, clay. Also uses vegetation beds.	In most studies, arrive > 20ºC, remain in temperatures up to 30ºC, emigrate when declines to 15ºC. Can not survive below 10ºC or above 34ºC. Fall migration in

			18-22ºC on inner continental shelf.
Adults	Generally oceanic, nearshore to well offshore over continental shelf. Not uncommon in bays, larger estuaries, as well as coastal waters.	Pelagic	Warm water, usually > 14-16ºC.

510.2.9. Butterfish (*Poronotus triacanthus*)

1. Butterfish are found from Newfoundland to Florida. In the Ocean SAMP area, butterfish are targeted by commercial fishermen.

Life History

2. Butterfish are pelagic fishes, forming loose schools (NEFSC 1999b). Butterfish are found in Narragansett Bay and in Rhode Island and Block Island Sounds from late spring through fall, appearing off Rhode Island in late April. They spawn usually within a few miles of the coast during the late spring and early summer, and migrate to the edge of the continental shelf during the winter (Collette and Klein-MacPhee 2002). Butterfish eggs are found within Narragansett Bay from June through August (NEFSC 1999b). The eggs of the butterfish are buoyant, and will hatch within two days in waters of around 65 degrees Fahrenheit (18 degrees Celsius). The juveniles will grow to about half their adult size within their first year (Collette and Klein-MacPhee 2002). Juvenile butterfish may associate with jellyfish during the summer to avoid predators (NEFSC 2006a). Butterfish mature in their second summer (Collette and Klein-MacPhee 2002). They can reach up to twelve inches (30 cm) in length, although most harvestable butterfish are between six and nine inches (15 and 23 cm). The maximum reported age for butterfish is six years, although most probably only live two to three years (Collette and Klein-MacPhee 2002).

Habitat

3. Butterfish feed primarily on tunicates and mollusks, as well as cnidarians, polychaetes, crustaceans, and other invertebrates (Collette and Klein-MacPhee 2002). Ctenophores have been found to make up an important component of the diet of juvenile butterfish in Narragansett Bay (Oviatt and Kremer 1977). They will often come close to shore into sheltered bays and estuaries, and they have a preference for sandy bottom as opposed to rocky or muddy bottom. They spend much of their time near the surface when they are near to shore, but spend the winter and early spring near the bottom at depths of up to 100-115 fathoms (183 to 210 m) (Collette and Klein-MacPhee 2002). Butterfish serve as prey to a number of species including hake, bluefish, weakfish, and swordfish, and are used commonly as bait in recreational tuna fisheries (Ross 1991).

Fishery

4. The butterfish stock is currently managed by the Mid-Atlantic Fishery Management Council under the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan. There is considerable uncertainty in butterfish abundance estimates. Discards of butterfish in fisheries targeting other species, particularly in the squid fishery, is an important source of mortality (NEFSC 2006a).

Table 5.11. Habitat characteristics of butterfish. (NEFSC 1999b)

Life Stage	*Habitat*	*Substrate*	*Temperature*
Eggs	Surface waters from continental shelf into estuaries and bays; collected to about 60 m deep in shelf waters.	Pelagic	Most eggs collected between 11-17ºC.
Larvae	Surface waters from continental shelf into estuaries and bays; collected to about 60 m deep in shelf waters; common in high salinity zone of estuaries and bays; may spend day deeper in the water column and migrate to the surface at night.	Pelagic	4.4-27.9ºC
Juveniles	From surface waters to depth on continental shelf; into coastal bays and estuaries; common in inshore areas, including the surf zone, and in high salinity and mixed salinity zones of bays and estuaries. Most collected in < 120 m. Commonly occur in bays and estuaries from MA to VA from spring through fall.	Larger individuals found over sandy and muddy substrates.	4.4-29.7ºC
Adults	From near surface waters in summer to depths of 270-420 m on continental shelf in winter; into coastal bays and estuaries; common in inshore areas, including the surf zone, and in high salinity and mixed salinity zones of bays and estuaries. Most collected in < 180 m. Spawning occurs on continental shelf, inshore areas, and in bays and estuaries.	Schools found over sandy, sandy-silt, and muddy substrates.	4.4-26.0ºC; Spawning does not occur at < 15ºC.

510.2.10. False Albacore *(Euthynnus alletteratus)*

1. The false albacore is also referred to as the little tunny. These fish are found in the tropical and temperate waters of the Western Atlantic from New England south to Brazil. Unlike other tunas, the false albacore is mostly scaleless (Ross 1991). In the Ocean SAMP area, false albacore are one of the most prized fish pursued by recreational fishermen for catch and release.

Life History

2. False albacore are usually about 25 inches (63 cm) in length, although they can grow to 40 inches (101 cm). They reach sexual maturity at about 15 inches (38 cm). The fish spawn from April to November (NMFS 2007b). A female will produce as many as 1.8 million eggs, which are released in several large batches during the spawning season. They are usually found traveling in large schools with similar-sized individuals, and sometimes in mixed schools with Atlantic bonito (Ross 1991).

Habitat

3. The false albacore is usually found near the coast, or around offshore shoals or islands further out on the continental shelf. In the Atlantic, the false albacore is rarely found in waters beyond the continental shelf. The fish prefers areas with strong currents. False

albacore migrate northward along the Atlantic coast of the United States in spring and summer, moving from the North and South Carolina coasts in May and June to southern New England by August and September. The false albacore feeds during the daytime on schools of sand lance, herring, mackerel, and young false albacore, as well as squid, euphausiid shrimp, and other crustaceans. They are preyed upon by yellowfin tuna and various species of sharks (Ross 1991).

Fishery

4. False albacore are managed internationally through the International Commission for the Conservation of Atlantic Tunas. At present, there is no Fishery Management Plan in place for false albacore; recreational anglers are not required to have a permit to fish for this species. There are no size or bag limits for false albacore.

Table 5.12. Habitat characteristics of false albacore. (Ross 1991)

Life Stage	*Habitat*	*Substrate*	*Temperature*
Juveniles/Adults	Near-coastal waters or around offshore shoals or islands. Usually on continental shelf, in areas with strong currents	Pelagic	N/A

510.2.11. Goosefish (monkfish) *(Lophius americanus)*

1. The goosefish, also commonly called monkfish, is found from Newfoundland to North Carolina, and in the Gulf of Mexico. In the Ocean SAMP area, monkfish are targeted by commercial fishermen.

Life History

2. Male monkfish become sexually mature at age four, and females at age five. They reproduce in shallow water from spring through early fall; typically from late June through mid-September in New England. They produce large masses of eggs in a single ribbon that can be up to 25-36 feet (7-11 m) in length that float within the water column, and can produce up to 2.8 million eggs at one time. By the time the fry reach about two inches (5 cm) in length, they become bottom-dwellers. They can reach four feet (1.2 m) in length and weigh up to 50 pounds (23 kg) (Ross 1991).

Habitat

3. Monkfish are found from the tideline out to depths of greater than 2,000 feet (610 m) on the continental slope. They live on various types of substrate, including sand, gravel, rocks, mud, and beds of broken shells. They have been found in a variety of temperatures, from 32 degrees to 70 degrees Fahrenheit (0 to 21 degrees Celsius), but prefer temperatures of 37-48 degrees Fahrenheit (3 to 9 degrees Celsius). Young monkfish fry will feed on copepods, crustacean larvae, and arrow worms (Ross 1991). Adult monkfish are voracious predators, feeding on skates, herring, mackerel, and silver hake, as well as lobsters and crabs. The most important prey species for monkfish in southern New England are little skate, red hake, sand lance, and other monkfish (Collette and Klein-MacPhee 2002). The monkfish often feeds by lying motionless in eelgrass, waving its “lure” to attract fish and then opening its enormous mouth to suck in the fish, earning it the nickname “angler”. The monkfish also eats seabirds, including cormorants,

herring gulls, loons, and other sea birds, the practice of which has given the fish the nickname "goosefish", although there have been no documented cases of a monkfish eating a goose. A monkfish can have up to half its own bodyweight in its stomach (Ross 1991), and can swallow a fish almost its own size (Collette and Klein-MacPhee 2002).

Fishery

4. Monkfish are currently managed under the Monkfish Fishery Management Plan by the New England and Mid-Atlantic Fishery Management Councils. Management measures include limited access, days-at-sea limitations, mesh size restrictions, minimum size limits, and trip limits. Monkfish are managed as two separate stocks; the monkfish in Rhode Island waters are considered part of the southern stock, which extends from the southern portions of Georges Bank to the Mid-Atlantic. Based on the 2007 stock assessment, monkfish biomass is 29% above that necessary to support maximum sustainable yield, and so monkfish are not considered overfished, nor is overfishing occurring (NMFS 2010b). Monkfish are caught throughout the Ocean SAMP area.

Table 5.13. Habitat characteristics of goosefish (monkfish). (NEFSC 1999c)

Life Stage	*Habitat*	*Substrate*	*Temperature*
Eggs	Upper water column, inner to mid-continental shelf, southern New England, and Mid-Atlantic Bight; not in estuaries. Contained in long mucus veils that float near or at surface.	Pelagic	4-18°C or higher
Larvae	Mainly mid-shelf in southern New England and Mid-Atlantic Bight. Upper to lower water column, at depths of 15 to > 1000 m; mostly 30-90 m.	Pelagic	6-20°C, most in 11-15°C
Juveniles	Southern New England: mostly mid to outer shelf. Seabed, > 20 m, peak abundance at 40-75 m.	Mud to gravelly sand, algae, and rocks.	2-24°C, most 3-13°C
Adults	Southern New England/Mid-Atlantic Bight: inshore in winter, offshore in summer fall. Seabed, 1- 800 m, most 50-99 m, sometimes at surface.	Mud to gravelly sand, algae, and rocks. Will hide in eelgrass to ambush prey.	Seasonally variable, 0-24°C; mostly 4-14°C.

510.2.12. Longfin Squid *(Loligo pealeii)*

1. Longfin squid are distributed from Cape Cod through Cape Hatteras. In the Ocean SAMP area, longfin squid are pursued by commercial fishermen.

Life History

2. The longfin squid grows to about eight to twelve inches long (20 to 30 cm), and is sexually dimorphic, with males growing faster than females. It moves by means of jet propulsion, taking in water through a siphon and then expelling it. The life span of the longfin squid is thought to be about six months (Macy and Brodziak 2001). Adult longfin squid are demersal during the day, coming to the surface at night to feed. Newly hatched squid are found at the surface, and move deeper in the water column as they grow, becoming demersal when they reach just under two inches (45 mm) in length (NEFSC 2005b). There is evidence that squid spawn throughout the year, with two main spawning periods in the summer and winter (Macy and Brodziak 2001).

Habitat

3. The greatest abundance of longfin squid are found in continental shelf and slope waters at depths between 55 and 92 fathoms (100 and 168 m). They generally migrate inshore to waters off Rhode Island and elsewhere in May or June, and by late November/early December they migrate to deeper waters along the edge of the continental shelf (Macy and Brodziak 2001). The adults feed on small fish, while juveniles feed on small crustaceans (Rathjen 1973). Squid are an important prey species to a number of other species including sharks, haddock, hakes, striped bass, black sea bass, bluefish, scup, mackerel, summer flounder, and tunas (Ross 1991).

Fishery

4. Two separate fisheries exist for longfin squid; an inshore fishery in summer and fall, and a larger offshore commercial fishery during the winter months, when the squid migrate to the edge of the continental shelf (Macy and Brodziak 2001). The longfin squid stock is currently managed by the Mid-Atlantic Fishery Management Council under the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan. They are managed through the use of permits, quotas, and gear restrictions. Landings of longfin squid have declined, due in part to seasonal closures (NEFSC 2006a). The relative biomass measures of longfin squid were below average through 2005, but increased to slightly above average in 2007. Estimates of the level of biomass needed to support maximum sustainable yield for longfin squid are not currently available. Overfishing is not presently occurring on this species (NMFS 2010b).

Table 5.14. Habitat characteristics of longfin (*loligo)* squid. (NEFSC 2005b)

Life Stage	*Habitat*	*Substrate*	*Temperature*
Eggs	Shallow waters, <50m and near shore.	Egg masses are Commonly found on sandy/mud bottom; usually attached to rocks/boulders, pilings, or algae.	Eggs found in waters 10-23ºC; usually > 8ºC. Optimal development at 12ºC.
Larvae	Found in coastal, surface waters in spring, summer, and fall. Hatchlings found in surface waters day and night. Move deeper in water column as they grow larger.	Pelagic	Found at 10-26ºC (at lower temperatures found at higher salinities).
Juveniles	Inhabit upper 10 m at depths of 50-100 m on continental shelf. Found in coastal inshore waters in spring/fall, offshore in winter. Migrate to surface at night.	Pelagic	Found at 10-26ºC. Juveniles prefer warmer bottom temperatures and shallower depths in fall than adults.
Adults	March-October: inshore, shallow waters up to 180 m. Winter: offshore deeper waters, up to 400 m on shelf edge. Most abundant at bottom during the day; move upwards at night. Generally found at greater depths and cooler bottom	Mud or sandy mud	Found at surface temperatures ranging from 9-21ºC and bottom temperatures ranging from 8-16ºC.

	temperatures in the fall than juveniles.		

510.2.13. Menhaden *(Brevoortia tyrannus)*

1. Atlantic menhaden (*Brevoortia tyrannus*), also called pogies, bunkers, and fatbacks, are found in estuarine and coastal waters stretching from Nova Scotia to northern Florida. Menhaden are a prey species that provide food to many commercially and recreationally important species. In addition, menhaden are used as bait in the lobster fishery.

Life History

2. Adult and juvenile menhaden form large schools near the surface, mostly in estuaries and along the shore from early spring through early winter. During the summer, menhaden schools will stratify by age and size along the coast; older, larger menhaden are generally found further north. In the fall and early winter, menhaden of all ages and sizes will migrate south to spawn in the waters between New Jersey and North Carolina, usually about twenty to thirty miles offshore. The eggs that are released float offshore; when the juveniles hatch, they will be carried into estuarine nursery areas by ocean currents where they will spend the first year of their lives, migrating south in the winter (ASMFC 2008a). Adults average about 7- 12 inches (20-30 cm) in length and weigh 0.5 – 1.3 pounds (0.25-0.6 kg) (Collette and Klein-MacPhee 2002).

Habitat

3. Menhaden spawn offshore in the waters between New Jersey and North Carolina during the fall and early winter, and spend the rest of the year in estuaries, migrating further north. Menhaden feed on plankton, most commonly diatoms and small crustaceans, by straining it from the water using their gill rakers. They themselves serve as an important food source for many larger fish, including striped bass and bluefish (ASMFC 2008a). This is highlighted by the 2006 menhaden stock assessment, which found that predation mortality is most likely the highest cause of natural mortality (Atlantic Menhaden Technical Committee 2006).

Management

4. Menhaden are managed by the Atlantic States Marine Fisheries Commission, and are managed through the use of seasonal restrictions and management areas in Rhode Island. Commercial fishing for menhaden typically includes both a bait fishery and a reduction fishery, where the fish are processed into fishmeal and oil. Rhode Island does not allow a reduction fishery to occur in state waters, but there is a bait fishery taking place here. They are of commercial importance largely because of their use as bait for the lobster fishery. Although they are typically fished from Narragansett Bay rather than from the Ocean SAMP area, menhaden pass through the Ocean SAMP area. Menhaden were historically a major fishery in Rhode Island (see Section 530). Some have argued that local stocks have been depleted due to fishing pressure off mid-Atlantic states, which has prevented menhaden from migrating northward (Oviatt et al. 2003). According to the Atlantic States Marine Fisheries Commission, menhaden are not overfished, and overfishing is not occurring (ASMFC 2008a).

Table 5.15. Habitat characteristics of menhaden (ASMFC 2008a; Collette and Klein-MacPhee 2002).

Life Stage	*Habitat*	*Substrate*	*Temperature*

Eggs	Buoyant; hatch at sea.	Pelagic	N/A
Larvae	Estuarine nursery areas with salinity < 10 ppt.	N/A	N/A
Juveniles	Live in estuaries for first year of life.	Unconsolidated bottom with sand, mud, organic material; rocky coves with cobble, rock, and sand bottoms in northern part of range.	N/A
Adults	Nearshore and inland tidal waters.	Ranges from a bottom composition of sand, mud and organic material to marine sand and mud with increasing amounts of rocks in the more northerly areas.	Prefer water temperatures near 18° C.

510.2.14. Scup *(Stenotomus chrysops)*

1. Scup, also known as porgy, are a migratory species found from Cape Cod to Cape Hatteras. Scup are pursued by both recreational and commercial fishermen in the Ocean SAMP area.

Life History

2. Scup spawn in inshore waters during the summer, with spawning reaching its peak in June off southern New England. The eggs will hatch about 40 hours after fertilization. Larval scup are pelagic and are found in coastal waters during the warmer months. Scup become sexually mature at age two or three (ASMFC 2008a). They form into schools of similarly-sized individuals. They can grow up to six pounds, but rarely exceed two pounds (one kg) in weight and fourteen inches (36 cm) in length. They can reach fifteen years of age, although it appears this is rare because of high mortality rates due to predation and fishing (Ross 1991).

Habitat

3. Scup are most commonly found in waters between 55 and 77 degrees Fahrenheit (13 and 25 degrees Celsius). They spend the winters in offshore waters from southern New Jersey to Cape Hatteras, and spawn in the summer in inshore waters from southern New England to Long Island, moving to New England waters in May until leaving in October. Juvenile scup inhabit coastal habitats, and will sometimes dominate the fish population of estuarine areas during the summer months (ASMFC 2008a). They prefer areas with smooth or rocky bottoms, and are often found around piers, rocks, offshore ledges, jetties, and mussel beds. During the winter, they prefer depths of 240 to 600 feet (73 to

183 m), where the water temperature is at least 45 degrees Fahrenheit (7 degrees Celsius). Adult scup feed on bottom invertebrates, including small crabs, squid, worms, clams, mussels, amphipods, jellyfish, and others. They are eaten by a variety of different fishes; as many as 80% of all juvenile scup annually are eaten by fish such as cod, bluefish, striped bass, and weakfish (Ross 1991).

Fishery

4. Scup is important as both a recreational and commercial species. Rhode Island has the largest share of scup landings in state waters along with New Jersey. The species is jointly managed by the Mid-Atlantic Fishery Management Council and the Atlantic States Marine Fisheries Commission through the Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan (ASMFC 2008a). Scup spawning stock biomass had declined greatly in the mid-1990s, but has steadily increased since then. Overfishing is not occurring, and the stock is not overfished. Scup biomass for 2008 was estimated to be 104% above that required for maximum sustainable yield. Spawning stock biomass was estimated to be around 188,000 metric tons in 2008 (NMFS 2010b).

Table 5.16. Habitat characteristics of scup. (NEFSC 1999d)

Life Stage	*Habitat*	*Substrate*	*Temperature*
Eggs	Water column, < 30 m in depth, Coastal Virginia – Southern New England.	Buoyant in water column.	11-23°C; most common 12-14°C
Larvae	Water column, < 20 m until juvenile transition.	Water column	14-22°C; peak densities at 15-20°C
Juveniles	Young-of-year: Estuarine and coastal; from intertidal to about 38 m. Winter juveniles: Mostly > 38 m depth; mid and outer continental shelf; sometime in deep estuaries.	Sand, mud, mussel, and eel grass beds.	Greater than ~9-27°C; mostly 16-22°C
Adults	2-38 m in summer. Mostly 38-185 m depths; mid/outer continental shelf in winter.	Fine to silty sand, mud, mussel beds, rock, artificial reefs, wrecks, and other structures in summer. Weedy and sandy habitats when spawning.	~7-25°C

510.2.15. Shark, Blue *(Prionace glauca)*

1. Sharks are pursued by recreational fishermen in the Ocean SAMP area. Whereas a number of different shark species may be pursued by fishermen, the most commonly targeted ones are blue, shortfin mako, and thresher. Compared with other marine fishes, sharks have a very low reproduction potential because of a combination of factors including slow growth, late sexual maturity, infrequent reproductive cycles, a small number of young produced, and requirements for nursery areas. These factors make sharks highly vulnerable to overfishing (ASMFC 2008a). The blue shark is widely

distributed in both inshore and offshore areas throughout the North Atlantic, and is one of the most commonly encountered shark species.

Life History

2. Male blue sharks grow to between five and six feet long at maturity. Like other shark species, the eggs are fertilized internally. Females will often not give birth until up to two years after mating, storing the sperm for up to a year after the first time they mate, and then incubating the embryo for up to one year. The young are between fourteen and eighteen inches (46 cm) at birth. Females may bear up to 82 young, although the average number is much lower. The largest blue sharks measure eleven or twelve feet (more than 3.5 m) in length (Ross 1991).

Habitat

3. Blue sharks are found in the Northwest Atlantic from May through October, often in waters of depths between 100 and 130 feet (30 and 40 m) off southern New England. Large females will typically migrate northward and inshore during the spring, and smaller females and males will follow later in the year. During the fall, blue sharks will migrate southward along the continental shelf to the margins of the Gulf Stream. They appear to prefer temperatures between 55 and 64 degrees Fahrenheit (13 and 18 degrees Celsius). They are often found near the surface in temperate areas, but frequent deeper, cooler waters in tropical regions. Blue sharks feed on squid and octopus, as well as bluefish, red and silver hakes, mackerel, menhaden, and herring (Ross 1991).

Table 5.17. Habitat characteristics of blue shark. (Ross 1991)

Life Stage	*Habitat*	*Substrate*	*Temperature*
Juveniles/Adults	Often found in waters of 30 to 40 meters of depth off southern New England coastline.	Pelagic	From 8 to 27ºC, prefer waters from 13 to 18ºC

Shark Fishery

4. Fishing efforts for most shark species are controlled by means of possession limits. Sharks are managed jointly by NMFS, through the Consolidated Atlantic Highly Migratory Species Fishery Management Plan (NMFS 2006), and by the Atlantic States Marine Fisheries Commission, under the Interstate Fishery Management Plan for Atlantic Coastal Sharks (ASMFC 2008d). The Atlantic States Marine Fisheries Commission's plan complements federal shark management actions and places special attention on the protection of pregnant females and juveniles in inshore nursery areas. .

510.2.16. Shark, Shortfin Mako *(Isurus oxyrinchus)*

1. Mako sharks are one of the three shark species most commonly targeted by recreational fishermen in the Ocean SAMP area.

Life History

2. Mako sharks spend the summer months at northern latitudes, and migrate south along the continental shelf to winter in the Caribbean during the winter. Males are sexually mature at three to four years of age, and females at seven years of age. Like other sharks, fertilization of egg cells occurs internally within mako sharks. After one year of

embryonic development, the female mako shark will give birth to from one to several young, each measuring more than two feet long at birth. Internal incubation allows newly born sharks to be more highly developed than species hatched through external fertilization, and provides them with a higher probability of survival than for larval fish (Ross 1991). Most adult mako sharks are between five and eight feet (1.5 to 2.5 m) in length.

Habitat

3. The mako shark is a pelagic shark not found in waters less than thirty feet (9 m) deep. They are usually found offshore either at or near the surface (Ross 1991). Mako sharks prefer tropical and warm temperate waters; southern New England is the northern part of their range. In southern New England waters, bluefish may make up to 80% of a mako shark's diet. Mako sharks also eat small schooling fish such as mackerel and herring, squid, and larger species including swordfish, bonito, and tuna species (Ross 1991). The current status of the shortfin mako shark is uncertain, but it may be approaching an overfished condition (NMFS 2010b).

Table 5.18. Habitat characteristics of mako shark. (Ross 1991)

Life Stage	*Habitat*	*Substrate*	*Temperature*
Juveniles/Adults	Oceanic, never within waters less than 9 m deep. Found at or near the surface.	Pelagic	N/A

4. Fishing efforts for most shark species are controlled by means of possession limits. Mako sharks are managed by NMFS, under the Consolidated Atlantic Highly Migratory Species Fishery Management Plan (NMFS 2006), and by the Atlantic States Marine Fisheries Commission under the Interstate Fishery Management Plan for Atlantic Coastal Sharks (ASMFC 2008d). There is a great deal of uncertainty over stock levels of mako sharks in the North Atlantic; the current stock levels may be below the biomass required to support maximum sustainable yield, suggesting the stock may be approaching an overfished condition (NMFS 2010b).

510.2.17. Shark, Thresher *(Alopias vulpinus)*

1. Thresher sharks are sometimes targeted by recreational fishermen in the Ocean SAMP area.

Life History

2. Thresher sharks are ovoviviparous; they develop *in utero* without a placental attachment. Females usually give birth to two to four pups at a time, and they are typically longer than 150 cm (59 inches) at birth. It is thought thresher sharks reproduce annually, as most mature female sharks caught are pregnant. Thresher sharks may attain a length of up to 300 cm (118 inches) (Collette and Klein-MacPhee 2002). It is estimated they may live anywhere from 19 to 50 years (NMFS 2010b).

Habitat

3. Thresher sharks are an epipelagic species, found in both coastal and oceanic waters. They are found from Nova Scotia to Argentina, and are common off southern New England

during the summer months. Juveniles are more likely to be found in inshore waters, and may also be found in coastal bays. Adults are often found over the continental shelf (Collette and Klein-MacPhee 2002). They are most common in temperate waters, but can also be found in cold-temperate and tropical waters (NMFS 2010b). Most young sharks are seen in southeast U.S. waters, so it has been suggested that the sharks may have a pupping ground in the south, but it is not known whether this is the case. Thresher sharks use their long caudal fins to stun their prey. They feed primarily on small schooling fishes including herring, menhaden, bluefish, sand lance, and mackerel, as well as on bonito and squids. Thresher sharks will often feed in groups, herding schools of fish into a tight group, and then whipping them with their tails (Collette and Klein-MacPhee 2002).

Table 5.19. Habitat characteristics for thresher shark. (Collette and Klein-MacPhee 2002)

Life Stage	*Habitat*	*Substrate*	*Temperature*
Juveniles	Inshore waters, coastal bays.	Pelagic	N/A
Adults	Oceanic; over the continental shelf.	Pelagic	N/A

Fishery

4. The status of Atlantic thresher sharks is unknown; it is not known if they are overfished or if overfishing is occurring. They are often caught as by-catch in longline fisheries targeting tuna and swordfish, and are taken recreationally in rod and reel fisheries (NMFS 2010b). Atlantic thresher sharks are managed by NMFS, under the Consolidated Atlantic Highly Migratory Species Fishery Management Plan (NMFS 2006), and by the Atlantic States Marine Fisheries Commission under the Interstate Fishery Management Plan for Atlantic Coastal Sharks (ASMFC 2008d).

510.2.18. Silver Hake *(Merluccius bilinearis)*

1. Silver hake, or whiting, are found along the continental shelf of North America, from Canada to the Bahamas, and are most abundant between Newfoundland and South Carolina (Collette and Klein-MacPhee 2002). There are two stocks of silver hake; one in the Gulf of Maine and northern Georges Bank, and the other on southern Georges Bank and the Mid-Atlantic Bight. In the Ocean SAMP area, silver hake are targeted by commercial fishermen.

Life History

2. Silver hake can reach a length of two and a half feet (76 cm) and weigh up to five pounds (2.3 kg), but usually are only around fourteen inches in length (36 cm). They do not form definitive schools, but will swim together in groups (Collette and Klein-MacPhee 2002). Silver hake spawn throughout the year, peaking from May through November, and with a peak in May to June in the southern stock (NEFSC 2004c). They reach sexual maturity at two to three years of age. The eggs are pelagic, and hatch within two days (Ross 1991). The larvae are just one-tenth of an inch (2.8 mm) in length after hatching. During their first summer or fall, when they are still less than an inch (17-22 mm), the silver hake larvae will descend to the bottom as juveniles (NEFSC 2004c). Females live longer and grow faster than males; males usually don’t live past six years, while females may occasionally live to between twelve and fifteen years in age (Ross 1991).

Habitat

3. Silver hake are wanderers, unconcerned with the depth or with the sea floor. They are sometimes found near the bottom, and sometimes close to the surface, as they chase prey throughout the water column. They are found as deep as 2400 feet (122 m) as well as just below the tide line. When they are found near the bottom, they are usually on sandy or pebbly ground, or mud (Collette and Klein-MacPhee 2002). There are two major stocks of silver hake, one north and one south of Georges Bank. The stock of silver hake found off Rhode Island spend their winters along the continental slope south of Georges Bank, and migrate to shallower waters in southern New England for the spring and summer. They spawn on the southern slopes of Georges Bank and Nantucket Shoals, and south of Martha's Vineyard (Ross 1991). The area between Cape Cod and Montauk Point, which includes the Ocean SAMP area, is a primary spawning ground for silver hake (NEFSC 2004c). Silver hake will move south and to offshore waters during the winter (NEFSC 2004c). Voracious predators, silver hake prey on many different schooling fish including herring, young mackerel, sand lance, and smaller silver hake (Collette and Klein-MacPhee 2002). They themselves are food for cod, mackerel, swordfish, spiny dogfish, flounders, and larger silver hake (Ross 1991).

Fishery

4. Silver hake and red hake were the two primary species targeted by Rhode Island's industrial fishery in the 1950s (Olsen and Stevenson 1975). Silver hake are managed by the New England Fishery Management Council as part of the "small mesh multispecies" management unit of the Northeast Multispecies Fishery Management Plan. The southern stock of silver hake is not currently considered to be overfished, nor is overfishing occurring, but there are concerns about the age structure of the stock; specifically that there are very few fish over the age of four within the population. Significant numbers of juvenile silver hake are discarded in otter trawl fisheries, which may limit opportunities to rebuild this stock (NEFSC 2006a).

Table 5.20. Habitat characteristics of silver hake. (NEFSC 2004c)

Life Stage	*Habitat*	*Substrate*	*Temperature*
Eggs	Most abundant in deep parts of Georges Bank and bank off southern New England; in southern New England waters July-October; most from 50-150 m.	N/A	Peak abundance from 11-17ºC.
Larvae	Present in Block Island Sound in June through November; abundant in southern New England July-September; most at depths from 50-130 m.	N/A	Temperature preference varies based on annual warming and cooling cycle.
Juveniles	Migrate to deeper waters of the continental shelf as water temperatures decline in the autumn and return to shallow waters in spring and summer. Large concentrations south of RI in fall.	Prefer mud bottoms, also transitional and sand bottoms.	Wide temperature ranges.
Adults	Migrate to deeper waters of the continental shelf as water temperatures decline in the autumn and return to shallow waters in spring	Prefer mud bottoms, also transitional	Prefer temperatures greater than 9ºC in Southern New England.

	and summer to spawn. Frequent spawning in October south of Martha's Vineyard. Older hake prefer the warmer waters of the shelf slope and deep-water shelf area. Found as deep as 122 m as well as in shallow waters.	and sand bottoms.	Found at wide temperature ranges. Spawning peaks between 7 and 13ºC.

510.2.19. Skates

1. Common skates to Rhode Island waters targeted in commercial fisheries are the little skate (*Leucoraja erinacea*), also known as the summer or common skate, and the winter skate (*Leucoraja ocellata*), also called the big skate. The two species are very similar in appearance, and difficult for many people to tell apart. Skates are listed and discussed here together as this is how NMFS reports skate fishery landings (NMFS 2009a).

Life History

2. Winter skates mature at a length of 24 inches (61 cm), and little skates at a length of sixteen inches (41 cm). The eggs are fertilized inside the female's reproductive tract, and then released into the water where much of the embryo's development will take place. It is believed the winter skate spawns in southern New England waters in summer and fall. The little skate spawns throughout the year, with spawning activity in southern New England peaking in June and July. Female skates produce egg cases two at a time, and may produce between 60 and 150 per year. The young hatch between six and nine months after fertilization, and are about three and a half inches (9 cm) long once hatched. The little skate will grow to about 21 inches (53 cm), and the winter skate to 42 inches (107 cm) (Ross 1991).

Habitat

3. Skates are most abundant from shallow waters to depths of up to 360 feet (110 m). The winter skate prefers temperatures between 34 to 70 degrees Fahrenheit (1 and 21 degrees Celsius), and little skates between 34 to 66 degrees Fahrenheit (1 and 19 degrees Celsius). The little skate is distributed along the coast from Chesapeake Bay to Georges Bank in winter and spring, with large numbers along the Long Island coast. They are most abundant between Georges Bank and Long Island in summer and fall. The winter skate is concentrated on Georges Bank throughout the year, and along the eastern shore of Long Island in the winter and spring. Both species of skate feed largely on rock crabs, shrimp, and squid, but also frequently eat amphipods, polychaetes, razor clams, and small fishes. In one study in Block Island Sound, skates fed almost exclusively on digger amphipods. Skates are commonly eaten by monkfish (Ross 1991).

Fishery

4. A market for skate as bait developed in southern New England in the 1980s, and landings have increased substantially. Prior to this, skate was mostly taken as bycatch or targeted as an industrial fish. The little skate is the species primarily targeted in the bait fishery, whereas the winter skate is sometimes also targeted as food fish for its wings, which are sold in a growing export market. Skates are frequently taken as bycatch in groundfishing operations. Skates are federally managed as a group under the Skate Fishery Management Plan through the New England Fishery Management Council. Little skate is

not currently overfished, nor is overfishing occurring. Winter skate is not considered to be overfished at present, but overfishing is occurring for this species (NEFSC 2006a).

Table 5.21. Habitat characteristics of little skate. (NEFSC 2003a)

Life Stage	*Habitat*	*Substrate*	*Temperature*
Eggs	Egg capsule is deposited on the bottom, perhaps in water < 27 m deep.	May be partially buried in sand.	Embryonic growth takes place when temperatures are > 7-8ºC and increases with increasing temperature.
Juveniles/Adults	Generally move into shallow water during spring, deeper water in winter. May leave some estuaries for deeper water during warmer months. Generally caught at depths <111 m, but occasionally at depths > 183 m.	Sandy or gravelly bottoms, but also on mud. Southern New England at 55 m. Skates are known to remain buried in depressions during the day and are more active at night.	Overall temperature range is 1-21ºC, although most are found between 2-15ºC.

Table 5.22. Habitat characteristics of winter skate. (NEFSC 2003b)

Life Stage	*Habitat*	*Substrate*	*Temperature*
Juveniles/Adults	Generally caught at depths from shoreline to 371 m, although most abundant <111 m.	Prefer sand and gravel bottoms.	Recorded over a temperature range of -1.2ºC to 19ºC.

510.2.20. Spiny Dogfish *(Squalus acanthias)*

1. The spiny dogfish (*Squalus acanthias*) is a coastal shark, and is the most abundant shark in the Northwest Atlantic, ranging from Labrador to Florida.

Life History and Habitat

2. Spiny dogfish have a long life, low fecundity, late maturation, and a long gestation period, making it highly vulnerable to population collapse. Spiny dogfish are born in the fall or winter, and are about 26-27 cm (10 inches) in length at birth. They do not reach maturity for ten or more years. Mating occurs in the winter months, and pups are delivered on the offshore wintering grounds (ASMFC 2008a). Females will produce a litter of between 1-15 pups, usually averaging 6-7 pups, and give birth every two years.

Habitat

3. Spiny dogfish are an important predator in the Ocean SAMP area, and eat fish of many sizes, including herring and hakes, squid, and ctenophores. They also eat bivalves, especially scallops, off southern New England. Dogfish diets have changed in response to changes in abundance of certain fish species due to fishing pressures. They migrate north during the spring and summer, and south in the fall and winter. Juvenile and adult spiny dogfish are abundant in the Mid-Atlantic waters extending to the southern part of Georges Bank in winter. During the summer months, they are found farther north in Canadian waters, and will move inshore into bays and estuaries (ASMFC 2008a). In the

fall they are commonly found closer to shore, and are abundant off Martha's Vineyard and Nantucket (NEFSC 2006a).

Management

4. The spiny dogfish is managed jointly by the Mid-Atlantic and New England Fishery Management Councils and the Atlantic States Marine Fisheries Commission. The fishery is managed primarily through trip limits and seasonal closures. Some Rhode Island fishermen participate in the spiny dogfish harvest, and they are commonly found within the Ocean SAMP area. Dogfish are frequently taken as bycatch with otter trawls and other gear targeting groundfish, and were heavily targeted by foreign fleets before the enactment of the EEZ. Management measures have been highly effective in reducing landings and bycatch mortality, and the stock is not currently considered overfished, nor is overfishing occurring. The biomass of spiny dogfish exceeded target levels in 2008 and was considered rebuilt; in 2009 biomass was estimated to be 163,256 metric tons (Rago and Sosebee 2010). In 2010, there was a proposal to list spiny dogfish in Appendix II of the Convention on the International Trade in Endangered Species, though this proposal was rejected (CITES 2010).

Table 5.23. Habitat characteristics of spiny dogfish. (NMFS 2010b; ASMFC 2008a)

Life Stage	*Habitat*	*Substrate*	*Temperature*
Juveniles	Most at depths below 50m.	Pelagic	7-15°C
Adults	Inshore in bays and estuaries in summer; offshore in winter. Large females may prefer nearshore shelf and lower salinities. Found at depths from 1-500 m.	Pelagic; demersal at times, found over soft sediment such as mud, sand, and silt where food is available.	7-15°C

510.2.21. Striped Bass *(Morone saxatilis)*

1. Atlantic striped bass range from the St. Lawrence River in Canada south to the St. John's River in Florida. They are an anadromous species, spending their life in estuaries and in the ocean. They are sometimes referred to as the striper or rockfish. Striped bass are usually found in Rhode Island waters from April through November. In the Ocean SAMP area, striped bass are one of the most important and popular fish pursued by recreational fishermen, and are also targeted in commercial fisheries.

Life History

2. Striped bass can live at least thirty years. They may grow up to 150 cm (59 inches) in length, and between 55 and 77 pounds (25 to 35 kg) (Collette and Klein-MacPhee 2002), although the largest striped bass ever caught weighed 125 pounds (57 kg). Females typically grow much larger than males. They are a migratory species, migrating north in the summers and south in the winters, and migrating into rivers during the spring to spawn. Females mature at age four, and males at age two; females will produce millions of eggs which they release into riverine spawning areas where they are fertilized by males. The eggs will drift downstream and eventually form into larvae. The larvae will mature into juveniles in nursery areas, which are usually located in river deltas, and

inland portions of coastal sounds and estuaries. After two years in these estuarine habitats, they will join the migratory coastal population in the Atlantic Ocean. Once mature, the fish will migrate to spawning areas in the spring (ASMFC 2008a). Frequently, male striped bass remain along the coast near the area where they were hatched, even after they mature, while females migrate much greater distances; Collette and Klein-MacPhee (2002) note that only about 10% of the striped bass found in northern waters are male. Young striped bass less than three years of age (sometimes referred to as "schoolies" by anglers) are found in small groups, while larger striped bass are found in large schools. Occasionally large females will be solitary (Ross 1991). Mycobacteriosis is a disease affecting striped bass that may be having an influence on mortality levels of this species; see Section 550.8 for more information on mycobacteriosis.

Habitat

3. Striped bass spawn in riverine areas, usually in fresh or nearly fresh waters, and the larvae will travel downstream to river deltas or the inland portions of coastal sounds and estuaries, where they will mature. The majority of striped bass found off Rhode Island will spawn within the Chesapeake Bay (ASMFC 2008a); some will also be fish born in the Hudson River, which rarely migrate beyond Cape Cod (Ross 1991). Typically, the fish spend their winters offshore between New Jersey and North Carolina. Striped bass rarely stray from within six or eight kilometers (three to five miles) of the shore, and are typically found along sandy beaches, in shallow bays, around rocks and boulders, and at the mouths of estuaries (Collette and Klein-MacPhee 2002). Striped bass feed on a wide variety of invertebrates, especially crustaceans, and on small fish.

Fishery

5. The striped bass fishery has been one of the most important Atlantic coast fisheries for centuries and is one of the most popular recreational fisheries in the Ocean SAMP area. Recreational fishermen take striped bass with hook-and-line, whereas in commercial fisheries they are also taken with gillnets, pound nets, haul seines, and trawls. In Rhode Island, commercial fishermen also use floating fish traps to catch striped bass. In 2006, commercial harvest accounted for 17% of fish removals, while commercial discards of dead fish accounted for 3%. Recreational harvest accounted for 45% of removals of striped bass, and recreational discards of dead fish accounted for an additional 34%. In Rhode Island, recreational vastly outweighs commercial harvest: in 2008, 732,564 pounds (332,285 kg) were harvested by recreational fishermen whereas 245,988 pounds (111,578 kg) were harvested by commercial fishermen (ASMFC 2008b). The striped bass populations declined sharply in the 1970s and 1980s, causing many states to close their striped bass fisheries. At present, the species is not overfished and overfishing is not occurring (ASMFC 2008a). The amount of female striped bass capable of reproduction, known as female spawning stock biomass, was estimated at 55 million pounds (25,000 metric tons) for 2004, which is well above the recommended biomass threshold of 30.9 million pounds (NMFS 2010b). Spawning stock biomass in 2004 was 42% greater than the target level (NEFSC 2006a). Striped bass are managed by the Atlantic States Marine Fisheries Commission through the Interstate Fishery Management Plan for Atlantic Striped Bass. Commercial fisheries are managed through effort restrictions such as size

limits and quotas, while recreational fisheries are managed through size limits, bag limits, and fishing seasons (ASMFC 2008a).

Table 5.24. Habitat characteristics of striped bass. (Ross 1991; Collette and Klein-MacPhee 2002)

Life Stage	*Habitat*	*Substrate*	*Temperature*
Eggs	Released into riverine areas, drift downstream.	Pelagic	Hatch from 14 to 22ºC.
Larvae/Juveniles	River deltas, inland portions of estuaries. Remain in natal estuary during first two years of their lives.	Sandy beaches, rocky areas, among rocks and boulders.	N/A
Adults	Found within several miles of shoreline, often in river mouths, estuaries, or along rocky shorelines and sandy beaches. Reproduce in rivers or brackish areas of estuaries.	Sandy beaches, rocky areas, among rocks and boulders, mussel beds.	Spawning takes place when water is about 18ºC. Migrate south when water temperatures reach 7ºC.

510.2.22. Summer Flounder (*Paralichthys dentatus*)

1. Summer flounder, also called fluke, are found in both inshore and offshore waters from Nova Scotia to Florida, although they are most abundant from Cape Cod south to Cape Fear, North Carolina. They are left-eyed flatfish, meaning the eyes are on the left side when viewed from above, with the top fin facing up, distinguishing them from winter flounder, which are right-eyed (ASMFC 2008a). In the Ocean SAMP area, summer flounder are targeted by both commercial and recreational fishermen.

Life History

2. Summer flounder reach sexual maturity at age two or three, when they are about ten inches (25 cm) in length. The fish spawn offshore in the fall; the oldest, largest fish migrate, and thus spawn, first, followed by the smaller fish. The larvae will migrate inshore to coastal and estuarine areas from October through May. Upon reaching the coast, the larvae will move to the bottom, and spend the first year of their lives in bays and other inshore areas. Summer flounder are born with eyes on both sides of their body, but the right eye will migrate to the left side within 20-32 days (ASMFC 2008a). Females are typically much larger than males and can grow up to three feet (0.9 m) in length and weigh up to 29 pounds (13 kg) (Collette and Klein-MacPhee 2002). Females can live for up to twenty years, although males rarely live more than seven years (Ross 1991).

Habitat

3. Summer flounder are concentrated in bays and estuaries from late spring through early fall, when they migrate offshore to the continental shelf to waters between 120 to 600 feet (37 to 183 feet) in depth, spending their fall and winters offshore. The summer flounder found off New England spend the winters east of the Hudson Canyon off New York and New Jersey (Ross 1991). Adult summer flounder spend most of their lives near the bottom, and prefer to bury themselves in sand substrate. During the summer, they are often found on hard sand, and prefer mud during the fall. They are often found hiding motionless in eelgrass or among the pilings of docks, but swim very quickly if disturbed (Collette and Klein-MacPhee 2002).

4. Summer flounder feed by waiting for their prey and then ambushing them. Summer flounder have well-developed teeth that allow them to capture such prey as small fish, squid, sea worms, shrimp, and other crustaceans (ASMFC 2008a). They are fierce predators, pursuing prey up to the surface and sometimes jumping out of the water while chasing prey, although they also feed on the bottom (Collette and Klein-MacPhee 2002).

Fishery

5. Summer flounder are one of the most sought-after species for both commercial and recreational fishing along the East Coast. The species is currently managed under a joint management plan between the Atlantic States Marine Fisheries Commission and the Mid-Atlantic Fisheries Management Council as part of the Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan. The current plan by the Atlantic States Marine Fisheries Commission allocates 60% of the quota to commercial fishing and 40% to recreational fishing (ASMFC 2008c). Fishing mortality of summer flounder has been declining and spawning stock biomass has been increasing since the 1990s. According to the Atlantic States Marine Fisheries Commission, summer flounder is not currently overfished, and overfishing is not occurring, although the stock is not yet rebuilt (ASMFC 2008c). Summer flounder has been under a rebuilding plan since 1993, which was recently extended to 2013. Biomass was estimated at about 77% of the target level in 2008, or about 46,029 metric tons (NMFS 2010b).

Table 5.25. Habitat characteristics of summer flounder. (NEFSC 1999e)

Life Stage	*Habitat*	*Substrate*	*Temperature*
Eggs	Eggs are pelagic and buoyant, mostly at depths of 30-70 m in the fall, as far down as 110 m in the winter, and from 10-30 m in the spring.	Pelagic	Most abundant in the water column where bottom temperatures are between 12 and 19ºC.
Larvae	Planktonic; most abundant 19-83 km from shore at depths of around 10-70 m. From October to May larvae and postlarvae migrate inshore to coastal and estuarine nursery areas.	Dominant in sandy substrates or where there was a transition from fine sand to silt and clay.	Larvae have been found in temperatures ranging from 0-23ºC, but are most abundant between 9 and 18ºC.
Juveniles	Juveniles are distributed inshore and in many estuaries throughout their range during spring, summer, and fall.	Dominant in sandy substrates or in transition areas from fine sand to silt and clay. Juvenile and adult summer flounder will hide in vegetation to ambush prey.	Most juveniles are caught over a range of temperatures from 10-27ºC in the fall, from 3-13ºC in the winter, from 3-17ºC in the spring, and from 10-27ºC in the summer.
Adults	During spring distributed widely over the continental shelf, from 0-360 m depth. Found in depths of less than 100 m in summer and fall. Generally are found at depths greater than 70 m in winter.	Prefer sandy habitats; can be found in a variety of habitats with both mud and sand substrates, including marsh creeks, seagrass beds, sand flats, among	Most adults are caught over a range of temperatures from 9-26ºC in the fall, from 4-13ºC in the winter, from 2-20ºC in the spring, and from 9-27ºC in the

		dock pilings. Summer flounder will hide in vegetation to ambush prey.	summer.

510.2.23. Tautog *(Tautoga onitis)*

1. Tautog, also called blackfish, are distributed along the coast of the Northwest Atlantic from Nova Scotia through Georgia, with the greatest abundance found between Cape Cod and the Chesapeake Bay. In the Ocean SAMP area, tautog are pursued primarily by recreational fishermen, with a small commercial fishery in the area as well.

