3.0 FISHERIES RESOURCES

The State of New Jersey has many valuable natural resources. The estimated value of goods and services associated with the state's natural resources ranges from $8.6 to $19.8 billion per year (NJDEP 2007b; NJDEP 2007a). Overall, freshwater and marine ecosystems have the highest ecoservice value ranging from $2.8 to $9.7 billion per year. One of the most economically valuable components of marine ecosystems is fishery resources. According to the Rutgers New Jersey Agricultural and Experiment Station, the economic impact of commercial fisheries, recreational fisheries, and aquaculture in New Jersey is around $4.5 billion annually.[1] Commercial fishery operations within or in the vicinity of the Study Area are highly active and key suppliers of marine products to domestic and foreign markets. In addition to commercial fisheries, recreational fisheries are also an important economic activity that occur off the coast of New Jersey and within the Study Area.

The New Jersey coastline consists of various inshore (e.g., estuaries, bays, salt marshes, tidal creeks, and coastal beaches) and offshore environments (e.g., sand ridges, continental shelf, canyons, hard bottom, and artificial reefs [e.g., ship wrecks and man-made structures]) that provide important habitats to many fish and invertebrates. In general, fish habitats off the coast of New Jersey can be categorized as coastal beaches, pelagic, demersal (benthic), and hard bottom (i.e., natural or artificial reef-structures). Within the Study Area, several economically valuable fish and invertebrate species use the area for feeding, spawning, and as nursery grounds. Marine fish depend upon and utilize many types of habitats (e.g., seagrass, salt marsh, solitary corals, and rocky intertidal areas) at different life stages. Because land and water activities can threaten to alter, damage, or destroy these habitats, regional Fishery Management Councils (FMCs) and federal and state agencies work together to address these threats by identifying EFHs for every federally managed fish species. In addition, Habitat Areas of Particular Concern (HAPCs) are also designated, which are defined as discrete subsets of EFH that provide important ecological functions that are especially vulnerable to degradation. Depending on the purpose and need, FMCs may designate a specific habitat area as an HAPC based on one or more of the following reasons: (1) importance of the ecological function provided by the habitat; (2) extent to which the habitat is sensitive to human-induced environmental degradation: (3) whether, and to what extent, development activities are, or will be, stressing the habitat type; and (4) rarity of the habitat type (NMFS 2002).

3.1 FISHERIES DYNAMICS

The distribution of fish and fishing efforts often vary greatly spatially and temporally. Fish distribution also varies by their life stage (Cross et al. 1999; Taylor et al. 2007). Some of the environmental factors influencing spatial fish distribution include, but are not limited to, salinity, water temperature, dissolved oxygen level, which is often associated with season. In addition, life history requirements and migration behaviors affect seasonal relative abundance (Musick and Mercer 1977; Moser and Shepherd 2009). Although natural patterns of variability in fish populations are expected, anthropogenic activities such as coastal development, pollution (e.g., water quality: nutrients and pH level), commercial and recreational fishing, and habitat alteration/destruction can also affect spatial and temporal distribution of fish (Saila and Pratt 1973; Malakoff 1997; Jiménez-Marrero et al. 1998; Lazaroff 2001). Jackson et al. (2001) stated that nearly all estuarine species (i.e., fishes and macroinvertebrates) have been adversely affected to some degree by human activities, which has negatively altered the relative abundance of many coastal fisheries (e.g., blue crabs [*Callinectes sapidus*], oysters, and Atlantic striped bass [*Morone saxatilis*]). Excess fishing efforts may result in growth and recruitment overfishing, leading to overfished fish populations (Dayton et al. 1995; Jackson et al. 2001; Lazaroff 2001; ASMFC 2009a; NMFS 2009b).

Over the past two centuries, and especially within the last 50 years, the overall commercial and recreational fishing effort has increased significantly because of the high demand for seafood products and for socioeconomic reasons. Yet commercial fishery landings for many marine species have generally decreased with time, which suggests that fish effort is unsustainable for some species (Parker and Dixon 1998; Williams 1998). The development of advanced technology, better and improved access to environmental data (e.g., water temperature and current information), and advancements in commercial fishing gears has improved the catch efficiency for many species (SeaWeb 2002). While improvements in

commercial fishing gears and methods continue to evolve, overall commercial catch rates, as a function of fishing effort continues to decline for many species. As commercial landings continue to decline for many economically valuable species, commercial fishermen are adapting toward targeting lower valued species that were once discarded (Caddy et al. 1998; Pauly et al. 1998).

3.2 FISHERIES MANAGEMENT

To develop effective fishery management and maintain thriving sustainable fisheries, public involvement and participation by the fishing community has become essential. Through the fishery management process, various federal laws, executive orders, proclamations, and regulations have been created to aid in the conservation and protection of fishery resources. Among the most important statutes was the establishment and implementation of the Magnuson-Stevens Fishery Conservation and Management Act (MSFMCA) or the Sustainable Fisheries Act (SFA). One of the unique mandates of the SFA was the creation of eight regional FMCs; each FMC is responsible for the status of valuable fishery stocks within their jurisdiction. Generally, management jurisdiction is defined as a common geographical area encompassing the federal waters known as the Exclusive Economic Zone (EEZ; i.e., 322-kilometer [km] or 200-mile [mi] limit). For example, the Mid-Atlantic Council (MAFMC) is responsible for the conservation and management of fish stocks within the EEZ off the coasts of New York, New Jersey, Delaware, Maryland, Virginia, and North Carolina. After developing fishery management plans (FMPs) for individual species or species complexes (a group of similar species), the FMCs then use these documents to convey the conservation strategies for specific fishery resources. In general, FMPs are updated at regular intervals in accord with new scientific information or other significant circumstances. In addition to the eight FMCs, the National Marine Fisheries Service (NMFS) also relies on an appointed Highly Migratory Species (HMS) advisory team that is charged with assisting NMFS with implementing the requirements of the International Committee for the Conservation of Atlantic Tunas (ICCAT). The NMFS is responsible for managing 44 species (34 sharks, 5 tunas, 4 billfishes, and 1 swordfish) in domestic and international waters (NMFS-IFD 2004; NMFS 2004).