Life History

2. Both male and female tautog reach sexual maturity at three or four years of age, and fecundity increases with size. Spawning takes place from May though August. Once they have reached sexual maturity, many fish will return to the same spawning area throughout their lives. Fertilized eggs will float for about two days before hatching. Within four days of hatching, larvae will begin to feed on microscopic plankton. Tautog are very slow growing. They can live up to 34 years and weigh up to 22 pounds (10 kg), although the average fish is usually between six and ten years old, and weighs between two and four pounds (one and two kilograms). Males grow larger and generally live longer than females (Ross 1991). Tautog have been observed to leave a home area during the daytime to feed, and then return to that home area throughout the night (Collette and Klein-MacPhee 2002).

Habitat

3. Tautog usually spend their summers in shallow, coastal waters, and move offshore to deeper waters in the fall. The fish migrate inshore to coastal waters and estuaries in the spring when the water temperatures reach around 48 degrees Fahrenheit (9 degrees Celsius). In the northern parts of their range, tautog remain inshore during the summer, and are frequently found in waters less than 60 feet (18 m) deep south of Cape Cod, although they may be found as far as 40 miles (64 km) from shore. They move offshore to deeper waters during the fall, generally to between 80 and 150 feet (24 to 46 meters) in depth, to spend the winter. Tautog spawn in the summer months, usually in water temperatures between 62 and 70 degrees Fahrenheit (17 and 21 degrees Celsius), and in areas dominated by eelgrass beds. Small juveniles seek out vegetated estuaries and other inshore areas, while larger juveniles and adults are found in deeper offshore waters, often preferring rocks and boulders, as well as piers, jetties, and mussel and oyster beds. Inshore they are often found around the mouths of estuaries and other inlets (ASMFC 2008a). The fish will often follow flood tides inshore to feed in the intertidal zone, moving to deeper water with the ebb tides (Ross 1991). Tautog will have a home site which they will remain close to, moving away during the day to feed, and returning to at night (ASMFC 2008a). They feed largely on invertebrates, including mussels, clams, crabs, amphipods, shrimp, sand dollars, small lobsters, and barnacles. Some individuals living near the shore feed largely on blue mussels, using their large teeth to tear the mussels from the substrate, and then grinding the mussels in their teeth before swallowing them (Ross 1991).

Fishery

4. The fishery for tautog is primarily recreational, accounting for about 90% of the fishery, although there is also a commercial fishery for this species in Rhode Island waters and elsewhere. Slow growth and reproduction rates, along with their tendencies to be found around rock piles, make tautog susceptible to overfishing. The species is managed by the Atlantic States Marine Fisheries Commission through the Interstate Fishery Management Plan for Tautog, which employs a minimum size limit. In addition, Rhode Island employs a self-imposed commercial quota which is managed in three seasons; the recreational fishery is managed by seasons and bag limits (RIDEM 2009). According to the Atlantic States Marine Fisheries Commission, the stock is currently considered overfished, but overfishing is not occurring (ASMFC 2008a). However it should be noted that Rhode Island and Massachusetts assess tautog on a regional basis and are therefore not bound to the coastwide assessment stock status (RIDEM 2010a).

Table 5.26. Habitat characteristics of tautog. (Ross 1991)

Life Stage	*Habitat*	*Substrate*	*Temperature*
Eggs	Eggs are buoyant.	Pelagic	17 - 21ºC
Larvae	N/A	Pelagic	N/A
Juveniles	Young tautog rarely stray from their home sites. Small juveniles seek out vegetated estuaries.	Steep, rocky shorelines, wrecks, mussel and oyster beds, boulders, vegetated estuaries.	N/A
Adults	Usually within 16 to 19 km of shore and in water depths of 18 to 24 m. Found in association with cover. Spawn inshore over eelgrass beds.	Steep, rocky shorelines, wrecks, mussel and oyster beds, boulders.	Peak spawning from 17 to 21ºC. Migrate inshore when water approaches 9ºC.

510.2.24. Tuna, Bluefin *(Thunnus thynnus)*

1. In the Ocean SAMP area, tuna are targeted primarily by recreational fishermen and were historically a major focus of Rhode Island sportfishing tournaments. The tuna species targeted recreationally in Rhode Island waters include the yellowfin tuna and bluefin tuna. Both species are important in commercial fisheries elsewhere around the globe.

Life History

2. The bluefin tuna is the largest species of bony fish in the world. Bluefin tuna are found both in schools and individually. They are generally classified into three size groups: juvenile or school tuna (5 to 70 pounds / 2 to 32 kg); medium tuna (70 to 270 pounds / 32 to 122 kg); and giant tuna (greater than 270 pounds / 122 kg). While bluefin tuna are found in both the Atlantic and Pacific Oceans, as well as the Mediterranean, Atlantic bluefin tunas grow to the largest size, reaching lengths of ten feet or greater and sometimes weighing more than 1,000 pounds (454 kg). A bluefin tuna reaches sexual maturity at about six years of age, and they can live up to 38 years of age. Giant bluefin

tunas will spawn in the Caribbean and Gulf of Mexico from April through June before heading north, while mid-sized tuna spawn later in the year, and may spawn as far north as the New York Bight. Like yellowfin tuna, bluefin tuna are warm-blooded, permitting them to withstand large fluctuations in temperature, and to maintain very high swimming speeds over a long period (Ross 1991). This fish is known for making long migrations, and fish tagged off North America have been found off Europe and Africa.

Habitat

3. Bluefin tuna, a pelagic species, are rarely found at depths greater than 300 feet (91 m) and are sometimes seen at the surface of the water. The species migrates along the Atlantic coast, moving northward and inshore during the spring and summer, and then offshore and to the south during the fall. Large bluefin tunas will sometimes be found in waters as cold as 50 to 54 degrees Fahrenheit (10 to 12 degrees Celsuis), but smaller fish prefer temperatures above 60 degrees Fahrenheit (16 degrees Celsius). Giant bluefin tunas appear in New England waters before smaller individuals, mostly in June and July. Small bluefin tunas will appear in southern New England later in July (Ross 1991). The fish can be found in Rhode Island waters through November, although they are most common in July. Small school tunas are relatively common off Rhode Island during the summer, although giant bluefin tuna are rare (Collette and Klein-MacPhee 2002). The bluefin tuna is a noted predator, feeding on schooling species such as herring, mackerel, squid, and silver hake (Ross 1991).

Table 5.27. Habitat characteristics of bluefin tuna. (Ross 1991)

Life Stage	*Habitat*	*Substrate*	*Temperature*
Juveniles	Both inshore and offshore areas, rarely found more than 90 meters below the surface.	Pelagic	Stay in waters above 16ºC
Adults	Both inshore and offshore areas, rarely found more than 90 meters below the surface. Follow the Gulf Stream.	Pelagic	Waters as cold as 10 to 12ºC

Fishery

4. In the Ocean SAMP area, bluefin tuna are targeted primarily by recreational fishermen. Bluefin tuna are managed domestically by the NMFS Consolidated Atlantic Highly Migratory Species Management Plan and internationally through the International Commission for the Conservation of Atlantic Tunas. The allocation of bluefin tuna in the United States is divided into five categories: a purse seine fishery, a harpoon fishery, a general category fishery (including hook-and-line, handline, and harpoon vessels), an incidental-catch fishery for vessels targeting other species or bluefin tuna of another size from one of the other categories, and an angling fishery for smaller bluefin tunas (Ross 1991). At one time, Galilee was known as the Tuna Capital of the World, and was home to the Atlantic Tuna Tournament, until the tournament was moved to Gloucester in 1973 (Olsen and Stevenson 1975). Bluefin tuna is considered overfished, and overfishing is occurring. Two different stock assessment scenarios place the spawning stock biomass of bluefin tuna at either 14% or 57% of target levels (NMFS 2010b). In 2010, there was a proposal to list bluefin tuna in Appendix 1 of the international Convention for the International Trade of Endangered Species (CITES), which would indicate the species

was threatened with extinction and international commercial trade would be restricted. This proposal was not accepted at the most recent CITES convention, but there is growing international concern over the stock status of bluefin tuna (CITES 2009, CITES 2010).

510.2.25. Tuna, Yellowfin *(Thunnus albacares)*

1. Yellowfin tuna is another tuna species targeted in the Ocean SAMP area by recreational fishermen. Like bluefin tuna, it is important in commercial fisheries elsewhere around the globe.

Life History

2. Yellowfin tunas, like other tunas, are warm-blooded, maintaining an internal body temperature that may be much higher than the external water temperature, permitting them to swim at higher speeds and for longer periods than other fish. Yellowfin tuna form schools with other individuals of a similar size, sometimes with similarly-sized tuna of other species. Tunas spawn throughout the year, with peaks during the summer months in the northern parts of their range. Some yellowfin tuna will mature at twelve to fifteen months of age, when they are between 20 and 24 inches (50 and 60 cm) in length, while others may not mature until they are at least 47 inches (145 cm) in length. The fish grow quickly, to about 21 inches (53 cm) by their first year, and reaching lengths of over six feet (1.8 m) (Ross 1991).

Habitat

3. The yellowfin tuna occurs along the edge of the continental shelf from Nova Scotia south through both temperate and tropical waters. The yellowfin is an open-ocean, schooling tuna found throughout the water column, usually in temperatures between 65 and 88 degrees Fahrenheit (18 and 31 degrees Celsius). They prefer waters of at least 68 degrees (20 degrees Celsius), and water temperature determines where this fish is found both geographically and also within the water column. Schooling usually occurs near the surface, and large schools are often found in major upwelling areas. After they hatch, larvae will remain in the upper 200 feet (61 meters) of the water column. Yellowfin usually feed during the daylight hours close to the surface. They eat a variety of finfishes, cephalopods, and crustaceans (Ross 1991).

Table 5.28. Habitat characteristics of yellowfin tuna. (Ross 1991)

Life Stage	*Habitat*	*Substrate*	*Temperature*
Juveniles/Adults	Open-ocean species, found throughout upper water column. Temperature determines where it is found in water column. Often found in areas of upwelling.	Pelagic	Between 18 to 31ºC

Fishery

4. Yellowfin tuna are managed domestically by the NMFS Consolidated Atlantic Highly Migratory Species Management Plan and internationally through the International Commission for the Conservation of Atlantic Tunas. Management measures include a recreational retention limit (NMFS 2010b). Both yellowfin and bluefin tuna have

historically been important to recreational fisheries in Rhode Island and were once the focus of multiple Rhode Island-based fishing tournaments. Recreational fishermen target yellowfin tuna using longline, handline, and rod and reel gear. The biomass level of Atlantic yellowfin tuna is currently considered to be at 96% of the level needed for maximum sustainable yield, and overfishing is not occurring (NMFS 2010b).

510.2.26. Winter Flounder *(Pseudopleuronectes americanus)*

1. Winter flounder, also called blackback flounder or lemon sole, are a right-handed flat fish found in shallow, estuarine habitats along the Northwest Atlantic coast. In the Ocean SAMP area, winter flounder are targeted by both commercial and recreational fishermen.

Life History

2. Winter flounder spawn in the winter and early spring, producing both demersal eggs and adhesive eggs (ASMFC 2008a). The eggs hatch about fifteen to eighteen days after being released (Ross 1991). Larvae will be found in the upper reaches of estuaries in early spring, and will move to the lower estuary as they grow (ASMFC 2008a). Studies of the genetic population structure of winter flounder larvae and juveniles in Narragansett Bay found that juvenile flounder tend to remain near their natal nursery grounds (Buckley et al. 2008). Winter flounder generally reach sexual maturity by age three (Ross 1991). Winter flounder depend on sight to feed, and therefore feed only during the day. At night they lie flat on the bottom and retract their eye turrets (ASMFC 2008a). They typically lie buried in the mud with only their eyes showing, but can dash quickly for a few yards when feeding. Adults are typically between twelve and fifteen inches long (30 to 38 cm), and weigh between a pound and a half and two pounds (0.6 and 0.9 kg), although fish as long as 25 inches (63 cm) have been recorded (Collette and Klein-MacPhee 2002). Winter flounder live for about twelve years (Ross 1991).

Habitat

3. Winter flounder get their name because they migrate into nearshore waters in the winter months. They prefer muddy sand habitat inshore, particularly eelgrass habitat. Many winter flounder move into estuarine habitats in the fall prior to spawning, typically spawning on shallow, sandy bottom, and move either offshore or to deeper, cooler portions of estuaries during the spring and summer (ASMFC 2008a). They are rarely found deeper than 180 feet (55 m), although have been found as deep as 420 feet (128 m) on Georges Bank (Ross 1991). Important nursery habitats for larvae and juveniles include saltwater coves, coastal salt ponds, embayments, and estuaries, although some larvae and juveniles have been found in the open ocean (ASMFC 2008a). Winter flounder are known to return to the same pond or portion of the Bay where they were hatched (Collette and Klein-MacPhee 2002). They are found in both Narragansett Bay and the Sounds off Rhode Island.

4. Winter flounder have a small mouth, and feed on small invertebrates, shrimp, clams, and worms. Larval flounder eat primarily diatoms (Collette and Klein-MacPhee 2002). In turn, adult winter flounder are prey for a number of species including cod, dogfish, monkfish, skates, hakes, striped bass, bluefish, and other fish. The larvae and juveniles

are preyed upon by striped bass, bluefish, and summer flounder, as well as birds, invertebrates, and marine mammals (ASMFC 2008a).

Fishery

5. Winter flounder are targeted in both commercial and recreational fisheries; recreational harvest has traditionally made up a significant percentage of total harvest levels for this species (Ross 1991). However, in the most recent decade the recreational harvest has been severely limited by regulation, and at present there is a two-fish bag limit for winter flounder. For management purposes, there are considered to be three stocks of winter flounder: the Gulf of Maine, Georges Bank, and Southern New England/Mid-Atlantic Bight stocks. The Southern New England/Mid-Atlantic Bight stock of winter flounder is currently considered overfished and experiencing overfishing. The stock of winter flounder has declined considerably from a combination of overfishing and habitat degradation, a threat to which winter flounder are particularly susceptible given the fact that they spawn in vulnerable near-shore habitats. According to the Atlantic States Marine Fisheries Commission, winter flounder is currently overfished, and overfishing is occurring. In 2007, the Southern New England/Mid-Atlantic Bight spawning stock biomass (SSB) was estimated at 7.4 million pounds (3.4 million kg), or 9% of the target SSB for this species. Fishing mortality in 2007 was at 262% of the plan target; presently, even if fishing mortality were reduced to zero, the stock would not be rebuilt by the current 2014 target (ASMFC 2008a). The stock is jointly managed by the Atlantic States Marine Fisheries Commission and the New England Fishery Management Council, employing fishing effort controls including seasonal closures, gear restrictions, size limits, trip limits, and days-at-sea restrictions. In addition, NMFS has recently implemented new groundfish rules which prohibit vessels from keeping southern New England winter flounder (NMFS 2010b). Because the area winter flounder seem to be made up of several local, genetically distinct populations, each of which returns to its own spawning ground, this puts the species at greater risk for localized losses. In the event that a spawning aggregation is lost to fishing or other factors, this localized population is unlikely to be able to rebuild (Buckley et al. 2008).

Table 5.29. Habitat characteristics of winter flounder. (NEFSC 1999f)

Life Stage	*Habitat*	*Substrate*	*Temperature*
Eggs	Found at 0.3-4.5 m (inshore); 90 m or less on Georges Bank.	Mud to sand or gravel.	Spawning initiated at about 3ºC; highest percent hatch at 3-5ºC; 18ºC lethal.
Larvae	1-4.5 m inshore. Salt water coves, salt ponds, estuaries, embayments.	Fine sand, gravel.	Hatch from 1-12ºC; larvae most abundant at 2- 15ºC.
Juveniles	Peak abundance of flounder less than 200 mm occurs in 18-27 m of water in Long Island Sound in April and May. Less than 100 m offshore.	Equally abundant on mud or sand shell.	Commonly found at 10-25ºC during summer and fall.
Adults	Most 1-30 m inshore, shallowest during spawning; less than 100 m offshore. Rarely deeper than 60m.	Mud, sand, cobble, rocks, boulders, eel grass.	0.6-23ºC; 12-15ºC suggested as preferred.

510.2.27. Yellowtail Flounder *(Limanda ferruginea)*

1. The yellowtail flounder is distributed from Labrador to the Chesapeake Bay. There are three stocks of yellowtail flounder for management purposes – the Cape Cod/Gulf of Maine, Georges Bank, and Southern New England/Mid-Atlantic stocks (NEFSC 2006a). Within the Ocean SAMP area, yellowtail flounder have traditionally been pursued by commercial fishermen.

Life History

2. Yellowtail flounder grow to about twenty-two inches (56 cm) and weigh up to 2.2 pounds (1 kg). Yellowtail flounder are sexually dimorphic, with females growing faster than males. Female fish reach sexual maturity at a median of 1.6 years of age off southern New England (NEFSC 1999g) Spawning occurs in spring and summer, peaking in May. Eggs are deposited on or near the bottom, and then float to the surface once fertilized. The larvae drift for about two months before settling to the bottom (NEFSC 2006a). Fish from the southern New England stock of yellowtail flounder typically remain within their fishing grounds, but migrate eastward during spring and summer, and then westward during fall and winter as water temperatures change (NEFSC 1999g).

Habitat and prey

3. Yellowtail flounder are found south of Block Island all year long, and in shallower waters during the winter. They prefer sand and sand-mud bottoms between 33 and 330 feet (10 and 100 m), and are most abundant at temperatures between 46 and 57 degrees Fahrenheit (8 and 14 degrees Celsius) (NEFSC 1999g). They generally avoid rocky areas or soft mud (Collette and Klein-MacPhee 2002). Yellowtail flounder eat small crustaceans, polychaetes, and sand dollars (NEFSC 1999g).

Fishery

4. Yellowtail flounder are managed under the New England Fishery Management Council's Northeast Multispecies Fishery Management Plan, along with fourteen other groundfish species. They are managed through fishing effort limitations which include gear restrictions, time/area closures, minimum size limits, a moratorium on permits, and days-at-sea. The fishery for yellowtail flounder off southern New England developed in the 1930s, and the stock collapsed in the early 1990s. Spawning biomass has remained low since then. Discards constitute about twenty percent of the catch. At present, the stock is considered overfished, and overfishing is presently occurring. The biomass of the southern New England/Mid-Atlantic stock of yellowtail flounder is estimated to be at 13% of targeted levels, or about 3,500 metric tons in 2007 (NMFS 2010b).

Table 5.30. Habitat characteristics of yellowtail flounder. (NEFSC 1999g)

Life Stage	*Habitat*	*Substrate*	*Temperature*
Eggs	Pelagic, near surface, along continental shelf waters of Georges Bank, northwest of Cape Cod, southern New England and nearshore along NJ and southern Long Island.	Pelagic	Range 2.0-15°C
Larvae	Pelagic, movement limited to water current. Peak during May-July in southern New England and southeastern Georges Bank.	Pelagic	Range 5.0-17°C

Juveniles	Spring and Fall: In Gulf of Maine concentrations occur between Mass. Bay, Cape Cod, and along the outer perimeter of Cape Cod. Southern edge of Georges Bank in spring.	Sand or sand and mud.	2.0-16°C in Spring, 5.0-18°C in Fall.
Adults	High concentrations around Cape Cod for both spring and autumn seasons. Concentrations pull away from coastal southern New England, Long Island, and the NY Bight during autumn months. Spawning along continental shelf waters of Georges Bank, northwest of Cape Cod, southern New England and nearshore along NJ and southern Long Island, peaks in April to June in southern New England. Prefer depths between 9 to 110 m.	Sand or sand and mud. Avoid rocky areas or soft mud.	2.0-16°C in Spring, 5.0-18°C in Fall. Spawning: estimated range 2.0-17°C

510.3. Stocks of Concern

1. Several of the above-mentioned finfish species include regional stocks that are of particular management concern within the vicinity of the Ocean SAMP area and adjacent waters. Those stocks include the Georges Bank and southward stock of cod (which includes cod found in Ocean SAMP waters) and the Southern New England/Mid-Atlantic winter flounder and yellowtail flounder stocks, all managed by the New England Fishery Management Council. These also include butterfish, which is managed by the Mid-Atlantic Fishery Management Council. Each of these stocks has additional management measures in place. Incidental catch quotas are in place for each of the New England Fishery Management Council-managed stocks, meaning that in addition to other multispecies regulations, there is a limit to how many fishermen can catch while targeting other species. Management of butterfish by the Mid-Atlantic Fishery Management Council has recently changed significantly to address butterfish bycatch. These stocks are further discussed below.

510.3.1. Georges Bank and Southward Cod[6]

1. The Georges Bank and southward stock of cod, which includes cod found in southern New England, is managed by the New England Fishery Management Council. Both the Georges Bank and Gulf of Maine stocks of cod have declined since the 1960s and are in the process of being rebuilt. Currently, the Georges Bank and southward cod stock is at 10% of the level needed to achieve maximum sustainable yield. According to the most recent stock assessment, whereas biomass levels for the Gulf of Maine stock have increased substantially such that this stock is no longer considered overfished, biomass levels for the Georges Bank stock have not changed much since an earlier stock assessment in 2004. In 2007, spawning stock biomass was estimated at 17,672 metric tons, a relatively small increase over 2004 estimates (NEFSC 2008).

[6] NMFS assesses and manages Atlantic cod as two distinct stocks, the "Gulf of Maine" stock and the "Georges Bank and Southward" stock (NMFS 2010b). It should be noted that cod found in southern New England, including the Ocean SAMP area, are part of the Georges Bank and Southward stock.

2. Cod are managed under the Northeast Multispecies Fishery Management Plan, which encompasses most species in the groundfish complex. Through the Fishery Management Plan, area closures, gear restrictions, and minimum size limits have been employed as the primary management tools. In 2004, the controversial Amendment 13 to the Fishery Management Plan was implemented, with tighter regulations on catch in an attempt to reduce mortality on this species. The Georges Bank stock of cod is a transboundary resource shared with Canada, which is responsible for managing a portion of the stock as well. Generally about 25% of the annual catch is taken by Canadian vessels, with the rest taken by American vessels (Mayo and O'Brien 2006). As of May 1, 2010, NMFS implemented additional catch limits and other management measures to further protect cod and other groundfish stocks (NMFS 2010b).

510.3.2. Southern New England/Mid-Atlantic Winter Flounder

1. The Southern New England/Mid-Atlantic stock of winter flounder is managed by the New England Fishery Management Council. According to the 2008 stock assessment, winter flounder stocks have severely declined. In 2007, the spawning stock biomass of Southern New England/Mid-Atlantic winter flounder was approximately 3,368 metric tons, or 9% of the target level. This was an increase from 2005 levels, which were a record low of 2,098 metric tons. Commercial landings of Southern New England winter flounder peaked in 1966 and again in 1981, then falling to a record low of 1,320 metric tons in 2005. Landings had increased somewhat by 2007, reaching 1,622 metric tons (NMFS 2010b).

2. Winter flounder are managed under the Northeast Multispecies Fishery Management Plan, which encompasses most species in the groundfish complex. Through the Fishery Management Plan, effort controls (days at sea), area closures, gear restrictions, and minimum size limits have been employed as the primary management tools. In 2004, the controversial Amendment 13 to the FMP was implemented, with tighter regulations on catch in an attempt to reduce mortality on this and other groundfish species (NMFS 2010b). In state waters, they are managed through the Atlantic States Marine Fisheries Commission's Fishery Management Plan for Inshore Stocks of Winter Flounder. Management measures under the Atlantic States Marine Fisheries Commission plan include a two-fish bag limit for recreational fishermen, and a 50 pound possession limit for non-federally permitted commercial fishermen (ASMFC 2008a). Recently, NMFS has also implemented new groundfish rules which include additional protections for winter flounder, including a prohibition against keeping winter flounder (NMFS 2010b).

510.3.3. Southern New England/Mid-Atlantic Yellowtail Flounder

1. The Southern New England/Mid-Atlantic stock of yellowtail flounder is managed by the New England Fishery Management Council. The spawning stock biomass of Southern New England/Mid-Atlantic yellowtail flounder is currently at 13% of the target levels needed to support maximum sustainable yield (NMFS 2010b). The fishery for yellowtail flounder in Southern New England began in the 1930s, and landings peaked in the 1960s; by the mid-1990s the fishery had collapsed. Between 1994 and 2005, spawning stock

biomass generally averaged around 1,100 metric tons, but increase to 3,500 metric tons in 2007. Landings of Southern New England yellowtail flounder reached a record low of 200 metric tons in 1995, increased to over 1,000 metric tons in 2000 and 2001, and declined again to 200 metric tons in 2006 and 2007 (NMFS 2010b).

2. Yellowtail flounder are managed under the Northeast Multispecies Fishery Management Plan, which encompasses most species in the groundfish complex. Through the Fishery Management Plan, effort controls (days at sea), area closures, gear restrictions, and minimum size limits have been employed as the primary management tools. In 2004, the controversial Amendment 13 to the FMP was implemented, with tighter regulations on catch in an attempt to reduce mortality on this and other groundfish species. Yellowtail flounder are also directly managed through days-at-sea restrictions and a moratorium on permits. As of May 1, 2010, NMFS implemented additional catch limits and other management measures to further protect yellowtail flounder and other groundfish stocks (NMFS 2010b).

510.3.4. Butterfish

4. Butterfish are managed by the Mid-Atlantic Fishery Management Council. Butterfish biomass estimates vary considerably from year to year. From 1968 to 2002, the spawning stock biomass ranged from 7,800 to 62,900 metric tons, although it has consistently declined since 1980. U.S. commercial landings of butterfish peaked in 1984, and have declined since then, reaching a low of 432 metric tons in 2005. Discards of butterfish in other fisheries can be substantial, ranging from an estimated 1,000 to 9,200 metric tons in recent years. From 1965 to 2002, commercial landings averaged 3,200 metric tons per year, while discards averaged 5,300 metric tons per year (NEFSC 2006a).

2. Butterfish are managed by the Mid-Atlantic Fishery Management Council as part of the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan. In 2005, butterfish was listed as overfished. As a result the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan was amended to address butterfish mortality resulting from bycatch and discarding through a variety of management measures (MAFMC 2009).

510.4. Forage Fish

1. Commercial and recreationally targeted species rely on the availability of forage fish to survive. The northern sand lance is an important forage fish found in Ocean SAMP waters, and serves as an important prey species in southern New England for smooth dogfish, winter skate, silver hake, Atlantic cod, summer flounder, windowpane, and yellowtail flounder (Bowman et al. 2000), as well as silversides and smelt. Other important forage fish in the Ocean SAMP area were mentioned above in the descriptions of commercially and recreationally important species, and include Atlantic herring, squid (both long- and short-fin), and butterfish. Menhaden is another important forage fish in this area (see above), as are alewife and blueback herring (see below under "river herring"). Herring and menhaden in particular have been the subject of fisheries management debates in recent years over how to consider their importance as a source of

food within the ecosystem for fish, seabird, and marine mammal species, while trying to set catch targets to permit commercial fisheries.

510.5. Threatened and Endangered Species and Species of Concern

1. Several finfish species that may occur within the Ocean SAMP area are not targeted through commercial or recreational fisheries, but are managed by the NMFS Office of Protected Resources. The NMFS Office of Protected Resources has jurisdiction over most marine and anadromous species listed as endangered or threatened under the federal Endangered Species Act. It also has jurisdiction over those species designated as "Species of Concern," which are species meriting conservation action but about which insufficient information is available to justify listing under the Endangered Species Act (NMFS 2010a). For further discussion of non-finfish species protected under the Endangered Species Act, see Chapter 2, Ecology of the Ocean SAMP Area.

2. According to the NMFS Northeast Regional Office Protected Resources Division, based on the best available information, no finfish currently listed as threatened or endangered are likely to occur within the Ocean SAMP area (Crocker, pers. comm. a). However, according to the NMFS Northeast Regional Offices Protected Resources Division (Crocker, pers. comm., b), the following species currently listed as "Species of Concern" (NMFS 2010a) could be present in the Ocean SAMP area: Atlantic halibut (*Hippoglossus hippoglossus)*; Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*); Atlantic wolffish (*Anarhichas lupus)*; Dusky shark (*Carcharhinus obscurus)*; Porbeagle shark (*Lamna nasus)*; Rainbow smelt (*Osmerus mordax);* River herring (which includes two species: Alewife (*Alosa pseudoharengus)* and Blueback herring (*Alosa aestivalis*); Sand tiger shark *(Carcharias taurus)*; and Thorny skate (*Amblyraja radiate).*

510.5.1. Atlantic Halibut *(Hippoglossus hippoglossus)*

1. The Atlantic halibut is distributed from Labrador to southern New England and is one of the largest fish found in the Gulf of Maine. There is currently no directed fishery for halibut, but there was a major commercial halibut fishery in the Gulf of Maine throughout the 19th century (NEFSC 2006a).

Life History and Habitat

2. Halibut are large, long-lived, right-eyed flounders. Females are typically larger than males, growing to an average of 100-150 pounds (45.5-68 kg). Halibut mature at approximately 10 years yet are prolific, with females spawning several batches of eggs each year. Period of spawning varies by region, and the depth at which halibut spawn is not known. Halibut eggs drift within the water column and hatch at a very immature stage. Halibut are bottom-dwelling flat fish typically found on sand, gravel, or clay bottom. They move into shallower waters in the summer and deeper waters in the winter, and have been found in U.S. waters in trawls at temperatures ranging from 4-13°C (39-55°F). Halibut prey for the most part on other fish, but also eat shellfish, crustacean, and even seabirds (Collette and Klein-MacPhee 2002).

Management

3. Atlantic halibut are managed by the New England Fishery Management Council under their Multispecies Fishery Management Plan, which includes a moratorium on direct harvests as well as bycatch limits and minimum fish sizes (NEFSC 2006a). Atlantic halibut were heavily fished throughout the 19th century and have not recovered since, and for this reason NMFS attributes the species' decline to overfishing (NMFS 2009b). According to NMFS, Atlantic halibut are listed as a species of concern because of demographic and genetic diversity concerns (NMFS 2009b).

510.5.2. Atlantic Sturgeon *(Acipenser oxyrinchus oxyrinchus)*

1. Atlantic sturgeon is an anadromous finfish found from Labrador to Florida. They are ancient fish, dating back at least 70 million years (ASMFC 2009c). In addition to its status as a species of concern, Atlantic sturgeon is a candidate for listing under the Endangered Species Act (NMFS 2010c).

Life History and Habitat

2. The average Atlantic sturgeon ranges in size from 2.9-6.6 feet (88 – 200 cm) (Collette and Klein-MacPhee 2002), although sturgeon have been known to grow up to 14 feet (425 cm) with weights of more than 800 pounds (363 kg) (NMFS 2010c). Sturgeon may live up to 60 years. There is significant variation in the age of sexual maturity, with fish at the northern end of their range maturing later. Atlantic sturgeon are anadromous fish, with adults migrating upriver in the spring to spawn. Spawning does not necessarily occur every year, and sturgeon eggs adhere to benthic substrate (Collette and Klein-MacPhee 2002). Sturgeon are bottom dwellers and prey upon shellfish, crustaceans, and small fish (ASMFC 2009c).

Management

3. Historically, Atlantic sturgeon were harvested commercially for a wide range of commercial uses of both the fish and its eggs. A moratorium on the harvest of Atlantic sturgeon was implemented in 1997, although according to NMFS, Atlantic sturgeon were identified as a species of concern in 1988. According to NMFS, Atlantic sturgeon numbers have declined because of fishing pressure as well as incidental mortality through bycatch, habitat degradation, and dams that have interrupted spawning behavior. NMFS identifies demographic and genetic diversity concerns as the main reason for listing Atlantic sturgeon as a species of concern. In October 2009, the Natural Resources Defense Council petitioned NMFS to list the Atlantic sturgeon under the Endangered Species Act. At the time of this writing, NMFS is undergoing a review process to determine whether to propose designating Atlantic sturgeon an endangered or threatened species (NMFS 2010c).

510.5.3. Atlantic Wolffish *(Anarhichas lupus)*

1. Atlantic wolffish are sedentary, solitary fish that are primarily taken as bycatch in other fisheries. They are known for their canine-like teeth and biting ability.

Life History and Habitat

2. Atlantic wolffish are large, slow growing fish known for their large teeth. They may grow up to 59 inches (150 cm) long and 40 pounds (18 kg) and live up to 20 years. Males and females form pairs before spawning, and females lay egg masses of varying sizes in clusters in protected areas which are then protected by the males. Spawning period varies by region (Collette and Klein-MacPhee 2002). Females may produce between 5,000 and 12,000 eggs, with larger females producing larger egg masses (NMFS 2009c). Atlantic wolffish are benthic dwellers with a preference for complex habitats such as rocky areas. They can be found in depths up to 1640 feet (500 meters) and in waters as cold as 1.3°C (34°F). They feed on a diverse diet of benthic fauna as well as a variety of shellfish, crustaceans, and echinoderms (Collette and Klein-MacPhee 2002).

Management

3. There is no fishery management plan for the Atlantic wolffish. Wolffish are frequently taken as bycatch in otter trawl fisheries, and small quantities of wolffish have been landed by commercial fishermen since the 1970s, though catches have declined to a recent low (NEFSC 2006a). According to NMFS, the decline of the wolffish can be attributed to bycatch as well as commercial fishing and habitat degradation caused by fishing gear. NMFS designated the Atlantic wolffish a species of concern in 2004 due to demographic and genetic diversity concerns. In 2008, NMFS was petitioned to list the Atlantic wolffish under the Endangered Species Act, and in 2009, NMFS found that listing was not warranted (NMFS 2009c).

501.5.4. Dusky Shark *(Carcharhinus obscurus)*

1. The dusky shark is a highly migratory large coastal shark that occurs from southern New England to the Caribbean and South America.

Life History and Habitat

2. Dusky sharks reach an average size of 11.8 feet (360 cm) long and 400 pounds (180 kg) and can live up to 40 years. Like many sharks, dusky sharks bear live young. They reproduce every three years, bearing litters ranging from 6 to 14 young, which may range in size from 33 to 39 inches (85-100 cm) (NMFS 2009d). The dusky shark is a highly migratory species, migrating north in the summer and south in the summer, following warmer waters. Dusky sharks seem to avoid estuaries and other areas of lower salinity (Collette and Klein-MacPhee 2002), and may be found from the surf zone to offshore and from the surface to depths up to 1300 feet (400 m) (NMFS 2009d).

Management

3. Dusky sharks are managed as a highly migratory species by NMFS under the Consolidated Atlantic Highly Migratory Species Fishery Management Plan and by the Atlantic States Marine Fisheries Commission under the Interstate Fishery Management Plan for Atlantic Coastal Sharks. According to NMFS, dusky sharks currently overfished and cannot currently be kept commercially or recreationally. They have been a popular target for recreational fishermen, though they have been harvested commercially and have also been taken as bycatch in directed fisheries. NMFS attributes their decline to recreational fishing pressure and incidental mortality as bycatch, and listed them as a

species of concern in 1997 due to a range of demographic and genetic diversity concerns (NMFS 2009d).

501.5.5. Porbeagle Shark *(Lamna nasus)*

1. The porbeagle shark is a large coastal and oceanic shark found from Newfoundland to New Jersey.

Life History and Habitat

2. The average porbeagle shark grows to between 4 and 6 feet (120-180 cm) in length, though may reach a maximum size near 10 feet (300 cm) and may live up to 46 years (Collette and Klein-MacPhee 2002). Porbeagle sharks give birth to live young, though prior to birth the young are nourished in utero with egg yolk for roughly 8-9 months (NMFS 2010d). Porbeagle shark are pelagic and infrequently enter shallow, coastal waters (Collette and Klein-MacPhee 2002). Porbeagle sharks in the northwest Atlantic are believed to make extensive annual migrations. They feed on small fish, other shark species, and squid (NMFS 2010d).

Management

3. Porbeagle sharks were harvested commercially in the Northwest Atlantic starting in the early 19th century (Collette and Klein-MacPhee 2002). Catch records indicate that the fishery collapsed in the early 1960s and dropped off through the 1970s and 1980s, allowing the population to rebuild. In the early 1990s a new fishery developed and catch rates increased dramatically, only to drop off again. Porbeagle sharks are managed by NMFS under the Consolidated Atlantic Highly Migratory Species Fishery Management Plan and by the Atlantic States Marine Fisheries Commission under the Interstate Fishery Management Plan for Atlantic Coastal Sharks. According to NMFS, porbeagle shark are overfished, although overfishing is not currently occurring. NMFS attributes the decline of porbeagle sharks to fishing pressure, and designated them a species of concern in 2006 (NMFS 2010d). In 2010, there was a proposal to list porbeagle sharks in Appendix II of the Convention on the International Trade in Endangered Species, though this proposal was rejected (CITES 2010).

510.5.6. Rainbow Smelt *(Osmerus mordax)*

1. Rainbow smelt are small, pelagic, anadromous fish found from Labrador to New Jersey.

Life History and Habitat

2. Rainbow smelt are small, slender fish, averaging 7 - 9 inches (18 – 23 cm) in length. Rainbow smelt are anadromous and make their migrations upriver to spawn in the early spring; they typically do not migrate far upstream and many spend most of their lives in relatively shallow estuarine or coastal waters. Rainbow smelt typically begin spawning at age two and a female can produce 7,000 to over 75,000 eggs depending on her size. Smelt often school during migrations, though little is known about smelt behavior while at sea. Smelt feed on amphipods, shrimps, euphausiids, mysids, and marine worms, as well as small fishes, and are themselves a major food source for larger fish as well as aquatic birds (Collette and Klein-MacPhee 2002).

Management

3. Historically, rainbow smelt have been targeted by both commercial and recreational fishermen, particularly in northern New England and Canada, and are still popular among sport fishermen (Collette and Klein-MacPhee 2002). According to NMFS, rainbow smelt populations have declined due to a variety of factors including fishing, dams and other habitat degradation that impacts spawning behavior, and acid precipitation. Citing a variety of demographic and genetic diversity concerns for this species in the northeastern U.S., NMFS listed rainbow smelt as a species of concern in 2004 (NMFS 2007a).

510.5.7. River Herring

1. River herring collectively refers to Alewife (*Alosa pseudoharengus)* and Blueback herring (*Alosa aestivalis*). Because of difficulties in distinguishing between alewife and blueback herring, these two species are managed together under this collective term and are discussed here together. Both species are designated as species of concern.

Life History and Habitat

2. Alewife are currently distributed from Newfoundland to North Carolina, whereas blueback herring are distributed from Nova Scotia to Florida. Alewife reach lengths of between 14 and 15 inches (36-38 cm) and live up to 10 years, whereas blueback herring grow to approximately 15 inches (40 cm) and live 8 years. Both are small, anadromous fish. Alewife initiate spawning when water temperatures reach 41 to 50° F (5-10 C°), and are prolific, producing between 60,000 and 467,000 eggs each year. Blueback herring spawn in slightly warmer and therefore follows alewife spawning by 3 to 4 weeks; egg production varies based on age and size. Both alewife and blueback herring feed on plankton as well as small fish while at sea. Both alewife and blueback herring are schooling fish while at sea and make seasonal migrations (Collette and Klein-MacPhee 2002).

Management

3. Alewife and blueback herring are managed together with shad, another anadromous fish, by the Atlantic States Marine Fisheries Commission. Both species were historically the target of both commercial and recreational fisheries, and in New England, landings declined dramatically between the 1970s and the 1990s. According to NMFS, river herring have declined due to a variety of factors including fishing pressure and mortality due to bycatch, habitat degradation, and dams that impede spawning (NMFS 2009e). Rhode Island and other adjacent states currently prohibit the harvest of river herring (ASMFC 2007). NMFS (2009e) designated both alewife and blueback herring as species of concern in 2006, citing a variety of demographic and genetic diversity concerns. Currently, there are several restoration initiatives taking place in upper Narragansett Bay that will restore fish passage and enhance depleted spawning populations of anadromous species including river herring (RI Coastal Resources Management Council 2010). These initiatives may result in an increase of river herring in the Ocean SAMP area in future years.

510.5.8. Sand Tiger Shark *(Carcharias Taurus)*

1. Sand tiger sharks can be found throughout the western Atlantic, and in southern New England are common in shoal waters near Woods Hole and Nantucket, MA (Collette and Klein-MacPhee 2002).

Life History and Habitat

2. Sand tiger sharks may grow up to 10.4 feet (318 cm) and live up to 17 years. Like many sharks, sand tiger sharks bear live young, nourishing them in utero with egg yolk prior to birth. Reproduction takes place every other year and a litter typically includes just one or two pups (NMFS 2009f). Sand tiger sharks have been described as relatively sluggish (Collette and Klein-MacPhee 2002). They are more active at night and are primarily coastal. They usually live near the bottom. Sand tiger sharks are voracious predators and feed on fish, small sharks and rays, squid, and some crustaceans (NMFS 2009f).

Management

3. Sand tiger sharks were historically harvested commercially in southern New England during the early 20th century (Collette and Klein-MacPhee 2002), though they are more commonly targeted in Japan for food. Increased exploitation in the 1980s and 1990s resulted in notable abundance declines. Sand tiger sharks are managed by NMFS under the Consolidated Atlantic Highly Migratory Species Fishery Management Plan, which currently prohibits the landing of sand tiger shark for commercial and recreational purposes, and by the Atlantic States Marine Fisheries Commission under the Interstate Fishery Management Plan for Atlantic Coastal Sharks. According to NMFS, sand tiger shark populations have declined because of fishing pressure and bycatch, because of their low reproduction rates, and because of estuarine pollution. For these reasons the sand tiger shark was listed as a species of concern throughout its entire range in 1997 (NMFS 2009f).

510.5.9. Thorny Skate *(Amblyraja radiate)*

1. Thorny skate is one of several skate species that occurs from Labrador to South Carolina. They are more abundant in the Gulf of Maine and only infrequently found in shallow, inshore areas.

Life History and Habitat

2. Thorny skate grow to lengths of over 39 inches (1 m) (NMFS 2009g) and live up to 20 years (Collette and Klein-MacPhee 2002). Thorny skate reproduce by depositing a single, fertilized egg in a rectangular, thorned egg capsule approximately 2-4 inches (48 to 96 mm) long. Thorny skate feed on benthic fish and invertebrates. They appear to be sedentary creatures with a preference for a range of bottom types and water temperatures ranging from 29 to 57° F (-1.4 to 14° C) (Collette and Klein-MacPhee 2002).

Management

3. Thorny skate are one of several skates historically harvested in New England. Skate species are not specified in NMFS commercial fisheries landings data; unspecified skate landings have increased markedly since the late 1970s/early 1980s. Northeast Fisheries

Science Center trawl survey data indicates that thorny skate biomass has declined since the 1960s and is now historically low (NEFSC 2006a). The New England Fishery Management Council manages thorny skate as part of the Northeast Skate Complex Fishery Management Plan. At present the species is overfished and overfishing is occurring. In addition to direct harvest by commercial fishermen, NMFS sites bycatch, predation of skate embryos, and competition for prey resources as the reasons for thorny skate's decline. NMFS listed thorny skate as a species of concern in 2004 in response to a series of demographic and genetic diversity concerns (NMFS 2009g).

510.6. Baseline Characterization

1. This section presents baseline data characterizing fisheries resources within and around the Ocean SAMP area. The purpose of the baseline characterization is to provide baseline information on the current state of fisheries resources in the area based on existing survey data. It is not an assessment of individual fish stocks, nor is it an analysis of longer-term trends in Rhode Island's offshore fisheries resources. Ten years of fisheries-independent bottom trawl survey data were used in this analysis as this provides enough data to smooth out interannual variability while still allowing an assessment of the current state of Ocean SAMP area fisheries resources. In addition, a ten-year period, rather than a longer time period, was chosen for this analysis because the goal was to assess the current, baseline conditions of fishery resources within the Ocean SAMP area, not to analyze longer-term trends in abundance. For a more detailed discussion of data sources, methods, and data products for the baseline characterization, see Bohaboy et al. 2010, included in Appendix A. See Chapter 2, The Ecology of the Ocean SAMP Area, for discussion of the interactions of fisheries resources with other aspects of the ecosystem, and for data on longer-term trends in stock abundance.

2. There is no one fisheries-independent survey or dataset that provides insight into the abundance and biomass of finfish, shellfish, and crustacean species throughout the entire Ocean SAMP area. Accordingly, data from four different bottom trawl surveys that are regularly conducted in or around the Ocean SAMP area were aggregated and analyzed to provide this baseline characterization. Data used in this analysis were obtained from the RI Department of Environmental Management (RIDEM) trawl survey (1999-2008); the URI Graduate School of Oceanography (GSO) trawl survey (1999-2008); the Northeast Area Monitoring and Assessment Program (NEAMAP) trawl survey (2007-2008); and the National Marine Fisheries Service (NMFS) trawl survey (1999-2008). Data included in this analysis were collected at survey stations within a polygon delineated by the following coordinates:

   41° 30' N, 071° 50.5'W
   40° 50' N, 071° 50.5'W
   41° 30' N, 070° 50'W
   40° 50' N, 070° 50'W

   Survey stations that occur adjacent to but just outside the Ocean SAMP area were included in this analysis in order to allow for a comprehensive analysis of fisheries resources in and around the planning area. See Figure 5.1 for a map showing the location of each of the survey stations included in this analysis, and see Appendix A for further discussion of data sources and methodology.

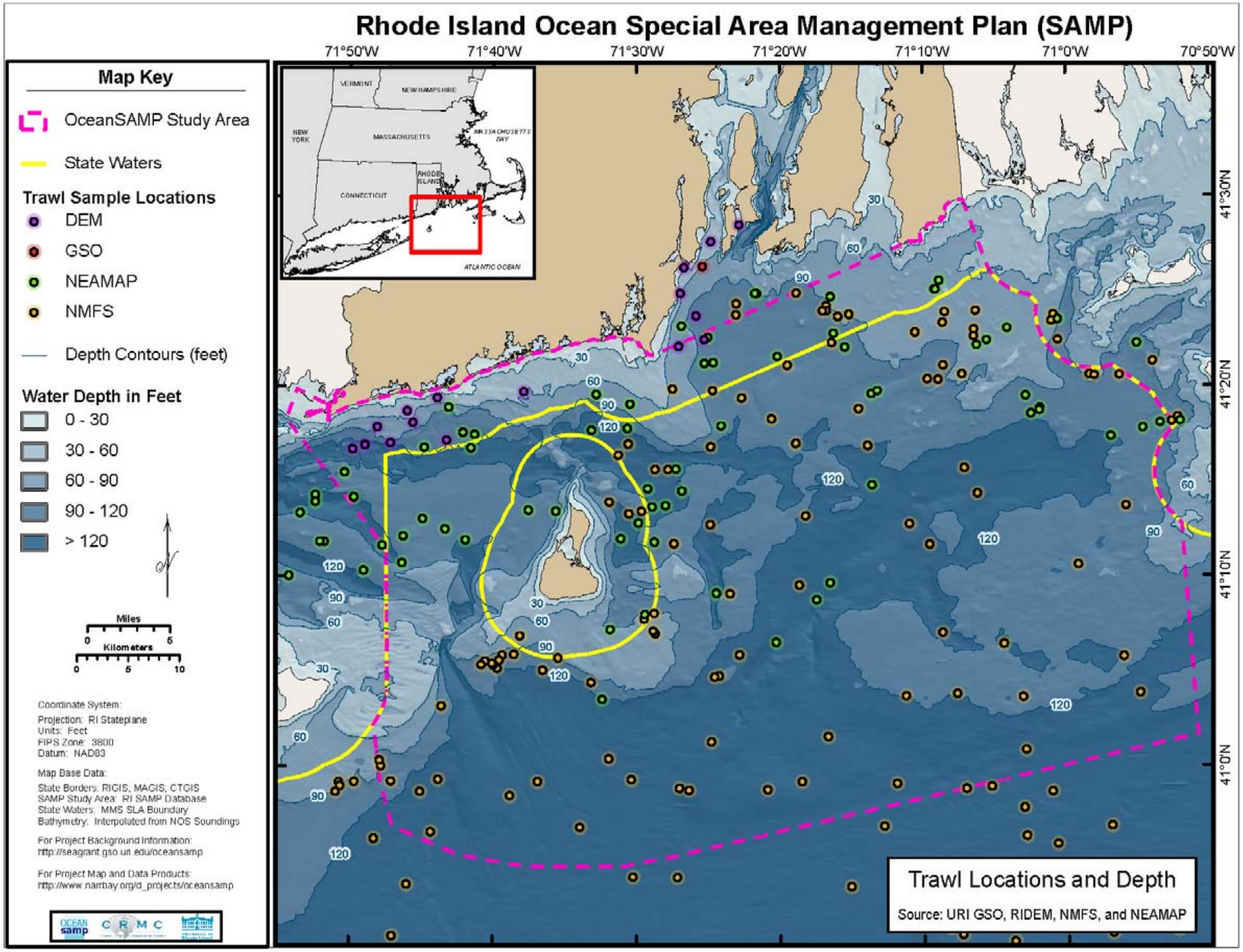

Figure 5.1. Locations of survey stations used in baseline characterization.