Marine fisheries resources (fish and invertebrates) that are found in the Study Area are managed through an elaborate process that includes the State of New Jersey, three FMCs (New England Fishery Management Council [NEFMC], MAFMC, and South Atlantic Fishery Management Council [SAFMC], the Atlantic States Marine Fisheries Commission (ASMFC), and the NMFS. In total, NEFMC manages 13 species, MAFMC manages 10 species, SAFMC manages 3 species, and NMFS manages 14 species that are found within the Study Area. In addition, six species are jointly managed by either two FMCs or one FMC and the ASMFC. In general, each FMC is only responsible for managing species within their respected jurisdictional areas. The MAFMC is one of the larger Councils that oversees some of the species found within the Study Area. It is accountable for managing fisheries in federal waters which occur mainly off the mid-Atlantic coast. States with voting representation on the Council include New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, and North Carolina, which is represented by the MAFMC and the SAFMC. The ASMFC manages shared marine fishery resources in state waters through the Interstate Fisheries Management Program (ISFMP). The ASFMC coordinates the conservation and management of 22 Atlantic coastal fish and invertebrate species and 2 species groups (shad/river herring and coastal sharks), which are found in the Study Area or vicinity (ASMFC 2008b). Both the SAFMC and GMFMC jointly manage fishes (i.e., coastal migratory pelagics) seasonally found in the Study Area. These FMCs are responsible for managing fisheries that are found in federal waters in the Gulf of Mexico and South Atlantic Bight (SAB). The HMS Management Division of the NMFS is responsible for managing swordfish, tunas, billfish, and sharks in domestic and international waters (outside of the EEZ). There are several HMS that are found in the Study Area or in the vicinity of the Study Area.

Despite the importance of New Jersey commercial fisheries, there are no comprehensive literature reviews on the commercial fisheries operating off the coast of New Jersey; however, some data are available from mandatory dealer reporting (state and federal: summer flounder, black sea bass, and scup [*Stenotomus chrysops*]) and other programs. For example, the New Jersey Division of Fish and Wildlife requires permit holders to submit monthly catch reports for summer flounder (*Paralichthys dentatus*), black sea bass, scup, tautog, horseshoe crab (*Limulus polyphemus*), Atlantic menhaden (bait), American

shad (*Alosa sapidissima*), and American lobster (ASMFC 2008b). Moreover, crab/pot and gill net mesh exemption permit holders must also submit monthly records of catch.

3.3 COMMERCIAL FISHERIES

The total economic value of commercial fisheries in New Jersey from 2003 through 2007 was nearly one billion dollars (an average of 178 million dollars a year; Idoine 1998); however, the actual economic value to the region was likely far greater in terms of the jobs, goods, and services associated with these fisheries. In 2007, commercial fisheries in New Jersey ranked eighth in value and tenth in landings in the U.S. (**Table 3-1**; **Figure 3-1**).

Table 3-1. Top commercial fishing gears, landings (metric tons), and associated value ($US) for fisheries operating within or in the vicinity of the Study Area (State of New Jersey) from 2003 to 2007.[2]

Gear	Landings (mt)	Value ($)
Dredges (all types)	165,388.0	$465,770,895
Trawls (all types)	103,542.7	$85,927,922
Purse Seine	39,701.5	$7,269,516
Hook-and-Line (all types)	16,759.4	$29,266,705
Gillnets (all types)	14,614.1	$33,074,635
Pots/Traps (all types)	11,987.3	$41,641,707
Total (All Gears)	**372,499.8**	**$714,050,993**