3. The RIDEM, GSO, NEAMAP, and NMFS bottom trawl surveys are all conducted for research purposes and are also used to inform stock assessments and other fisheries management decisions. The RIDEM survey is conducted in Rhode Island state waters but does not include survey stations within the state waters surrounding Block Island. The GSO survey has been run by URI since 1959, and is the longest continuous record of fish and invertebrate relative abundance in Rhode Island.[7] The NEAMAP survey is also unique in that a fisherman conducts the survey, using gear designed by fishermen and drawing upon advice from local fishermen about which of the randomly-selected survey stations in a given area are towable.[8] In all cases, the purpose of these surveys is to assess the overall occurrence of fisheries resources in the area, not to compare relative occurrence or abundance at specific sites.

4. Bottom trawl surveys, which employ the use of otter trawls, are used for this baseline characterization because they provide the only consistent record of fish abundance. However, while bottom trawl surveys are appropriate for sampling demersal and some pelagic species, they may not accurately characterize the occurrence of some pelagics, shellfish and crustaceans. Moreover, bottom trawl surveys do not sample untrawlable bottom types of high habitat complexity, which may include moraines and other rocky areas. For these reasons, this baseline characterization does not provide insight into all habitats of importance as well as several recreational species of importance (see list above). It should also be noted that site-specific surveys employing multiple gear types will be required as part of the permitting process for future developments within the Ocean SAMP area; see Section 560, Policies and Standards, for further discussion.

5. The baseline characterization focused on 29 finfish, shellfish, and crustacean species and assessed species abundance and biomass. Baseline characterization species included the above-mentioned commercially and recreationally targeted species, with the exception of some pelagics (e.g. tunas) which are not adequately sampled in bottom trawl surveys. This analysis also included several "Species of Concern" (see Section 510.5) which are present in the Ocean SAMP area and adequately sampled through bottom trawl surveys. Abundance and biomass for these species were assessed for the spring and fall seasons in aggregate and for each individual species. Survey data were aggregated by calculating the survey catch weight (biomass) for each survey by dividing the catch per tow (weight) by the area of each tow. Survey biomass units are milligrams per square meter (mg / m2). The purpose of these calculations was to allow for comparison between the surveys. However, these calculations do not account for all differences between the surveys, and results show that relative biomass estimates nonetheless vary significantly between the surveys (Bohaboy et al. 2010). See Appendix A for further details on data sources and methodology.

[7] For further information on the URI GSO Fish Trawl Survey, see http://www.gso.uri.edu/fishtrawl/.
[8] For further information on the NEAMAP Mid-Atlantic Nearshore Trawl Survey, see http://www.neamap.net/.

Table 5.31. Species assessed in the baseline characterization**.**
See Bohaboy et al 2010, included in Appendix A.

Common Name	**Scientific Name**
Alewife	*Alosa pseudoharengus*
American lobster	*Homarus americanus*
American shad	*Alosa sapidissima*
Atlantic cod	*Gadus morhua*
Atlantic herring	*Clupea harengus*
Atlantic mackerel	*Scomber scombrus*
Atlantic sea scallop	*Placopectin magellanicus*
Barndoor skate	*Dipturus laevis*
Black sea bass	*Centropristis striata*
Blueback herring	*Alosa aestivalis*
Bluefish	*Pomatomus saltatrix*
Butterfish	*Peprilus triacanthus*
Cusk	*Brosme brosme*
Dusky shark	*Carcharhinus obscurus*
Goosefish	*Lophius americanus*
Little skate	*Leucoraja erinacea*
Longfin squid	*Loligo pealeii*
Rainbow smelt	*Osmerus mordax*
Scup	*Stenotomus chrysops*
Silver hake	*Merluccius bilinearis*
Smooth dogfish	*Mustelus canis*
Spiny dogfish	*Squalus acanthias*
Striped bass	*Morone saxatilis*
Summer flounder	*Paralichthys dentatus*
Tautog	*Tautoga onitis*
Thorny skate	*Amblyraja radiate*
Winter flounder	*Pseudopleuronectes americanus*
Winter skate	*Leucoraja ocellata*
Yellowtail flounder	*Limanda ferruginea*

510.6.1. Analysis of Total Catch Biomass

1. Analysis of total catch biomass was conducted to determine the sources of variability in the data by assessing the effects of season (fall or spring), survey (RIDEM, GSO, NEAMAP, or NMFS), water depth, and part of the Ocean SAMP area (east or west). Multiple-way analysis of variance based on natural log transformed data indicates that season, survey, and depth are all significant factors affecting total survey biomass (actual p-value < 0.001). Region, as defined by survey stations east or west of -71.38° (West) longitude, does not have a significant effect on total catch biomass. As is illustrated by Figure 5.2, total catch biomass is higher in the fall and lower in the spring. This difference may be due to the fact that young of the year (YOY) are recruited to the fishery in the fall and thus reflected in fall trawl surveys. Figure 5.2 also illustrates that deep depth strata (60 to 90 ft and 90+ ft) have higher total catch biomass than shallow depth strata (20 to 40 ft and 40 to 60 ft) (Bohaboy et al. 2010).

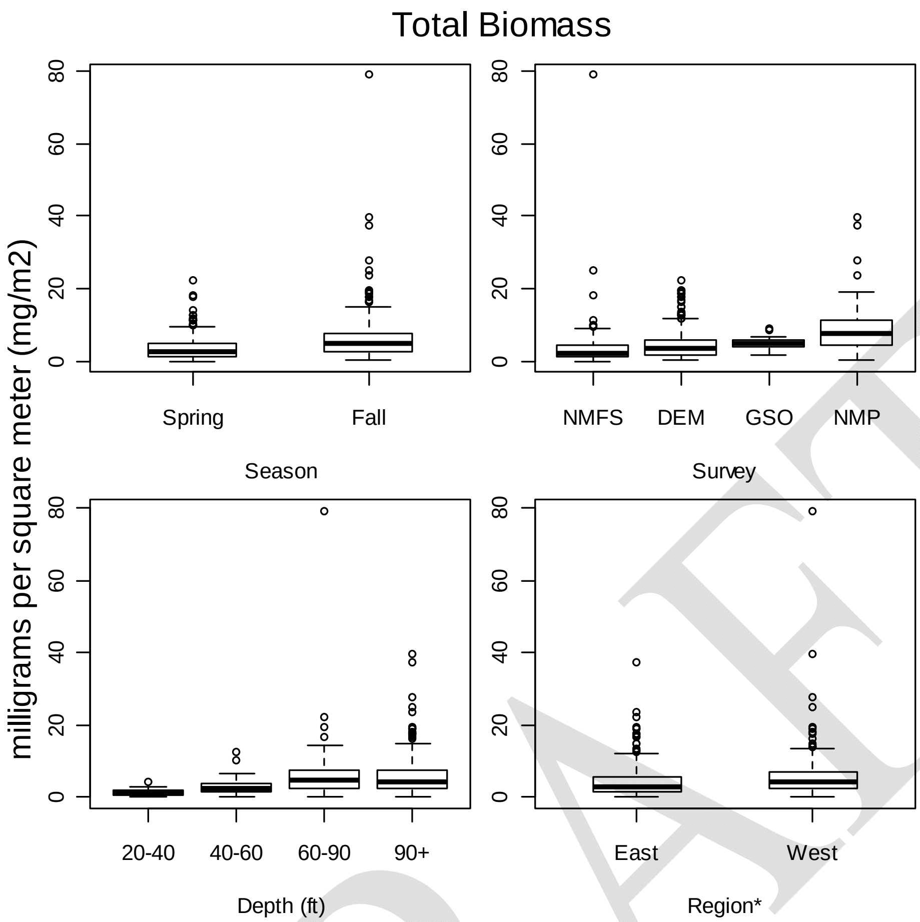

Figure 5.2. Results of multi-way ANOVA of total biomass. (Bohaboy et al. 2010)
**Region defined as survey stations east or west of -71.38° (west) longitude. See Appendix A for data sources and methods, including sample sizes for each analysis.*

2. The spatial distribution of total catch biomass during the spring and fall seasons is shown below in Figure 5.3 and Figure 5.4. A comparison of these figures indicates that there is a depth/season interaction in the spatial distribution of total catch biomass. Figure 5.3 illustrates that in the spring, higher biomass is largely located inshore in shallower, protected waters. By contrast, Figure 5.4 illustrates that in the fall, higher biomass is distributed further offshore in deeper, open waters. It should be noted that these maps reflect a synthesis of data from the four different fisheries-independent trawl surveys; however, there are differences between the vessel types, gear types, and methods used in these different surveys. It should also be noted that the absence of biomass, or relatively low biomass, in a given area does not necessarily mean that there are no fish there. Rather, it may mean that the area was not sampled through any of the survey programs. See Appendix A for maps showing the spatial distribution of individual species biomass and for further discussion of data sources and methodology.

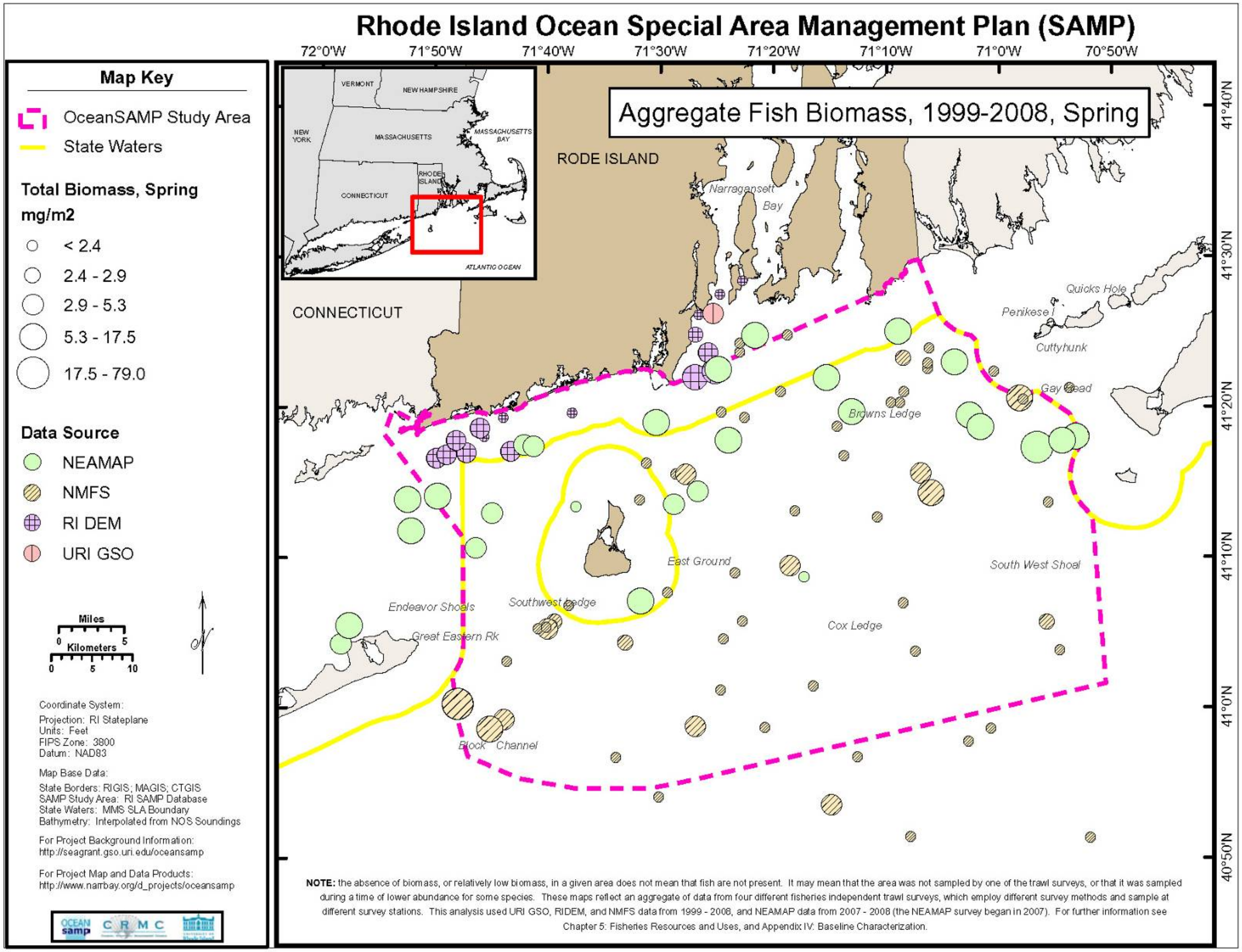

Figure 5.3. Aggregate fish biomass, 1999-2008, spring.

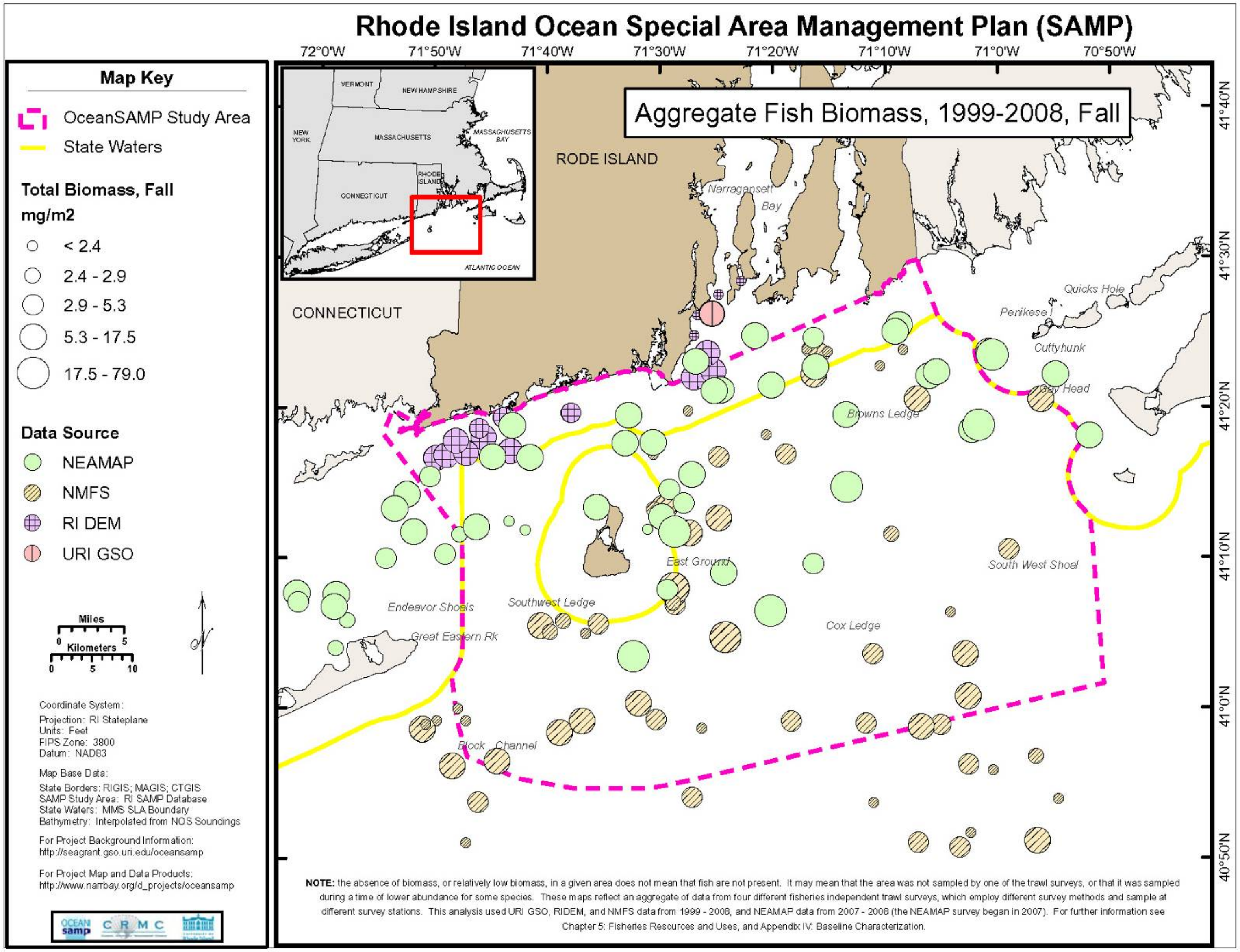

Figure 5.4. Aggregate fish biomass, 1999-2008, fall.

510.6.2. Analysis of Catch by Individual Species

1. Catch biomass data from the four trawl surveys were also used to assess the relative biomass of key species for which data were available. Figure 5.5 below shows the relative biomass of individual species within the study area based on a simple sum of RIDEM, GSO, and NMFS survey data from 1999-2008. NEAMAP data were not included in this figure as only two years of data are available. This figure illustrates that in the fall surveys, little skate, scup, and longfin squid were among the species with the highest relative biomass in the study area, whereas in the spring surveys, little skate, scup, and winter flounder were among the species with the highest relative biomass in the study area. Figures 5.6 to 5.9 below show the relative biomass of individual species based on each seasonal survey. Note that all figures represent the relative biomass on a logarithmic scale to allow for comparison between the figures (Bohaboy et al. 2010).

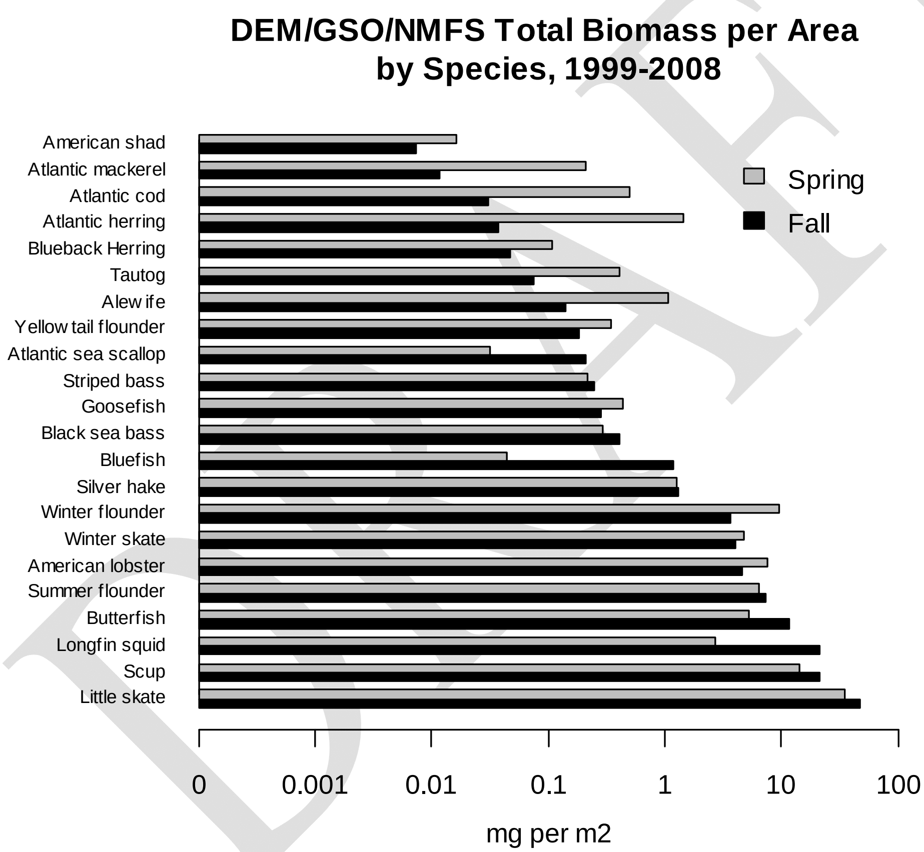

Figure 5.5. Total biomass per area by species, 1999-2008. (Bohaboy et al. 2010).\
**Based on RIDEM, URI GSO, and NMFS trawl surveys*

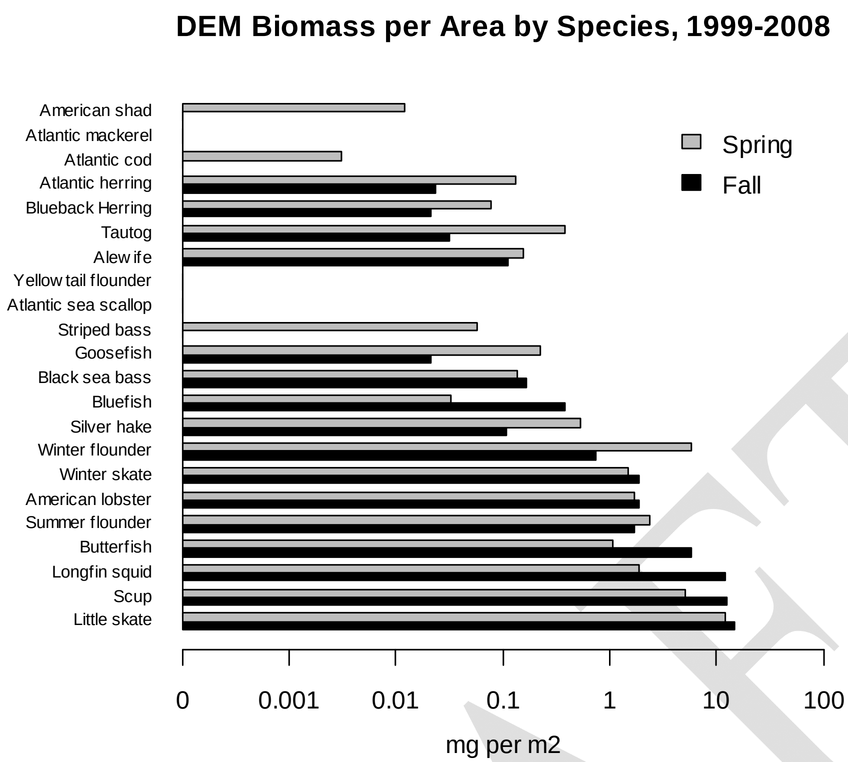

Figure 5.6. DEM trawl survey biomass per area by species. (Bohaboy et al. 2010)

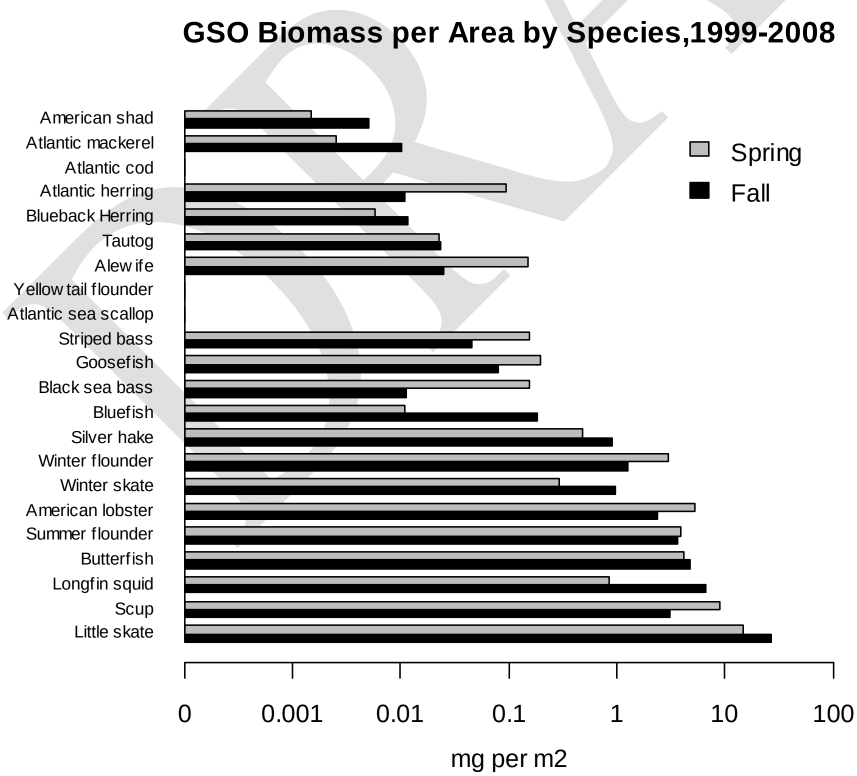

Figure 5.7. GSO trawl survey biomass per area by species. (Bohaboy et al. 2010)

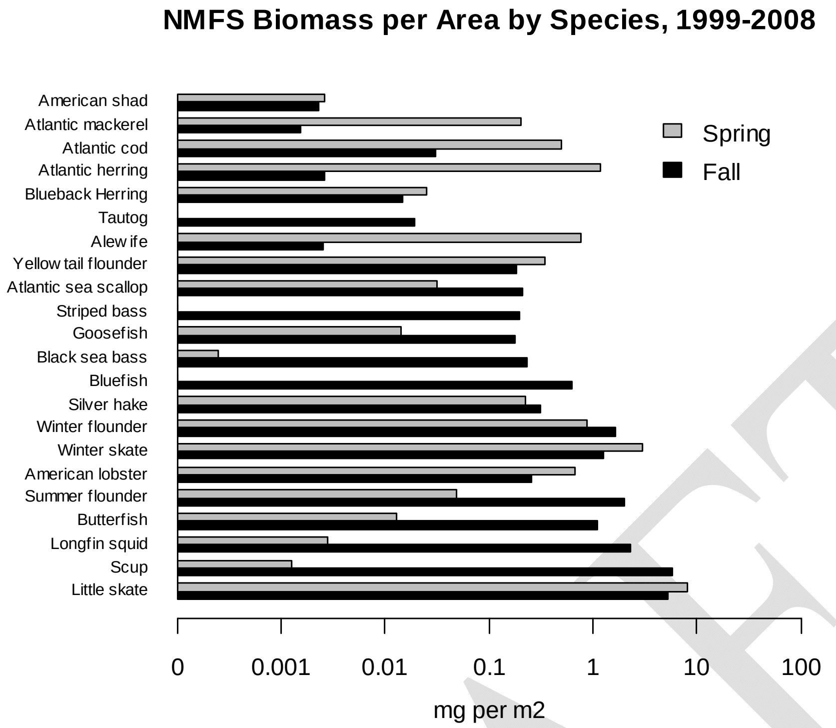

Figure 5.8. NMFS trawl survey biomass per area by species. (Bohaboy et al. 2010)

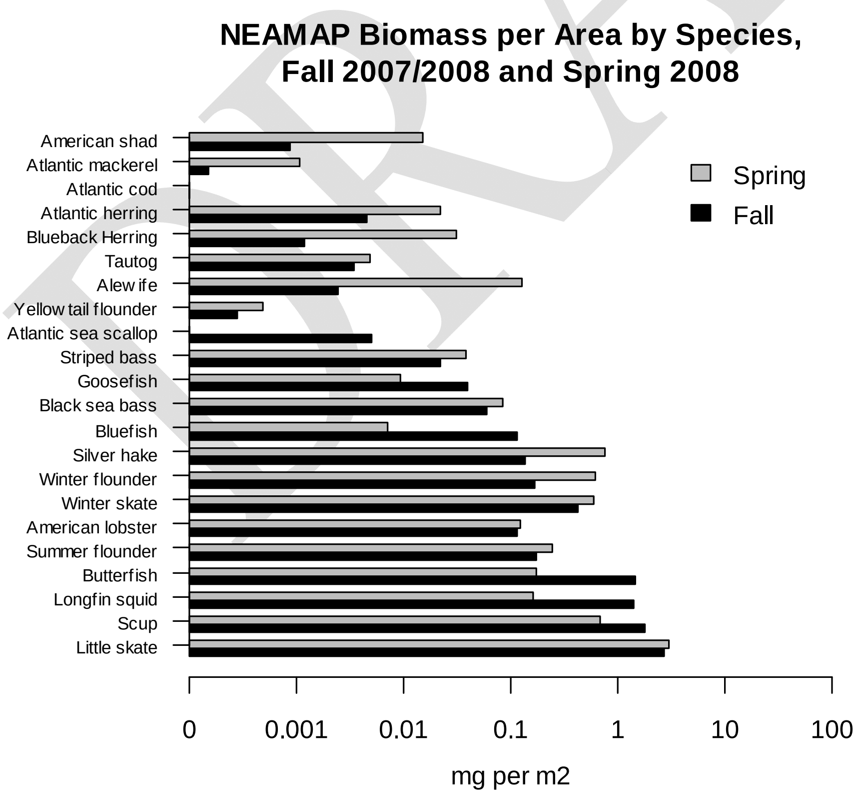

Figure 5.9. NEAMAP trawl survey biomass per area by species. (Bohaboy et al. 2010)

2. Individual species catch biomass data also provide insight into trends in biomass over the past decade. Data from the DEM, GSO, and NMFS trawl surveys were used to assess trends in biomass for the Ocean SAMP area from 1999 to 2008; spring and fall trends figures for each of the key species for which data were available are included in Appendix A. NEAMAP data were not used in these figures as only two years of data were available.

3. Multivariate analyses identified 17 species that effectively control the demersal fish and invertebrate community composition within the Ocean SAMP area (see Figure 5.10 below). Although these species may not be the most abundant within the Ocean SAMP area, they are of immense ecological importance to the stability and resiliency of the local marine community. When attempting to predict the effects of development and exploitation on the demersal fish community within the Ocean SAMP area, it is essential to consider these community-shaping species. As illustrated by this figure, many of these species vary in abundance from fall to spring. Such seasonal community dynamics should also be considered when planning offshore construction and directed exploitation (Bohaboy et al. 2010).

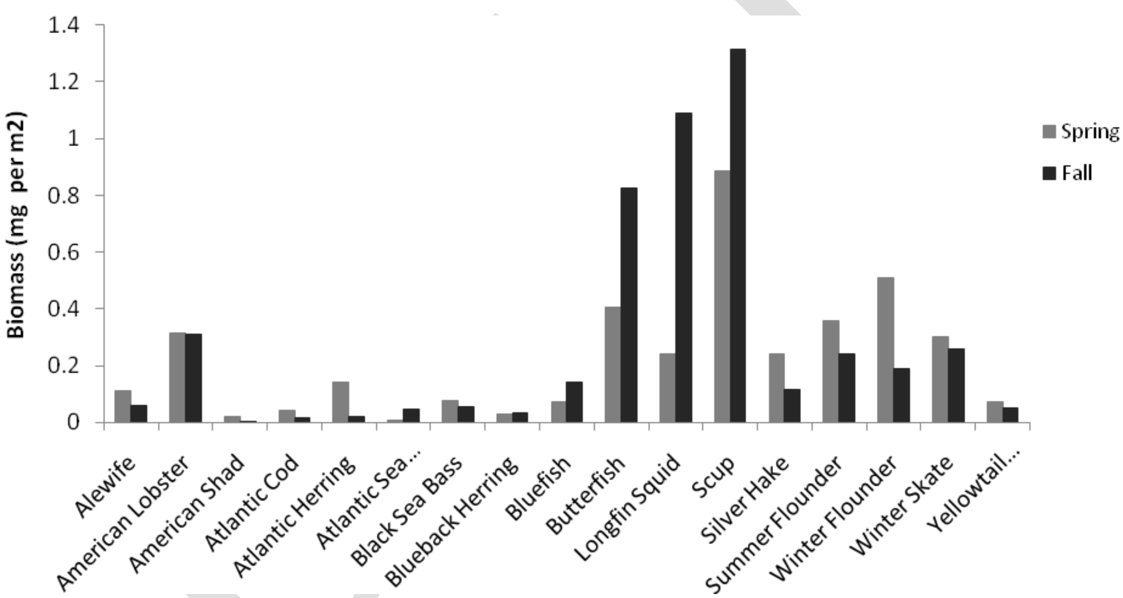

Figure 5.10. Spring and fall biomass of species identified as a driver of demersal fish and invertebrate community composition (Primer 6.0, BVStep, R=0.940). (Bohaboy et al. 2010)

4. The spatial distribution of individual species catch biomass during the spring and fall seasons is shown in a series of maps that are included in Appendix A. Maps are included for all of the species identified in Figure 5.10, as well as the remaining species of commercial and recreational importance for which bottom trawl survey data were available.

Section 520. Fish Habitat in the Ocean SAMP area

520.1. Benthic Habitat

1. Fish populations in the Ocean SAMP area and elsewhere require access to suitable habitats at all stages of the life cycle in order to thrive. Habitat requirements vary widely by species. Suitable habitat for a given species may include specific chemical and physical properties of the water column as well as specific geological or biological bottom characteristics. For an extensive discussion of habitat in the Ocean SAMP area, as well as other ecosystem characteristics, see Chapter 2, The Ecology of the Ocean SAMP Area.

2. This section focuses on the current status of fish habitat in the Ocean SAMP area. Potential impacts to habitat from existing activities are discussed below in Section 550. It should be noted that future uses of the Ocean SAMP area may result in habitat disturbances. Conversely, future uses of the Ocean SAMP area may result in habitat enhancements through the creation of artificial reefs or other factors. See Chapter 8, Renewable Energy for discussion of the potential effects of renewable energy on fish habitat, and Chapter 9, Other Future Uses for discussion of artificial reefs and other potential future uses of the Ocean SAMP area.

3. Very little mapping of geological and biological habitats has been done to date in the Ocean SAMP area. At the time of this writing, URI Graduate School of Oceanography researchers are conducting research on benthic habitat and have mapped approximately 15% of the total Ocean SAMP area. Future efforts by these researchers and by the NOAA hydrographic mapping program will result in approximately 40% of the area being mapped by 2011. This work will provide maps of geological and biological habitats, including fish habitat, for those areas being studied (J. King and J. Collie pers. comm.). Results of this study are forthcoming in 2010 and will be incorporated into subsequent revisions of the Ocean SAMP document. Preliminary results are summarized in Chapter 2, The Ecology of the SAMP Area. A technical report detailing these preliminary results (Malek et al. 2010) may be found in the Ocean SAMP Appendices.

520.2 Habitat Requirements for Species of Importance

1. As noted above, habitat requirements vary widely by species. Table 5.32 below is a summary of the habitat requirements for the commercial and recreational species of importance found within the Ocean SAMP area, summarized from Section 510.3; this table also includes a column summarizing the presence of designated Essential Fish Habitat (EFH) in the area. See Section 520.3 below for further discussion. For more information on specific habitat preferences, please refer to the individual species descriptions and tables in Section 510.3.

Table 5.32. Habitat requirements for species of importance found within the Ocean SAMP area.
This table is a summary of Tables 5.3-5.28 included above in the individual species descriptions; for references, see those individual tables.

Species	**Life Stage**	**Pelagic**	**Rocky**	**Cobble**	**Sand**	**Mud**	**Clay**	**Gravel**	**Boulder**	**Algae/ Vege-tation**	**Shell fragments/ shellfish beds**	**Man-made structures /wrecks**	**EFH Des-ignated in Ocean SAMP Area**
American Lobster	Eggs	X											N/A
	Larvae	X											
	Juveniles		X										
	Adults			X	X	X							
Atlantic bonito	Juveniles	X											N/A
	Adults	X											
Atlantic cod	Eggs	X											X
	Larvae	X											X
	Juveniles			X						X			X
	Adults		X					X					X
Atlantic herring	Eggs		X	X	X			X	X		X	X	
	Larvae	X											X
	Juveniles	X											X
	Adults				X			X					X
Atlantic mackerel	Eggs	X											X
	Larvae	X											X
	Juveniles	X											X
	Adults	X											X
Atlantic sea scallop	Eggs												X
	Larvae				X						X		X
	Juveniles		X					X		X	X		X
	Adults			X	X			X			X		X
Black sea bass	Eggs	X											
	Larvae	X											X
	Juveniles		X	X						X	X	X	X
	Adults		X	X			X				X	X	X
Bluefish	Eggs	X											X
	Larvae	X											X
	Juveniles	X			X	X	X			X			X
	Adults	X											X
Butterfish	Eggs	X											X
	Larvae	X											X
	Juveniles					X							X
	Adults				X	X							X
False albacore	Juveniles	X											N/A
	Adults	X											
Monkfish	Eggs	X											X
	Larvae	X											X
	Juveniles		X		X	X		X		X			X
	Adults		X		X	X		X		X			X
Loligo squid	Eggs		X		X	X			X	X		X	
	Larvae	X											
	Juveniles	X											X
	Adults	X			X	X							X
Menhaden	Eggs	X											N/A
	Larvae	X											
	Juveniles	X	X	X	X	X							
	Adults	X	X		X	X							
Scup	Eggs	X											X
	Larvae	X											X
	Juveniles				X	X				X	X		X
	Adults		X		X	X				X	X	X	X
Sharks (all)	Juveniles	X											N/A
	Adults	X											
Silver hake	Eggs	X											X
	Larvae	X											X
	Juveniles	X			X	X							X
	Adults	X			X	X							X

Skate, little	Eggs Juveniles Adults				X X X	 X X		 X X					 X X
Skate, winter	Juveniles Adults				X X			X X					X X
Spiny dogfish	Juveniles Adults	X X			 X	 X							N/A
Striped bass	Eggs Larvae Juveniles Adults	X	 X X X		 X X X				 X X X		 X		N/A
Summer flounder	Eggs Larvae Juveniles Adults	X			 X X X	 X	 X X			 X X		 X	X X X X
Tautog	Eggs Larvae Juveniles Adults	X X	 X X						 X X	 X	 X X	 X X	N/A
Tunas (all)	Juveniles Adults	X X											N/A
Winter flounder	Eggs Larvae Juveniles Adults		 X	 X	X X X X	X X X		X X	 X	 X			X X X X
Yellowtail flounder	Eggs Larvae Juveniles Adults	X X			 X X	 X X							X X X X

520.3 Essential Fish Habitat

1. Under the Magnuson-Stevens Act, Essential Fish Habitat (EFH) is defined as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” EFH is designated by the respective regional fishery management councils through their fishery management plans. EFH designation requires NMFS and federal agencies to work to protect these areas from actions which may have an adverse effect on EFH (NMFS n.d.).

2. Within the Ocean SAMP area, EFH has been designated for 24 finfish, shellfish, and crustacean species for at least part of their life cycle (see Table 5.33 below). Figure 5.11 below shows the total number of EFH species per ten minute square; Figures 5.12 to 5.15 below show the number of EFH species per ten minute square by life stage.

Table 5.33. Species for which Essential Fish Habitat has been designated within the Ocean SAMP area. (NMFS Office of Habitat Conservation, 2010)

American plaice	Scup
Atlantic cod	Silver hake
Atlantic herring	Skate, little
Atlantic mackerel	Skate, winter
Atlantic sea scallop	Spiny dogfish
Black sea bass	Squid, *Illex*
Bluefish	Squid, *Loligo*
Butterfish	Surf clams
Haddock	Summer flounder
Monkfish	Windowpane flounder
Ocean pout	Winter flounder
Ocean quahog	Witch flounder
Red hake	Yellowtail flounder

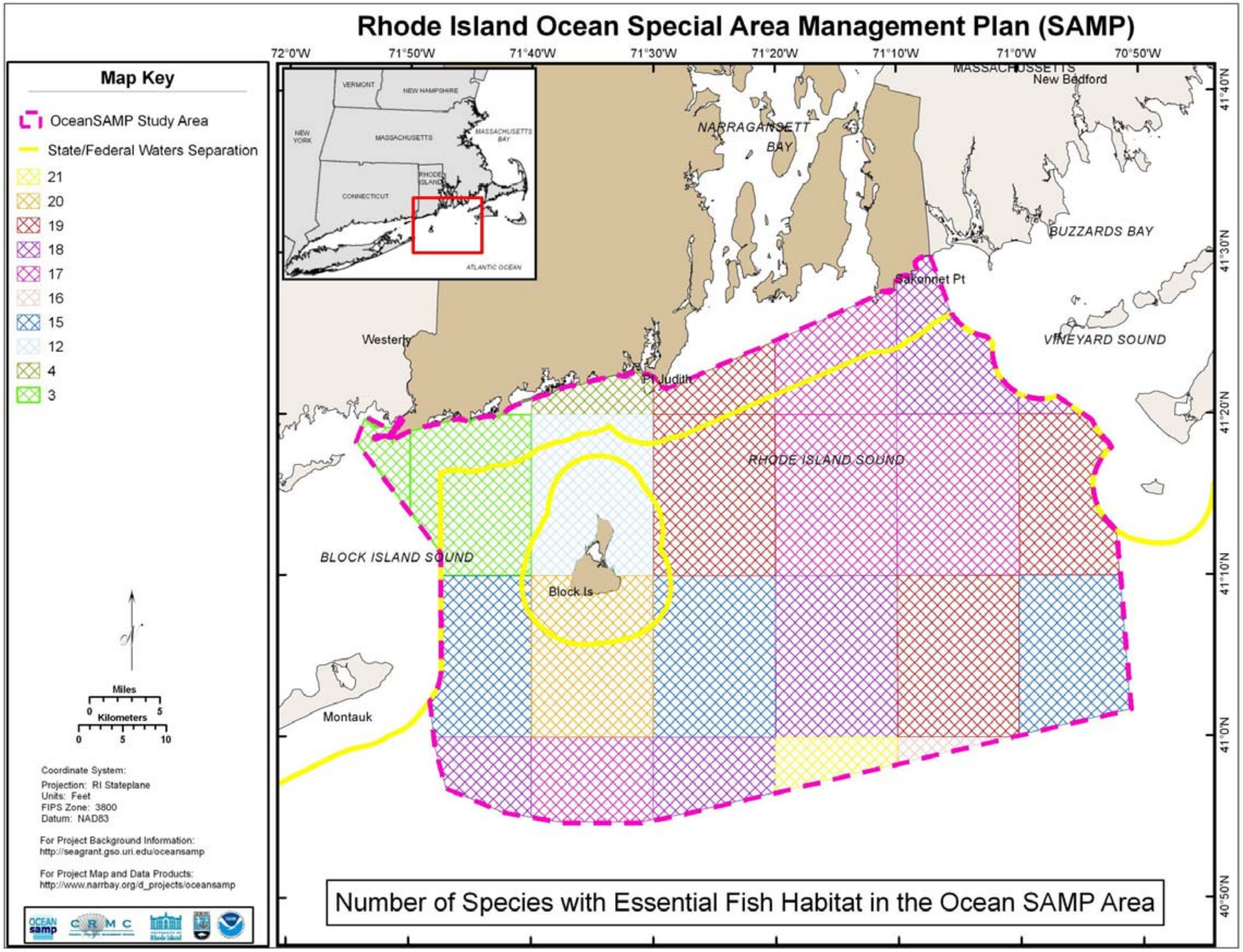

Figure 5.11. Number of species per ten minute square with Essential Fish Habitat, all life stages. (Data: NMFS; Map prepared by RIDEM Div. Fish and Wildlife, 2010)

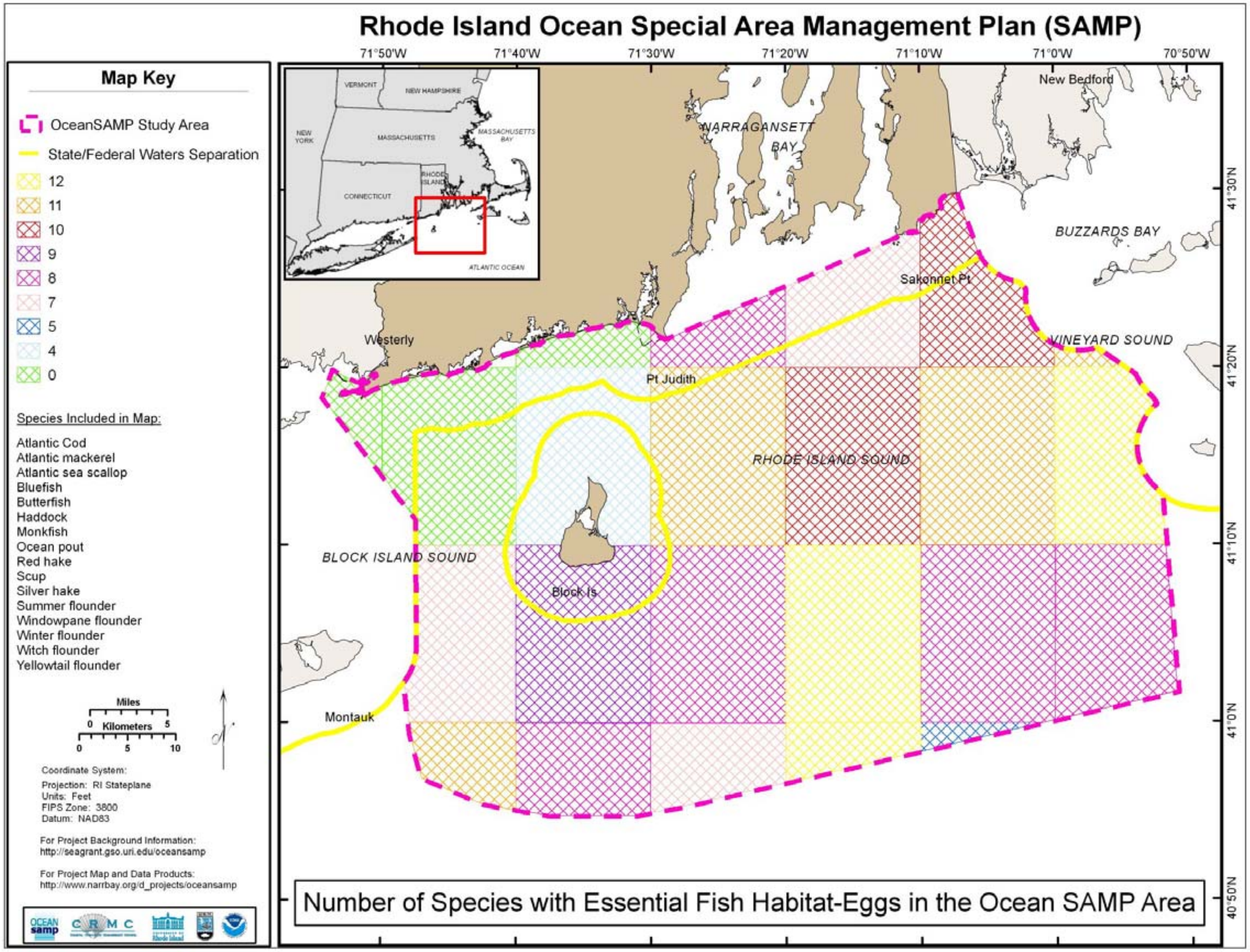

Figure 5.12. Number of species per ten minute square with Essential Fish Habitat, egg life stage. (Data: NMFS; Map prepared by RIDEM Div. Fish and Wildlife, 2010)