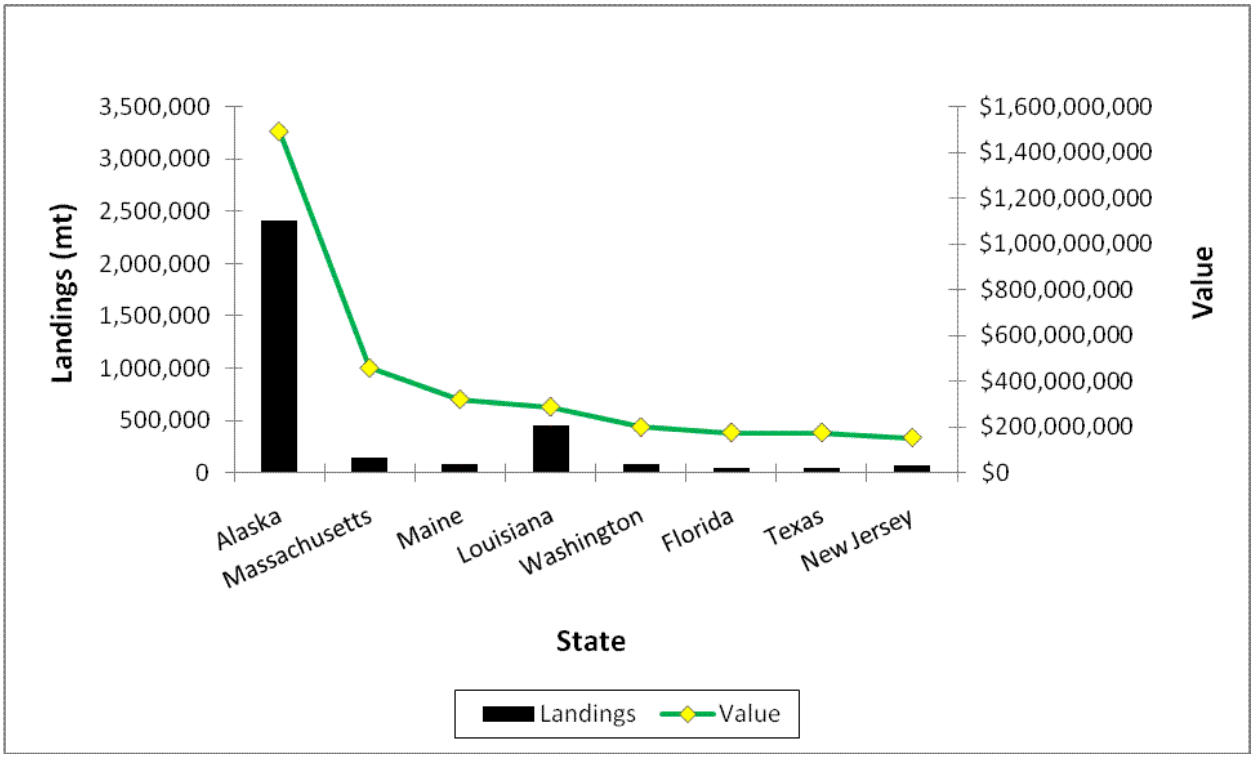

Figure 3-1. Commercial fishing landings (metric tons) and value ($US) in 2007.[2]

Commercial fisheries are generally referred to by the name of the species targeted or by the gear type utilized by fishermen. There are many types of fishing gears used off the coast of New Jersey and within or in the immediate vicinity of the Study Area, such as dredges, trawls, pound nets, gillnets, fixed nets (e.g., fyke nets and parallel nets) and hook-and-line; however, the primary gears utilized were dredges, trawls, purse seines, hook-and-line, gillnets, and pots/traps (**Table 3-1**) with the clam dredge, which was used to target Atlantic surfclam and ocean quahog (**Figures 3-2** and **3-3**), utilized the most. The total landings with clam dredge gear from 2003 through 2007 were 133,333 metric tons (mt; (146,666 tons [T]); clam dredge gear represented 50.5% of the total landings. Clam dredge landings ranged from a low of 22,612 mt (24,873 T) in 2005 to a high of 32,541 mt (35,794 T) in 2003 with a mean of 26,667 mt (29,334 T). The values of landings with clam dredge during this five year period was $159,612,233 which represented 43.8% of the total value. The fifth most valuable fishing gear was pots and traps, which ranged from $4,166,381 in 2003 to $6,110,242 in 2005. Overall, the northeast multispecies groundfish fishery (dredge and trawl gear) was the predominant fishery in terms of landings and number of active vessels (**Tables 3-1** and **3-2**).

The American lobster, Atlantic sea scallop (*Placopecten magellanicus*), and clam fisheries were also important fisheries within or near the vicinity of the Study Area. Some of these commercial fisheries have been established for more than a century. Another important fishery that operates within the vicinity of the Study Area is the pelagic longline fishery that targets offshore species such as tuna and swordfish. Recently, several commercial fisheries (e.g., skates [Rajidae], spiny dogfish shark [*Squalus acanthias*] and monkfish or goosefish [*Lophius americanus*]) have become more important as traditional fish stocks continue to decline. Furthermore, some fisheries, such as the herring (Clupeidae) fishery, have recently expanded the fishing grounds into other areas in hopes of increasing their landings. Depending on a species habitat requirements and behaviors, fishing operations target specific geographical areas at particular times.