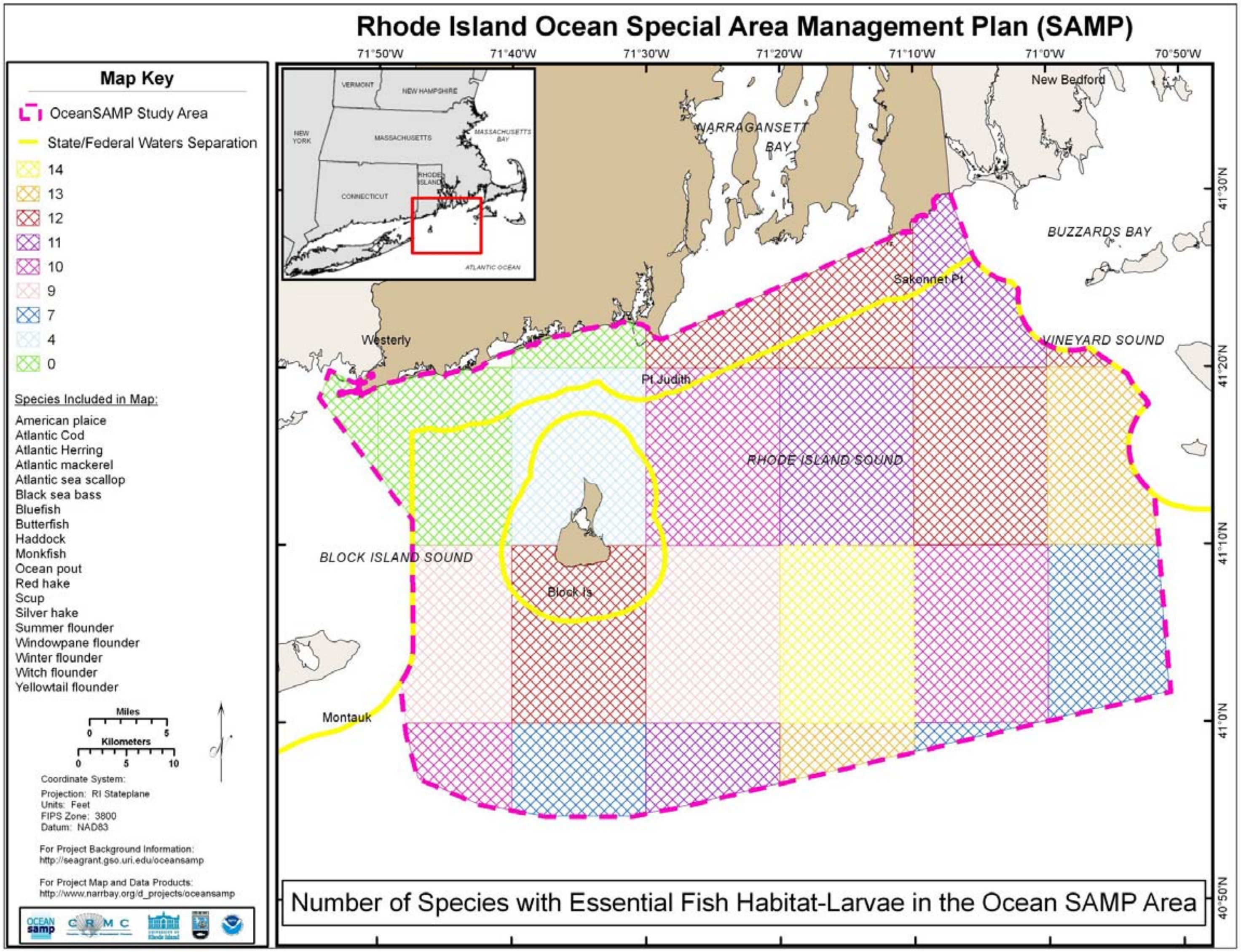

Figure 5.13. Number of species per ten minute square with Essential Fish Habitat, larval life stage. (Data: NMFS; Map prepared by RIDEM Div. Fish and Wildlife, 2010)

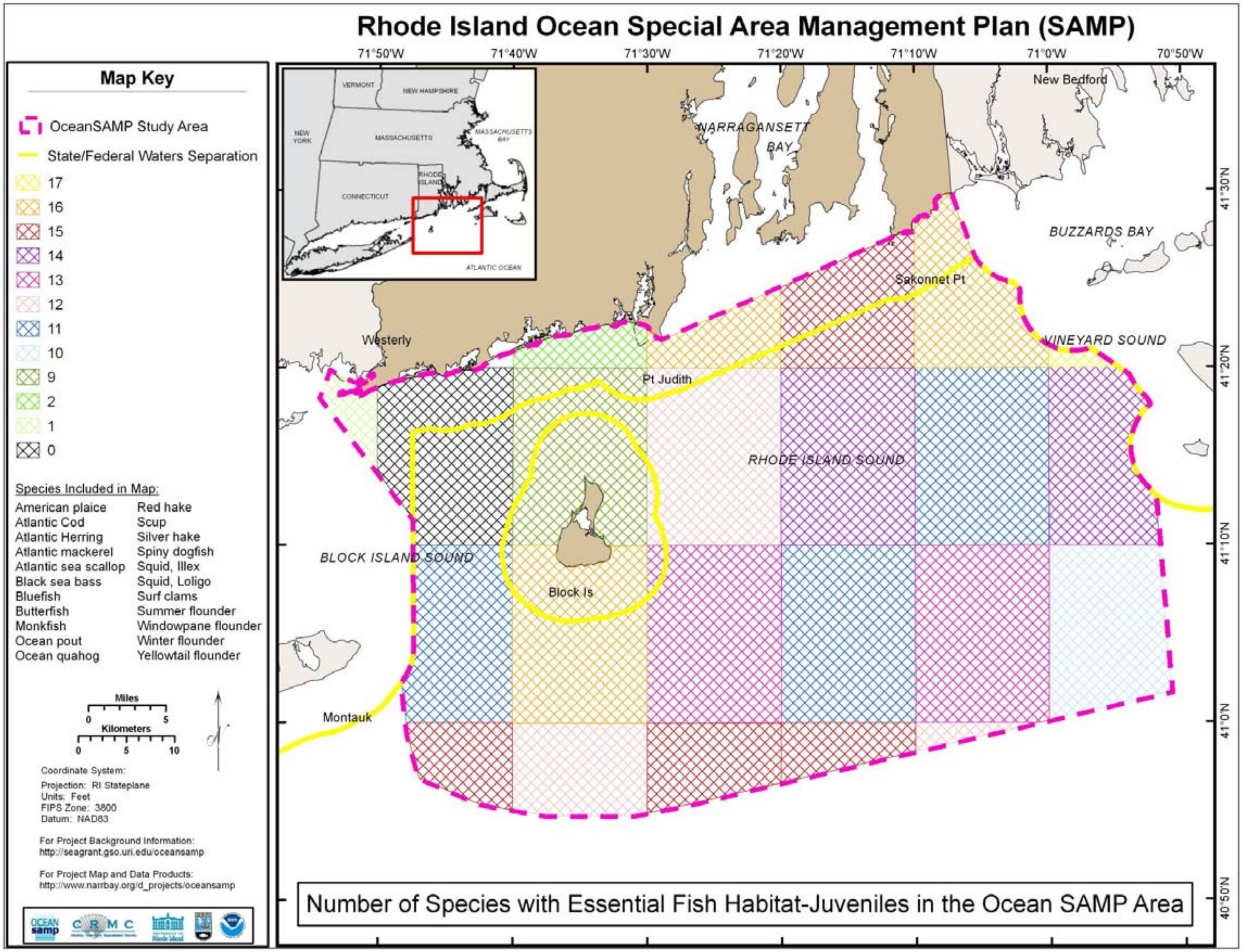

Figure 5.14. Number of species per ten minute square with Essential Fish Habitat, juvenile life stage. (Data: NMFS; Map prepared by RIDEM Div. Fish and Wildlife, 2010)

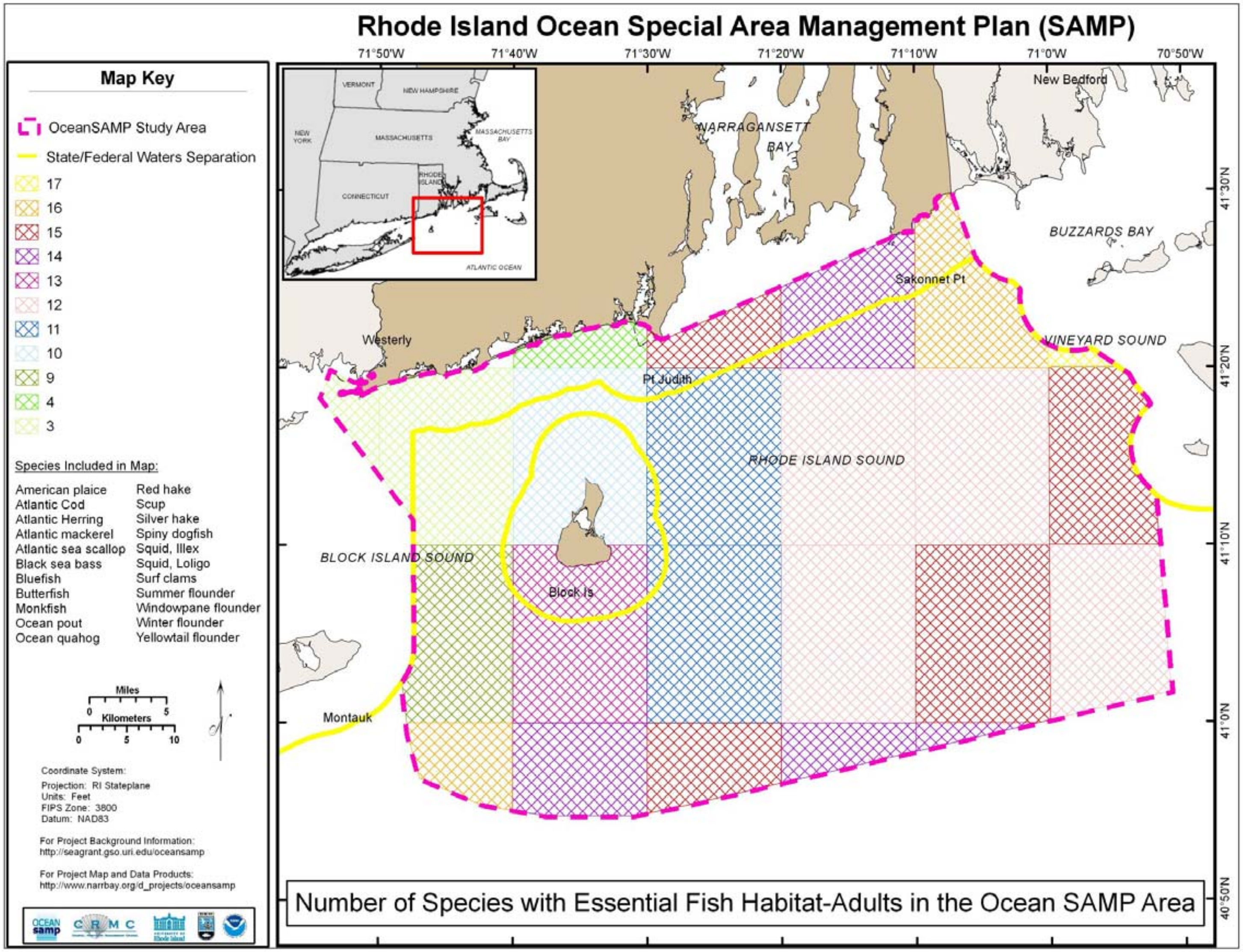

Figure 5.15. Number of species per ten minute square with Essential Fish Habitat, adult life stage. (Data: NMFS; Map prepared by RIDEM Div. Fish and Wildlife, 2010)

3. Under the Magnuson-Stevens Act, federal agencies must consult with NMFS on actions that adversely affect EFH. Part of an EFH consultation is an EFH assessment, which is a site- and project-specific analysis of the potential impacts of an action on EFH.

520.4. Critical Habitat

1. Under the Endangered Species Act, Critical Habitat is designated for species listed under the Act as threatened or endangered. The ESA describes Critical Habitat as those areas that are "essential to the conservation of the species and which may require special management considerations or protection." According to the NOAA Northeast Regional Office Protected Resources Division, there is no Critical Habitat for any listed finfish species within the Ocean SAMP area (Crocker, pers. comm. a.).

Section 530. Commercial and Recreational Fisheries in the Ocean SAMP Area

530.1. History of Fisheries in Rhode Island

530.1.1. Commercial Fishing History

1. The commercial fisheries of Newport and Sakonnet Point have origins dating back to the 17th century (Hall-Arber et al. 2001). Colonial fishermen in Rhode Island used a hook and line and fished from a small skiff, or set seine nets along the shore. The small fish caught with seines were used primarily as manure in the fields (Olsen et al. 1980). Seining usually involved leaving a net in the water for an hour or so, and returning to pull up the net and whatever it had caught. Poggie and Gersuny (1974) describe the fishing gangs in South Kingstown who would have fish houses along the beach equipped with bunks, where they would stay while fishing for striped bass. Each fishing gang typically used two boats and a seine.

2. The historically important food species of fish in Rhode Island have been striped bass, scup, tautog, bluefish, and mackerel (Sedgwick et al. 1980). During the mid-1800s, the use of staked and floating fish traps, set close to shore, came into prominence as a fishing technique, eclipsing the hook and line method. This new method of fishing was much more efficient (Olsen et al. 1980). At the time, traditional hook and line fishermen claimed that the waters of Rhode Island were being overfished by these new technologies. In 1870, the Rhode Island General Assembly appointed a special committee to investigate these claims (Poggie and Gersuny 1974). By 1910 there were 400 fish traps in use throughout Rhode Island. Eventually, because they were so numerous, the state placed restrictions on where and when they could be used (Olsen et al. 1980).

3. Fishermen also seined for menhaden using larger nets, usually requiring a more substantial operation with four men rowing the boat, two men to throw the net overboard, and about sixteen men on shore to haul the net ashore. Typically, neighbors would assist in the process in exchange for a share of the catch. Menhaden were generally used for rendering fertilizer and fish oil rather than food, and as many as 100,000 were sometimes taken in a single catch (Poggie and Gersuny 1974). Menhaden became a highly important industrial fishery in Rhode Island and throughout New England in the late 1800s and early 1900s. In 1889, there were a reported 127 million pounds of fish landed in Rhode Island, of which 89 percent were menhaden (Olsen and Stevenson, 1975). Menhaden plants, which rendered the fish for oil, were common along the New England coastline around the turn of the century. Scup and alewives were also important species to commercial fisheries in this period (Poggie and Pollnac, eds. 1981).

4. The development of the fishing industry coincided with the development of markets for fish and with the ability to store and transport fish. Around the turn of the last century, fish could be shipped by steamship from Newport to New York, or via railroad. There is evidence that ice was used in keeping fish as early as 1900, but its early use was limited because of cost (Poggie and Gersuny 1974). Other methods of shipping fish included boxing them or placing them in barrels (Sedgwick et al. 1980).

5. During the 1920s and 1930s, menhaden began to disappear off the coast of New England as stocks were overfished, and many of the menhaden plants were forced to close. Fishermen were pushed to pursue other species (Poggie and Pollnac, eds. 1981). In the 1930s, the first otter trawls were used off Rhode Island (Olsen and Stevenson 1975). Marine diesel engines were also introduced around this time, allowing fishermen to travel further offshore in pursuit of fish (Poggie and Pollnac, eds. 1981). Trawling quickly became the dominant method of fishing, and trap fishermen soon began criticizing trawlers for a decline in stocks. Whiting (silver hake) and red hake, both used for industrial purposes, usually in the form of fertilizer or protein, were the two species initially targeted by otter trawls (Poggie and Pollnac, eds. 1981). As trawling became more commonplace, the species caught as well as people's preferences for food fish both changed, and flounder, which had previously been considered "trash" fish, eclipsed scup, bluefish, and mackerel in the marketplace (Sedgwick et al. 1980). See Figure 5.16 for offshore areas used by trawlers during the 1970s.

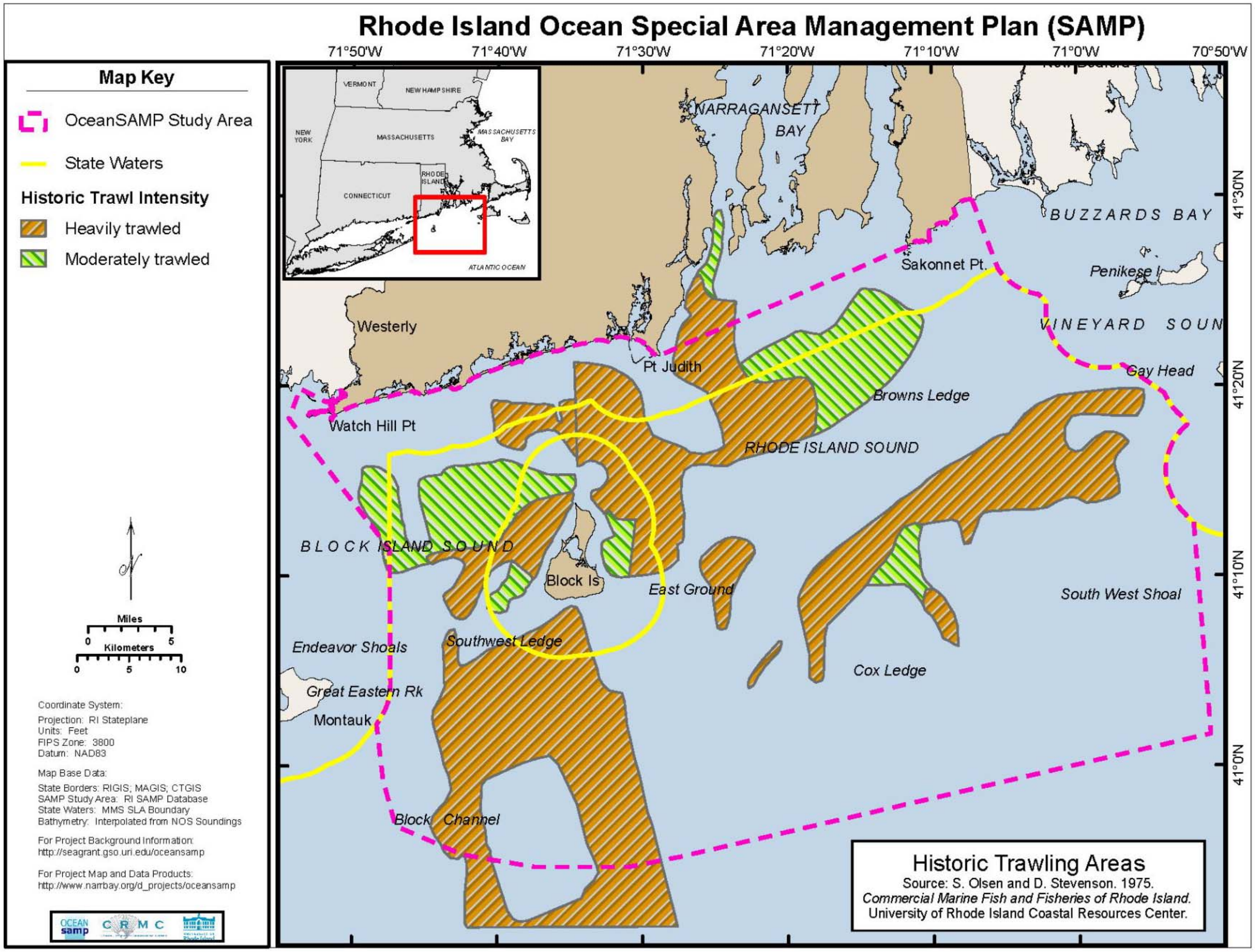

Figure 5.16. Historic trawling areas.

6. During the 1960s, significant stocks of lobsters that had not previously been fished were discovered offshore, providing a large boost to landings and value in the state's lobster fishery (Sedgwick et al. 1980). Around this time, traps replaced trawling as the dominant method for catching lobsters offshore, and this also significantly boosted lobster landings and revenues (Poggie and Pollnac, eds. 1981).

7. As in other states around the country, the presence of foreign fishing fleets was a contentious issue in Rhode Island in the 1960s through the mid-1970s, until the passage of the Magnuson Stevens Fishery Conservation and Management Act in 1976, which declared a 200-mile limit on U.S. waters. Rhode Island offshore fisheries continued to grow even during the time of massive fishing efforts by foreign fleets, as some of the offshore stocks were not heavily exploited by foreign fleets, and were thus targeted by Rhode Island vessels. A significant period of development in fisheries followed the passage of the Act, in which Rhode Island fishermen, more so than other New England fishermen, diversified their targeted species to include butterfish, whiting (silver hake), and squid, based both on the abundance of these species in Rhode Island waters compared with northern New England, where their geographic range does not extend, and also on a willingness of Rhode Island fishermen to target non-traditional species (Sedgwick et al. 1980). This led to rapid expansion of Rhode Island fisheries in the late 1970s and early 1980s. In 1979, there were a record 264 offshore vessels landing at Rhode Island ports, although some of these vessels were home ported elsewhere. As the number of vessels grew in this period, so did vessel length, tonnage, and horsepower, and the traditional wooden eastern rigged side trawler was replaced by new steel-hulled stern trawlers (Sedgwick et al. 1980).

8. Rhode Island's important squid fishery began in the late 1800s as a bait fishery, and a market for human consumption developed during the 1960s. Whereas longfin squid have been harvested since the late 1800s, harvesting of shortfin (*illex*) squid as a bait fishery began somewhat more recently. From the late 1960s through early 1980s, longfin squid were heavily exploited in Rhode Island waters by foreign fishing fleets. After the departure of foreign vessels from U.S. waters, Rhode Island vessels were among the first to target squid in large numbers; Rhode Island commercial landings for longfin squid increased by an order of magnitude from 1981 through 1992 (DeAlteris et al. 2000).

9. During the 1980s, the commercial fishing industry in Rhode Island was growing, increasing by 24 percent in total landings from 1980 through 1987, while landings in the other New England states declined by 37 percent. This increase was due in part to an increase in fish consumption nationwide, to the increased harvesting of what at the time were underutilized species (such as squid, butterfish, and silver hake), and also to a significant increase in international exports from Rhode Island, particularly to Japan. This growth was also aided by public investment into the fishing industry during the late 1970s and 1980s, including the development of piers at both Newport and Galilee (Intergovernmental Policy Analysis Program, University of Rhode Island, 1989).

530.1.2. Recreational Fishing History

1. Recreational fishing, also known as sport fishing, also has a long and important history in Rhode Island. However, as with many other types of recreation, there is very little documentation of recreational fishing history, both in Rhode Island and throughout the U.S. In the late 19th-century, recreational boating became a popular pastime, and Newport and other Rhode Island coastal communities became destinations for wealthy people seeking leisure time and recreational activities. Coastal recreation and tourism activities, including boating and beach-going, became increasingly popular with the emergent middle class during the early- to mid-20th century. Recreational fishing also emerged as a popular activity during this time.

2. Rhode Island's many fishing clubs and organizations are a testament to the presence of recreational fishing within the state's history. The Narragansett Salt Water Fishing Club, for example, has been in existence since 1936, and the club had as many as 800 members in the 1940s and 50s. Historically, there were tuna clubs in coastal communities such as Block Island, where the Atlantic Tuna Club had a club house in 1915 (Allen 2010). The RI Party and Charter Boat Association was established by 15 party and charter boat operators in 1962 in order to promote their industry; today, membership has grown to 70 members from throughout the state with vessels ranging in size from 18 to 100 feet long (Bellavance, pers. comm.). The RI Saltwater Anglers Association was established more recently, in 1999, as a forum and advocacy organization for recreational fishermen, and currently has approximately 1,800 members (Hittinger, pers. comm. a).

3. Rhode Island has a long history of recreational fishing tournaments, many of which are focused on species found in the Ocean SAMP area. The Atlantic Tuna Tournament, alternately known as the Point Judith Tuna Tournament, is one of the better known of these tournaments. This tournament began in the 1940s (Conley 1986) and became especially popular in the 1950s and 1960s, drawing large crowds to Galilee. Galilee was known as the Tuna Capital of the World until the tournament was moved to Gloucester in 1973 (Olsen and Stevenson 1975). Other large recreational fishing tournaments described in a 1986 history of Rhode Island include the Rhode Island Tuna Tournament, the Point Judith Masters Invitational, the Snug Harbor Shark Tourney, the Block Island Bluefish Tournament, and the Block Island Striper Tournament (Conley 1986).

4. Recreational fishing in Rhode Island has also expanded in recent years through the growth of the party and charter boat industry. RI Department of Environmental Management licensing data indicates that 240 party and charter boats are currently licensed; this is more than twice the number than were licensed in 1999 when the licensing program first took effect (RIDEM 2010b).

530.2. Rhode Island's Commercial and Recreational Fishing Ports

1. Rhode Island today has two major commercial fishing ports, Point Judith and Newport, as well as several smaller fishing ports used by both commercial and recreational fishermen. These ports have seen significant changes over the years, as the fishing industry has given way to tourism and other waterfront development. However, Rhode

Island's ports still serve as the physical and social nexus of fishing activity within the state, and have an important place in the state's history and culture.

2. Rhode Island's commercial fishing ports serve commercial fishermen and fishing vessels both from within the state of Rhode Island and from other states along the East Coast. The nature of fishing regulations and markets is such that at various times of the year, fishermen from as far away as North Carolina and Florida may be fishing in the Ocean SAMP area, and may make use of the infrastructure present in the state to unload and sell their catch. Likewise, Rhode Island fishermen may land their catch in other states at times.

3. Because of the importance of recreational fishing to Rhode Island, recreational fishermen, and boats used either occasionally or frequently for recreational fishing, can be found in every port and harbor in the state. Point Judith and Newport, critical to the state's commercial fishing industries, also host much of the state's recreational fishing activity, particularly for vessels fishing within the Ocean SAMP area.

530.2.1. Point Judith/Galilee

1. Commercial fishing did not become a prominent industry at Point Judith until the 1930s. During the 17th and most of the 18th centuries, farming was the primary activity in the South Kingstown/Narragansett area (Narragansett was part of the town of South Kingstown until splitting off in 1888). A textile industry developed in 1802, and was a prominent industry here throughout the 19th century (Poggie and Gersuny 1974).

2. The development of the Point Judith commercial fishing industry coincided with the development of the Harbor of Refuge. Between 1892 and 1915, the US Army Corps of Engineers built three breakwaters at Point Judith to create the Harbor of Refuge (Olsen and Stevenson 1975). Previously, Point Judith had presented a hazard to navigation between Boston and New York, and the shifting sands of the pond had made it impossible for use as a harbor. In 1934 and 1935, the state and the Public Works Administration built two state piers and dredged a 35-acre anchorage basin – these improvements allowed the commercial fishing industry to prosper here. Landings of commercial fish at Point Judith grew exponentially from 300 tons in 1895 to 3,000 tons in 1935, and then from 17,000 tons in 1945 to 30,000 tons in 1970 (Poggie and Gersuny 1974). The fishery during the 1950s was primarily an industrial fishery, largely for whiting and red hake used as industrial feeds. This fishery had a rapid decline after peaking in 1956, but other fisheries continued to be robust (Olsen and Stevenson 1975).

3. One major force in the development of the commercial fishing industry at Point Judith was the creation of a cooperative. The Point Judith Fishermen's Cooperative was founded in 1948 by returning World War II veterans, and served as a marketing cooperative for local fishermen, rather than as a fishing cooperative. At its start, it had 65 members and 20 fishing vessels (Poggie and Gersuny 1974). The coop provided its members with organized marketing and with lumpers (fish handlers). They provided low-cost insurance and unemployment compensation to members. The coop also had a store where they sold equipment and supplies such as line, boots, gloves, and replacement

parts, saving the coop members valuable time and money by not having to go elsewhere. The coop also provided fuel and ice. By 1973, the coop had 129 members and employed 82 people. There were approximately 120 trawlers and lobster boats landing regularly at the coop, and most of the fish was sold to Fulton Fish Market in New York (Olsen and Stevenson 1975).

4. During the 1970s, as commercial fisheries expanded due to the creation of the 200 mile limit, membership in the coop increased to the point where a moratorium was placed on membership. In the 1980s, the coop increased its processing capacity by moving into a larger building. During the moratorium, other companies developed to fill this gap, and after its expansion there were few incentives to join the coop. The combination of increased competition and growing operating costs (which were not accompanied by growth in membership) contributed to the coop's ultimate demise, and it shut its doors in 1994 (Griffith and Dyer 1996). Declining fish stocks and low prices also contributed to the coop's closure. The coop exists today as an independent fish marketing organization (Clay et al. 2008).

5. Point Judith did not become a significant commercial fishing port until the 1930s, so it lacks the long tradition of fishing of some other New England towns, including Newport. Many of the fishermen do not come from fishing families with a long fishing history, but became fishermen during the 1960s or 1970s as the industry was expanding. However, many of the fishermen also have last names found in the 1774 census for South Kingstown, indicating that many of the fishermen are from families who have lived in the area for generations (Poggie and Gersuny 1978). Most of the commercial fishermen who dock their vessels here live within a 20-mile radius of Point Judith, but not in the immediate vicinity of the port, because of a lack of housing around Point Judith. However, there is still a distinct community of fishermen, and culture of commercial fishing, in Point Judith (Hall-Arber et al. 2001).

6. Today Point Judith is the center of the Rhode Island commercial fishing industry. The vast majority of vessels docked at Point Judith use the port on a full-time basis, rather than being transient among multiple ports. Most of Point Judith's fishermen land there throughout most of the year, although they frequently change targeted fisheries several times throughout the year (Sedgwick et al. 1980).

7. Point Judith has sufficient infrastructure to support its commercial fishing industry, as well as to provide shoreside services to fishermen around the state. There are a number of docks, processing facilities, and dealers, and a commercial bait dealer to serve trap fishermen (Clay et al. 2008). The Division of Coastal Resources of the Rhode Island Department of Environmental Management is responsible for the development and management of the port of Galilee. There are over 230 commercial fishing vessels, including charter fishing boats, berthed in Galilee (RIDEM Division of Coastal Resources n.d.).

8. The largest fish processors in Point Judith are the Town Dock Company and the Point Judith Fishermen's Company. Town Dock came to Point Judith in 1980 and is now one of the largest seafood processing companies in Rhode Island. Its facility supports

unloading, processing, and freezing facilities under one roof and services over half of the trawlers based out of Point Judith (approximately 30 full-time deep sea fishing trawlers), as well as a large day-boat fleet. They handle and process species including squid, scup, and butterfish (Clay et al. 2008).

9. The Point Judith Fishermen's Company, which employs approximately fifteen people at its plant, processes squid which are sold wholesale at the Hunts Point Market in New York. Handrigan's is another unloading facility located in Point Judith. Several smaller processors located in the Point Judith area include: Deep Sea Fish of RI, Ocean State Lobster Co., Narragansett Bay Lobster Co., Fox Seafood, South Pier Fish Company, and Osprey Seafood (also known as the Black Point Fish Trap Company) (Clay et al. 2008).

10. Trawlworks, Inc. in Narragansett is a manufacturer, supplier and distributor of marine hardware and rigging supplies for industrial, institutional, and commercial fishing for both mid-water and bottom use. The corporation was formed in 1980. Superior Trawl is also located in Narragansett, and builds fishing gear sold throughout New England and the Mid-Atlantic. The Bait Company sells bait to local lobstermen (Clay et al. 2008).

11. The majority of commercial vessels docked at Point Judith are bottom trawlers, and most of these are between 45 and 75 feet in length. There are a few larger boats (70' and longer) which fish primarily for squid, herring, and whiting (silver hake), while many of the medium sized boats target a mix of pelagic and groundfish species. Typically, the smaller vessels have 1-2 person crews, while the larger boats may have a crew of four or five. Generally, fishermen in Point Judith are flexible, and target whatever species are available and marketable. Fishermen in Point Judith have the advantage of being close to fish stocks, and of being able to switch between traditionally mid-Atlantic stocks such as butterfish as well as traditionally northern fisheries such as the groundfish species complex, which includes bottom-dwelling fish such as cod, haddock, and flounders. Squid are usually caught year round, with the bulk of squid fishing done in May; herring are caught December to April, mackerel are caught from March through May, and both whiting and scup are caught year-round. Groundfishing boats fish both inshore and offshore depending on the season, targeting traditional groundfish species offshore, and yellowtail, winter, and summer flounder closer to shore. There are also a number of lobster boats located in Point Judith, including both inshore and offshore lobster boats (Hall-Arber et al. 2001). Much of the fish landed at Point Judith ends up either at the Hunts Point Fish Market in New York or the Boston Fish Exchange. Fish product from Point Judith is usually considered to be of high quality, and fetches a good price. Most of Rhode Island's fish exports are made up of squid and lobster (Hall-Arber et al. 2001).

12. Today Point Judith is still a major commercial fishing port. In 2009, there were 179 vessels with federal permits home ported in the Point Judith area (NMFS 2010e). The most valuable species landed here were squid, butterfish, and mackerel, followed by lobster. In 2008, it was ranked 17th among U.S. fish ports for total value of landings in the United States, and 21st for weight (NMFS 2009a).

13. Point Judith is also a significant recreational fishing port. The majority of charter boats in the state are based at Point Judith or in the port of Galilee, and all of the state's party

boats are found here. By one count, between 2001-2005, 66 different charter and party boats made a total of 7,709 trips out of Point Judith, carrying almost 100,000 anglers (Clay et al. 2008). The shores around Point Judith Pond are filled with marinas and private docks, supporting a large number of recreational boats, a majority of which will spend some time fishing within the Ocean SAMP area. Snug Harbor, across the pond from Point Judith and Galilee, is home to numerous recreational fishing boats and hosts several fishing tournaments.

14. Commercial and recreational fisheries are presently competing for space in Point Judith. While the commercial fishing presence has diminished in Point Judith, as it has done elsewhere around the state, recreational and for-hire fishing has expanded as part of the state's growing recreation and tourism economy. Many of the former gathering spots for fishermen have been converted to ice cream shops and seafood restaurants. The commercial fishing infrastructure cannot be further expanded because of competition from the recreational boating sector (Hall-Arber et al. 2001). However, because of the significant economic value of both recreational and commercial fishing in Point Judith, and the cultural importance of both commercial and recreational fishing to this area, commercial fishing is likely to retain a stronghold in Point Judith alongside a thriving recreational fishing industry.

15. Point Judith has a Blessing of the Fleet celebration for the fishing fleet, featuring food, games, parades, and other festivities. Traditionally, visitors would get to tour a commercial fishing vessel and participate in the parade. However, the fishermen's insurance companies refused to cover the liability of any non-fisher who might be injured on one of the vessels, and much of the commercial fleet had to stop participating in the event (Griffith and Dyer 1996). The Blessing of the Fleet still takes place today, and features a road race and seafood festival, but primarily involves recreational vessels. This event has shifted away from a tradition of cultural importance for fishermen toward a tourism-oriented event (Hall-Arber et al. 2001).

530.2.2. Newport

1. Newport's history and cultural traditions are strongly tied to tourism and recreational boating, and commercial fishing has also always had a presence here (Hall-Arber et al. 2001). Newport has one of the best natural harbors in the Northeast (Olsen and Stevenson 1975). Although not much historical information is available on fishing during Newport's early history, it is a safe assumption that fishing played a vital role in Newport's economy in the early days when the city was first settled by Europeans (Poggie and Pollnac, eds. 1981). Before the port of Galilee was developed, Newport was the center of both shipping and fishing in Rhode Island. During the 1870s, there were four industrial fish processing plants on Aquidneck Island processing menhaden, mackerel, herring, and scup as agricultural fertilizers (Sedgwick et al. 1980). Commercial fishing declined in prominence here after World War II, just as the Naval Base was gaining in size and importance to the economy.

2. Newport was Rhode Island's principal commercial fishing port in the 1930s but was surpassed by Point Judith when its industrial fishery blossomed in the late 1940s and 50s.

Some suggested factors in the decline of commercial fishing in Newport at that time include the growth of recreational boating and tourism, and commercial fishermen being enticed to New Bedford and Point Judith by the increase in services and infrastructure in those ports (Poggie and Pollnac, eds. 1981). During the 1960s, Newport again became an important port for trawlers from New Bedford (Olsen and Stevenson 1975). At this time, many of the trawlers fishing in New Bedford and other ports, including many New Jersey vessels, were dissatisfied with the dealers in these locations, and were enticed to Newport by the dealers there (Poggie and Pollnac, eds. 1981). Olsen and Stevenson noted of Newport in 1975 that the vessels landing here were on average larger than those landing in Point Judith, making longer trips out to Georges Bank as opposed to shorter trips closer to home. Newport was still the dominant commercial fishing port in Rhode Island until around 1973 (Hall-Arber et al. 2001), but fishing here has declined considerably since that time. During the 1970s, Newport's waterfront underwent a dramatic transformation as recreational boating, tourism, and residential development out-competed commercial fishing for use of much of the city's waterfront. There have been no new commercial fishing-related businesses coming into the fishery in Newport for close to thirty years. This has been the result of increasing property values, restricting fishing-related businesses from opening, and increased competition for dock space with recreational vessels (Hall-Arber et al. 2001).

3. Traditionally, a number of transient commercial vessels from New Bedford and other ports have landed in Newport. These are usually long-trip boats fishing for scallops or groundfish on Georges Bank that come to Newport to sell to one of the fish buyers here. There are also a number of lobster boats that fish out of Newport. The Division of Coastal Resources of the Rhode Island DEM is responsible for managing and maintaining State Pier 9, the only state-owned commercial fishing facility in Newport. The pier provides dockage for approximately 60 full-time commercial fishing vessels (RIDEM Division of Coastal Resources n.d.), the majority of which are lobster boats (Clay et al. 2008).

4. Newport has the infrastructure and services to support its commercial fishing fleet, but has been losing fishing-related business in recent years, and at present commercial fishermen must go to New Bedford or Point Judith for most fishing supplies. The city has several seafood wholesalers and retailers. The most significant of these include: Omega Sea, which markets scallops and coldwater shrimp; Aquidneck Lobster, a large lobster wholesaler; and Parascandolo and Sons, which buys finfish. Other commercial fishing-related businesses here include International Marine Industries, Long Wharf Seafood, and Neptune Trading Group. Parascandolo and Sons maintains a private dock, primarily used by the multispecies groundfish fleet who land fish here, but they also have a substantial number of vessels landing squid here. Parascandolo and Sons requires a large volume in order to be able to maintain their business (Clay et al. 2008).

5. In 2009, there were 41 commercial vessels with federal licenses listing Newport as their home port (NMFS 2010e). Newport was ranked 75th among U.S. fish ports for landings value in 2008, and 60th by weight (NMFS 2009a). In recent years, scallops and lobster have been among the most valuable commercial species landed in Newport (Clay et al. 2008).

6. Recreational fishing is an important activity in Newport because of the large number of recreational boats located here. The harbor's location means that recreational boats can easily access the Ocean SAMP area. There are also several charter boats located in Newport harbor.

7. Newport also has an annual Blessing of the Fleet that takes place each December as part of the city's Christmas celebrations, where both recreational and commercial vessels are decorated for a parade around the harbor (Clay et al. 2008).

530.2.3. Sakonnet Point

1. Sakonnet Point in Little Compton is a considerably smaller port than either Point Judith or Newport, but fishermen here also fish within the Ocean SAMP area. Commercial fishing is considered to be one of the most important economic activities in Little Compton. Most fishermen based in Sakonnet Point are combination lobster-gillnet fishermen (Hall-Arber et al. 2001). There are a number of fish traps outside of Sakonnet Harbor and at the mouth of the Sakonnet River, many currently operated by Parascandolo and Sons. Some of the permits and sites for the traps date back to colonial times (Clay et al. 2008).

2. There are three major fishing related businesses here. Sakonnet Lobster is a lobster wholesaler located in Sakonnet Point adjacent to the harbor (Clay et al. 2008). The Point Trap Company and H.N. Wilcox Inc. are primarily engaged in trap fishing (Little Compton Harbor Commission 2008).

3. The fishery at Sakonnet Point is small but highly diverse. According to the Sakonnet Harbor Management Plan, there are currently approximately 30 commercial fishing vessels based in the harbor, which may include both vessels with federal permits and vessels with state permits (Little Compton Harbor Commission 2008). According to NMFS, in 2009 there were 17 vessels with federal permits home ported in the Sakonnet Point/Little Compton area (NMFS 2010e). There are also one or two transient fishing vessels that use the harbor regularly. About three quarters of these vessels engage in commercial lobstering, primarily from April through November. The remainder of the boats target finfish or shellfish using a variety of different gear types including fish traps. Vessels that fish in the winter months primarily engage in gillnetting, and many of the harbor's lobster boats can be adapted for this use (Little Compton Harbor Commission 2008). The most valuable commercial species landed at Sakonnet Point in recent years have included monkfish, summer flounder, scup, black sea bass, and lobster (Clay et al. 2008).

530.2.4. Block Island

1. Block Island has a small commercial fishing presence; in 2009, there were 10 federally licensed fishing vessels listed as having their home port in Block Island (NMFS 2010e). Similar to Sakonnet Point, the most valuable commercial species landed at Block Island

in recent years have included monkfish, summer flounder, scup, black sea bass, and lobster (Clay et al. 2008).

2. Block Island is an important port for recreational fishing, with at least seven charter boats listed for the island. There are several recreational fishing tournaments held out of Block Island each year (Clay et al. 2008). Consultation with Rhode Island recreational fishing stakeholders has indicated that many recreational fishing vessels, including charter boats, docked at other ports in Rhode Island frequently fish the waters around Block Island.

530.2.5. Other Commercial and Recreational Fishing Ports

1. While Rhode Island does have several other ports involved in fisheries, the vast majority of commercial fishing activity out of other ports takes place within Narragansett Bay (e.g. quahogging) and is thus outside of the Ocean SAMP waters. However, there are a few other fishing vessels scattered around Narragansett Bay that may make use of or pass through the Ocean SAMP area. North Kingstown, Tiverton, and Jamestown all have a small number of lobster boats that may fish within Rhode Island Sound. Warren has a couple of hydraulic dredge clam boats that fish for ocean quahogs in the waters south of the Ocean SAMP area at around 35 to 40 fathoms; if quahog populations rebound in Rhode Island and Block Island Sounds, they may again fish this area.

2. In the Davisville area of North Kingstown there are two large freezer trawlers owned by Sea Freeze that target squid, herring, mackerel, and butterfish within the Ocean SAMP area as well as further offshore. The most valuable species landed in North Kingstown in recent years have included squid and mackerel. Port-specific landings value data are not available for North Kingstown as this information is kept confidential by NMFS in order to protect the privacy of the one major company located in this port (Clay et al. 2008).

3. Numerous other ports throughout the state serve an important role for recreational fisheries, as recreational vessels docked at any location throughout Rhode Island may occasionally or frequently fish within the Ocean SAMP area. As noted above, the majority of the state's recreational fishing party and charter boats are based out of Point Judith and, to a lesser extent, Newport. Point Judith and Newport also provide dockage and support services for numerous private recreational fishing vessels that operate in the Ocean SAMP area. In addition, many private recreational fishing vessels that operate in the Ocean SAMP area are based in the ports of Sakonnet Point and Block Island (discussed above), as well as Charlestown, Westerly, Wickford, Warwick, and East Greenwich (R. Hittinger, pers. comm. a).

530.3. Description of Rhode Island's Fisheries

1. For the purposes of the Ocean SAMP, fisheries have been divided up into commercial and recreational fisheries. Commercial fisheries is further divided into two categories – mobile gear and fixed gear fisheries. Mobile gear fisheries are those in which fishing gear such as an otter trawl is deployed while in motion aboard a vessel, while fixed gear fisheries employ static gear such as lobster pots, fish pots, and gillnets, which are set in one location and then retrieved later. The term recreational fisheries is used here to describe both recreational anglers and recreational fishing aboard private boats and party and charter boats. See Section 530.7 below for further discussion.

530.3.1. Bottom Types, Seasonal Migrations, and Fishing

1. Commercial and recreational fishing activity can be further characterized by the fisherman's target species and the benthic features, or bottom types, which may present the fishermen with the best possible harvest of those species. Many migrating bottom species congregate in areas of habitat change, known as transition zones or "edges," whenever possible because they can exploit the benefits of both habitats in order to find food or shelter, or for reproductive purposes. Transition zones include, but are not limited to, the edges that represent changes from mud to sand, sand to gravel, gravel to boulders, and boulders to ledge. In the Ocean SAMP area, many targeted species make seasonal migrations from offshore to inshore, and back offshore; each transition zone provides a point in that migration where fish can stop and exploit the benefits of both habitat types. Fishermen know these seasonal migratory patterns as well as the tendency of fish to congregate in these transition zones, and concentrate their fishing effort accordingly.

2. These migratory patterns are particularly pronounced for species such as lobster that are targeted by fixed gear fishermen (both lobstering and gill-netting), and so transition zones such as moraines and moraine edges are especially important to these fishermen. Transition zones of other bottom types can be equally important to fixed gear fishermen following fish on their seasonal migrations. Mobile gear fishermen such as bottom trawlers also follow fish on their seasonal migrations and seek to exploit transition zones, although the nature of bottom trawling limits the types of bottom that can be trawled, and so these fishermen only exploit transition zones that are conducive to this gear type. In the Ocean SAMP area, most bottom trawling takes place on smooth bottom types (e.g. sand, mud, and gravel), although some trawlers with rockhopper gear occasionally trawl in areas with boulders. See Chapter 2, The Ecology of the Ocean SAMP Area for further discussion of moraines and other benthic features, as well as a broader discussion of the geology and benthic ecology of the Ocean SAMP area.

530.3.2. Mapping Fisheries Activity Areas

1. Commercial and recreational fishing takes place throughout most of the Ocean SAMP area. A two-part approach was taken to map fishing activity for inclusion in the Ocean SAMP document. First, commercial and recreational fishing activity was characterized and mapped through qualitative input from fishermen. In a series of interviews and meetings that took place in 2008-2009, Rhode Island commercial and recreational

fishermen were asked to indicate, on nautical charts, areas where they fish (see Appendix B for detailed methodology). Second, commercial fishing activity was characterized and mapped through analysis of quantitative fisheries-dependent data collected from 1998 - 2008. As a means of monitoring fisheries activity, NMFS requires commercial fishermen with federally-permitted groundfish, scallop, and monkfish vessels to submit one Vessel Trip Report (VTR) for each fishing trip. On each report, the fisherman reports the location of that trip as one set of coordinates (latitude/longitude or Loran). These maps were created by aggregating the VTRs of all RI-based vessels using these gear types from 1998 – 2008 as a set of point data, and then creating a density plot using a 1-minute by 1-minute grid overlay to determine the relative density of fishing trips. Darker-shaded areas represent the areas with a higher density of fishing activity. Although these VTR maps are based on quantitative data, they must still be viewed with caution. VTR location information is only an approximation of fishing activity because the fisherman self-reports only one set of coordinates for the trip, despite the fact that one trip may include multiple tows that take place in many different locations across a much wider area.

2. Figure 5.17 shows total fishing activity based on qualitative input from fishermen. Figure 5.18 shows total commercial mobile gear and gillnet fishing based on NMFS VTR data. Additional maps are provided in the subsequent sections below to illustrate fishing activity by gear type. See Appendix B for a detailed methodology and additional maps. Together, these mapping processes resulted in a series of maps that create an accurate approximation of many types of Ocean SAMP area fishing activity. However it is important to note that fishing is a very dynamic activity and as such is inherently difficult to capture through a static mapping exercise. Fishing effort varies widely throughout the year, and from year to year, depending on the individual fisherman, vessel type, target species, regulatory environment, and market demand. In addition, fishing effort varies in location and intensity throughout the year because fishermen follow their target species on their seasonal migrations. A number of the targeted species move within the Ocean SAMP area, while others move into and out of the Ocean SAMP area, throughout the course of a year.

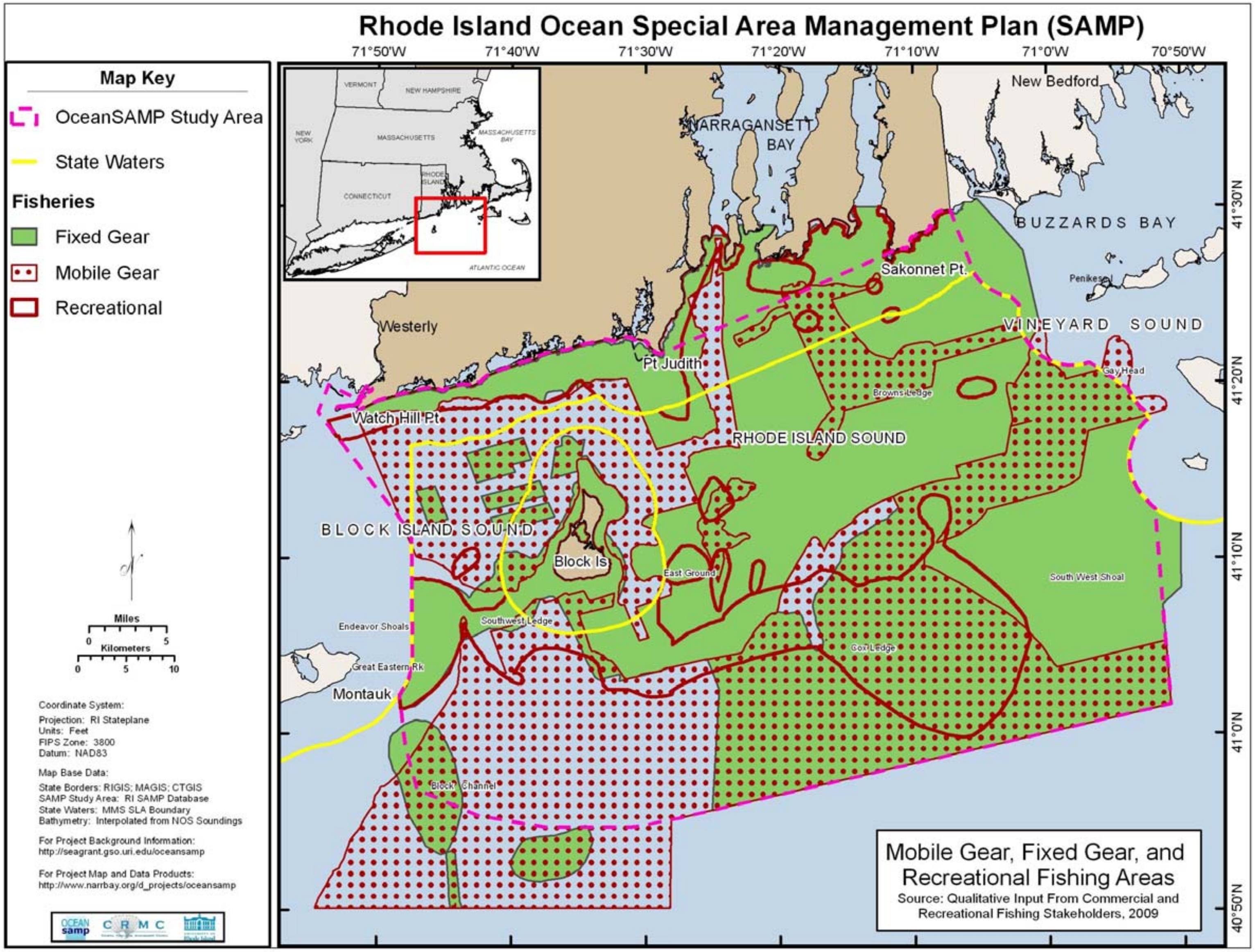

Figure 5.17. Mobile gear, fixed gear, and recreational fishing areas based on qualitative input.

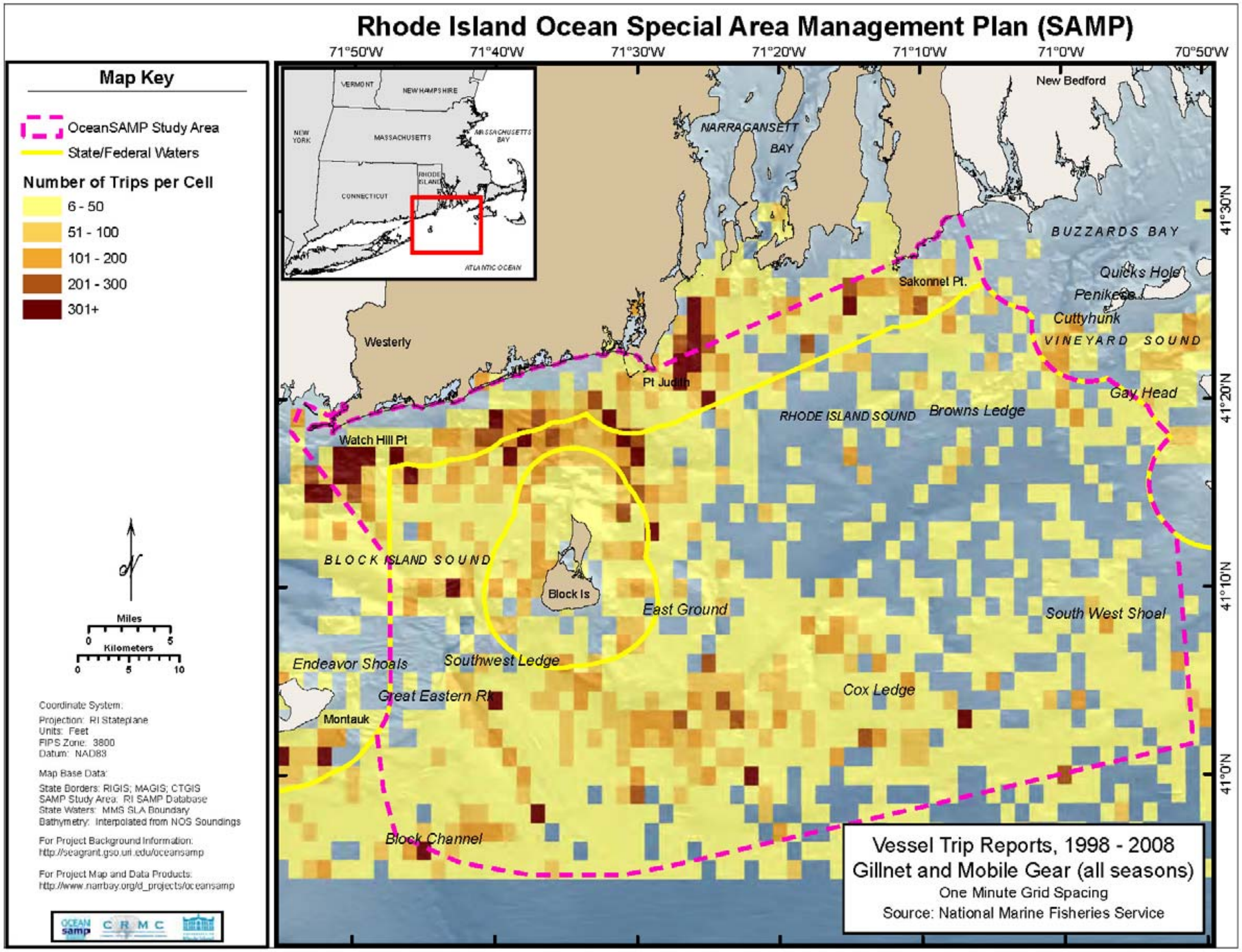

Figure 5.18. Commercial mobile gear and gillnet fishing areas based on NMFS Vessel Trip Reports, 1998 - 2008.

530.4. Contemporary Commercial Mobile Gear Fisheries

530.4.1. Description

1. Commercial fishing activity in the Ocean SAMP area can mostly be divided into two categories – mobile gear and fixed gear fisheries. Mobile gear fisheries are those in which the fishing gear is being actively employed from a vessel while capturing the fish, as opposed to fixed (static) gear, which is set in one location to fish and then retrieved later (for more on fixed gear fisheries, see Section 530.5). Commercial mobile gear fishing methods employed in fisheries in the Ocean SAMP area include: bottom and mid-water trawling (also called dragging), dredging, purse seining, and rod and reel fishing. While the majority of mobile gear fishing taking place within the Ocean SAMP area is by Rhode Island-based vessels, trawlers from other states will frequently transit through or fish in the federal waters of the Ocean SAMP area at certain times of year.

2. One of the most common and traditional methods for fishing within the Ocean SAMP area is otter trawling (commonly referred to as dragging), in use in Rhode Island since the 1930s. Trawlers fishing within the Ocean SAMP area are primarily either day boats or short-trip boats (at sea from one to three days). Species traditionally targeted by the trawlers in the Ocean SAMP area include squid, butterfish, fluke, scup, hake, cod, monkfish, yellowtail flounder, and winter flounder. Rhode Island fishermen, more so than fishermen from elsewhere in New England, typically fish for "mixed species" throughout much of the year, including squid, butterfish, and scup, or whiting (silver hake), all of which are fished with an otter trawl. Squid are at present the most important fishery to Rhode Island fishermen, both in terms of landings value and landed weight (see Section 530.6 for further discussion). Most of the fishing for squid takes place outside the Ocean SAMP area by large trawlers. However, from May through September or October, squid can often be found within the northern Ocean SAMP area in the waters south of Point Judith and Charlestown. Many of the smaller inshore draggers as well as some larger vessels from Rhode Island ports will focus on this fishery during these months, and vessels will sometimes come from Massachusetts to target these squid as well. During those months, this is an important fishery for the dayboat fleet. Whiting, or silver hake, is another important fishery for Rhode Island fishermen, who will fish for it all year long, frequently within the southern portions of the Ocean SAMP area. Many of the Rhode Island fishermen will target groundfish species when available. Most of the groundfish targeted in the Ocean SAMP area are flounder and are harvested from the smoother bottom areas south of Block Island. Codfish catches within the Ocean SAMP area have been improving in recent years and are a late winter/early spring target. Skates are both a directed fishery and bycatch. In the Ocean SAMP area, most bottom trawling takes place on smooth bottom types (e.g. sand, mud, and gravel), although some trawlers with rockhopper gear occasionally trawl in areas with boulders.

3. Rhode Island mid-water trawlers will fish in the Ocean SAMP area for herring and mackerel in the fall and winter months. Other vessels from ports including Massachusetts, Maine, New Jersey, and North Carolina come to Rhode Island Sound just for this season. When the herring are close to shore, a number of vessels will participate

in this fishery. This is an important fishery for small boats in Rhode Island during the months these fish are in the area.

4. A number of vessels with general access scallop permits, which limit them to 400 pounds of scallops per day, may fish in the Ocean SAMP area. Scalloping is traditionally done using a dredge towed behind the vessel. These boats make up a small percentage of total sea scallop landings for Rhode Island, but this is an important fishery for vessels without limited access permits for scallop. This fishery is generally restricted to smaller boats that take day trips to the southern part of the Ocean SAMP area.

5. There is a commercial rod and reel harvest in the Ocean SAMP area for striped bass, tuna, scup, and fluke. According to the RIDEM state license reports, vessels with commercial rod and reel permits operating in statistical area 539 made 8,304 trips in 2007, 9,699 trips in 2008, and 8,882 in 2009. In all three years commercial rod and reeltrips represented the largest number of fishing trips made by any single gear type; see Table 5.35 (RIDEM 2010b).

530.4.2. Mobile Gear Fisheries Activity Areas

1. Mobile gear fishing takes place throughout most of the Ocean SAMP area. Characterizing the locations of fishing activity requires both qualitative input from fishermen as well as analysis of NMFS fisheries dependent datasets. Together, these data create an accurate approximation of mobile gear fishing activity. However it is important to note that fishing is a very dynamic activity and as such is inherently difficult to capture through a static mapping exercise. Fishing effort varies widely throughout the year, and from year to year, depending on the individual fisherman, vessel type, target species, regulatory environment, and market demand. In addition, fishing effort varies in location and intensity throughout the year because fishermen follow their target species on their seasonal migrations. A number of the targeted species move within the Ocean SAMP area, while others move into and out of the Ocean SAMP area throughout the course of a year.

2. Figure 5.19 shows mobile gear fishing areas based on qualitative input from fishermen. See Appendix B for the methodology used to develop these maps. All of the areas shown as mobile gear fishing areas are used at some point in the course of the fishing season. Because of the dynamic nature of fishing described above, all mobile gear fishing areas are not in use all of the time. This does not, however, diminish the importance of the use of these areas.

3. Figures 5.20, 5.21 and 5.22 show bottom trawling, scallop dredging, and mid-water trawling areas based on NMFS Vessel Trip Report data. As noted above, bottom trawling and scallop dredging are the two main types mobile gear fishing in the Ocean SAMP area. As a means of monitoring fisheries activity, NMFS requires commercial fishermen with federally-permitted groundfish, scallop, and monkfish vessels to submit one Vessel Trip Report (VTR) for each fishing trip. On each report, the fisherman reports the location of that trip as one set of coordinates (latitude/longitude or Loran). These maps were created by aggregating the VTRs of all RI-based vessels using these gear types from

1998 – 2008 as a set of point data, and then creating a density plot using a 1-minute by 1-minute grid overlay to determine the relative density of fishing trips. Darker-shaded areas represent the areas with a higher density of fishing activity. Although these VTR maps are based on quantitative data, they must still be viewed with caution. VTR location information is only an approximation of fishing activity because the fisherman self-reports only one set of coordinates for the trip, despite the fact that one trip may include multiple tows that take place in many different locations across a much wider area. See Appendix B for a more detailed discussion of data sources and methodology.

4. A comparison of Figure 5.19 (which represents both methods of mobile gear fishing) with Figures 5.20-5.22 reveals that these maps create a relatively consistent depiction of mobile gear fishing in the Ocean SAMP area. Bottom trawling is concentrated in the waters between Block Island and the mainland, as well as the waters south and southeast of Block Island. Scallop dredging is concentrated in the furthest offshore parts of the Ocean SAMP area, including waters south and southwest of Block Island and the Cox Ledge area.

5. Mobile gear fishermen follow their target species on their seasonal migrations and work the areas with bottom type suitable to their gear types. For example, while much dragging takes place in areas with soft bottom, some scallop dredging takes place in rockier areas. One fishing area of particular importance is Cox Ledge, which is used by mobile gear as well as fixed gear and recreational fishermen. Distinct polygons shown within the shaded mobile gear areas represent areas that are only used by mobile gear fishermen during certain parts of the year; these areas are used during other times of the year by fixed gear fishermen through informal cooperative agreements between fishermen. See Section 530.5 for further discussion of fixed gear fisheries, and Section 530.7 for further discussion of recreational fisheries.

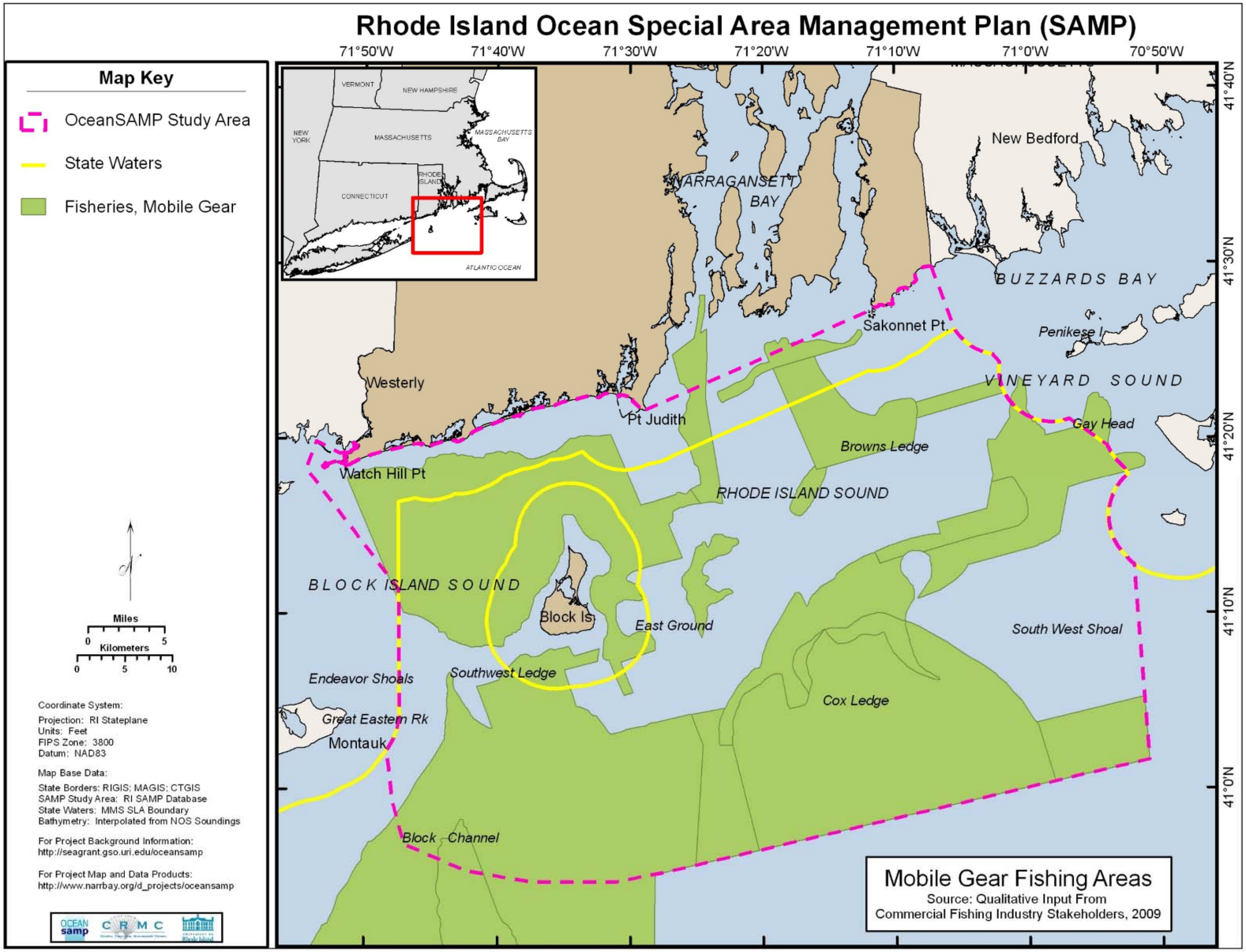

Figure 5.19. Mobile gear fishing areas based on qualitative input.

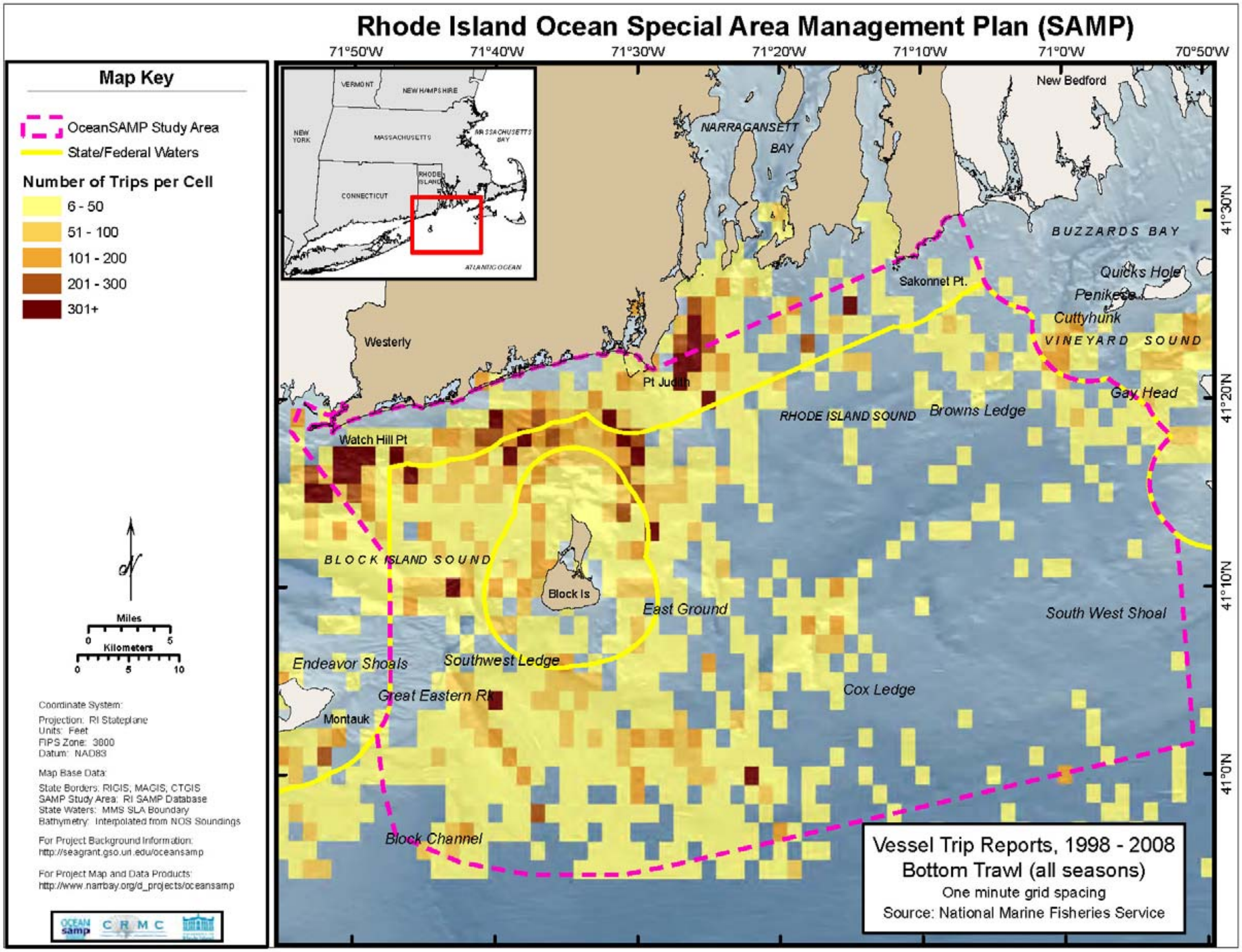

Figure 5.20. Bottom trawling areas based on NMFS Vessel Trip Reports, 1998 - 2008.

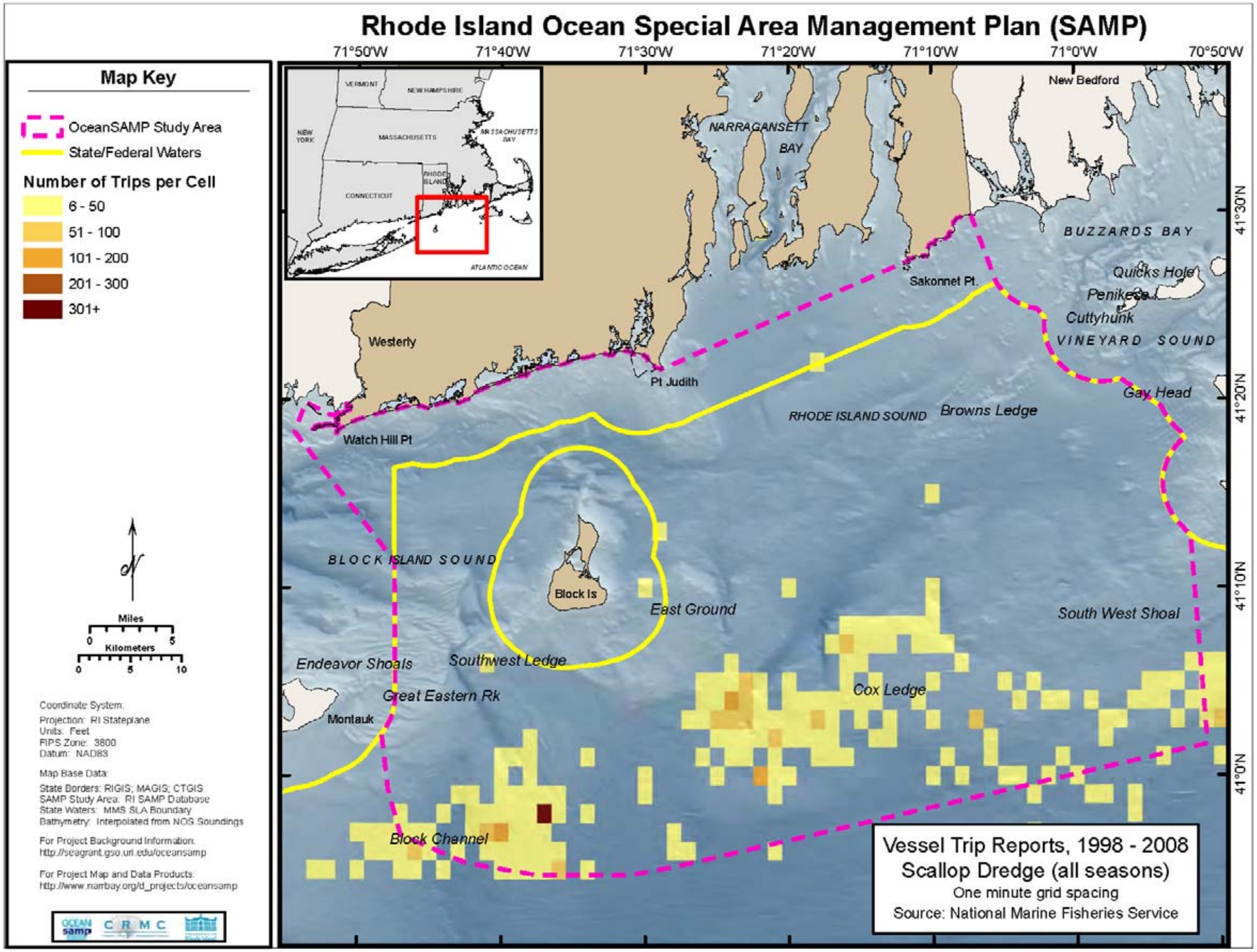

Figure 5.21. Scallop dredging areas based on NMFS Vessel Trip Reports, 1998 - 2008.

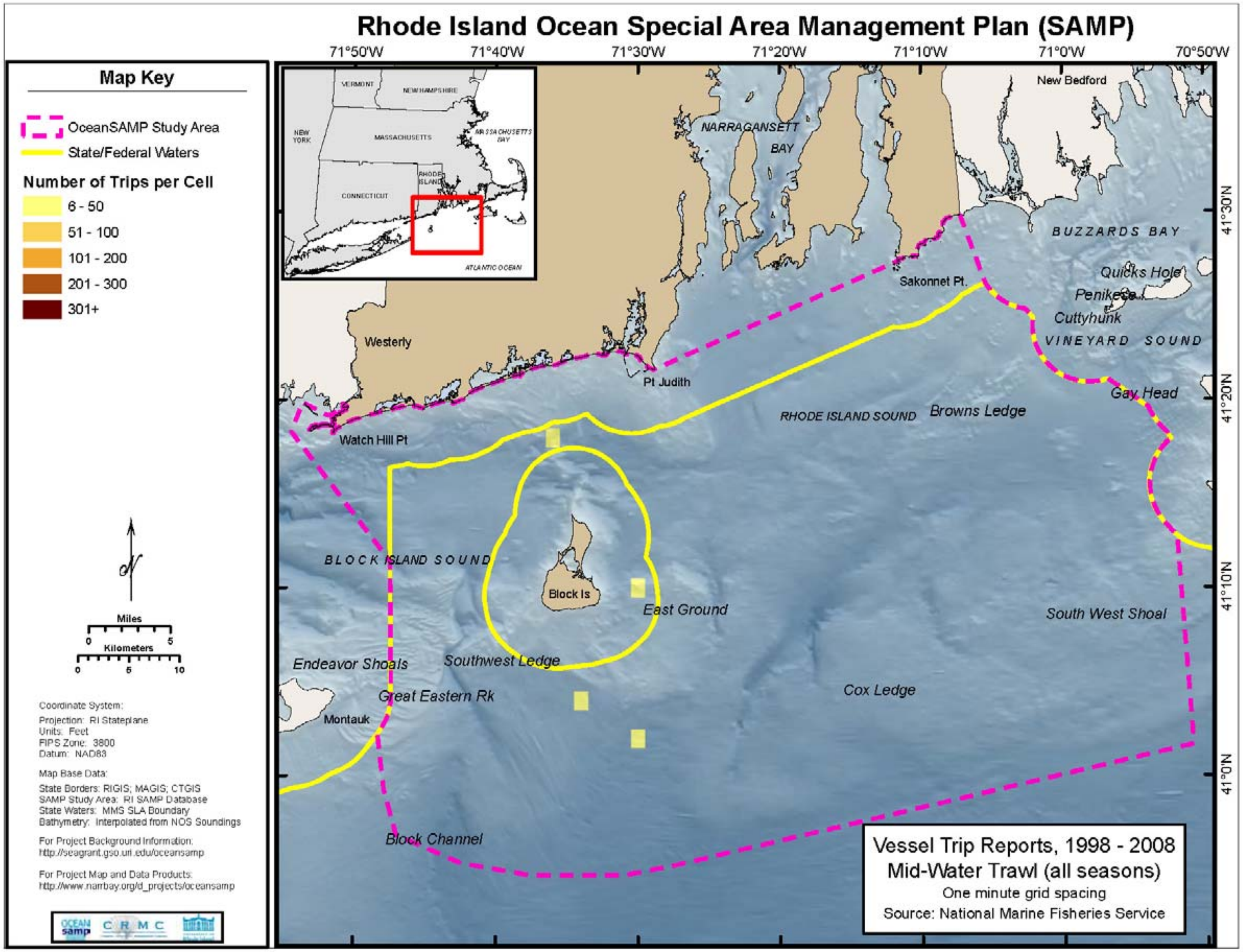

Figure 5.22. Mid-water trawling areas based on NMFS Vessel Trip Reports, 1998 - 2008.

530.5. Contemporary Commercial Fixed Gear Fisheries

530.5.1. Description

1. Rhode Island has a number of significant fixed gear commercial fisheries. These include gillnetting as well as trap fisheries, which includes the use of lobster pots and fish pots. These fisheries are primarily near shore fisheries, conducted on day trips using smaller vessels, usually with a crew of only one or two fishermen. Because these fisheries tend to occur near shore, the vast majority take place within the Ocean SAMP area. Also, because of the nearshore nature of these fisheries, the majority of fishermen and vessels participating in this fishery are based out of Rhode Island.

2. Fishing for lobster using traps is common throughout the Ocean SAMP area; most lobsters landed within Rhode Island are caught in this area. Lobster fishing is generally seasonal, and takes place primarily from the spring through late December. Lobster fishing within the Ocean SAMP area is commonly done by small boats with a crew of one or two, while offshore lobstermen will travel further out beyond the Ocean SAMP area to fish the canyons. Lobster boats are permitted to set up to 800 traps, and typically a boat will set a few dozen strings of 15-25 traps each. Before 1950, lobsters were primarily taken as incidental catches in trawls for demersal finfish. Of lobsters landed in Rhode Island, 98.5% are taken with traps, and the remaining 1.5% by otter trawl (DeAlteris et al. 2000).

3. Rhode Island has a significant floating fish trap fishery concentrated in state waters. Figure 5.23 shows currently active or permitted fish trap locations. Most floating fish traps are located off Sakonnet and Newport, and off of Narragansett and Pt. Judith. It should be noted that there are additional possible fish trap locations that are identified in RI DEM regulations but not presently active.[9] Floating fish trap catch includes scup, squid, striped bass, and other migratory fish. Floating fish trap fishermen would be seriously affected if these targeted fish were diverted to other areas.

4. Gillnets make up an important segment of the state's fixed gear fisheries. Gillnet fishermen target a number of species including groundfish, scup, bluefish, fluke, and skate. Gillnets are also the primary gear used in the monkfish fishery; a large majority of the Rhode Island monkfish fishery takes place within the Ocean SAMP waters. There are a number of gillnet fishermen out of Sakonnet Point who fish primarily within the Ocean SAMP area.

[9] See RI Marine Fisheries Statutes and Regulations, Part XIV – Fish Traps, online at http://www.dem.ri.gov/pubs/regs/regs/fishwild/rimf14.pdf , for further information on fish trap locations.

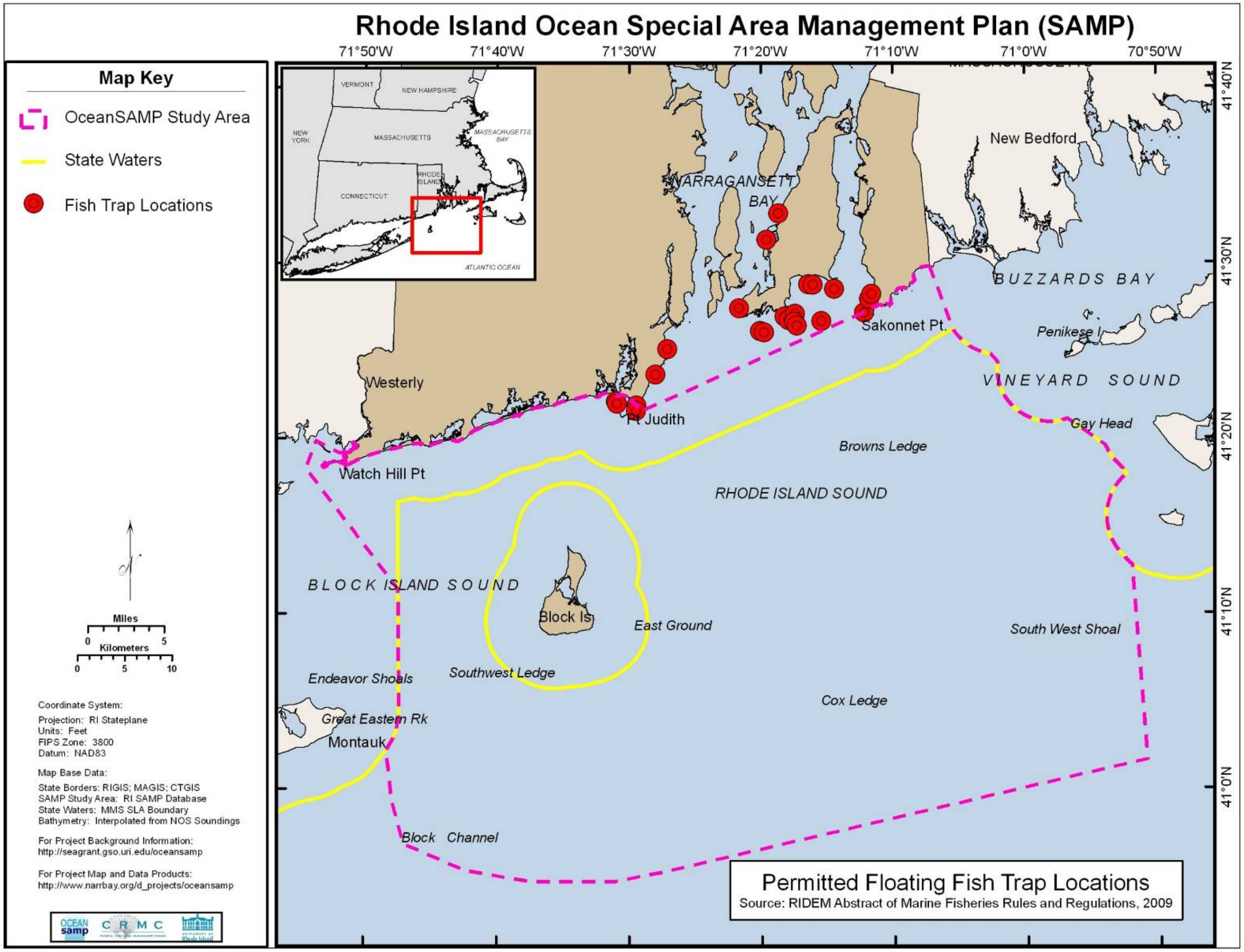

Figure 5.23. Currently active or permitted floating fish trap areas.

530.5.2. Fixed Gear Fishing Activity Areas

1. Fixed gear fishing, which here includes fishing with lobster pots, fish pots, and gillnets, also takes place throughout most of the Ocean SAMP area. As noted above in section 530.4.2, characterizing the locations of fishing activity requires both qualitative input from fishermen as well as analysis of NMFS fisheries dependent datasets. Fixed gear fisheries are similar to mobile gear fisheries in that fishing effort varies widely throughout the year, and from year to year, depending on the individual fisherman, vessel type, target species, and regulatory environment. In addition, fishing effort varies in location and intensity throughout the year because fishermen follow their target species on their seasonal migrations.

2. Figure 5.24 shows fixed gear fishing areas based on qualitative input from fishermen. See Appendix B for the methodology used to develop these maps. All of the areas shown as fixed gear fishing areas are used at some point in the course of the fishing season, though not all fixed gear fishing areas are not in use all of the time. One fishing area of particular importance is Cox Ledge, which is used by fixed gear as well as mobile gear and recreational fishermen. Distinct polygons shown within the shaded fixed gear areas represent areas that are only used by fixed gear fishermen during certain parts of the year; these areas are used during other times of the year by mobile gear fishermen through informal cooperative agreements between fishermen. See Section 530.4 for further discussion of mobile gear fisheries, and Section 530.7 for further discussion of recreational fisheries.

3. Figure 5.25 shows gillnetting areas based on NMFS Vessel Trip Report data. As noted above, gillnetting and lobstering are the two main types of fixed gear fishing in the Ocean SAMP area. NMFS requires commercial fishermen with federal-permitted vessels to submit one Vessel Trip Report for each fishing trip; each VTR includes self-reported location information about the trip. It is important to note that no Vessel Trip Report data, or equivalent data, are available for lobstering. NMFS does not collect VTRs from lobstermen because the lobster fishery is managed by the ASMFC (see Section 510.2.1). Whereas RIDEM collects logbook data from lobstermen, these data include location information reported by statistical area, not by latitude/longitude or Loran, which do not allow for a fine-resolution analysis of lobstering activity. See Section 530.3.2 above and Appendix B for further discussion of data sources and methodology.

4. In Figure 5.25, darker-shaded areas represent the areas with a higher density of gillnetting activity. This map reveals that some gillnetting is concentrated in a couple of areas just outside the mouth of Narragansett Bay, whereas other gillnetting activity is concentrated much further offshore in the waters southeast and east of Block Island and in the Cox Ledge area. It is difficult to accurately compare Figures 5.24 and 5.25 given the absence of VTR lobstering data.

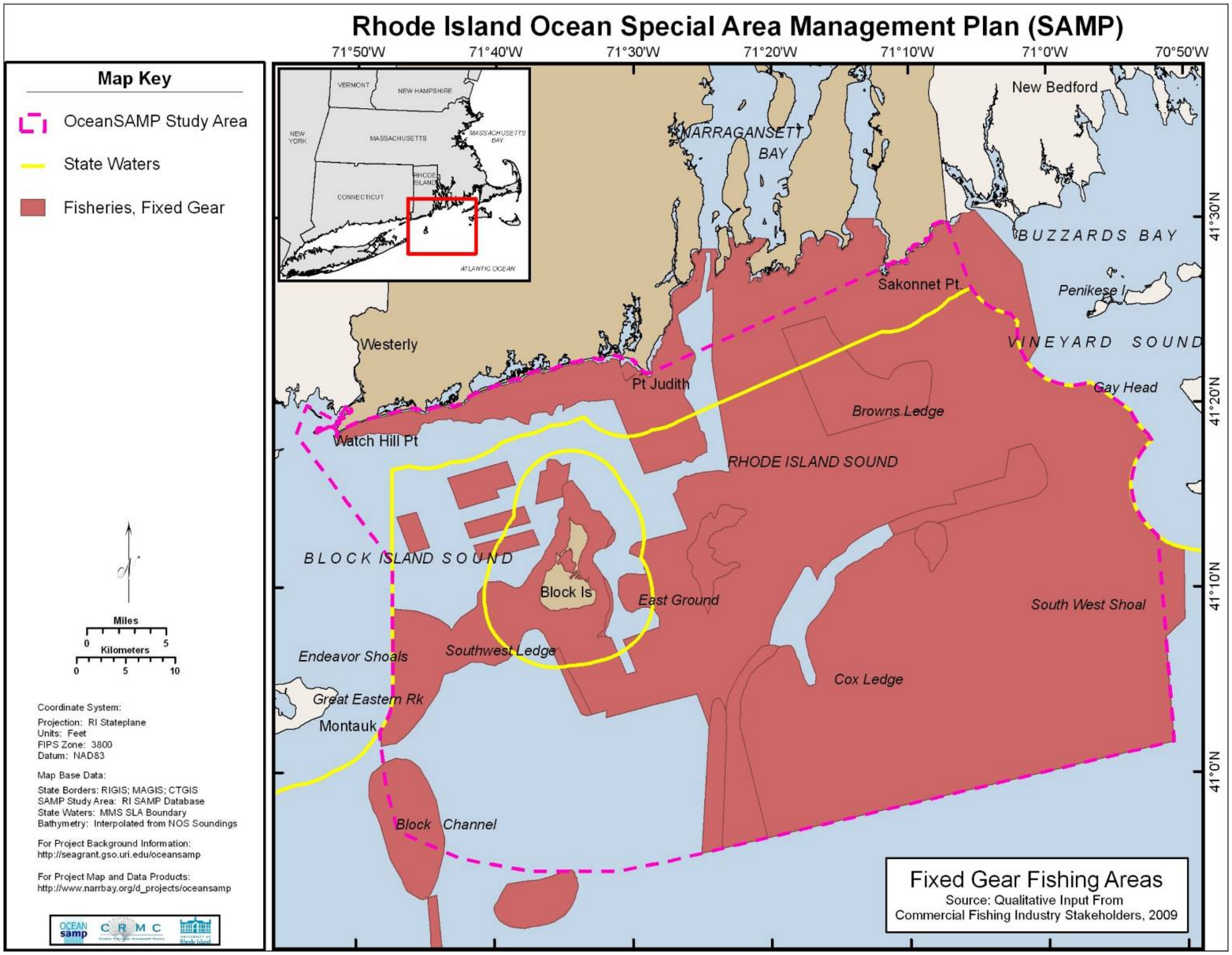

Figure 5.24. Fixed gear fishing areas based on qualitative input.

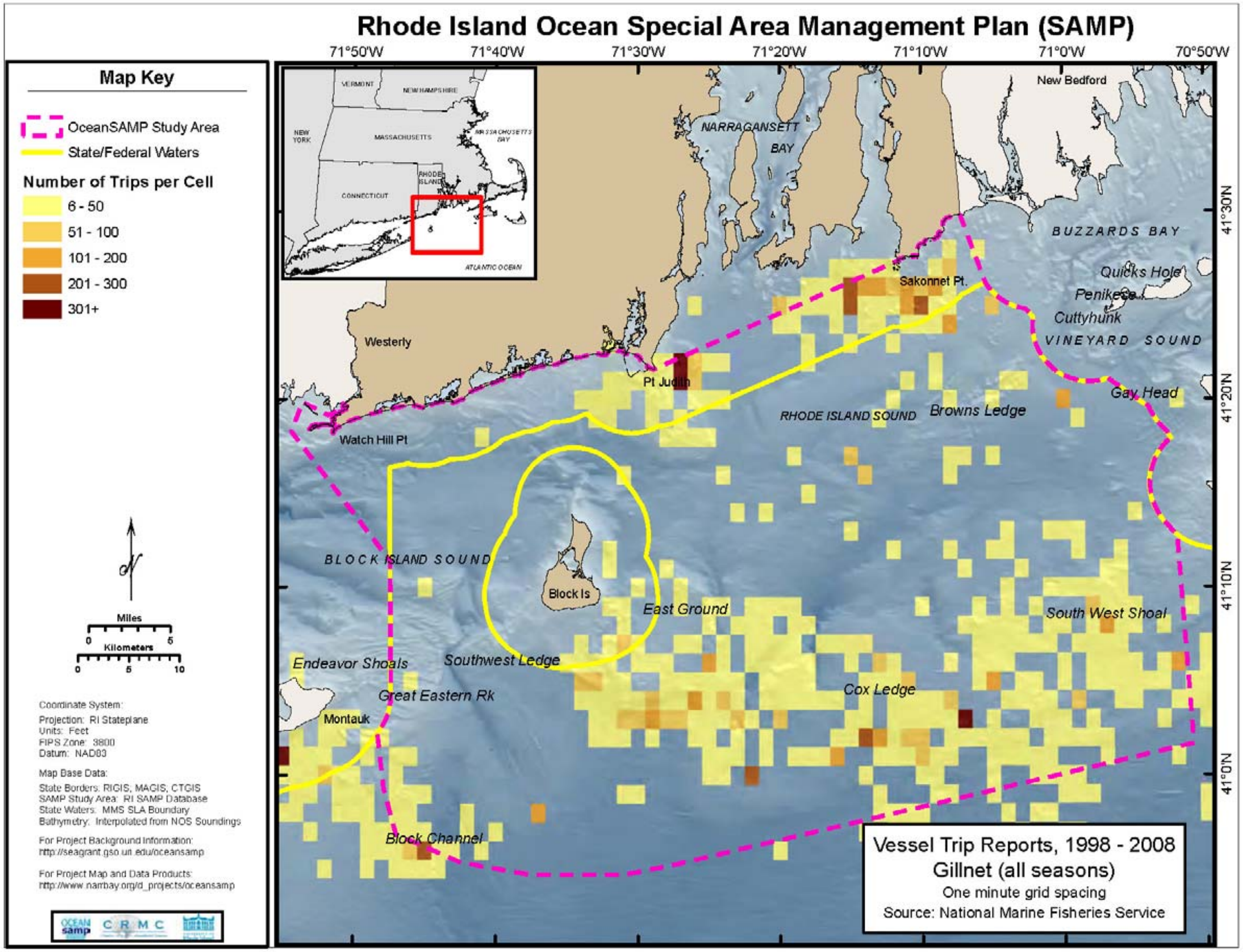

Figure 5.25. Gillnetting areas based on NMFS Vessel Trip Reports, 1998 - 2008

530.6. Rhode Island Commercial Fisheries Effort and Landings

530.6.1. Rhode Island Commercial Fisheries Landings

1. Commercial fisheries landings data presented below are provided by the National Marine Fisheries Service, Fisheries Statistics Division. Landings data for the state of Rhode Island is dealer-reported; seafood dealers within the state report twice per week to the Standard Atlantic Fisheries Information System (SAFIS) on the pounds and ex-vessel dollar value of landings sold at each dealer.[10] These data encompass all landings taking place at Rhode Island ports. Vessels based in Rhode Island may at times land their catch outside of the state, in New Bedford, for example. Likewise, some of the landings in Rhode Island may be from vessels based outside of the state; during the winter months, boats from New Jersey and other Mid-Atlantic states will fish in Rhode Island waters, and land their catch here. Landings data do not include where the catch was actually harvested. Thus, it is not possible to differentiate among catch from within the Ocean SAMP area or outside of the Ocean SAMP area.