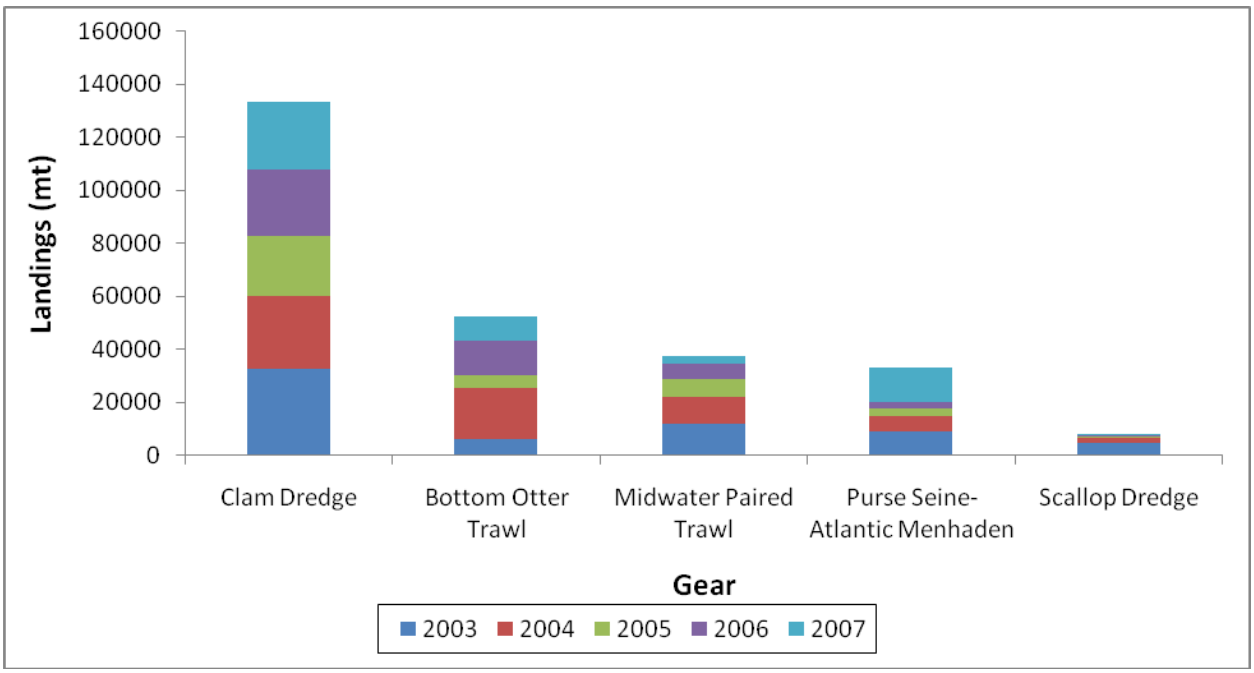

Figure 3-2. The primary commercial fishing gears utilized off New Jersey by landings (metric tons [mt]) from 2003 to 2007.[2]

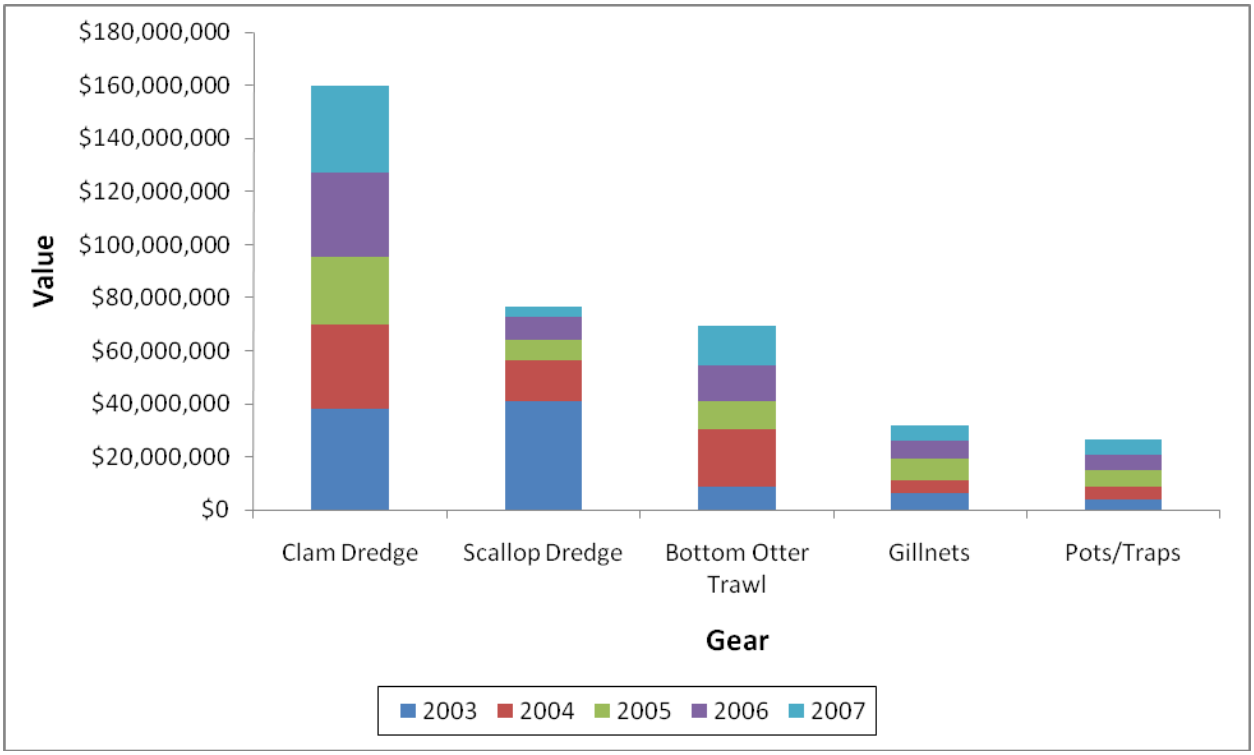

Figure 3-3. The primary commercial fishing gears utilized off New Jersey by value ($US) from 2003 to 2007.[2]

Table 3-2. Major commercial fisheries, active season, and gear utilized within or in the vicinity of the Study Area (peak months/seasons given in parentheses).