2. Much of the effort data provided here, given as the numbers of trips taken by vessels and the number of trips on which vessels caught certain species, are provided only for Rhode Island state fishing licenses. This means these data include only vessels targeting certain species managed at the state level, such as lobster and herring, or vessels fishing only within state waters (within three miles of shore). Thus, much of the activity taking place within the Ocean SAMP area, including fishing done through federally-permitted vessels and fishing done by out-of-state vessels, is not encompassed in this effort data provided below. In lieu of effort data for federal waters, included below are federal data on the pounds and dollar value of Rhode Island landings, broken down by gear type, which provide some insight into fishing effort. These landings data reflect federally permitted vessels which land their catch in Rhode Island.

3. The top fishery in Rhode Island averaged for the years 1999-2008 by weight was Atlantic herring, followed by *loligo* (longfin) squid and Atlantic mackerel (see Table 5.34).[11] The squid fishery in Rhode Island has been and continues to be an important and profitable fishery in the state. Herring and mackerel are taken in midwater trawls, and are part of an important fishery occurring within the Ocean SAMP area. The next species by weight is skates, which are taken in large numbers but are often considered a trash fish or used as bait (little skate and winter skate are also listed individually; the skates category includes both species, and if the three are combined, the average landings are more than those for mackerel). Of all Rhode Island commercial fisheries, finfish caught in Narragansett Bay account for only 5%, meaning the remaining 95% of finfish landings were caught in the Ocean SAMP area or beyond. Likewise, Narragansett Bay accounts for about 10-25% of

[10] The Standard Atlantic Fisheries Information System (SAFIS) is an electronic reporting system developed by the National Marine Fisheries Service (NMFS) and the Atlantic Coastal Cooperative Statistics Program.

[11] "Other shellfish" is the term used by NMFS to report some shellfish landings. NMFS landings data are sometimes classified broadly in this way (finfish or shellfish) in order to protect the confidentiality of dealers purchasing the species. See NMFS Fisheries Statistics Division. 2009. "Data Caveats." Online at http://www.st.nmfs.noaa.gov/st1/commercial/landings/caveat.html.

all lobster landings, leaving the remaining 75-90% to the Ocean SAMP area and further offshore (DeAlteris et al. 2000).

Table 5.34. Top landed species in Rhode Island by weight for 1999-2008.[12] (ACCSP 2010)
Note: Important species in the Ocean SAMP area are italicized. Average dollar value calculated based on each year's nominal landings value, which do not account for inflation.

Species	Average Pounds 1999-2008	Average Dollar Value 1999-2008	Number of Years Landed
Herring, Atlantic	19,426,667	$1,637,564	10
Squid, Longfin inshore	18,426,084	$14,018,015	10
Mackerel, Atlantic	7,623,878	$1,921,248	10
Skates	6,455,051	$627,053	10
Hake, Silver	6,290,385	$2,543,255	10
Goosefish (Monkfish)	5,148,746	$4,921,970	10
Lobster, American	4,340,526	$19,113,035	10
Scup	3,131,617	$2,381,122	10
Squid, Northern shortfin	3,089,620	$882,507	6
Skate, Little	2,374,344	$196,849	6
Flounder, Summer	2,158,836	$4,660,022	10
Butterfish	1,588,842	$680,673	10
Flounder, Winter	1,173,497	$1,599,963	10
Crab, Atlantic rock	952,517	$489,484	8
Flounder, Yellowtail	941,055	$1,067,699	10
Crab, Jonah	892,223	$471,098	10
Quahog, Northern	890,965	$5,675,621	10
Hake, Red	797,796	$191,042	10
Scallop, Sea	719,914	$4,847,792	10
Crab, Red	608,303	$452,849	6
Bluefish	553,631	$185,447	10
Crabs, Brachyura	484,718	$242,149	7
Cod, Atlantic	454,363	$511,321	10
Dogfish, Spiny	409,938	$71,208	10
Haddock	336,594	$369,411	10
Menhadens	326,289	$38,916	10
Bass, Black sea	315,991	$758,978	10
Skate, Winter	217,973	$42,254	6
Bass, Striped	202,593	$540,829	10
Surfclam, Atlantic	181,261	$6,272	1
Flounder, Witch	168,881	$211,958	10
Plaice, American	119,517	$118,531	10
Clam, Soft	102,742	$711,869	10

5. Figures 5.26 and 5.27 below show average landings of species both by pounds and by value for all of Rhode Island for the years 1999-2008. Landings by pounds are dominated

[12] Includes all species landed in Rhode Island for 1999-2008 where average pounds landed over the ten year period is more than 100,000. Some species included here are primarily caught outside of the SAMP area.

by Atlantic herring, followed by longfin (*loligo*) squid and mackerel. The most valuable landings for this period, on the other hand, were of lobster, followed by longfin squid. See Section 540.1 for more on the value of commercial fisheries landings within Rhode Island.

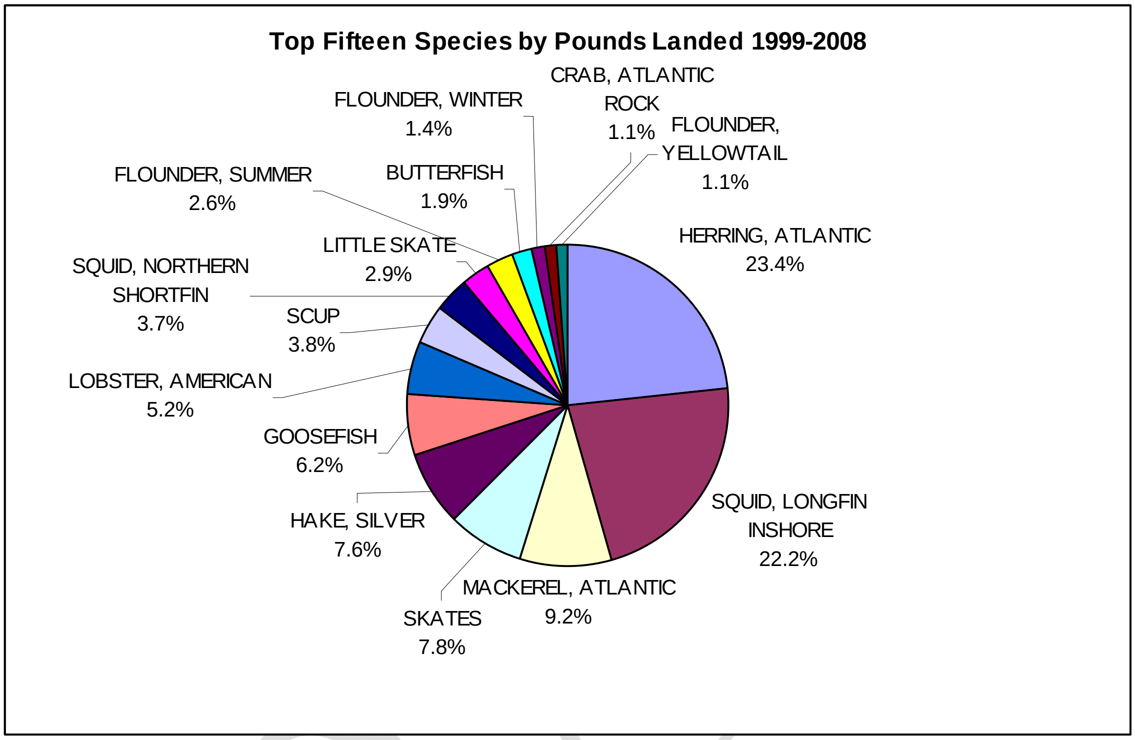

Figure 5.26. Top landed species in Rhode Island by weight, 1999-2008. (ACCSP 2010)

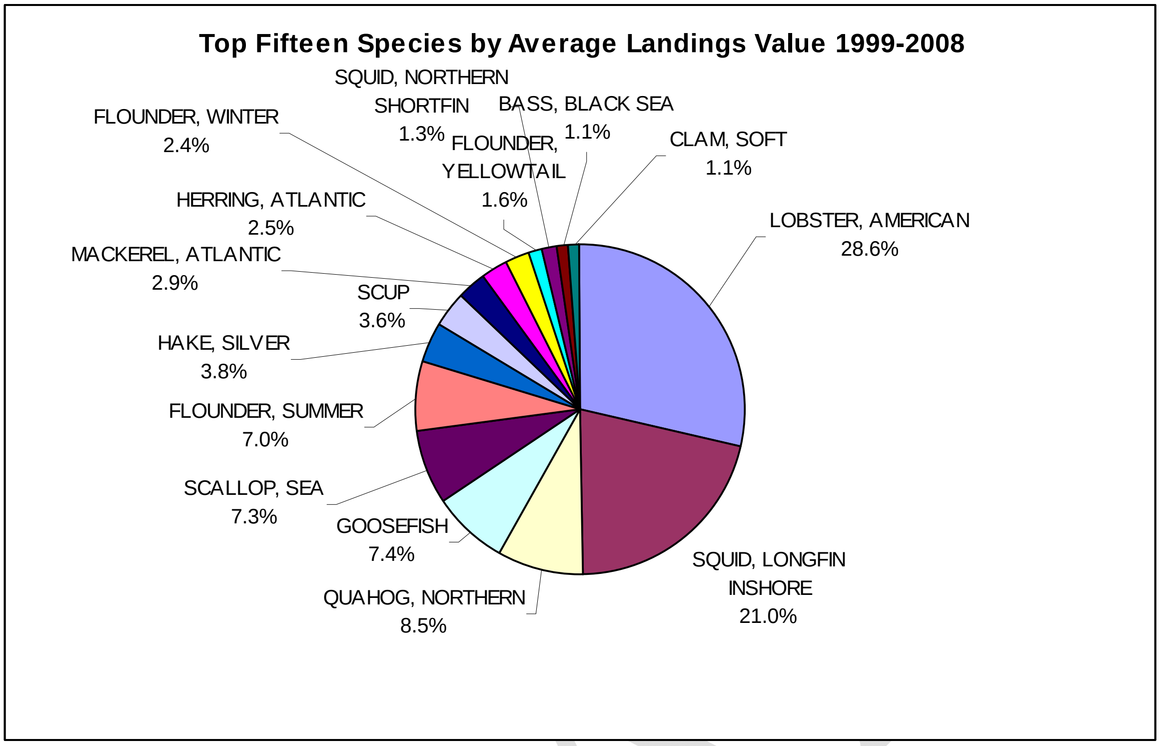

Figure 5.27. Top landed species in Rhode Island by dollar value averaged for 1999-2008. (ACCSP 2010) *Note: Average dollar value calculated based on each year's nominal landings value, which do not account for inflation.*

5. Figure 5.28 below shows a longer-term time series of total commercial fisheries landings by weight from 1970 - 2008. Landings increased to a high in the early and mid-1990s, and have been declining since then.

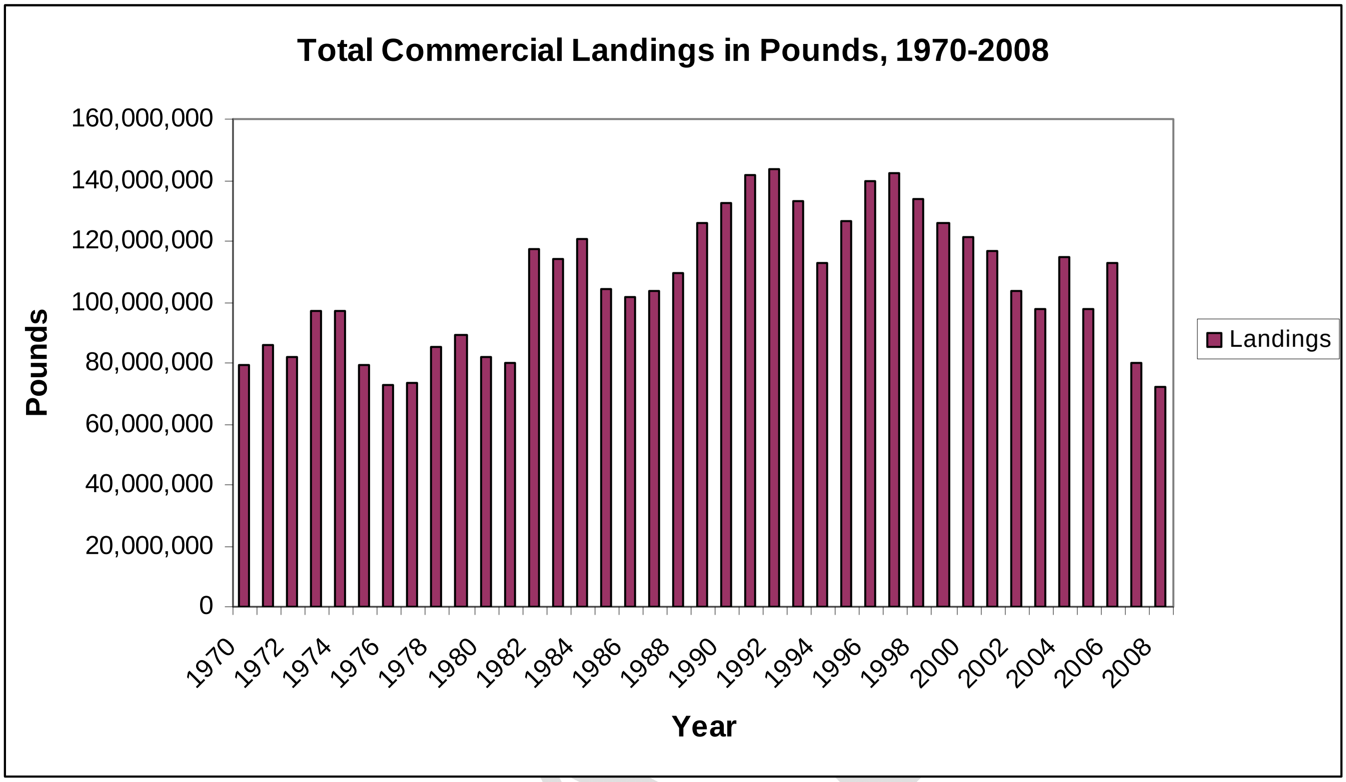

Figure 5.28. Rhode Island landings by weight, 1970-2008. (NMFS, Fisheries Statistics Division 2009a)

530.6.2. Rhode Island Commercial Fishing Effort

1. Commercial fisheries effort is defined as the amount of fishing activity that takes place within a specified period of time. Effort is typically quantified by the number of fishing trips, and/or the number of "days at sea" (as defined by the management regime, not a calendar day). Data provided below includes the numbers of trips on which various species were caught, indicating how often those species are harvested, although not necessarily how often they are targeted. Effort is also not indicative of the volume of catch. Data are also provided for the weight and dollar value for landings of various gear types, indicating which types of fisheries produce the greatest harvest and have the greatest economic value within the state. Some of the data provided below are only for state-licensed vessels, while others are for federally permitted fisheries.

2. Table 5.35 below lists species caught in 2007-2009 in NMFS statistical area 539 by vessels with state permits, and the number of trips within each month on which those species were caught. See Figure 5.29 for a map showing statistical area 539. Only species caught on an average of 50 or more trips in a given year are included. These data include only species landed with a state permit, and therefore include only species caught within state waters, including Narragansett Bay, and do not include species caught within federal waters of the SAMP area, or by vessels possessing federal permits. This means these data do not reflect the majority of activity taking place in the SAMP area. These numbers reflect effort, but not necessarily abundance, as certain fisheries may be closed during certain times of the year (e.g. monkfish, tautog), and effort may be shifted elsewhere during that month.

Table 5.35. Average number of trips on which species were landed (state data only), 2007-2009 (RIDEM 2010b).

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Summer Flounder	3	3	4	107	1,663	1,753	2,142	1,252	18	2	35	7	**6,989**
Lobster, American	215	115	122	225	479	1,050	1,624	1,279	650	428	394	317	**6,898**
Scup	2		2	66	364	388	1,126	957	812	383	82	8	**4,190**
Black Sea Bass	2	3	1	25	375	345	558	895	478	278	82	1	**3,044**
Striped Bass	1			9	60	1,299	93	71	451	108	4	2	**2,096**
Bluefish				2	100	272	308	319	230	124	41	7	**1,402**
Tautog	1			114	316	2	130	147	9	294	116	3	**1,131**
Skate	7	4	9	49	245	185	132	71	38	24	26	8	**798**
Winter Flounder	11	2	6	89	246	86	56	24	21	18	28	10	**598**
Squid, Loligo	11			19	174	84	54	35	12	5	21	7	**422**
Conger Eel	2	4	2	3	11	16	70	153	80	59	16	1	**418**
Butterfish	6			8	100	69	43	14	14	8	19	3	**284**
Gray Triggerfish						11	71	85	64	26	1		**258**
Monkfish	3	2	4	7	48	49	30	12	6	11	26	5	**200**
Menhaden				15	45	61	35	20	10	5	4	3	**199**
Sea Robin				11	73	49	36	17	4	1	3	3	**198**
American Eel			2	4	28	17	14	25	33	27	13	11	**174**
Spiny Dogfish					50	58	32	12	8	3		1	**163**
Crab, Jonah	7	3	7	9	16	23	22	18	19	12	9	6	**151**
Weakfish				7	31	22	19	13	9	6	3		**110**
Crab, Rock	1	2	2	5	10	15	22	16	12	6	4	4	**98**
Smooth Dogfish				2	30	30	16	8	7	1			**95**
Windowpane Flounder	2		1	19	43	11	8	1	7		1		**92**
Cunner					5	3	6	25	21	17	5		**84**
Hickory Shad				3	12	26	25	12	5	2			**83**
Bonito						7	16	27	20	13			**82**
Cod	5	3	7	11	11	4	6	4	4	4	13	5	**77**
Winter Skate	1			5	12	15	6	13	6	3	7		**68**
False Albacore							1	14	39	13			**67**
Crab, Green				3	5		3	1	6	23	13	2	**55**
Red Hake		3	2	1	12	17	4	2	3	4	5	2	**54**
Horseshoe Crab			5	14	21	7	1	1	1	1			**51**
Silver Hake	7	1			10	13	8	2	1		4	4	**50**

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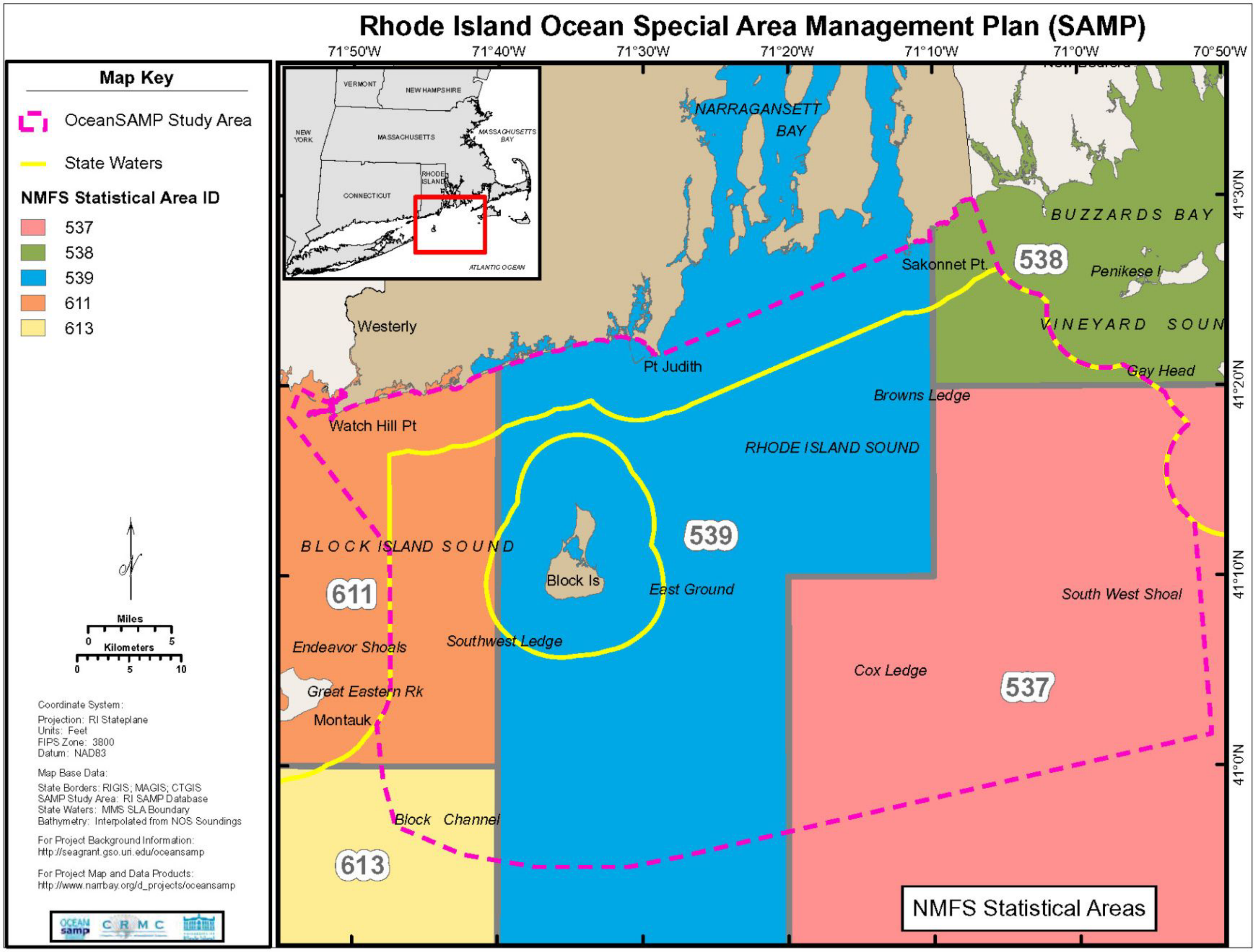

Figure 5.29. NMFS Statistical Areas.

3. Prior to 2007, RI DEM only collected data on lobster trips; these data are available from 2003 to 2006. In 2003, 8,964 lobster trips took place in NMFS Statistical Area 539; 8,812 trips in 2004; 10,226 trips in 2005; and 10,797 trips in 2006 (RIDEM 2010b). Though these data represent too few years to indicate a trend, they suggest a short-term increase in the number of lobster trips in Area 539.

4. Table 5.36 and Figure 5.30 below show what types of fishing gear have been used most commonly by Rhode Island fishermen over the last decade, and how much they land for each gear type, both by pounds and the dollar value of landings. The gear used by Rhode Island fishermen to catch the most fish by weight is the otter trawl, and the value of species landed by otter trawl is the highest among all gear. In addition to the groundfish species such as cod and flounders landed with an otter trawl, the small-mesh net otter trawl is used in Rhode Island's squid fishery, which is why this gear represents more than 50% of landings by weight. The next gear type weight is the paired midwater trawl, followed by pots and traps (other), which may include some lobster landings as well as squid landings. Ranked second by value of landings among gear types is inshore lobster pots and traps, which averaged over $9 million in landings over this time period.

5. Of the gear types listed below, most are used either predominantly or partially in the Ocean SAMP area. Most of the lobster traps are fished in the Ocean SAMP area, and fish pots and gillnets occur almost exclusively in the Ocean SAMP area.[13]

Table 5.36. Rhode Island landings by gear type, 1999-2008. (NMFS, Fisheries Statistics Division 2009a) *Note: Average dollar value calculated based on each year's nominal landings value, which do not account for inflation.*

Gear	Average Landings in Pounds 1999-2008	Average Dollar Value of Landings 1999-2008
Otter Trawl, Bottom, Fish	59,131,329	$29,159,418.80
Trawl Midwater, Paired	10,380,727	$686,795.60
Pots And Traps, Other	9,968,096	$6,567,691.60
Not Coded/Other	7,898,880	$9,646,535.00
Otter Trawl, Midwater	7,649,674	$480,073.40
Gill Nets	4,245,477	$3,386,439.60
Pots And Traps, Lobster Inshore	2,446,071	$9,148,139.80
Dredge, Clam	1,874,640	$1,095,295.80
Pots And Traps, Lobster Ofshore	1,780,073	$5,687,875.70
Dredge, Other	1,775,492	$4,312,557.70
Floating Traps (Shallow)	983,610	$776,261.70
Rakes	812,491	$4,556,840.90
Lines Hand, Other	654,659	$1,144,331.30
Pound Nets	364,243	$297,889.00
Purse Seines	297,909	$12,837.30
Long Lines	275,902	$636,117.20
Pots And Traps, Fish	186,843	$237,619.80
Dredge, Sea Scallop	173,667	$947,181.00

[13] NMFS and RI DEM use different categories for differentiating fishing activity by gear type (see Table 5.36 below). For this reason it is not possible to accurately compare federal and state data by gear type.

Diving Outfits, Other	171,106	$856,444.80
Lines, Troll, Other	62,752	$21,311.30
Hoes	61,181	$351,099.00
Tongs	38,513	$214,584.30
By Hand, Other	35,083	$90,976.00
Otter Trawl, Bottom, Other	28,628	$52,474.60

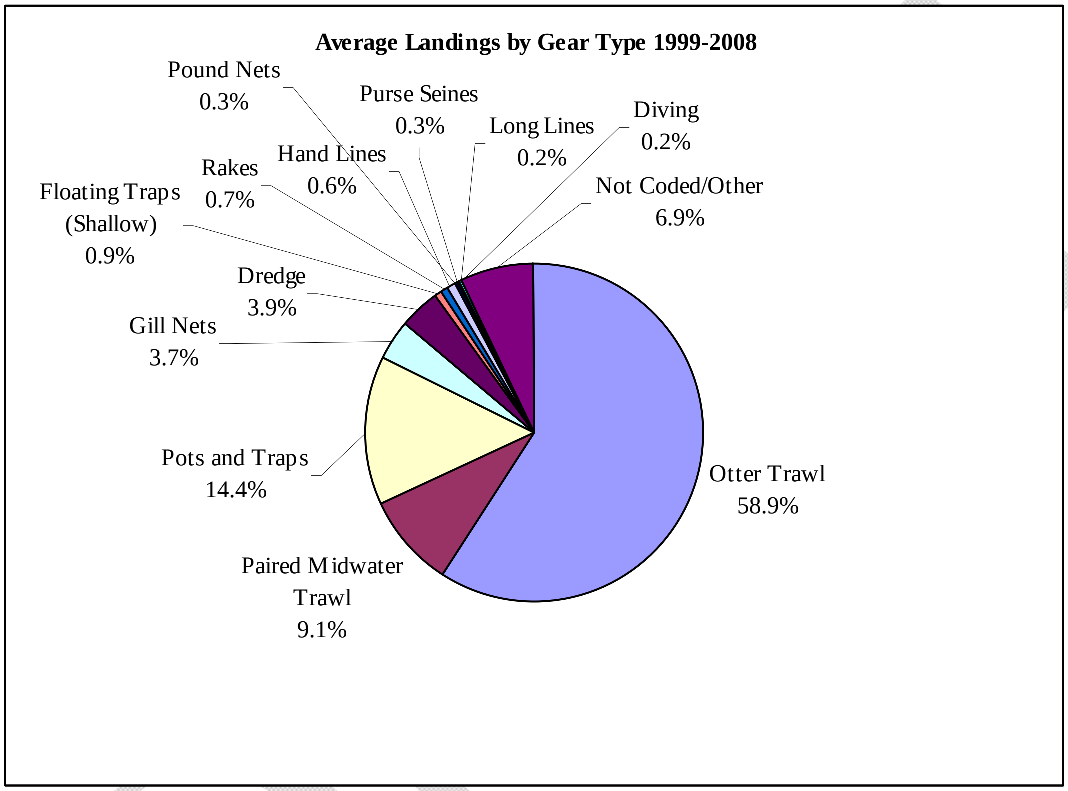

Figure 5.30. Rhode Island landings in pounds by gear type for 1999-2008. (NMFS, Fisheries Statistics Division 2009a)[14]

6. Table 5.37 below displays average commercial fishing effort for 2007-2009 in NMFS Statistical Area 539 for vessels with state permits. This table shows the number of trips per month by gear type, this time broken out into the number of fishing trips taken with each gear type for each month. These data show that commercial rod and reel trips were most prevalent during 2007-2009, and lobster trips were the second most common type of commercial fishing activity. As stated above, these data are only for state fisheries, and include fishing effort within Narragansett Bay. These numbers indicate the frequency with which these gear types are used, which is very different than the above table illustrating the pounds of fish taken by each gear type, and the value of the landings taken with each gear type.

[14] Some gear types are combined in this figure, and gear types with fewer than 500,000 pounds of landings are excluded.

Table 5.37. Average number of trips per month by gear type, 2007-2009 (state fishing licenses only).[15] (RIDEM 2010b)

Gear Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Rod & Reel	3	3	7	49	1057	2546	2085	1542	974	544	144	8	**8962**
Pots & Traps (Lobster)	207	112	119	209	423	959	1496	1201	642	430	384	314	**6496**
Pots & Traps (Fish)	2	2	2	7	115	191	544	555	464	263	50	4	**2198**
Gillnet	2	1	6	97	455	247	208	121	38	55	29	4	**1262**
Otter Trawl	18	9	9	28	238	216	237	154	54	26	40	20	**1050**
Floating Fish Trap				19	95	77	69	54	35	19	2		**370**
Other	6	7	8	27	37	50	39	26	20	18	20	6	**262**

[15] 2007 is the most recent data provided by RI DEM and the only year for which complete finfish and crustacean data are available. RI DEM did not collect data on species other than lobsters prior to 2007. Please note that monthly effort is affected by closures and other regulatory measures. .

530.7. Contemporary Recreational and For-Hire Fishing

530.7.1. Description

1. Recreational fishing, which here includes both recreational fishing that takes place aboard for-hire party and charter boats as well as recreational anglers from shore or aboard private boats, has a long history in Rhode Island. Marine recreational fishing is a major recreational activity for Rhode Islanders as well as a major tourist attraction that brings in visitors from out-of-state. Recreational fishing also has a significant economic impact on the state, which is discussed below in Section 540.2. Recreational fishing in the Ocean SAMP area is done both from shore and by boat, including both private vessels and party and charter boats. Whereas there is a great deal of recreational fishing that takes place within Narragansett Bay, this section is focused primarily on fishing that takes place outside of the Bay in offshore waters.

2. Recreational fishermen, or anglers, who fish aboard private vessels or from shore, are regular users of the Ocean SAMP area. According to NMFS, the most common recreationally targeted species in marine waters in RI include Atlantic bonito, Atlantic cod, black sea bass, bluefish, scup, striped bass, summer flounder, tautog, winter flounder, and yellowfin tuna (NMFS 2008b). A different recreational fishing study, commissioned by the RIDEM, found striped bass and bluefish to be the two most popular species targeted by recreational anglers in Rhode Island. This survey includes anglers fishing both within and outside of Narragansett Bay. The most popular shore sites for fishing according to this survey were all bordering along the Ocean SAMP area, and include shore sites in Narragansett, Newport, and Jamestown (RIDEM 2006).

3. Some recreational fishermen who fish in the Ocean SAMP area only fish there occasionally, while others are regular users of the area. The Rhode Island Saltwater Anglers Association (RISAA), which is the largest recreational fishing organization in the state, estimates that of its 1,800 members, approximately 30% fish outside of Narragansett Bay in the Ocean SAMP area on a regular basis – roughly once a week - whereas 70% of their members fish in the Ocean SAMP area at least once a year. RISAA further estimates that there are recreational fishing vessels from every RI coastal town that use the Ocean SAMP area. Almost half of all boaters who use the Ocean SAMP area launch their boats directly from Point Judith boat ramps (Hittinger, pers. comm. a).

4. Recreational fishermen may also participate in organized fishing tournaments. RISAA currently sponsors 15 special fishing tournaments each year. According to RISAA, of these events, the Fluke, Team Fluke, Junior Catch and Release All-Species, Cod, Black Sea Bass, Bluefish/Striped Bass Combo, and Fall Bluefish/Striper Catch and Release tournaments all involve a significant amount of fishing in the Ocean SAMP area. In addition, RISAA sponsors a “Yearlong Tournament” which targets 15 different species. According to RISAA, of these species, the cod, haddock, striper, false albacore, bonito, pollock, tuna, mahi mahi, and fluke categories are usually won by a fish caught in the Ocean SAMP area (RISAA 2010; Hittinger, pers. comm. b).

5. Most of the RI-based party and charter boats that run fishing trips regularly operate in the Ocean SAMP area. Charter boats are for-hire vessels operated by a licensed captain and crew, usually carrying up to six passengers who have hired out the boat for the entire trip. A party or head boat, on the other hand, is typically a larger vessel where passengers pay individually for a space fishing on the vessel. The Rhode Island Party and Charter Boat Association has 70 members, and there are other charter boats in Rhode Island that are not a part of the association (Bellavance pers. comm.). However, many of the boats belonging to the association and most of the boats that are not members fish only on a limited basis. One member of the association estimated that about 30 party and charter boats are actively fishing, each making at least 30 trips each year (Donilon, pers. comm.). All of these vessels fish within the Ocean SAMP area for most or all of the year, although they move to different fishing grounds based on the time of year and the species they are targeting. The vast majority of the charter boats are based in Galilee, with one or two in Watch Hill, and one or two located further up in Narragansett Bay. The charter boats located in the Upper Bay often fish in the Bay instead of going out to the Ocean SAMP area, but they do fish in the Ocean SAMP area, as do the boats in the Lower Bay (Rainone, pers. comm.).

6. Table 5.38 below lists the number of charter and party boat licenses issued each year since 1999, when the licensing program took effect. The license is for two years; thus in 2009, there are 240 active charter and party boat licenses within the state of Rhode Island, reflecting those issued in 2008 - 2009.

Table 5.38. Party and charter boat licenses issued by year. (RIDEM 2010b)

Year	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Licenses	90	21	31	24	29	27	36	63	167	94	146

7. There are five party boats fishing out of Rhode Island, all of them based in Galilee. The larger party boat operation runs about 700 trips each year, and carries approximately 18,000 passengers a year (Blount, pers. comm.).

530.7.2. Recreational Fishing Catch and Effort Data

1. Recreational fishing catch, effort, economic impact, and activity areas are generally more difficult to characterize than those of commercial fishing because, generally speaking, less information on recreational fishing is collected and published by federal and state regulatory agencies. This is in part because there is no federal recreational fishing licensing program currently in place in the northeastern U.S., though it should be noted that the National Saltwater Angler Registry and the Rhode Island Recreational Saltwater Fishing License Program, both of which took effect in 2010, are both designed to improve recreational fishing data collection.[16]

2. This section and Section 540.2, below, include the most recent and best available existing data and information that has been published to date by federal and state agencies and

[16] See https://www.countmyfish.noaa.gov/index.html for further information on the National Saltwater Angler Registry and http://www.dem.ri.gov/programs/bnatres/fishwild/reclic.htm for further information on Rhode Island's Recreational Saltwater Fishing License Program.

other parties. Recreational data sources used here and in Section 540.2 include the NMFS Marine Recreational Fisheries Statistics Survey program (MRFSS) (updated through 2008). The MRFSS program provides data extrapolated from surveys administered to a sampling of recreational fishermen. The MRFSS program consists of two independent surveys - an intercept survey of marine anglers at fishing access sites, and a random digit dial telephone survey conducted in coastal counties. Survey results are then extrapolated to estimate fishing effort across the nation. Because of these methods and the associated margin of error, these data should be viewed as estimates, rather than verifiable facts. Moreover, the MRFSS data must be interpreted with additional caution, as methodological issues have recently been identified with the program's survey methods, such that NMFS is developing a new program to gather data on recreational fishing.[17] However, because the MRFSS data are among the few available datasets to characterize recreational fishing, they may be considered the best available data and are included here for illustrative purposes. In this section and Section 540.2 below, MRFSS data are supplemented with other data and information provided in recent surveys and reports, though it should be noted that these documents and all other sources should also be viewed with caution insofar as they include survey-based estimates of recreational fishing activity.

3. Figure 5.31 and Table 5.39 below show average estimated recreational catch, by species, for 1999 – 2008, as illustrated by MRFSS data. These data include only fish caught in the ocean waters, including both federal and state waters, and not fish caught within Narragansett Bay. Striped bass and summer flounder (fluke) are the two most commonly caught species, followed by bluefish and scup. Although bluefish and striped bass are often cited as the two most commonly targeted recreational species within the state, much of the fishing for these species takes place within the waters of Narragansett Bay. These data are only projected estimates of catch, and have a large standard error associated with the projected numbers.

[17] In 2006 the National Research Council studied the MRFSS program and identified several problems with the program, including issues a lack of resources and problems with the sampling and survey methods. See National Research Council. 2006. "Report in Brief: Review of Recreational Fisheries Survey Methods." Online at http://dels.nas.edu/dels/rpt_briefs/rec_fish_brief_final.pdf. Because of these issues, the MRFSS program will be replaced with the Marine Recreational Information Program (MRIP).

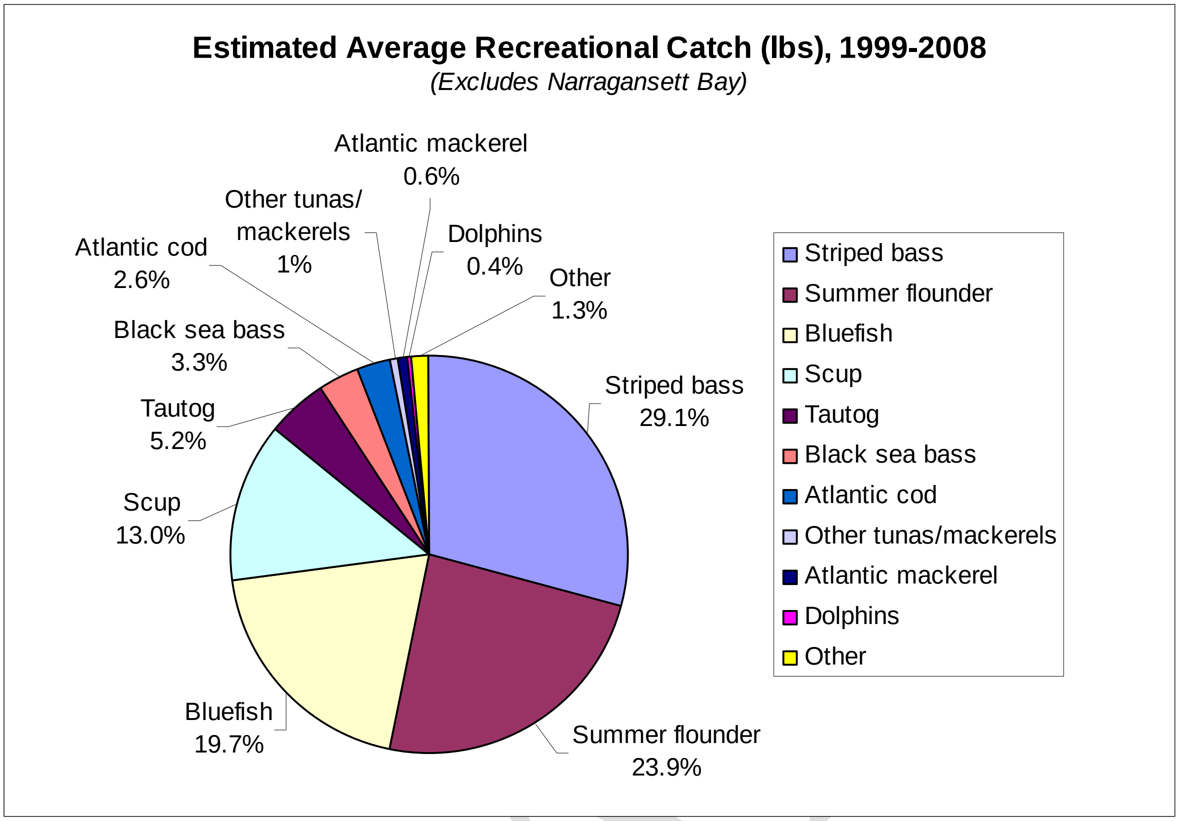

Figure 5.31. Estimated average recreational catch by species, 1999-2008, based on MRFSS data. (Pers. comm., NMFS Fisheries Statistics Division, MRFSS, 2010)

Table 5.39. Estimated average recreational catch, 1999-2008, based on MRFSS data. (Pers. comm., NMFS Fisheries Statistics Division, MRFSS, 2010)

Species Name	**Average catch (lbs)**
Striped bass	835,941
Summer flounder	687,416
Bluefish	566,135
Scup	374,226
Tautog	149,944
Black sea bass	94,146
Atlantic cod	74,431
Other tunas/mackerels	22,096
Atlantic mackerel	18,499
Dolphins	12,493
Winter flounder	11,650
Little tunny/Atlantic bonito	8,573
Other sharks	4,234
Other fishes	2,612
Dogfish sharks	1,953
Weakfish	1,721
Skates/rays	1,468
Cunner	1,197
Herrings	1,085
Other cods/hakes	853
Red hake	678
Pollock	652
Triggerfishes/filefishes	574
Sea robins	345
Other jacks	266
Spanish Mackerel	130
Sculpins	29
Eels	20
King mackerel	7
Other flounders	2

4. According to the MRFSS program, it is estimated that during 1999-2008, an average of nearly 385,000 people participated in recreational ocean fishing in RI each year, making over 785,000 fishing trips yearly. These figures include both RI residents and out-of-state fishermen; for this time period, an average of approximately 143,000 (37%) Rhode Islanders and 242,000 out-of-state residents (63%) fished in RI ocean waters. These data include only recreational fishing in ocean waters, including both federal and state waters, and not fishing within Narragansett Bay. As these figures are estimates, they vary considerably from year to year. Figure 5.32 and 5.33 below show the number of trips and participants from 1999-2008, as well as the annual breakdown of participants by residency. Together, these figures show that while the number of trips varies year to year, participation in recreational fishing has generally been growing over the past decade. Figure 5.33 also illustrates how out-of-state fishermen consistently comprise the majority of recreational fishermen fishing in RI ocean waters. For more information on the economic impact of these activities, see Section 540.2 below.

5. Figure 5.34 shows the breakdown of recreational fishing trips by mode. These data include only recreational fishing in ocean waters, including both federal and state waters, and not fishing within Narragansett Bay. Shore-based fishing makes up nearly 50% of recreational ocean fishing trips in Rhode Island. Fishing by private boat, whether owned or rented, makes up over 45% of saltwater fishing trips within the state, and many of these trips will take place in the Ocean SAMP area. Party and charter boat fishing (for-hire fishing), while having the smallest number of trips of the three fishing modes surveyed, occurs almost entirely in the Ocean SAMP area.