Fishery	Season	Gear
Northeast groundfish	Year-round (seasonal by region)	Bottom trawls, bottom longlines, sink gillnets
Monkfish	Year-round (winter and summer)	Bottom trawls, scallop dredges, sink gillnets
Skates	Year-round (summer)	Bottom trawls, sink gillnets
Spiny dogfish	Year-round (seasonal by region)	Bottom trawls, sink gillnets
Atlantic sea scallop	Year-round (seasonal by region)	Scallop dredges, bottom trawls
Clams: Atlantic surfclam and Ocean quahog	Year-round (summer)	Hydraulic dredges, scallop dredges, bottom trawls
Atlantic herring	Year-round (seasonal by region)	Purse seines, mid-water trawls, pair trawls
American lobster	Year-round (May through December)	Traps, bottom trawls
Winter trawl	September through April	Bottom trawls, mid-water trawls
Highly migratory species	Year-round (seasonal by region, species, and gear type)	Bottom and pelagic longlines, sink and pelagic gillnets, purse seines, hand gear

Sources: (NEFMC 1983; Ross; NEFMC 1993; Shepherd and Terceiro; NEFMC 1996; ASFMC 1997; Idoine 1998; NEFMC 1998a; MAFMC and NEFMC 1999; NEFMC 1999a; NMFS 1999a; Clark et al. 2000; Weinberg 2000; Idoine 2001; Weinberg 2001; NEFMC 2003b; NEFMC 2003a; NMFS 2008; NMFS 2009d).

Generic descriptions of the primary fishing gears used in the waters off New Jersey are described below:

- Dredges—rugged, steel frame supported box or bag-shaped device used to target benthic animals, such as bivalve mollusks. Dredges are towed behind a fishing vessel along the seafloor. Dredge gear primarily takes clams, oysters, scallops, and mussels. The number of Atlantic coast crab dredge licenses issued ranged from 205 to 228 during 1999 through 2004 (Chuenpagdee et al. 2003; Fullenkamp 2006). Average licenses sold from 2008 to 2009 was 217 with limited entry and no cap (pers. comm., Brandon Muffley, New Jersey Department of Fish and Wildlife, 4 June 2010)

- Trawls—large nets (bag-shape) constructed with natural fibers or synthetic materials that are rectangle or polygon shaped (mouth openings), which are towed behind a fishing vessel to target fish. Trawls are towed at different water depths (usually bottom and mid-water) depending on target species; trawls are used to target squid, Atlantic mackerel, summer flounder, black sea bass, scup, Atlantic croaker (*Micropogonias undulatus*), and winter flounder. The number of otter trawl licenses issued ranged from 75 to 98 during the period of 1999 through 2003; shrimp trawl licenses ranged from 309 to 334 (Chuenpagdee et al. 2003; Fullenkamp 2006). Average licenses sold from 2008 to 2009 was 80 (pers. comm., Brandon Muffley, New Jersey Department of Fish and Wildlife, 4 June 2010).

- Purse seines—nets constructed with natural fibers or synthetic materials that are used to encircle a school of fish. Once the net has captured a school of fish, it is then cinched; purse seines are used to target Atlantic menhaden and Atlantic herring (*Clupea harengus*). This gear is also used to target bluefish in nearshore waters. The number of purse seine permits issued during the period of 1999 through 2003 ranged from 31 to 47 (Fullenkamp 2006). Average licenses sold from 2008 to 2009 was 33 (pers. comm., Brandon Muffley, New Jersey Department of Fish and Wildlife, 4 June 2010).

- Longline/Hook-and-Line—a longline consists of a monofilament mainline that has baited hooks attached at regular predetermined intervals. Longline gear is set either at the surface (using floats and highflyers) or along the seafloor. Longlines either drift with the currents or are stationary. Longlines are used to target benthic (e.g., Atlantic cod, haddock [*Melanogrammus aeglefinus*], and sharks) and pelagic species (tuna, swordfish, or pelagic sharks (Chuenpagdee et al. 2003; Fullenkamp 2006). No longlines licenses are issued since it is not a gear type allowed in state waters (pers. comm., Brandon Muffley, New Jersey Department of Fish and Wildlife, 4 June 2010).

- Hook-and-Line gear—consists of monofilament line that is deployed and retrieved by a reel. The reel is attached to fiberglass or carbon fiber constructed rod that usually ranges in length from 1.85 to 2.78 m (6 to 9 ft). Hook and line gear is used by commercial and recreational anglers to target various nearshore and offshore species such as bluefish, summer flounder, tautog, weakfish, or Atlantic striped bass (Chuenpagdee et al. 2003; Fullenkamp 2006).Average permits sold from 2008 to 2009 was 29 with limited entry (pers. comm., Brandon Muffley, New Jersey Department of Fish and Wildlife, 4 June 2010).

- Gillnets—rectangular panels of net constructed of monofilament or synthetic materials that are used to target a variety of species (e.g., mackerel or sharks) at the surface, mid-water, or on the seafloor. Gillnets are used to target Atlantic menhaden, butterfish, northern kingfish, spot (*Leiostomus xanthurus*), and river herring (*Alosa* spp.). The number of gillnet mesh exemption permits issued ranged from 13 to 18 during the period of 1999 through 2004. Drift gillnets are used to target Atlantic bonito (*Sarda sarda*), weakfish, and bluefish. The number of licenses issued in New Jersey ranged from 544 to 679 during the period of 1999 through 2003. Anchor gillnets are used to target Atlantic croaker, Atlantic menhaden, butterfish, spot, northern kingfish, smooth dogfish (*Mustelus canis*), American shad, and black drum (*Pogonias cromis*). The number of licenses issued ranged from 2,648 to 3,305 during the period of 1999 through 2003. Stake gillnets are used to target Atlantic menhaden, Atlantic croaker, butterfish, spot, northern kingfish, bluefish, weakfish (*Cynoscion regalis*), smooth dogfish, American shad, and black drum. The state only issues a staked and anchored gillnet license (Chuenpagdee et al. 2003; Fullenkamp 2006). From 2008 to 2009, the average gillnet exemption permits issued was 19, the average drifting gillnet licenses was 593, and the average staked/

anchored gillnets was 2,834, all with limited entry (pers. comm., Brandon Muffley, New Jersey Department of Fish and Wildlife, 4 June 2010).

- Pot and traps—rectangle, square, or cylindrical devices usually set on the seafloor to target benthic fish and invertebrates. Pots and traps are usually set for an extended period; locations are marked at the surface with a buoy (float) that is attached to the pot or trap by a rope. Pots/traps are used to target lobsters, whelk (Buccinidae), and black sea bass. In general, pots/traps are often set in a string (a number of pots/traps connected by a groundline) near natural or artificial structure, especially to target fish (**Figure 3-4**).The number of licenses issued for lobster, fish, and whelk during the period of 1999 through 2003 ranged from 167 to 274. The number of crab pots licenses during the period of 1999 through 2003 ranged from 333 to 377. In 2004, the number of lobster permits issued was 165, which allowed 117,570 pots (Chuenpagdee et al. 2003; Fullenkamp 2006). From 2008 to 2009, the average number of commercial blue crab pot licenses issued was 309 and the average number of lobster permits was 108 both with limited entry (pers. comm., Brandon Muffley, New Jersey Department of Fish and Wildlife, 4 June 2010).

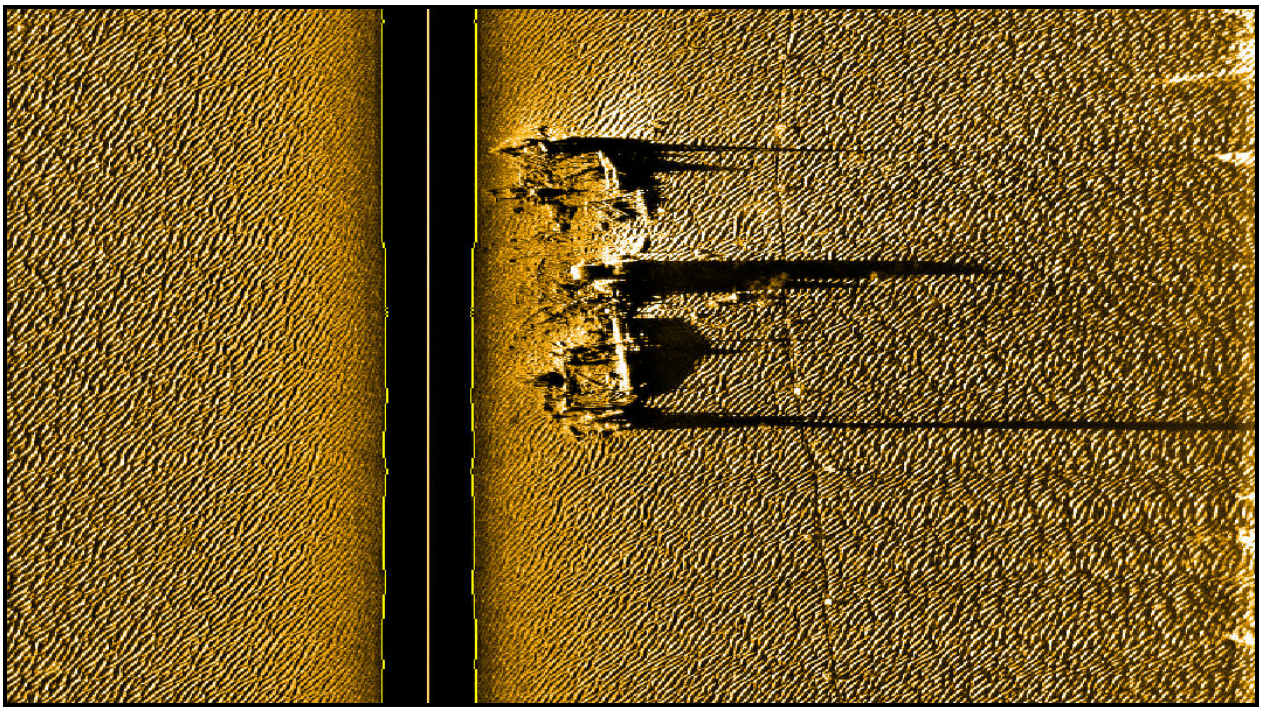

Figure 3-4. A side-scan sonar image of a commercial fishing string of pots/traps and its association to bottom structure in the Study Area. The location of this bathymetric image was 39°26.3474′ North Latitude; 074°08.2308′ West Longitude.

Commercial fishing effort within or in the vicinity of the Study Area varies spatially and temporally depending on the target species and weather conditions (storm fronts). The annual landings for New Jersey from 2003 through 2007 ranged from a high of 69,302 mt (76,232 T) in 2006 to 85,190 mt (93,709 T) in 2003 with a mean of 74,500 mt (81,950 T) (**Figure 3-5**). Most of the fishing landings generally occurred from March through August and most were in May and September. In terms of value, May ($77,690,018) and August ($74,658,970) were the most important months (**Figure 3-6**).