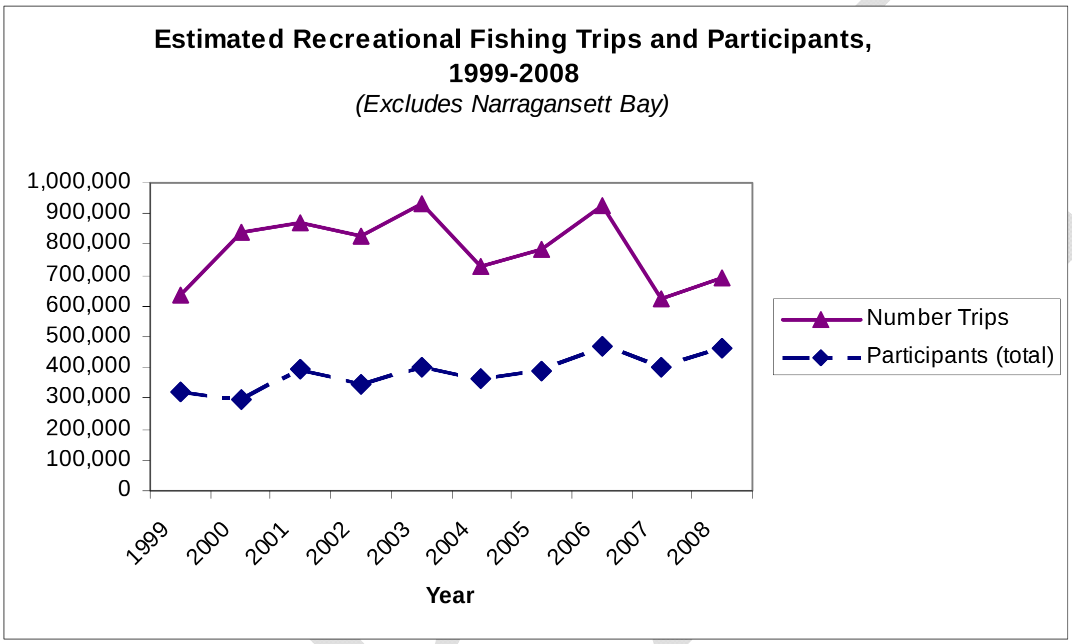

Figure 5.32. Estimated recreational fishing trips and participants, 1999-2008. (Pers. comm., NMFS Fisheries Statistics Division, MRFSS, 2010)

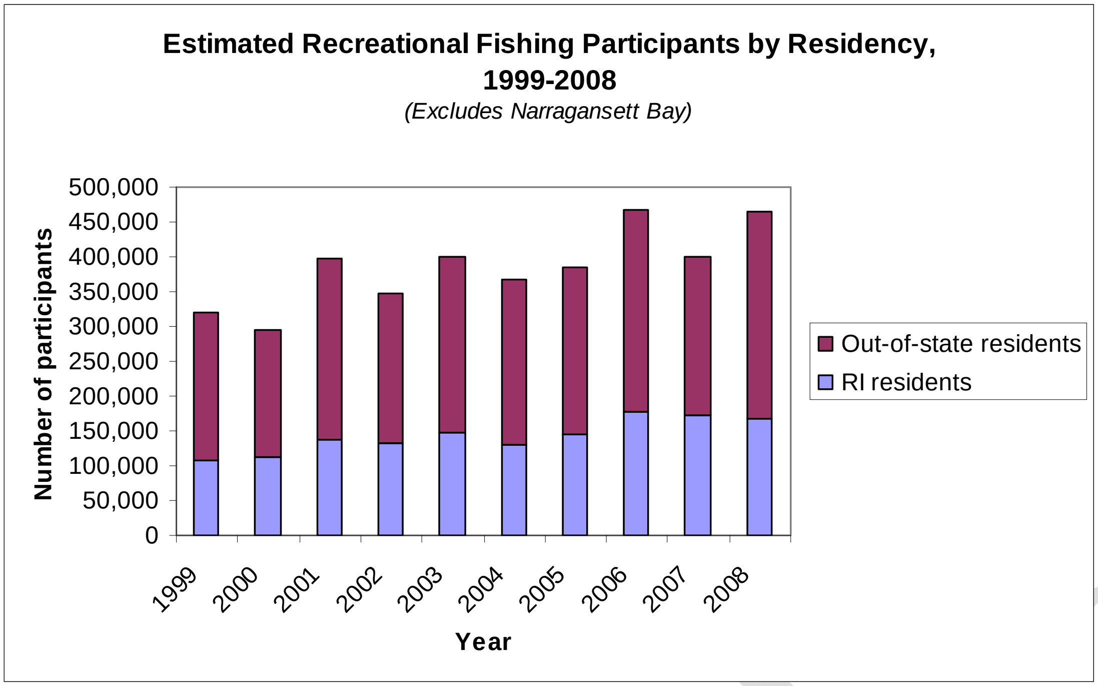

Figure 5.33. Estimated recreational fishing participants by residency, 1999-2008. (Pers. comm., NMFS Fisheries Statistics Division, MRFSS, 2010)

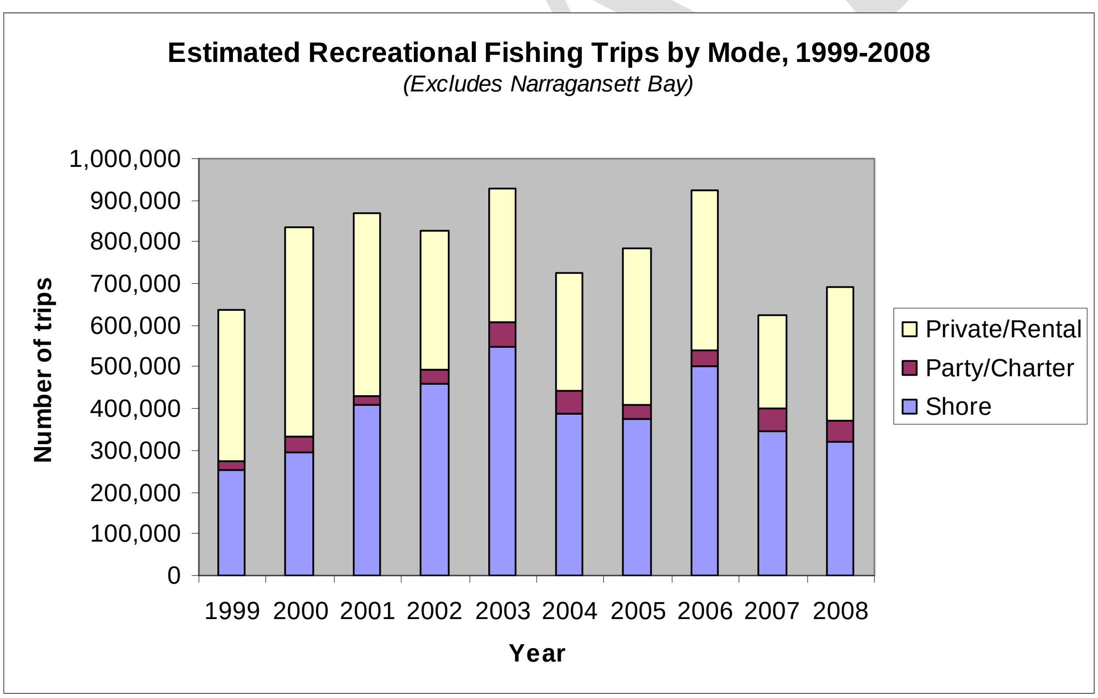

Figure 5.34. Estimated recreational fishing trips by mode, 1999-2008, based on MRFSS data. (Pers. comm., NMFS Fisheries Statistics Division, MRFSS, 2010)

530.7.3. Recreational and For-Hire Fishing Activity Areas

1. Recreational fishing takes place throughout much of the Ocean SAMP area. For the Ocean SAMP, recreational fishing has been characterized primarily through qualitative input from recreational fishermen. Figure 5.35 shows areas based on qualitative input from fishermen. Recreational fishing areas shown on this map represent both private recreational fishing and recreational fishing aboard for-hire party and charter boats. See Appendix B for the methodology used to develop these maps. It should be noted that fishermen involved in this mapping effort clearly indicated that all state waters surrounding Block Island were heavily used for recreational fishing. Other fishing areas of particular importance to recreational fishermen are the waters southwest of Block Island, including Southwest Ledge, and Cox Ledge. Like commercial fishing, recreational fishing effort varies widely throughout the year, and from year to year, depending on the individual fishermen, vessel type, target species, regulatory environment, and seasonal migrations of target species.

2. During the spring, Rhode Island-based party and charter boats are almost exclusively targeting cod, which have started to make a recovery to numbers suitable for recreational fishing. Most fishing for cod is done on Cox Ledge and south of Block Island. During the summer, most recreational fishing is focused on striped bass and bluefish, with some boats targeting fluke closer to shore. Later in the summer, some of the recreational fishing boats will move further offshore to target sharks, which are generally caught anywhere from 20 to 50 miles offshore. Sharks targeted include blue, mako, thresher, and hammerhead sharks, and most shark fishing is catch and release. Some tuna fishing also takes place within an area east of Block Island and northwest of Cox Ledge known as the Mud Hole (often called Deep Hole by commercial fishermen). Starting in September, much of the fishing switches to sea bass and scup around Block Island, or to striped bass closer to shore at that time of year.

3. Some out-of-state party and charter boats from Connecticut, Massachusetts, and New York also regularly fish within the Ocean SAMP area. Some of these boats fish in Rhode Island state waters surrounding Block Island, target striped bass on Southwest Ledge off the southwest corner of the island and summer flounder in various areas around the island. Some of these boats also fish for scup, black sea bass, and tuna in federal waters south of Block Island (Bellavance, pers. comm.).

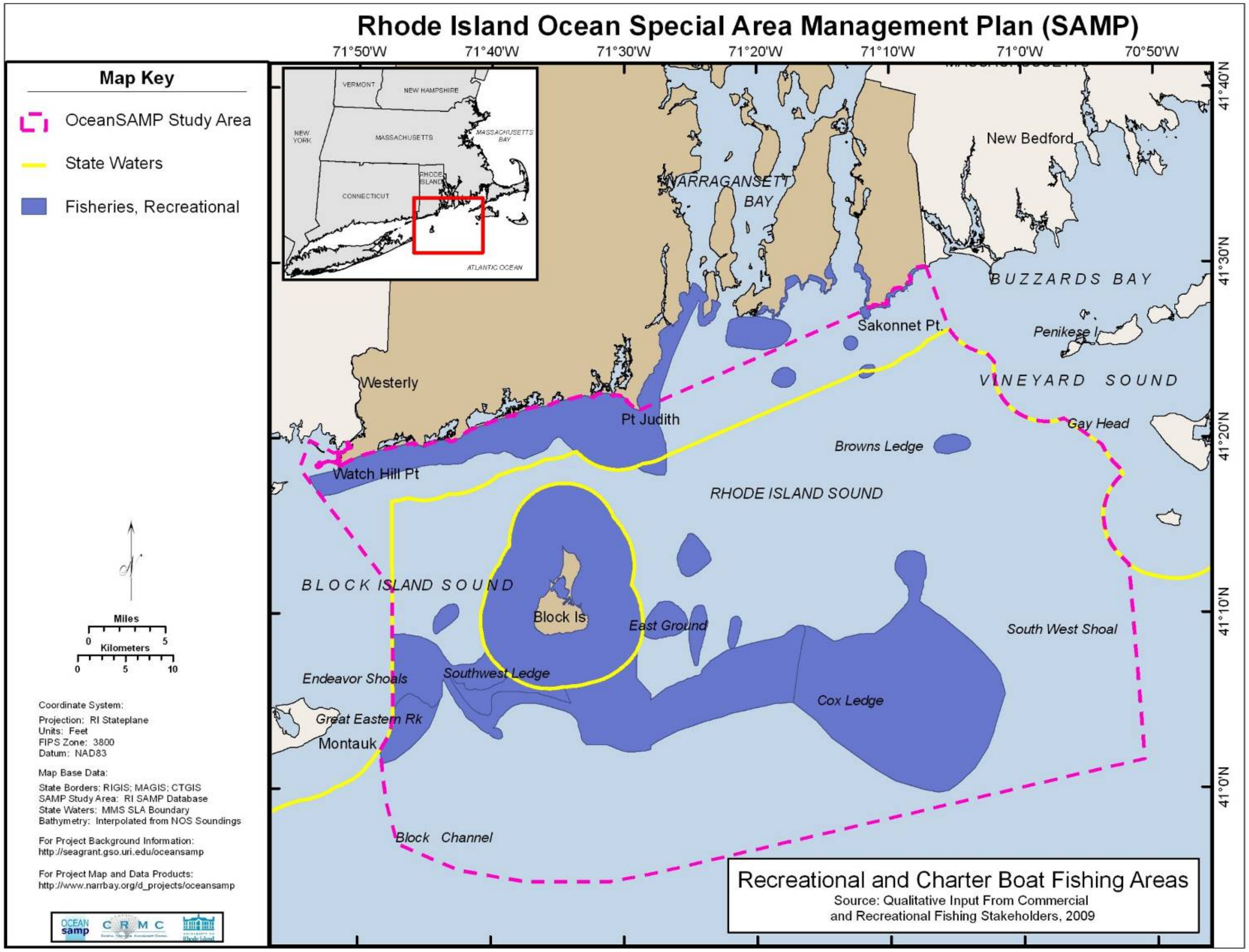

Figure 5.35. Recreational and charter boat fishing areas based on qualitative input.

Section 540. Economic Impact of Commercial and Recreational Fisheries

1. Commercial and recreational fisheries are both significant contributors to Rhode Island's economy. However, it is not possible to directly and accurately compare the values of commercial fisheries and recreational fishing. For commercial fisheries, the value of the fishery is primarily determined by the value of the fish landed within the state, regardless of where the fish were caught. Some economic analyses of commercial fisheries may also consider related activities, such as seafood processing and distribution, employment, and the multipliers associated with commercial fishing. By contrast, recreational fishing cannot be assessed by fish landed as many fish are not landed at all (but are caught through catch-and-release fishing), and none are sold on the market. Instead, the economic value of recreational fishing is in the act of fishing itself, and as such is measured by assessing the industry itself – i.e. income and employment associated with charter boat businesses, boat manufacturers, and tackle shops.

540.1. Commercial Fisheries Landings Value and Economic Impact

1. Commercial fishing is an important contributor to the state's economy. The economic contribution of commercial fishing is determined by the landings values of the fish landed within the state, the export of fisheries products, the impact of processing, distribution, and retail, the resulting employment, and other factors. The section below includes discussion of the ex-vessel revenue associated with commercial fisheries landings, and also summarizes available data on the broader economic impact of commercial fisheries to RI.

2. Because of the nature of fisheries activity and fisheries data, is not possible to directly attribute a dollar amount to the contribution of fisheries in the Ocean SAMP area. Commercially harvested species that are landed in RI ports may be harvested anywhere; conversely, species harvested in the Ocean SAMP area may be landed in an out-of-state port and accounted for in that state's landings data. This section summarizes information about the value of all state landings as well as the economic impact of commercial fishing to the state. Where possible, distinctions are made to emphasize the particular value of Ocean SAMP area fishing to the state of Rhode Island.

3. A 2008 study conducted by NMFS found that ex-vessel revenue from commercial fisheries landings increased 41% (adjusted for inflation) from 1997 through 2006 in New England. This increase was largely due to an increase in revenue from shellfish – the revenue from finfish landings decreased in this period. The total landings revenue in Rhode Island in 2006 was roughly $98.6 million. This included $28 million in revenue for finfish landings, and more than $70 million in revenue for shellfish landings (which includes sea scallops, lobster, and squid) (NMFS 2008a).[18]

4. Table 5.39 below shows that the most valuable landings on average in Rhode Island for 1999-2008 were lobster ($19,113,035), followed by *loligo* squid ($14,018,015), northern quahogs ($5,675,621), monkfish ($4,921,970), and sea scallops ($4,847,792). The most

[18] At the time of this writing, NMFS "Fisheries Economics of the United States 2006" is the most recent commercial fisheries economic study available.

valuable species per pound on average was oysters at $14.35/pound, followed by sea scallops, averaging $6.73/pound, northern quahogs at $6.37/pound, and lobster at $4.40/pound. These figures include all ports in Rhode Island, and include species targeted both within and outside of the Ocean SAMP area, including Narragansett Bay. Of the species listed, all but oysters and quahogs are currently fished for within the Ocean SAMP area.

Table 5.40. Top landed species in Rhode Island by value averaged for 1999-2008.[19] (ACCSP 2010)
Note: Ocean SAMP area commercially important species highlighted. Data on landings values by port are based on the NOAA Fisheries commercial dealer weigh out data, which includes the pounds landed and sold to the dealer, and the total price paid for each species. Average dollar value was calculated using the annual nominal landings value, which does not account for inflation.

Species	**Average Pounds Landed 1999-2008**	**Average Dollar Value 1999-2008**	**Average Price per Pound**
Lobster, American	4,340,526	$19,113,035	$4.40
Squid, Longfin inshore	18,426,084	$14,018,015	$0.76
Quahog, Northern	890,965	$5,675,621	$6.37
Goosefish (Monkfish)	5,148,746	$4,921,970	$0.96
Scallop, Sea	719,914	$4,847,792	$6.73
Flounder, Summer	2,158,836	$4,660,022	$2.16
Hake, Silver	6,290,385	$2,543,255	$0.40
Scup	3,131,617	$2,381,122	$0.76
Mackerel, Atlantic	7,623,878	$1,921,248	$0.25
Herring, Atlantic	19,426,667	$1,637,564	$0.08
Flounder, Winter	1,173,497	$1,599,963	$1.36
Flounder, Yellowtail	941,055	$1,067,699	$1.13
Squid, Northern shortfin	3,089,620	$882,507	$0.29
Bass, Black sea	315,991	$758,978	$2.40
Oyster, Eastern	50,676	$742,558	$14.65
Clam, Soft	102,742	$711,869	$6.93
Butterfish	1,588,842	$680,673	$0.43
Skates	6,455,051	$627,053	$0.10
Bass, Striped	202,593	$540,829	$2.67
Cod, Atlantic	454,363	$511,321	$1.13
Crab, Atlantic rock	952,517	$489,484	$0.51
Crab, Jonah	892,223	$471,098	$0.53
Crab, Red	608,303	$452,849	$0.74
Haddock	336,594	$369,411	$1.10
Crabs, Brachyura	484,718	$242,149	$0.50
Swordfish	85,632	$236,487	$2.76
Flounder, Witch	168,881	$211,958	$1.26
Skate, Little	2,374,344	$196,849	$0.08
Hake, Red	797,796	$191,042	$0.24
Bluefish	553,631	$185,447	$0.33
Plaice, American	119,517	$118,531	$0.99
Whelk, Channeled	93,273	$118,367	$1.27

[19] Species included in the table are those for which the average landings value is over $100,000 for 1999-2008

5. Figure 5.36 below shows trends in landings and landings value in Rhode Island for the years 1999-2008. The dollar values here are nominal values only, and not adjusted for inflation, and therefore are weighted toward the more recent years. Landings have decreased over that time period, while the landings values have seen less fluctuation.

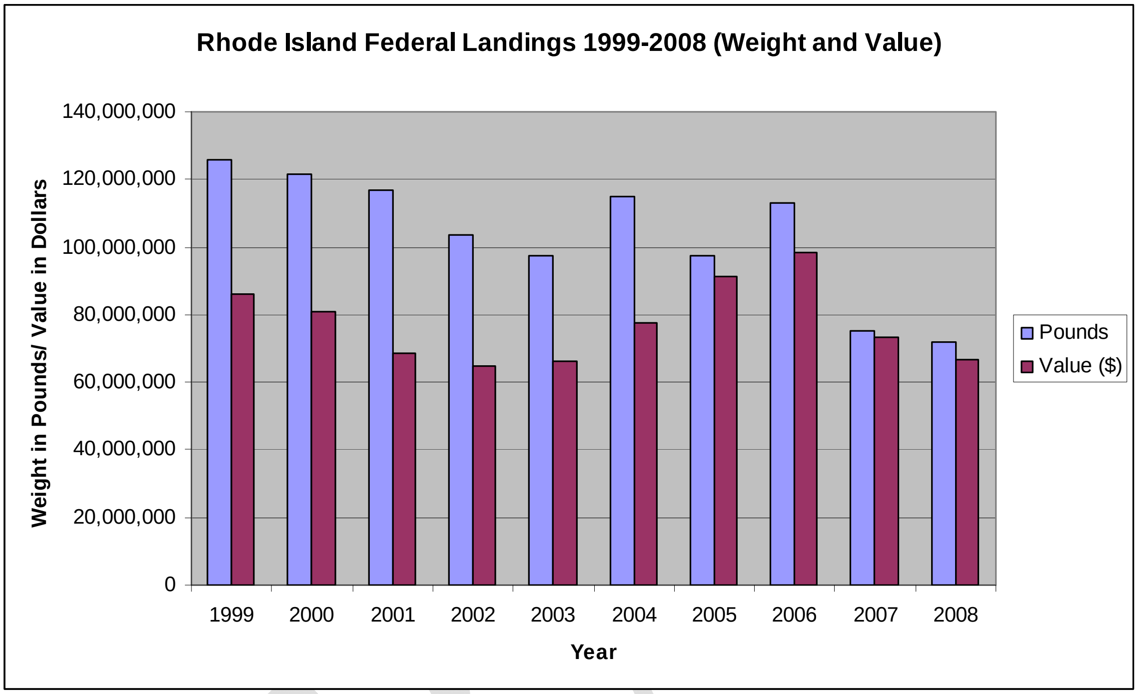

Figure 5.36. Rhode Island commercial landings by value, 1999- 2008. (NMFS, Fisheries Statistics Division 2009a)
Note: dollar values are annual nominal landings values only and are not adjusted for inflation.

540.1.1. Point Judith

1. Clay et al. (2008) report that in 2006, there were 168 vessels with federal permits in Point Judith, and the total federal landings value in Point Judith was $46,947,791 (see Table 5.41). The most valuable federally managed group of species was squid, mackerel, and butterfish (combined into one group for management purposes), with a 2006 landings value of $13,188,211, followed by lobster, with landings of over $8.6 million (see Table 5.42).[20]

[20] Clay et al. 2008 represents the most recently published and best available data on port-specific landings and value.

Table 5.41. Federal vessel permits and landings value between 1997 and 2006 for Point Judith/Narragansett. (Clay et al. 2008)

Year	# Vessels	Value of landings in Point Judith ($)
1997	181	$47,529,746
1998	175	$42,614,251
1999	181	$51,144,479
2000	184	$41,399,853
2001	186	$33,550,542
2002	179	$31,341,472
2003	173	$31,171,867
2004	174	$36,016,307
2005	171	$38,259,922
2006	168	$46,947,791

Table 5.42. Dollar value of landings of federally managed groups of species for Point Judith. (Clay et al. 2008)

	Average from 1997 – 2006	2006 only
Squid, Mackerel, Butterfish	$11,298,781	$13,188,211
Lobster	$11,022,301	$8,675,086
Summer Flounder, Scup, Black Sea Bass	$4,718,136	$6,495,568
Smallmesh Groundfish[21]	$2,816,677	$1,799,479
Monkfish	$2,687,563	$2,110,227
Largemesh Groundfish[22]	$2,451,647	$3,383,452
Other[23]	$2,056,576	$2,697,425
Scallop	$1,457,702	$7,420,396
Skate	$618,033	$604,990
Herring	$470,065	$376,506
Tilefish	$230,142	$32,985
Bluefish	$112,378	$118,466
Dogfish	$48,031	$45,000
Red Crab	$9,593	$0

2. Figure 5.37 shows Point Judith commercial landings by weight and value from 1999-2008. The dollar values here are nominal values only, and not adjusted for inflation, and therefore are weighted toward the more recent years. The landings by weight indicate that whereas landings declined from 1999-2001, they have since remained fairly consistent.

[21] Smallmesh Multi-Species: red hake, ocean pout, mixed hake, black whiting, silver hake (whiting)
[22] Largemesh groundfish: cod, winter flounder, witch flounder, yellowtail flounder, American plaice, sand-dab flounder, haddock, white hake, redfish, and pollock
[23] "Other" species includes any species not accounted for in a federally managed group, including species managed at the state level

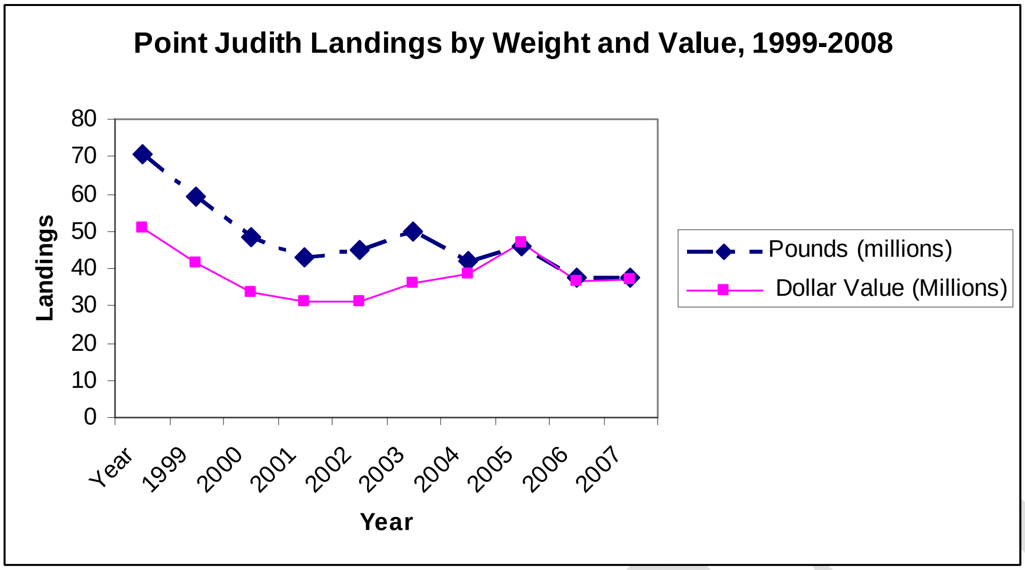

Figure 5.37. Point Judith landings by dollar value and weight, 1999-2008. (NMFS 2009a) *Dollar values are annual nominal landings values only and are not adjusted for inflation.*

540.1.2. Newport

1. Clay et al. (2008) report that in 2006, there were 48 vessels with federal licenses listing Newport as their home port, and the total value of landings was $20,837,561 (see Table 5.43).[24] The most valuable species landed in Newport in 2006 was scallops, with a landed value of $13,267,494, followed by lobster, worth just under $3 million (Clay et al. 2008) (see Table 5.43).

Table 5.43. Federal vessel permits and landings value between 1997 and 2006 for Newport. (Clay et al. 2008)

Year	# Vessels	Value of landings in Newport ($)
1997	52	7,598,103
1998	52	8,196,648
1999	52	8,740,253
2000	59	8,296,017
2001	52	7,485,584
2002	55	7,567,366
2003	52	9,082,560
2004	52	8,402,556
2005	54	14,281,505
2006	48	20,837,561

Table 5.44. Dollar value for landings of federally managed species for Newport. (Clay et al. 2008)

	Average from 1997-2006 ($)	2006 only ($)
Lobster	2,758,908	2,971,680

[24] Clay et al. (2008) represents the most recent and best available data on port-specific landings and value.

Scallop	2,528,448	13,267,494
Squid, Mackerel, Butterfish	1,425,947	1,315,229
Largemesh Groundfish[25]	1,039,962	445,273
Monkfish	878,265	1,068,547
Summer Flounder, Scup, Black Sea Bass	739,880	815,918
Other[26]	334,103	401,779
Smallmesh Groundfish[27]	179,296	43,165
Skate	58,481	224,184
Herring	42,538	267,164
Dogfish	26,441	6,037
Red Crab	15,560	0
Bluefish	11,759	9,878
Tilefish	9,230	1,213

2. Figure 5.38 shows Newport commercial landings and value from 1999-2008. The dollar values are nominal values only and are not adjusted for inflation, and therefore are weighted toward the more recent years. Whereas the value of Newport's landings seems to have fluctuated, the weight of landings stayed relatively consistent from 2004-2007.

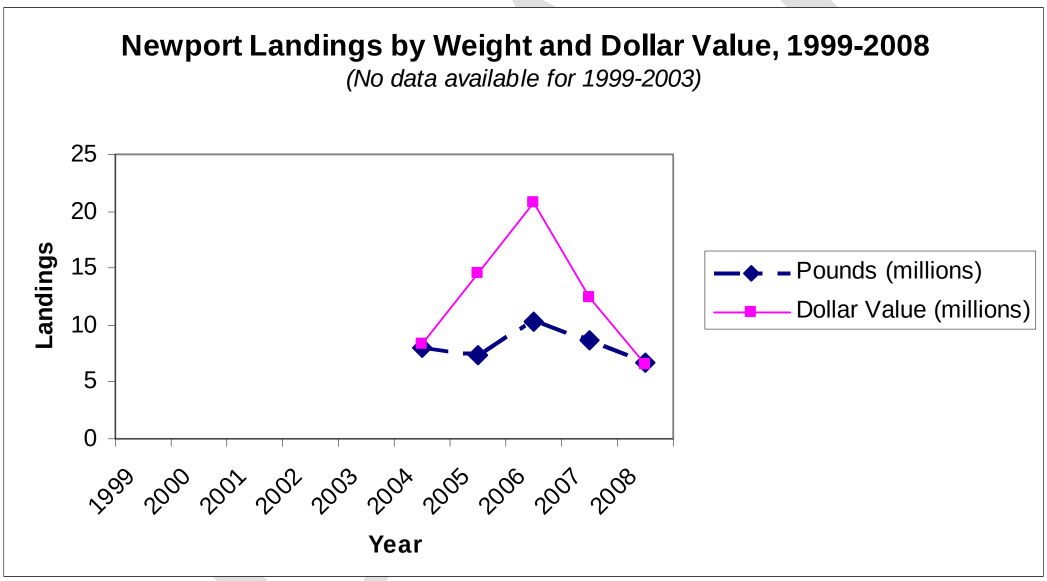

Figure 5.38. Newport landings by dollar value and weight, 1999-2008. (NMFS 2009a)

3. Figure 5.39 and Figure 5.40 track the ranking of Point Judith and Newport amongst all major U.S. fishing ports by both landings value and pounds landed. Point Judith has steadily been declining in ranking of pounds landed since 1998 and in landings value, although landings value has fluctuated more than pounds. The rank of Point Judith did climb in 2008 from 21st to 18th in value of landings, and from 24th to 21st in pounds.

[25] Largemesh groundfish: cod, winter flounder, witch flounder, yellowtail flounder, am. plaice, sand-dab flounder, haddock, white hake, redfish, and pollock

[26] "Other" species includes any species not accounted for in a federally managed group, including species managed at the state level

[27] Smallmesh Multi-Species: red hake, ocean pout, mixed hake, black whiting, silver hake (whiting)

Newport did not appear in the rankings for 1999-2003. Newport climbed significantly in the rankings for both pounds landed and landings value for 2006, but declined again in 2007. Data for Newport for 2008 were not available (NMFS 2009a).

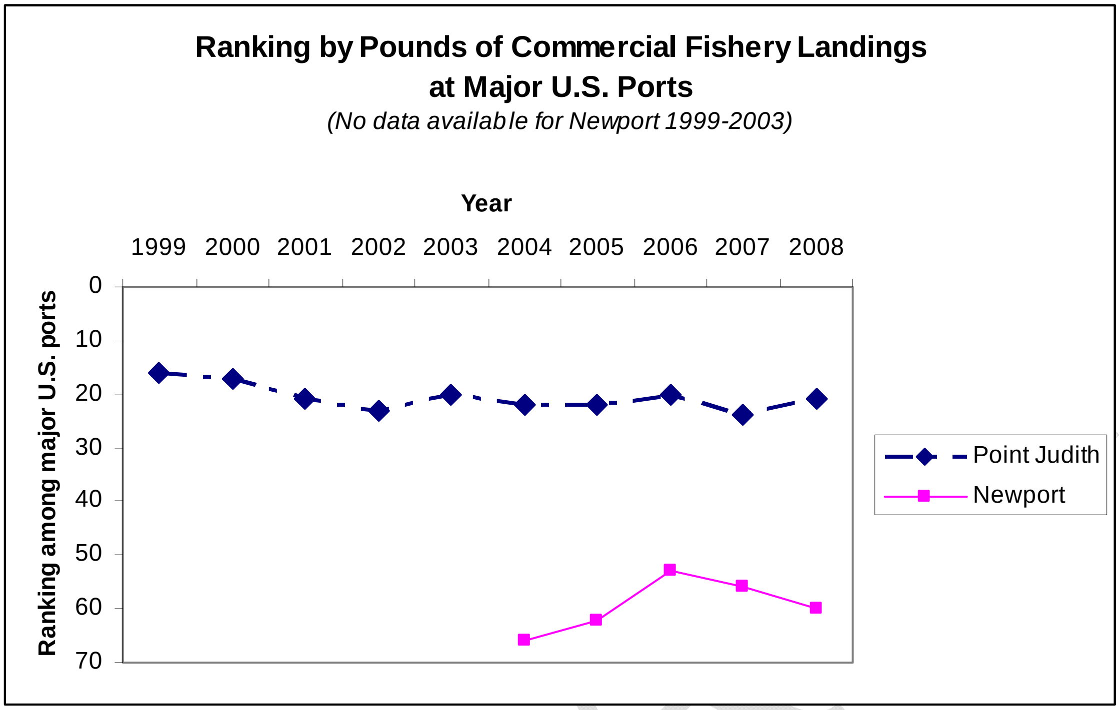

Figure 5.39. Ranking by pounds of commercial fishery landings at major U.S. ports, 1999-2008. (NMFS 2009a)

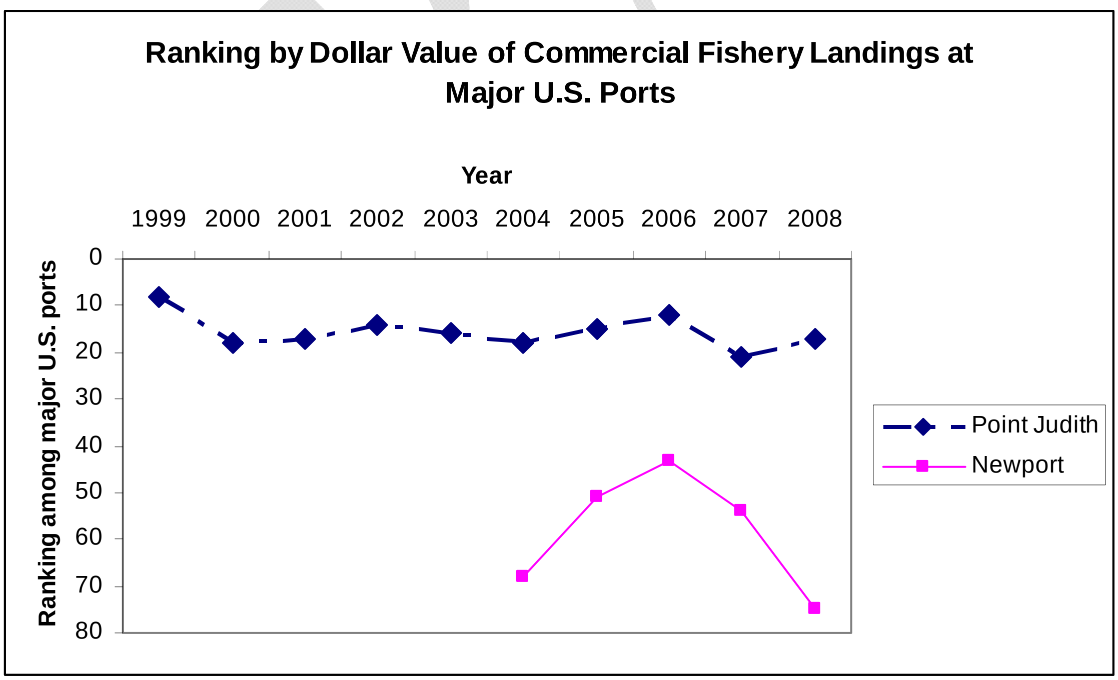

Figure 5.40. Ranking by dollar value of commercial fishery landings at major U.S. ports, 1999-2008. (NMFS 2009a)

4. While commercial fisheries landings have great value in themselves, the commercial fishing industry has a broader effect on Rhode Island's economy through the jobs, income, and sales associated with the commercial fishing industry. However, accurately assessing the economic impact of the state's commercial fishing industry is difficult for a variety of reasons, including the fact that many fishermen are self-employed and fishing vessels do not always land their catch in the same state in which they are home ported. For this reason, estimates of the economic impact of commercial fishing vary by study. One 2008 study analyzed 2006 landings and employment data and determined that the RI commercial fishing industry represents approximately 1700 jobs and nearly $98 million in wages, and accounted for $11-18 million in vessel operation costs and another $9-15 million in vessel maintenance costs. In total, this study found that the state's commercial fishing industry is responsible for at least $100 million in economic activity each year (RI Economic Monitoring Collaborative 2008).

5. A 2008 NMFS fisheries economic study found that the estimated total sales impacts from the Rhode Island commercial fishing industry were approximately $705,938,000, and the estimated income impacts from this industry state-wide totaled $378,396,000 (see Table 5.45). The majority of economic impacts in both areas came from the resulting impacts on the retail sectors of seafood sales. Commercial harvesting itself also provided significant economic impacts to the economy, with more than $75 million in income impacts to the state, and over $3 million in employment impacts (NMFS 2008a).[28] Once again, because it is not feasible to determine the amount or value of landings originating within the Ocean SAMP area, it is impossible to determine what percentage of these impacts can be attributed to fishing activity and resources found within the Ocean SAMP area.

Table 5.45. Economic impacts of commercial fishing industry in Rhode Island, 2006. (NMFS 2008a)

	Sales Impacts	**Income Impacts**	**Employment Impacts**
Commercial Harvesters	$171,075,000	$75,223,000	$3,308,000
Seafood Processors and Dealers	$50,924,000	$18,474,000	$465,000
Seafood Wholesalers and Distributors	$97,988,000	$50,549,000	$947,000
Retail Sectors	$385,951,000	$234,149,000	$10,246,000
Total Impacts	**$705,938,000**	**$378,396,000**	**$14,966,000**

6. A 2009 NMFS economic study of marine-related industries (Thunberg 2009) provides additional insight into the broader economic impacts of commercial fishing. According to this study, the number of establishments in Rhode Island involved in seafood commerce was 112 in 1999, and declined to 92 in 2005 (see Table 5.46).[29] Seafood commerce includes commercial fishing, seafood dealers, seafood processors, and retail seafood markets. The number of employees in these establishments was 2,291 in 1999, and fell to 1,925 by 2005 (see Table 5.46). In 2005, 68.0% of employment in the seafood commerce

[28] This NMFS study, *Fisheries Economics of the United States 2006*, is at the time of this writing the most updated and best available data on the economic impact of commercial fishing throughout the region.
[29] This NMFS study, *Trends in Northeast Region Marine Industries* (Thunberg 2009) is based on data through 2005 and provides the most recent and best available data on commercial fishing-related businesses in RI.

sector was made up of commercial fishing employees, 16.2% was made up of seafood dealers, 14.0% was in the processing sector, and 7.3% was in seafood retail. There were a total of 1,211 sole proprietors engaged in fishing in Rhode Island in 2005, and Rhode Island fishermen in sole proprietorships earned more than the average for the Northeast region. At the same time, wage-based income was higher for fishermen than income earned through a sole proprietorship in Rhode Island, but lower in many other Northeast states. The consumer price index adjusted annual fishing wages in Rhode Island in 2005 averaged $31,546, while the adjusted average receipts for sole proprietorships in 2005 were $27,954 (Thunberg 2009).

Table 5.46. Total number of Rhode Island seafood commerce establishments and employees, 1999-2005. (Thunberg 2009)

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Year	Number of Establishments	Number of Employees
1999	112	2,291
2000	110	2,240
2001	112	2,235
2002	104	2,057
2003	104	2,225
2004	105	2,057
2005	92	1,925

7. This 2009 NMFS study also analyzed fishing-related employment in Rhode Island and found Bristol, Newport, and Washington Counties all had a fishing quotient higher than one, meaning fishing employment in these counties is higher than average, and these three counties would be disproportionately affected by a reduction in fishing employment. In 2005, the number of fishing employees and sole proprietorships in Bristol County was 76; in Newport County, 198; and in Washington County, 176 (Thunberg 2009).

8. NMFS further analyzed employment at seafood dealer establishments and found that in 2005, total employment in Rhode Island in the seafood dealer sector was 206 at 32 seafood dealer establishments. Rhode Island had as many as 66 seafood dealer establishments in 1993, but this number declined steadily through the 1990s and early 2000s. Overall, Rhode Island had more residents employed by seafood dealers as a percentage of all employment state-wide than the average for most Northeast states, and Newport and Washington Counties had the highest dependence on seafood dealer employment, with 61 employees in eight establishments in Newport County, and 70 employees in 12 establishments in Washington County in 2005 (Thunberg 2009) (see Table 5.47).

9. NMFS also investigated seafood processing establishments and found that Rhode Island had seven such businesses in 2005, employing 270 people. Like for seafood dealers, the percentage employment in seafood processing is generally higher in Rhode Island than the average employment in the sector for the Northeast. In 2005, Bristol County had two seafood processors with 192 employees, Newport County had two seafood processors with 63 employees, and Washington County had one processor with two employees.

Rhode Island had 31 retail seafood markets in 2005 with 140 employees, which, again, was higher than the average employment for the Northeast (Thunberg 2009) (see Table 5.47).

Table 5.47. Fisheries sector employment impacts, 2005. (Thunberg 2009)

Sector		**Bristol County**	**Newport County**	**Washington County**	**RI Total**
Seafood Dealers	Number of Establishments	N/A	8	12	32
	Employees	N/A	61	70	206
Seafood Processors	Number of Establishments	2	2	1	7
	Employees	192	63	2	270
Retail Seafood Market	Number of Establishments	3	3	5	31
	Employees	5	23	34	140

540.2. Economic Impact of Recreational Fishing

1. While recreational fishing is different than commercial fishing in that fish caught are not landed and sold on the market, it nonetheless has a significant economic impact in the state of Rhode Island. Unlike commercial fishing, the value of recreational fishing lies in the act of fishing itself, and the expenditures associated with that act. As noted above in Section 530.7.2, recreational fishing catch, effort, and associated economic impact are generally more difficult to characterize because of the lack of data collected by state and federal regulatory agencies. Estimates of the economic impact of recreational fishing are typically based on surveys administered to a sampling of recreational fishermen and extrapolated to a larger population, combined with analysis of the businesses (e.g. tackle shops and boat manufacturers) associated with recreational fishing. Results of these studies tend to vary widely depending on the sample size and location, methods, and data sources used. For these reasons, all recreational fishing data should be regarded with caution and should be viewed as estimates, rather than verifiable facts.

2. Several studies have attempted to extrapolate from survey results to create estimates of the economic impact of recreational fishing in Rhode Island. One such study was conducted by NMFS in connection with the Marine Recreational Fisheries Statistics Survey (MRFSS) program, discussed above in Section 530.7.2. Economic data on fishing expenditures were gathered from an economic survey added on to the traditional MRFSS survey; this was performed in 2006 (Gentner and Steinback 2008).[30] Other economic impact studies of RI recreational fishing include one commissioned by the Rhode Island Saltwater Anglers Association (RISAA) which incorporated 2006 angler intercept survey results as well as MRFSS and other pre-existing data sets (Ninigret Partners 2007), and one conducted by the U.S. Fish and Wildlife Service in 2006. Together, these studies represent the best available and most up-to-date recreational fishing economic impact data for Rhode Island; results of each study are summarized below. As is the case for

[30] A prior study was conducted in 1998 and published in 2004 (Steinback, Gentner, and Castle 2004). NMFS has conducted an updated study based on 2008 data, but at the time of this writing, study results are not yet available.

commercial fishing data, it is infeasible to directly apportion a percentage of recreational fishing activity to within the Ocean SAMP area based on the available data. In addition it should be noted that the discrepancy between surveys and the lack of clear survey methods make recreational fisheries economic data difficult to compare with commercial fisheries economic data.

3. The most recent available recreational fishing economic data from NMFS are summarized in *Fisheries Economics of the United States, 2006* (NMFS 2008a) and detailed in Gentner and Steinback (2008). In this study, economic intercept surveys were added onto the traditional MRFSS survey methodology discussed above in Section 530.7.2. This survey includes direct impacts, which occur when anglers spend money at fishing-related businesses, indirect impacts, based on expenditures by the fishing-related businesses on supplies and operating costs for their business, and inducted impacts, which occur when employees in the direct and indirect sectors make purchases as a part of normal household consumption. The resulting estimates of the multiplier effects from these activities represent the impacts from saltwater sportfishing expenditures to the economy (Gentner and Steinback 2008). The data include expenditures by both residents and non-residents; expenditures by non-residents are higher in Rhode Island than those for residents, typically because they have to travel further and are more likely to stay overnight in the state, producing an overall net increase in economic impacts from saltwater recreational fishing to the state (Gentner and Steinback 2008).

4. This study found that in 2006, recreational anglers spent an estimated $182,606,000 on recreational fishing. This figure includes both trip expenditures and durable equipment expenditures. This study estimated that fishermen spent an estimated $60,412,000 on fishing trips; Rhode Island residents fishing in-state spent $18,727,000, and non-residents fishing in Rhode Island spent $41,685,000. This study also found that total durable equipment expenditures for recreational fishing in Rhode Island, including fishing tackle, other equipment, boats, and the vehicles and second home expenses related to recreational fishing, at $122,194,000. At over $55 million, fishing tackle represents the greatest expenditure for recreational fishermen. In addition, because of the costs associated with owning and operating a boat, boat-based fishing is a significant economic driver within the state, with $11 million in expenses by residents and an additional $12 million by non-residents. See Tables 5.48 and 5.49 for more information.

Table 5.48. Angler trip expenses, 2006. (NMFS 2008a)

Fishing Mode	**Expenditures- non-residents**	**Expenditures – residents**
Private Boat	$11,858,000	$11,130,000
Shore	$25,522,000	$6,634,000
For-Hire	$4,305,000	$963,000
Total	**$41,685,000**	**$18,727,000**

Table 5.49. Durable equipment expenditures, 2006. (NMFS 2008a)

Durable Equipment	**Expenditure**
Fishing Tackle	$55,326,000
Other Equipment	$17,367,000

Boat Expenses	$22,042,000
Vehicle Expenses	$25,660,000
Second Home Expenses	$1,799,000
Total Durable Equipment Expenditures	**$122,194,000**

5. This study also estimated that in 2006, the total impact from RI marine recreational fishing was $166,869,000 (see Table 5.50). This includes both resident and non-resident activity. The 2006 estimated value added for Rhode Island based on expenditures was roughly $82 million, and the 2006 income impact was estimated at over $52 million. This survey further estimated that 1,476 jobs in Rhode Island are the result of expenditures on marine recreational fishing, of which 1,001 are the result of direct expenditures (Gentner and Steinback 2008).

Table 5.50. Economic impacts from recreational fishing in Rhode Island, 2006. (Gentner and Steinback 2008)

Impact Type	Resident Status	Expenditures	Direct Impact	Indirect Impact	Induced Impact	Total Impact
Output ($1,000)	Resident	$75,823	$50,586	$14,441	$13,688	**$78,684**
	Non-Resident	$106,783	$57,765	$14,913	$15,506	**$88,184**
	Total	**$182,606**	**$108,351**	**$29,324**	**$29,194**	**$166,869**
Value Added ($1,000)	Resident	$75,823	$21,312	$8,261	$8,394	**$37,967**
	Non-Resident	$106,783	$26,535	$7,916	$9,628	**$44,079**
	Total	**$182,606**	**$47,847**	**$16,177**	**$18,022**	**$82,046**
Income ($1,000)	Resident	$75,823	$15,247	$4,964	$4,503	**$24,714**
	Non-Resident	$106,783	$17,588	$4,834	$5,285	**$27,707**
	Total	**$182,606**	**$32,836**	**$9,798**	**$9,787**	**$52,422**
Employment (jobs)	Resident	$75,823	414	102	123	**639**
	Non-Resident	$106,783	587	110	140	**836**
	Total	**$182,606**	**1,001**	**212**	**263**	**1,476**

6. A prior NMFS study using 1998 survey data (Steinback et al. 2004) also assessed the economic impact of recreational fishing in RI. This study indicated that recreational fishing supported 1,068 jobs and the total economic impact of recreational fishing expenditures exceeded $93 million (2000 dollars). Note that this figure is not inflation-adjusted and therefore cannot be directly compared with the 2006 data presented above. While small methodological changes make it difficult to compare between this and the current study on a state-by-state basis, Gentner and Steinback (2008) indicate that for the nation as a whole, recreational fishing expenditures have increased 79% in comparison to inflation-adjusted estimates for 2000 (Gentner and Steinback 2008).

7. Another survey based on 2006 survey data, the U.S. Fish and Wildlife Service (FWS) National Survey of Fishing, Hunting, and Wildlife Associated Recreation, estimated a total of 158,000 anglers fishing in Rhode Island, of which 82,000 were from out of

state[31]. These figures, which are much more conservative estimates than those provided by the MRFSS program (see Section 530.7.2 above), include both saltwater and freshwater fishing – saltwater fishing only had an estimated 122,000 anglers. This survey places the total recreational fishing-related expenditures in the state of Rhode Island at $153,694,000 for both fishing trip and equipment expenses. This total includes both saltwater and freshwater fishing for an average of $968 per angler. When only saltwater fishing is considered, the total expenditures are placed at $115,913,000, a considerably lower estimate than for the MRFSS program (U.S. Fish & Wildlife Service 2006). There are a few reasons why the NMFS estimates are so much higher than the USFWS survey. The NMFS survey estimates much higher rates of participation in marine recreational fishing, in part because of differences in sampling procedures. The NMFS survey targets marine anglers specifically, as opposed to both salt and freshwater fishing. Additionally, the NMFS survey contains many more expenditure categories than does the USFWS survey (Gentner and Steinback 2008).

8. A 2007 recreational fishing economic impact study commissioned by RISAA incorporated results from an intercept study as well as pre-existing datasets from numerous other sources including NMFS (1998 data summarized in Steinback et al. 2004) and a 2001 survey conducted by the FWS. This study found that the annual direct expenditures of RI recreational saltwater anglers are $70 million, and that RI recreational fishing has a total economic impact of $160 million (Ninigret Partners 2007). These figures are more conservative than those included in the NMFS and FWS studies described above; this may be due to the fact that this study included older survey data than was included in the above-mentioned studies.