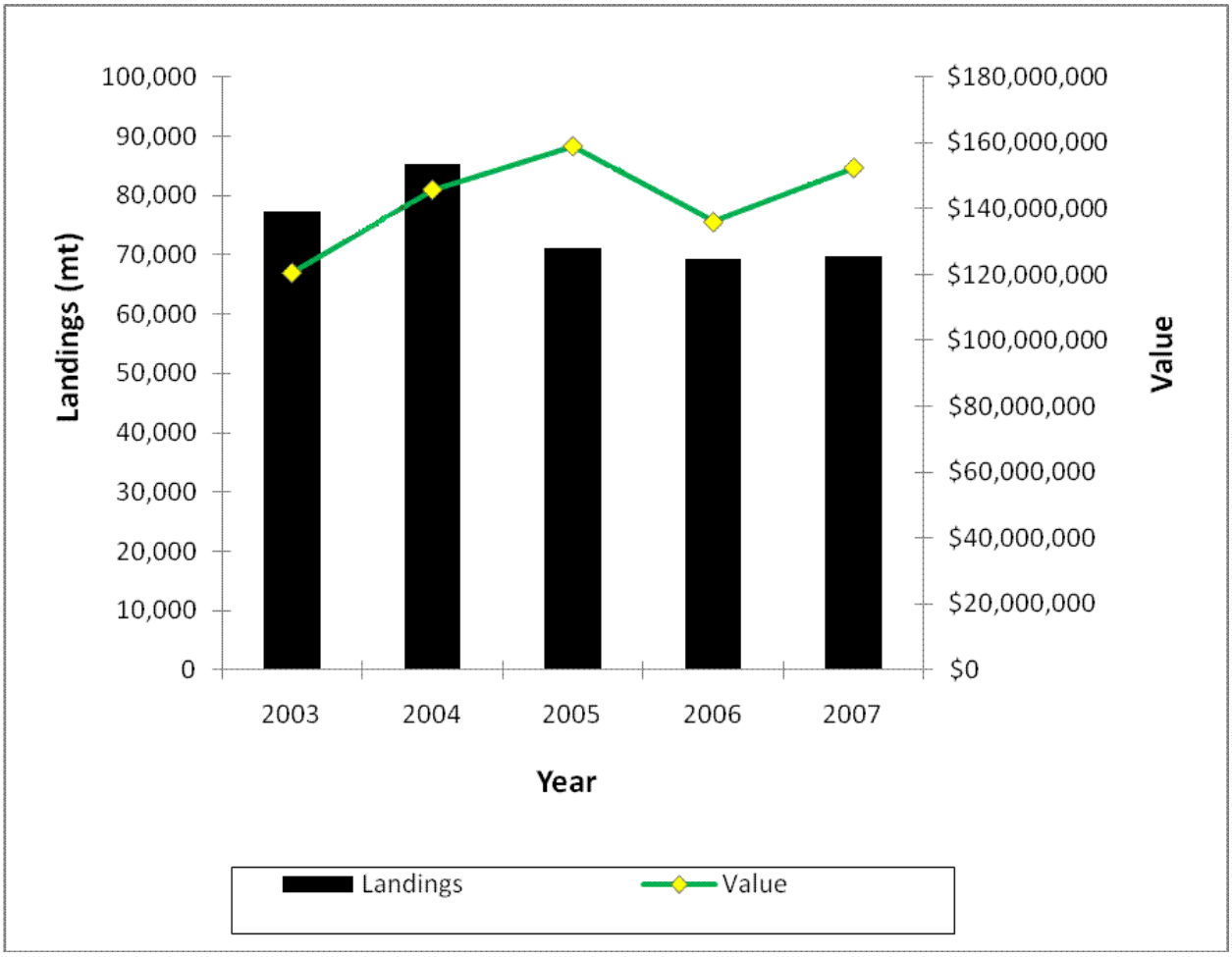

Figure 3-5. Cumulative annual commercial fishing landings (metric tons) and value ($US) for New Jersey from 2003 to 2007. Source data: NMFS.[2]

The top five species landed in New Jersey from 2003 through 2007 were Atlantic surfclam, sea scallop, ocean quahog, goosefish (monkfish), and summer flounder. Overall, Atlantic surfclam was the primary species landed in New Jersey (**Figure 3-7**). Atlantic surfclam landings from 2003 through 2007 ranged from a low of 17,676 mt (19,444 T) in 2005 to a high of 23,286 mt (25,615 T) in 2003 with a mean of 20,163 mt (22,179 T). The most valuable species landed in New Jersey was Atlantic sea scallop **(Figure 3-8**). Atlantic sea scallop value from 2003 through 2007 ranged from $43,506,985 in 2003 to $88,482,451 in 2005 with a mean of $66,856,061. It should be noted that although blue crab landings and economic value ranked fourth, the fishery is primarily conducted in the nearshore waters of Delaware Bay. The most valuable finfish landed in New Jersey was goosefish (monkfish). Goosefish value from 2003 through 2007 ranged from a low of $3,496,170 in 2004 to a high of $6,199,514 in 2003 with a mean of $7,675,132. In terms of landings, the most dominant fish species were Atlantic mackerel, Atlantic menhaden, goosefish, summer flounder, and Atlantic herring (**Figure 3-9**). Total landings for the primary fish species from 2003 through 2007 ranged from a low of 13,182 mt (14,500 T) in 2007 to a high of 40,724 mt (44,796 T) in 2003 with a mean of 27,389 mt (30,128 T). These data demonstrated that annual total landings for the primary fish species have decreased with time, which parallels the overall commercial landings trend in New Jersey.