[31] This U.S. Fish and Wildlife Service survey is conducted every five years.

Section 550. Impacts of Existing Activities and Trends on Fisheries Resources and Habitats

1. By definition, fishing impacts fisheries resources, and in some instances, habitats. Other existing activities that will affect fisheries and fish habitat include, but are not restricted to: coastal development; introduced species; marine transportation; and marine fisheries diseases (Johnson et al. 2008). These impacts are discussed below.[32]

2. Potential future uses of the Ocean SAMP area, which may include offshore renewable energy development or other activities, may also have impacts on fisheries resources. See Chapter 8, Renewable Energy and Chapter 9, Other Future Uses for further discussion of these issues.

550.1. Fisheries and Overfishing

1. A significant impact on fisheries resources in the Ocean SAMP area comes from fishing activity. Fishing of any kind will have an effect on the ecosystem. Fishing can have both primary and secondary impacts on fish populations and species assemblages, including population declines from overfishing (defined in the Magnuson Stevens Fishery Conservation and Management Act as fishing at a rate or level or mortality that jeopardizes the capacity of a fishery to produce the maximum sustainable yield on a continuing basis) and from shifts in community dynamics.

2. At present, seven of the species of importance to commercial and recreational fisheries are either listed as overfished or overfishing is occurring on the stock (Atlantic cod, American lobster, bluefin tuna, tautog, winter flounder, winter skate, and yellowtail flounder). Many of the other species found with in the Ocean SAMP area have been in the past or are in danger of becoming overfished. Overfishing can lead to a reduction in recruitment, or of fish growing large enough and old enough to spawn, as well as to a decline in the average size of targeted species (e.g. Collie et al. 2008; Fogarty and Murawski 1998).[33]

3. Fishing can change the species composition in the food web. The intense harvest of certain stocks will change the ecological balance of an area by causing the decline of that stock; that stock's decline may in turn have an impact on species which relied on the depleted stock for food, or have an impact on other species which become the new food source for hungry predators. For example, on Georges Bank, as groundfish populations have declined, dogfish and skate populations, which target similar prey, exploded (Fogarty and Murawski 1998). Likewise, a decline in cod populations in the North Atlantic has led to increased abundance of certain invertebrates such as lobster and crab that are commonly eaten by cod. Overfishing may also have indirect ecosystem effects,

[32] Johnson et al. (2008) also list coastal-based issues including the alteration of freshwater systems, agriculture, and the chemical and physical effects from water intake and discharge facilities. These issues are not enumerated here because they primarily impact the near-shore environment, and are less relevant to the offshore areas of the Ocean SAMP. Additionally, Johnson et al. (2008) have listed energy-related activities and dredging and disposal activities as potentially impacting fish habitat. These activities are discussed further in Chapter 9: *Other Future Uses*.

[33] It should be noted that a stock can be overfished with overfishing not occurring, or conversely, overfishing can occur on a stock that has not yet been found to be overfished.

as smaller species may proliferate when their predators are reduced through fishing pressure (Piet and Jennings 2005). In Narragansett Bay and in at least some parts of the Ocean SAMP area, it has been demonstrated that the species composition has shifted from one dominated by benthic fish species to one dominated by pelagic fish and benthic invertebrates, in part because of the impact of fishing on benthic fish species (Collie et al. 2008). See Chapter 2, Ecology of the Ocean SAMP Area for further discussion of this shift.

4. Bycatch, including the incidental and regulatory discard of species in commercial and recreational fisheries, can negatively alter the species composition inhabiting the ecosystems of the Ocean SAMP area, and additionally is a waste of valuable fisheries resources.

5. Fishing activity can also impact fish habitat, particularly through the use of bottom fishing gear. Trawls and dredges physically damage the sediment surface, and a large portion of the epifaunal species living there (such as sponges, corals, and tube worms) are damaged or removed (Olsgard et al. 2008). Collie et al. (2000) found that one trawling pass may reduce the abundance of fauna by as much as 55%. These benthic communities provide habitat for other species, as well as providing food for fish species and shelter for juveniles (Collie et al. 2004). This loss of habitat complexity may have important consequences for fish species (Collie et al. 2000). Bottom fishing may also reduce the abundance of prey species important to commercially and recreationally important fish species. The particular effects, both initial and long-term, will depend on the sediment type, the sensitivity of benthic organisms to disturbance, the level of natural disturbance, and the type of fishing gear being used. The impact of trawling will be higher at locations that experience low levels of natural disturbance, such as sites in deeper water, than those areas frequently subject to natural disturbance such as wave action (Hiddink et al. 2006). Some soft-sediment habitats, such as sand and mud, may be able to recover fully within a year, while other bottom types may take longer (Collie et al. 2004). Intensively fished areas may remain in a permanently altered state (Collie et al. 2000). Some areas are trawled repeatedly; the initial impact of trawling on pristine habitat will be much larger than further trawling activity in previously fished areas (Hiddink et al. 2006). Areas that are frequently trawled may be dominated by small-bodied, opportunistic species (Olsgard et al. 2008), as they can withstand higher rates of mortality, as opposed to large invertebrates, whose abundance may be reduced through trawling disturbance because of their slow life history (Hiddink et al. 2008). This loss of large invertebrates may lead to a loss of local biodiversity (Hiddink et al. 2006). Trawling may have some positive secondary effects for fish species that primarily feed on small invertebrates by increasing food production of these species; this does not necessarily mean the net effects of trawling are positive for these species, however, because of the undesirable ecosystem-level effects (Hiddink et al. 2008). These impacts to habitat can have secondary effects on fish stocks and on the ecosystem as a whole.

6. Overall, there is a lack of adequate methods to assess trawling impacts at the fishery scale, and the problem has not been addressed at an ecosystem level. These impacts to habitat can have secondary effects on fish stocks and on the ecosystem as a whole. To address this problem, the New England Fishery Management Council is in the process of

developing an Omnibus Habitat Amendment that will address the effects of fishing on Essential Fish habitat. The Council is also in the process of developing the Swept Area Seabed Impact (SASI) Model. The model includes ten different categories of fishing gear, and will be used to quantitatively assess the effects of fishing to Essential Fish Habitat. The SASI model may be available for use sometime in 2011 (Bachman pers. comm.).

550.2. Coastal Development

1. Threats to fish habitat in the Ocean SAMP area from coastal development primarily result from the discharge of nonpoint source pollution and urban runoff, and specifically the introduction of pathogens, petroleum products, heavy metals, pesticides, and other pollutants that can affect marine organisms, even in offshore environments. These pollutants may sometimes have direct toxic effects on fish, but are more likely to have sublethal effects that may inhibit the development and reproduction of marine organisms. Metals, for example, including mercury, lead, copper, and cadmium, can be lethal to fish at high concentrations, and may also produce effects such as reduced hatch rates of eggs, increased larval mortality, developmental problems in larvae, and endocrine disruption. While many of these problems may not have a significant effect on many marine organisms, metals as well as other compounds bioaccumulate, moving up the food chain through trophic levels resulting in higher and more damaging concentrations in top predators, as well as causing health problems in human consumers of fish (Johnson et al. 2008).

2. Eutrophication resulting from nutrient loading can also be a threat, particularly to the inshore portions of the Ocean SAMP area. These threats can also impact sensitive estuarine nursery and spawning areas, including Narragansett Bay, of the fish species found in the Ocean SAMP area (Johnson et al. 2008).

550.3. Introduced Species

1. The introduction of nonnative species is another threat to fish and fish habitat. Introduced species may include finfish, shellfish, plankton, bacteria, viruses, and pathogens. Introduced species can cause alterations to habitat, species communities, species diversity, and food webs, as well as introducing diseases, affecting the health of native species, and affecting water quality. For example, the green crab, one of the most common crustaceans in New England waters, is an introduced species from Europe that grazes on submerged aquatic vegetation and preys on newly settled winter flounder. *Didemnum* is an invasive tunicate that has colonized parts of Georges Bank as well as many coastal areas in New England. This benthic filter-feeder forms dense mats along the seafloor that prevent the settlement of other benthic organisms, smother benthic organisms beneath it, and reduce food availability for juvenile scallops and groundfish. *Didemnum* also has the ability to change the benthic community structure; it has been observed to transform heterogeneous gravel habitat into a homogeneous tunicate mat, reducing important habitat for species such as cod, haddock, and scallops. The changes to the benthic habitat that occur from bottom trawling and scallop dredging are likely to contribute to the spread of *Didemnum* (Lengyel et al. 2009). Nonnative species are likely

to be introduced through the ballast water of ships coming into or passing through the area from elsewhere, or through aquaculture operations (Johnson et al. 2008).

2. Introduced species are discussed in more detail in Chapter 2, Ecology of the Ocean SAMP Area.

550.4. Marine Transportation

1. There is a great deal of commercial shipping through the Ocean SAMP area, and this activity may have a variety of impacts on fisheries resources. Commercial shipping may create habitat disturbances by disturbing sediment when operating close to shore, in shallow waters, or when anchoring. It may also increase underwater noise, which may affect some fish species (see Chapter 8, Renewable Energy for further discussion). Vessel operations may also increase the likelihood that invasive species or pollutants, such as petroleum products, are introduced into the environment. Much of the Ocean SAMP area shipping traffic involves the movement of petroleum products. While oil spills are infrequent, such spills can have a major impact on marine species and on habitat. These impacts can disrupt benthic community composition and oil can persist in sediments for years after a spill. In addition, the noise generated by commercial ship traffic can adversely affect fishery resources, impacting fish spawning, migration, and recruitment behaviors (Johnson et al. 2008). In January 1996, the *North Cape* barge ran aground off South Kingstown, in the Ocean SAMP area, and spilled approximately 828,000 gallons of home heating oil into Block Island Sound and the South County coastal salt ponds. The result was a significant loss of lobster, finfish, surf clams, seabirds, and other species, and significant impacts on the commercial fishing and lobstering as well as recreational fishing industries in the state (NOAA General Counsel for Natural Resources 2010). See Chapter 7, Marine Transportation, Navigation, and Infrastructure for further discussion.

550.5. Dredged Material Disposal

1. The disposal of dredged materials offshore involves environmental effects beyond those produced in the dredging process. The U.S. Army Corps of Engineers disposes approximately 65% of its dredged materials in open waters. For dredged material to be disposed of offshore, it must be demonstrated that the sediment is compatible with the sediment at the disposal site, and that the disposal will not disrupt the benthic habitat or communities (Johnson et al. 2008). Yet the disposal of dredged material can still have a significant impact. Benthic organisms may be buried in the process, and more mobile species may leave the area. Recolonization may increase the occurrence of opportunistic species. These processes may affect fish by reducing prey availability. Dumping may change the biological and chemical characteristics of the sediment, and will temporarily increase the turbidity of the water column. The increased volume of suspended sediments is likely to push some fish out of the area, may affect foraging patterns, and can even cause injury or death. Sedimentation may also affect the viability of fish eggs and larvae. On the other hand, some species, including lobster and winter flounder, have been found to be attracted to dredge disposal sites (Johnson et al. 2008). The disposal of dredged material can also result in a release of contaminants, making contaminants biologically

available to organisms in the water column or through the food chain. However, this is only likely to occur in trace amounts, as generally the disposal of toxic materials through offshore dumping is prohibited (Johnson et al. 2008).

550.6. Marine Debris

1. Marine debris is an issue in the Ocean SAMP area as it is in the rest of the world's oceans. Marine debris may be anything accidentally or intentionally discarded that makes its way into the ocean, and can include various types of plastics, such as bags, bottles, or fishing gear. One of the major impacts from marine debris is the entanglement of marine wildlife, including fish, causing injury or death. A particularly relevant problem for the Ocean SAMP area may also be the impact of ghost gear, or lost or abandoned fishing gear, that continues to catch fish long after it has been lost. Marine debris, including ghost gear, can also damage benthic habitats.

550.7. Marine Fisheries Diseases

1. Marine diseases, including lobster shell disease and mycobacteriosis in striped bass, are another factor affecting fisheries resources within the Ocean SAMP area. Marine diseases are discussed further in Chapter 2, Ecology of the Ocean SAMP Area.

550.8. Global Climate Change

1. Global climate change is having, and will likely continue to have, significant impacts on fisheries resources. Temperature changes can affect the location and timing of spawning, as well as the timing of plankton blooms and the availability of food, which in turn can impact the growth and survival of commercially important fish species. The warming water temperatures are also likely to cause shifts in distribution, with species moving further north or into deeper waters. Some species important to Rhode Island commercial fisheries, such as cod and lobster, may shift their range out of the Ocean SAMP area, while other species found more typically to the south may become more abundant off Rhode Island. See Chapter 3, Global Climate Change for further discussion.

Section 560. Policies and Standards

560.1. General Policies

1. The commercial and recreational fishing industries, and the habitats and biological resources of the ecosystem they are based on, are of vital economic, social, and cultural importance to Rhode Island's fishing ports and communities. Commercial and recreational fisheries are also of great importance to Rhode Island's economy and to the quality of life experienced by both residents and visitors. The Council finds that other uses of the SAMP area could potentially displace commercial or recreational fishing activities or have other adverse impacts on commercial and recreational fisheries.

2. The Council recognizes that finfish, shellfish, and crustacean resources and related fishing activities are managed by a host of different agencies and regulatory bodies which have jurisdiction over different species and/or different parts of the SAMP area. Entities involved in managing fish and fisheries within the SAMP area include, but are not limited to, the Atlantic States Marine Fisheries Commission, the RI Department of Environmental Management, the RI Marine Fisheries Council, the NOAA National Marine Fisheries Service, the New England Fishery Management Council, and the Mid-Atlantic Fishery Management Council. The Council recognizes the jurisdiction of these organizations in fishery management and will work with these entities to protect fisheries resources.

3. The Council's policy is to protect commercial and recreational fisheries within the SAMP area from the adverse impacts of other uses, while supporting actions to make ongoing fishing practices more sustainable. It should be recognized that scientific knowledge of the impacts of fishing on habitats and fish populations will advance. Improvements in more sustainable gear technology, fishing practices, and management tools may improve the state of fisheries resources. A general goal of the Council is to constantly improve the health of the Ocean SAMP area ecosystem and the populations of fish and shellfish it provides. Cooperative research, utilizing the unique skills and expertise of the fishing community, will be a cornerstone to this goal.

4. Commercial and recreational fisheries activities are dynamic, taking place at different places at different times of the year due to seasonal species migrations and other factors. The Council recognizes that fisheries are dynamic, shaped by these seasonal migrations as well as other factors including shifts in the regulatory environment, market demand, and global climate change. The Council further recognizes that the entire Ocean SAMP area is used by commercial and recreational fishermen employing different fishing methods and gear types. Changes in existing uses, intensification of uses, and new uses within the area could cause adverse impacts to these fisheries. Accordingly, the Council shall:

    i. In consultation with the Fishermen's Advisory Board, as defined in section 560.2.1, identify and evaluate prime fishing areas on an ongoing basis through an adaptive framework.

ii. Review any uses or activities that could disrupt commercial and recreational fisheries activities.

5. The Council shall work together with the U.S. Coast Guard, the U.S. Navy, the U.S. Army Corps of Engineers, NOAA, fishermen's organizations, marine pilots, recreational boating organizations, and other marine safety organizations to promote safe navigation, fishing, and recreational boating activity around and through offshore structures and developments, and along cable routes, during the construction, operation, and decommissioning phases of such projects. The Council will promote and support the education of all mariners regarding safe navigation around offshore structures and developments and along cable routes.

6. Consultations with the U.S. Coast Guard, the U.S. Department of Interior Bureau of Ocean Energy Management, Regulation, and Enforcement, and the U.S. Army Corps of Engineers have indicated that no vessel access restrictions are planned for the waters around and through offshore structures and developments, or along cable routes, except for those necessary for navigational safety. Commercial and recreational fishing and boating access around and through offshore structures and developments and along cable routes is a critical means of mitigating the potential adverse impacts of offshore structures on commercial and recreational fisheries and recreational boating. The Council endorses this approach and shall work to ensure that the waters surrounding offshore structures, developments, and cable routes remain open to commercial and recreational fishing, marine transportation, and recreational boating, except for navigational safety restrictions. The Council requests that federal agencies notify the Council immediately of any federal action that may affect vessel access around and through offshore structures and developments and along cable routes. The Council also requests ongoing review of any federal agency decisions regarding vessel access around and through offshore structures and developments and along cable routes.

560.2. Regulatory Standards

1. The Council shall appoint a standing Fishermen's Advisory Board (FAB) which shall provide advice to the Council on the siting and construction of other uses in marine waters. The FAB is an advisory body to the Council that is not intended to supplant any existing authority of any other federal or state agency responsible for the management of fisheries. The FAB shall be comprised of six members, one representing each of the following fisheries: bottom trawling; scallop dredging; gillnetting; lobstering; party and charter boat fishing; and recreational angling. FAB members shall serve four-year terms and will serve no more than two consecutive terms. The Council shall provide to the FAB a semi-annual status report on Ocean SAMP area fisheries-related issues, including but not limited to those of which the Council is cognizant in its planning and regulatory activities, and will notify the FAB in writing concerning any project in the Ocean SAMP area. The FAB shall meet not less than semi-annually and on an as-needed basis to provide the Council with advice on the potential adverse impacts of other uses on commercial and recreational fishermen and fisheries activities, and on issues including, but not limited to, the evaluation and planning of project locations, arrangements, and alternatives; access limitations; and measures to mitigate the potential impacts of such

projects. Any Large-Scale Offshore Development, as defined in Section 1160.1 of Chapter 11, The Policies of the Ocean SAMP, will require a pre-application meeting with the FAB, the applicant, and the Council staff to discuss potential fishery-related impacts, such as, but not limited to, project location, construction schedules, alternative locations, and project minimization. During the pre-application meeting for a Large-Scale Offshore Development, the FAB can also identify areas of high fishing activity or habitat edges.

2. The Council shall prohibit any other uses or activities that would result in significant long-term negative impacts to Rhode Island's commercial or recreational fisheries. Long-term impacts are defined as those that affect more than one or two seasons.

3. The Council shall require that the potential adverse impacts of Offshore Developments and other uses on commercial or recreational fisheries be evaluated, considered, and mitigated as described in section 560.2.4.

4. For the purposes of Sections 560.1-560.2, mitigation is defined as a process to make whole those fisheries user groups that are adversely affected by proposals to be undertaken, or undertaken projects, in the Ocean SAMP area. Mitigation measures shall be in consonance with the purposes of duly adopted fisheries management plans, programs, strategies and regulations of the agencies and regulatory bodies with jurisdiction over fisheries in the SAMP area, including but not limited to those set forth above in 560.1.2. Mitigation shall not be designed or implemented in a manner that substantially diminishes the effectiveness of duly adopted fisheries management programs. Mitigation measures may include, but are not limited to, compensation, effort reduction, habitat preservation, restoration and construction, marketing, and infrastructure improvements. Where there are potential impacts associated with proposed projects, the need for mitigation shall be presumed. Negotiation of mitigation agreements shall be a necessary condition of any approval or permit of a project by the Council. Mitigation shall be negotiated between the Council staff, the FAB, the project developer, and approved by the Council. The reasonable costs associated with the negotiation, which may include data collection and analysis, technical and financial analysis, and legal costs, shall be borne by the applicant. The applicant shall establish and maintain either an escrow account to cover said costs of this negotiation or such other mechanism as set forth in the permit or approval condition pertaining to mitigation. This policy shall apply to all Large-Scale Offshore Developments, underwater cables, and other projects as determined by the Council.

5. The Council has designated glacial moraines, as identified in Figure 11.3 and Figure 11.4 in Chapter 11, The Policies of the Ocean SAMP, as Areas of Particular Concern. Glacial moraines are important habitat areas for fish because of their relative structural permanence and structural complexity. The Council also recognizes that because glacial moraines contain valuable fish habitats they are also important to commercial and recreational fishermen. See Chapter 11, The Policies of the Ocean SAMP, for requirements associated with Areas of Particular Concern.

6. The Council recognizes that moraine edges, as illustrated in Figure 11.3 and Figure 11.4 in Chapter 11, The Policies of the Ocean SAMP, are important to fishermen. In addition

to these mapped areas, the FAB may identify other edge areas that are important to fisheries within a proposed project location. The Council shall consider the potential adverse impacts of future activities or projects on these areas to Rhode Island's commercial and recreational fisheries. Where it is determined that there is a significant adverse impact, the Council will modify or deny activities that would impact these areas. In addition, the Council will require assent holders for Offshore Developments to employ micro-siting techniques in order to minimize the potential impacts of such projects on these edge areas.

7. The finfish, shellfish, and crustacean species that are targeted by commercial and recreational fishermen rely on appropriate habitat at all stages of their life cycles. While all fish habitat is important, spawning and nursery areas are especially important in providing shelter for these species during the most vulnerable stages of their life cycles. The Council shall protect sensitive habitats where they have been identified through the Site Assessment Plan or Construction and Operation Plan review processes for Offshore Developments as described in Section 1160.5 in Chapter 11, The Policies of the Ocean SAMP.

8. The Council shall consult with the U.S. Coast Guard, the U.S. Navy, marine pilots, the FAB, fishermen's organizations, and recreational boating organizations when scheduling offshore marine construction or dredging activities. Where it is determined there is a significant conflict with season-limited commercial or recreational fisheries activities, recreational boating activities or scheduled events, or other navigation uses, the Council shall modify or deny activities to minimize conflict with these uses.

9. The Council shall require the assent holder to provide for communication with commercial and recreational fishermen, mariners, and recreational boaters regarding offshore marine construction or dredging activities. Communication shall be facilitated through a project website and shall complement standard U.S. Coast Guard procedures such as Notices to Mariners for notifying mariners of obstructions to navigation.

10. For all Large-Scale Offshore Developments, underwater cables, and other development projects as determined by the Council, the assent holder shall designate and fund a third-party fisheries liaison. The fisheries liaison must be knowledgeable about fisheries and shall facilitate direct communication between commercial and recreational fishermen and the project developer. Commercial and recreational fishermen shall have regular contact with and direct access to the fisheries liaison throughout all stages of an offshore development (pre-construction; construction; operation; and decommissioning).

11. Where possible, Offshore Developments should be designed in a configuration to minimize adverse impacts on other user groups, which include but are not limited to: recreational boaters and fishermen, commercial fishermen, commercial ship operators, or other vessel operators in the project area. Configurations which may minimize adverse impacts on vessel traffic include, but are not limited to, the incorporation of a traffic lane through a development to facilitate safe and direct navigation through, rather than around, an Offshore Development.

12. The items listed below shall be required for all Offshore Developments:

   i. A biological assessment of commercially and recreationally targeted species shall be required within the project area for all Offshore Developments. This assessment shall assess the relative abundance, distribution, and different life stages of these species at all four seasons of the year. This assessment shall comprise a series of surveys, employing survey equipment and methods that are appropriate for sampling finfish, shellfish, and crustacean species at the project's proposed location. Such an assessment shall be performed at least four times: pre-construction (to assess baseline conditions); during construction; and at two different intervals during operation (i.e. 1 year after construction and then post-construction). At each time this assessment must capture all four seasons of the year. This assessment may include evaluation of survey data collected through an existing survey program, if data are available for the proposed site. The Council will not require this assessment for proposed projects within the Renewable Energy Zone that are proposed within two years of the adoption of the Ocean SAMP.

   ii. An assessment of commercial and recreational fisheries effort, landings, and landings value shall be required for all Offshore Developments. Assessment shall focus on the proposed project area and alternatives. This assessment shall evaluate commercial and recreational fishing effort, landings, and landings value at three different stages: pre-construction (to assess baseline conditions); during construction; and during operation. At each stage, all four seasons of the year must be evaluated. Assessment may use existing fisheries monitoring data but shall be supplemented by interviews with commercial and recreational fishermen. Assessment shall address whether fishing effort, landings, and landings value has changed in comparison to baseline conditions. The Council will not require this assessment for proposed projects within the Renewable Energy Zone that are proposed within 2 years of the adoption of the Ocean SAMP.

Section 570. Works Cited

Allen, G. 2010. Bluefin tuna in Narragansett Bay – A look back. RI Saltwater Anglers Association newsletter, April 2010.

Atlantic Coastal Cooperative Statistics Program. 2010. Commercial Catch and Effort Data. Accessed May 26, 2010 from: http://www.accsp.org/dataware.htm

Atlantic Menhaden Technical Committee. 2006. *2006 Stock Assessment Report for Atlantic Menhaden*. Online at: www.asmfc.org.

Atlantic States Marine Fisheries Commission. 2009a. *American Lobster Stock Assessment Report for Peer Review*. Online at: www.asmfc.org/americanLobster.htm. Last accessed June 21, 2010.

Atlantic States Marine Fisheries Commission. 2009b. Species Profile: Black Sea Bass. Online at: www.asmfc.org/blackseabass.htm. Last accessed March 25, 2010.

Atlantic States Marine Fisheries Commission. 2009c. Species Profile: Atlantic Sturgeon. Online at www.asmfc.org/Atlanticsturgeon.htm. Revised April 2009. Last accessed June 21, 2010.

Atlantic States Marine Fisheries Commission. 2008a. *ASMFC Stock Status Overview*.

Atlantic States Marine Fisheries Commission. 2008b. Annual Coast Striped Bass Landings, 1982-2008. Online at http://www.asmfc.org/stripedbass.htm. Last accessed March 23, 2010.

Atlantic States Marine Fisheries Commission. 2008c. Species Profile: Summer Flounder. Online at: www.asmfc.org/sumerflounder.htm. Last accessed March 25, 2010.

Atlantic States Marine Fisheries Commission. 2008d. Interstate Fishery Management Plan for Atlantic Coastal Sharks. Online at http://www.asmfc.org/speciesDocuments/coastalSharks.htm.

Bachman, Michelle. 2010. New England Fishery Management Council. Personal communication, May 26, 2010.

Atlantic States Marine Fisheries Commission. 2007. Species Profile: Shad & River Herring. Online at: www.asmfc.org. Revised October 2007.

Bellavance, Rick. 2010. Rhode Island Party and Charter Boat Association. Personal communication, April 28, 2010.

Bigelow, H.B.; Schroeder, W.C. 1953. Fishes of the Gulf of Maine. Volume 53: Fishery Bulletin of the Fish and Wildlife Service. Washington: United States Government Printing Office.

Blount, Frank, Frances Fleet. Personal communication, July 13, 2009.

Bohaboy, E., Collie, J., Malek, A. 2010. Baseline Characterization. *Appendix A* to Ocean SAMP Chapter 5, *Commercial and Recreational Fisheries Resources and Uses*.

Bowman, R.E., Stillwell, C.E., Michaels, W.L., Grosslein, M.D. 2000. Food of Northwest Atlantic fishes and two common species of squid. NOAA Tech. Memo. NMFS-F/NE-155, 138 pp.

Buckley, L., Collie, J., Kaplan, L.A.E., Crivello, J. 2008. Winter flounder larval genetic population structure in Narragansett Bay, RI: Recruitment to juvenile young-of-the-year. *Estuaries and Coasts,* 31: 745-754.

Convention on International Trade in Endangered Species (CITES). 2009. Proposal to include Atlantic Bluefin Tuna (*Thunnus thynnus*) on Appendix I of CITES in accordance with Article II 1 of the Convention. October 2009. Available online from: http://www.cites.org/common/cop/15/raw_props/E-15%20Prop-MC%20T%20thynnus.pdf. Last accessed June 21, 2010.

CITES. 2010. CITES conference ends without new sharks in its net. Press release, March 25, 2010, online at http://www.cites.org/eng/news/press_release.shtml. Last accessed June 21, 2010.

Clay, P., Colburn, L., Olsen, J., Pinto da Silva, P., Smith, S., Westwood, A., Ekstrom, J. 2008. *Community Profiles for the Northeast US Fisheries*. Northeast Fisheries Science Center, NOAA. Available at: http://www.nefsc.noaa.gov/read/socialsci/community_profiles/

Cobb, J.S., Wahle, R.A. 1994. Early Life History and Recruitment Processes of Clawed Lobsters. *Crustaceana, 67*(1): 1-25.

Collette, B.B., Klein-MacPhee, G., eds. 2002. *Bigelow and Schroeder's Fishes of the Gulf of Maine*. Third Edition. Washington, D.C.: Smithsonian Institute Press.

Collie, J.S., Hall, S.J., Kaiser, M.J., Poiner, I.R. 2000. A Quantitative Analysis of Fishing Impacts on Shelf-Sea Benthos. *Journal of Animal Ecology,* 69 (5): 785-798.

Collie, J.S., Hermsen, J.M., Valentine, P.C., Almeida, F.P. 2004. Effects of fishing on gravel habitats: assessment and recovery of benthic megafauna on Georges Bank. In: *Benthic habitats and the effects of fishing*. Barnes, P. and Thomas, J., (eds). American Fisheries Society, Bethesda, MD. In press.

Collie, J.S., Wood, A.D., Jeffries, H.P. 2008. Long-term shifts in the species composition of a coastal fish community. *Canadian Journal of Fisheries and Aquatic Sciences,* 65: 1352-1365.

Collie, Jeremy. 2009. URI Graduate School of Oceanography. Personal communication, December 4, 2009.

Conley, P. 1986. *An Album of Rhode Island History, 1636 – 1986*. Virginia Beach, VA: Donning Company Publishers.

Crocker, Julie. 2010. NMFS Northeast Regional Office Protected Resources Division. Personal Communication a, February 3, 2010.

Crocker, Julie. 2010. NMFS Northeast Regional Office Protected Resources Division. Personal Communication b, March 23, 2010.

DeAlteris, J.T., Gibson, M., Skrobe, L.G. 2000. *Fisheries of Rhode Island* (Working Draft). Narragansett Bay Summit 2000: White Paper.

Donilon, Charlie. 2009. Rhode Island Party and Charter Boat Association, Personal communication, June 23, 2009.

Fogarty, M.J., Murawski, S.A. 1998. Large-scale disturbance and the structure of marine systems: Fishery impacts on Georges Bank. *Ecological Applications,* 8(1) Supplement: S6-S22.

Gentner, B., Steinback, S. 2008. *The Economic Contribution of Marine Angler Expenditures in the United States, 2006.* U.S. Dept. of Commerce, NOAA Tech. Memo. NMFS-F/SPO-94.

Griffith, D., Dyer, C.L. 1996. *An Appraisal of the Social and Cultural Aspects of the Multispecies Groundfish Fishery in the New England and the Mid-Atlantic Regions*. Report prepared under Contract Number 50-DGNF-5-00008, National Oceanic and Atmospheric Admin and Aguirre International [cited Jan 2007]. Available at: http://www.nefsc.noaa.gov/clay/overvue.htm

Hall-Arber, M., Dyer, C., Poggie, J., McNally, J., Gagne, R. 2001. *New England's Fishing Communities.* Cambridge (MA): MIT Sea Grant 01-15. Available from: http://seagrant.mit.edu/cmss/marfin/index.html. Last accessed June 21, 2010

Hiddink, J.G., Jennings, S., Kaiser, M.J., Queirós, A.M., Duplisea, D.E., Piet, G.J. 2006. Cumulative impacts of seabed trawl disturbance on benthic biomass, production, and species richness in different habitats. *Canadian Journal of Fisheries and Aquatic Sciences*, 63: 721-736.

Hiddink, J.G., Rijnsdorp, A.D., Piet, G. 2008. Can bottom trawling disturbance increase food production for a commercial fish species? *Canadian Journal of Fisheries and Aquatic Sciences*, 65: 1393-1401.

Hittinger, Richard. 2010. Rhode Island Saltwater Anglers Association, Personal communication, April 8, 2010.

Hittinger, Richard. 2010. Rhode Island Saltwater Anglers Association, Personal communication, April 26, 2010.

Incze, L., Xue, H., Wolff, N., Xu, D., Wilson, C., Steneck, R., Wahle, R., Lawton, P., Pettigrew, N., Chen, Y. 2010. Connectivity of lobster (*Homarus americanus*) populations in the coastal Gulf of Maine: part II. Coupled biophysical dynamics. *Fisheries Oceanography*, 19(1): 1-20.

Intergovernmental Policy Analysis Program, University of Rhode Island. 1989. *The Commercial Fishing Industry in Rhode Island: An Inventory, Analysis, and Assessment*. Prepared for: The Rhode Island Port Authority and Economic Development Corporation.

Johnson, M.R., Boelke, C., Chiarella, L.A., Colosi, P.D., Greene, K., Lellis-Dibble, K., Ludemann, H., Ludwig, M., McDermott, S., Ortiz, J., Rusanowsky, D., Scott, M., Smith, J. 2008. *Impacts to Marine Fisheries Habitat from Nonfishing Activities in the Northeastern United States*. NOAA Technical Memorandum NMFS-NE-209.

King, John. 2009. URI Graduate School of Oceanography. Personal communication, December 4, 2009.

Lengyel, N.L., Collie, J.S., Valentine, P.C. 2009. The invasive colonial ascidian *Didemnum vexillum* on Georges Bank: Ecological effects and genetic identification. *Aquatic Invasions, 4* (1): 143-152.

Little Compton Harbor Commission. 2008. *Sakonnet Harbor Management Plan*.

Lobster Conservancy. 2004. Lobster Biology. Accessed May 4, 2010 from: http://www.lobsters.org/tlcbio/biology.html

Macy, W.K., Brodziak, J. 2001. Seasonal maturity and size at age of *Loligo pealeii* in waters of southern New England. *ICES Journal of Marine Science*, 58: 852-864.

Malek, A., Collie, J., LaFrance, M., and King, J. 2010. Fisheries Ecology and Benthic Habitat in Rhode Island and Block Island Sounds for the Rhode Island Ocean Special Area Management Plan. University of Rhode Island, June 25, 2010.

Mayo, R., O'Brien, L. 2006. *Atlantic Cod. Status of Fishery Resources off the Northeastern U.S.* NEFSC – Resource Evaluation and Assessment Division. Available online from: http://www.nefsc.noaa.gov/sos/spsyn/pg/cod/. Last accessed June 21, 2010.

Mid-Atlantic Fishery Management Council (MAFMC). June 2009. Amendment 10 to the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan.

Mullen, D.M., Moring, J.R. 1986. Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (North Atlantic). Sea Scallop.

Ninigret Partners. 2007. *Rhode Island Recreational Saltwater Fishing Industry Trends and Economic Impact.* Prepared for the RI Saltwater Anglers Association.

NOAA National Marine Fisheries Service Northeast Fisheries Science Center (NEFSC). 2008. *Assessment of 19 Northeast Groundfish Stocks through 2007*. Online at: http://nefsc.noaa.gov/nefsc/publications/crd/crd0815/. Last accessed June 21, 2010.

NEFSC. 2007. Essential Fish Habitat Source Document: Black Sea Bass, *Centropristis striata*, Life History and Habitat Characteristics. NOAA Technical Memorandum NMFS-NE-200.

NEFSC. 2006a. The Status of Fishery Resources off the Northeastern United States. Accessed September 2009. Available from: http://www.nefsc.noaa.gov/sos/

NEFSC. 2006b. Essential Fish Habitat Source Document: Bluefish, *Pomatumus saltatrix*, Life History and Habitat Characteristics. NOAA Technical Memorandum NMFS-NE-198.

NEFSC. 2005a. Essential Fish Habitat Source Document: Atlantic Herring, *Clupea harengus*, Life History and Habitat Characteristics. NOAA Technical Memorandum NMFS-NE-192.

NEFSC. 2005b. Essential Fish Habitat Source Document: Longfin Inshore Squid, *Loligo pealeii*, Life History and Habitat Characteristics. NOAA Technical Memorandum NMFS-NE-193.

NEFSC. 2004a. Essential Fish Habitat Source Document: Atlantic Cod, *Gadus morhua*, Life History and Habitat Characteristics. NOAA Technical Memorandum NMFS-NE-190.

NEFSC. 2004b. Essential Fish Habitat Source Document: Sea Scallop, *Placopecten magellanicus*, Life History and Habitat Characteristics. NOAA Technical Memorandum NMFS-NE-189.

NEFSC. 2004c. Essential Fish Habitat Source Document: Silver Hake, *Merluccius bilinearis*, Life History and Habitat Characteristics. NOAA Technical Memorandum NMFS-NE-186.

NEFSC. 2003a. Essential Fish Habitat Source Document: Little Skate, *Leucoraja erinacea*, Life History and Habitat Characteristics. NOAA Technical Memorandum NMFS-NE-175.

NEFSC. 2003b. Essential Fish Habitat Source Document: Winter Skate, *Leucoraja ocellata*, Life History and Habitat Characteristics. NOAA Technical Memorandum NMFS-NE-179.

NEFSC. 1999a. Essential Fish Habitat Source Document: Atlantic Mackerel, *Scomber scombrus*, Life History and Habitat Characteristics. NOAA Technical Memorandum NMFS-NE-141.

NEFSC. 1999b. Essential Fish Habitat Source Document: Butterfish, *Peprilus triacanthus*, Life History and Habitat Characteristics. NOAA Technical Memorandum NMFS-NE-145.

NEFSC. 1999c. Essential Fish Habitat Source Document: Goosefish, *Lophius americanus*, Life History and Habitat Characteristics. NOAA Technical Memorandum NMFS-NE-127.

NEFSC. 1999d. Essential Fish Habitat Source Document: Scup, *Stenotomus chrysops*, Life History and Habitat Characteristics. NOAA Technical Memorandum NMFS-NE-149.

NEFSC. 1999e. Essential Fish Habitat Source Document: Summer Flounder, *Paralichthys dentatus*, Life History and Habitat Characteristics. NOAA Technical Memorandum NMFS-NE-151.

NEFSC. 1999f. Essential Fish Habitat Source Document: Winter Flounder, *Pseudopleuronectes americanus*, Life History and Habitat Characteristics. NOAA Technical Memorandum NMFS-NE-138.

NEFSC. 1999g. Essential Fish Habitat Source Document: Yellowtail flounder, *Limanda ferruginea*, Life History and Habitat Characteristics. NOAA Technical Memorandum NMFS-NE-140.

NEFSC. N.d. Fisheries Technical Terms. Accessed June 8, 2010 from: http://www.nefsc.noaa.gov/techniques/tech_terms.html.

NOAA National Marine Fisheries Service (NMFS). 2010a. Species of Concern. Online at: http://www.nmfs.noaa.gov/pr/species/concern/#list. Updated February 2, 2010. Last accessed March 24, 2010.

NMFS. 2010b. Fish Watch: U.S. Seafood Facts. Available online from: http://www.nmfs.noaa.gov/fishwatch/ Last accessed March 26, 2010.

NMFS. 2010c. Atlantic Sturgeon. Online at: http://www.nmfs.noaa.gov/pr/pdfs/species/atlanticsturgeon_detailed.pdf. Updated February 23, 2010. Last accessed June 22, 2010.

NMFS. 2010d. Porbeagle Shark. Online at: http://www.nmfs.noaa.gov/pr/pdfs/species/porbeagleshark_detailed.pdf. Revised February 23, 2010. Last accessed June 22, 2010.

NMFS. 2010e. Northeast Region Permit Database, updated April 6, 2010.

NMFS. 2009a. Fisheries Statistics Division. Annual Commercial Landings Statistics. Online at: http://www.st.nmfs.noaa.gov/st1/commercial/landings/annual_landings.html.

NMFS. 2009b. Atlantic Halibut. Online at: http://www.nmfs.noaa.gov/pr/pdfs/species/atlantichalibut_detailed.pdf. Revised May 2009.

NMFS. 2009c. Atlantic Wolffish. Online at:

http://www.nmfs.noaa.gov/pr/pdfs/species/atlanticwolffish_detailed.pdf. Revised May 11, 2009.

NMFS. 2009d. Dusky Shark. Online at: http://www.nmfs.noaa.gov/pr/pdfs/species/duskyshark_detailed.pdf. Revised May 19, 2009.

NMFS. 2009e. River Herring (Alewife & Blueback Herring). Online at: http://www.nmfs.noaa.gov/pr/pdfs/species/riverherring_detailed.pdf. Revised May 19, 2009.

NMFS. 2009f. Sand Tiger Shark. Online at: http://www.nmfs.noaa.gov/pr/pdfs/species/sandtigershark_detailed.pdf. Revised May 11, 2009.

NMFS. 2009g. Thorny Skate. Online at: http://www.nmfs.noaa.gov/pr/pdfs/species/thornyskate_detailed.pdf. Revised May 19, 2009.

NMFS. 2008a. *Fisheries Economics of the United States 2006*. Online at http://www.st.nmfs.noaa.gov/st5/publication/economics_communities.html.

NMFS. 2008b. Fisheries of the United States 2007. Online at: http://www.st.nmfs.noaa.gov/st1/fus/fus07/02_commercial2007.pdf.

NMFS. 2007a. Rainbow Smelt. Online at: http://www.nmfs.noaa.gov/pr/pdfs/species/rainbowsmelt_detailed.pdf. Revised November 1, 2007. Accessed June 21, 2010.

NMFS. 2007b. A Guide to the Tunas of the Western Atlantic Ocean. Online at: https://hmspermits.noaa.gov/other/tunaguide%202007%20waterproof%20version%20new%20pic.pdf. Last accessed May 5, 2010.

NMFS. 2007c. Magnuson-Stevens Fishery Conservation and Management Act. Public Law 94-265. Online at: http://www.nmfs.noaa.gov/msa2005/docs/MSA_amended_msa%20_20070112_FINAL.pdf

NMFS. 2006. Final Consolidated Atlantic Highly Migratory Species Fishery Management Plan. Online at: http://www.nmfs.noaa.gov/sfa/hms/hmsdocument_files/sharks.htm.

NMFS, Office of Habitat Conservation. 2010. Essential Fish Habitat. Available from: http://www.nmfs.noaa.gov/habitat/habitatprotection/efh/index.htm. Last accessed June 22, 2010.

National Marine Fisheries Service, Fisheries Statistics Division. 2010. Marine Recreational Fisheries Statistics Survey (MRFSS). Personal communication, May 5, 2010.

NMFS. n.d. Essential Fish Habitat and Critical Habitat: A Comparison. Available from: http://www.nmfs.noaa.gov/habitat/habitatprotection/pdf/efh/factsheets/EFH_CH_Handout_Final_3107.pdf. Last accessed June 22, 2010.

NOAA General Counsel for Natural Resources. 2010. Case: North Cape, RI. Available from: http://www.darrp.noaa.gov/northeast/north_cape. Accessed January 28, 2010.

Olsen, S., Robidue, D., Lee, V. 1980. *An Interpretive Atlas of Narragansett Bay*. Coastal Resources Center, Marine Bulletin 40, University of Rhode Island.

Olsen, S., Stevenson, D. 1975. *Commercial Marine Fish and Fisheries of Rhode Island*. Coastal Resources Center, University of Rhode Island: Marine Technical Report 34.

Olsgard, F., Schaanning, M.T., Widdicombe, S., Kendall, M.A., Austen, M.C. 2008. Effects of bottom trawling on ecosystem functioning. *Journal of Experimental Marine Biology and Ecology*, 366: 123-133.

Oviatt, C.A., Kremer, P.M. 1977. Predation on the ctenophore, *Mnemiopsis leidyi*, by butterfish, *Peprilus triacanthus*, in Narragansett Bay, Rhode Island. *Chesapeake Sci.*, 18: 236-240.

Oviatt, C., Olsen, S., Andrews, M., Collie, J., Lynch, T., Raposa, K. 2003. A Century of Fishing and Fish Fluctuations in Narragansett Bay. *Reviews in Fisheries Science* 11 (3) 221-242.

Piet, G.J., Jennings, S. 2005. Response of potential fish community indicators to fishing. *ICES Journal of Marine Science*, 62: 214-225.

Poggie, J., Gersuny, C. 1974. *Fishermen of Galilee: The Human Ecology of a New England Coastal Community*. Kingston (RI): University of Rhode Island Marine Bulletin, Series no. 17.

Poggie, J.J., Pollnac, R.B., eds. 1981. *Small Fishing Ports in Southern New England*. NOAA/Sea Grant. University of Rhode Island: Marine Bulletin 39.

Pogsay, J. A. 1979. Population assessment of the Georges Bank sea scallop stocks. *Rapp P.-V. R eu n. Cons. Int. Explor. Mer* 175:109-113.

Rago, P.J., Sosebee, K.A. 2010. Biological Reference Points for Spiny Dogfish. Northeast Fisheries Science Center Reference Doc. 10-66, 52p.

Rainone, John. 2009. Rhode Island Party and Charter Boat Association. Personal communication, July 4, 2009.

Rathjen, W.F. 1973. Northwest Atlantic squids. *Marine Fisheries Review*, 35 (12): 20-26.

Read, A.J., Brownstein, C.R. 2003. Considering other consumers: Fisheries, predators, and Atlantic herring in the Gulf of Maine. *Conservation Ecology*, 7(1): 2.

RI Coastal Resources Management Council (CRMC). 2010. CRMC funds 10 habitat restoration projects. Press release, March 22, 2010, online at: http://www.crmc.ri.gov/news/2010_0322_habrest.html. Last accessed June 22, 2010.

R.I. Department of Environmental Management (RIDEM). 2010a. 2010 Management Plan for the Finfish Fishery Sector. Available online at: http://www.dem.ri.gov/pubs/regs/regs/fishwild/fishamnd.htm. Last accessed June 22, 2010.

RIDEM. 2010b. Raw data on Rhode Island Marine Fisheries provided by RIDEM Division of Fish and Wildlife, June 2010.

RIDEM. 2009. Abstract of Marine Fisheries Rules and Regulations. Available online at: http://www.dem.ri.gov/programs/bnatres/fishwild/pdf/saltabs.pdf. Last accessed June 22, 2010.

RIDEM, Division of Planning and Development. 2006. Public Access to Shoreline Recreational Fishing in Narragansett Bay. Prepared by Gordon R. Archibald, Inc.

RIDEM, Division of Coastal Resources. N.d. Coastal resources index page. Accessed December 15, 2009 from: http://www.dem.ri.gov/programs/bnatres/coastal/

RI Economic Monitoring Collaborative. 2008. Fiscal Year 08 Economic Monitoring Report.

Rhode Island Saltwater Anglers Association (RISAA). 2010. Tournaments. Rhode Island Saltwater Anglers Association homepage. Available online at: http://www.risaa.org/tournaments/tournaments.html. Last accessed January 26, 2010.

Ross, M.R. 1991. *Recreational Fisheries of Coastal New England*. Amherst, MA: University of Massachusetts Press.

Saila, S.B., Flowers, J.M. 1968. Movements and behavior of berried female lobsters displaced from offshore areas to Narragansett Bay, Rhode Island. *Journal du Conseil*, 31: 342-351.

Sedgwick, S., Collins, C., Olsen, S. 1980. *Commercial Fishing Facilities Needs in Rhode Island*. Coastal Resources Center, University of Rhode Island: Marine Technical Report 80.

Steinback, S., Gentner, B., Castle, J. 2004. *The Economic Importance of Marine Angler Expenditures in the United States*. NOAA Professional Paper NMFS 2.

Thunberg, E. 2009. *Trends in Selected Northeast Region Marine Industries*. NOAA Technical Memorandum NMFS-NE-211.

US Fish and Wildlife Service. 2006. *2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation – Rhode Island*. Available online at:

Wahle, R.A. 1992. Body-size dependent anti-predator mechanisms of the American lobster. *Oikos* 65: 52-60.