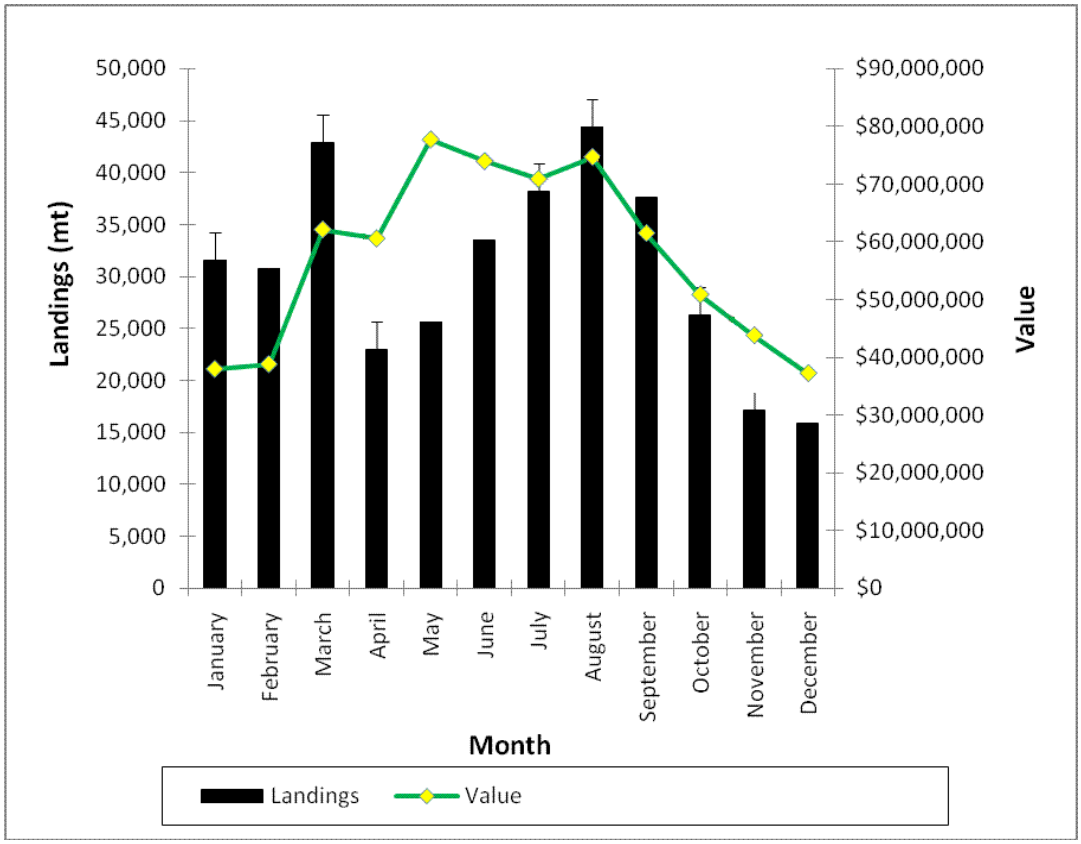

Figure 3-6. Cumulative monthly commercial fishing landings (metric tons) and value ($US) for New Jersey from 2003 to 2007.[2]

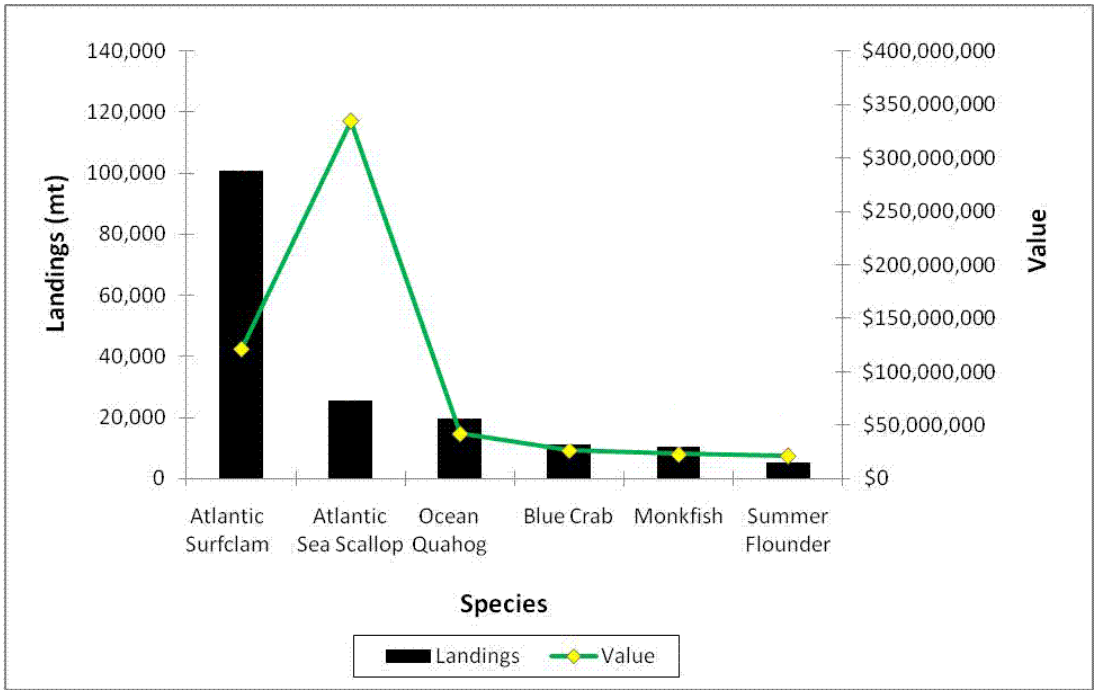

Figure 3-7. The primary commercial species landed (metric tons) and value ($US) in New Jersey from 2003 to 2007.[2]

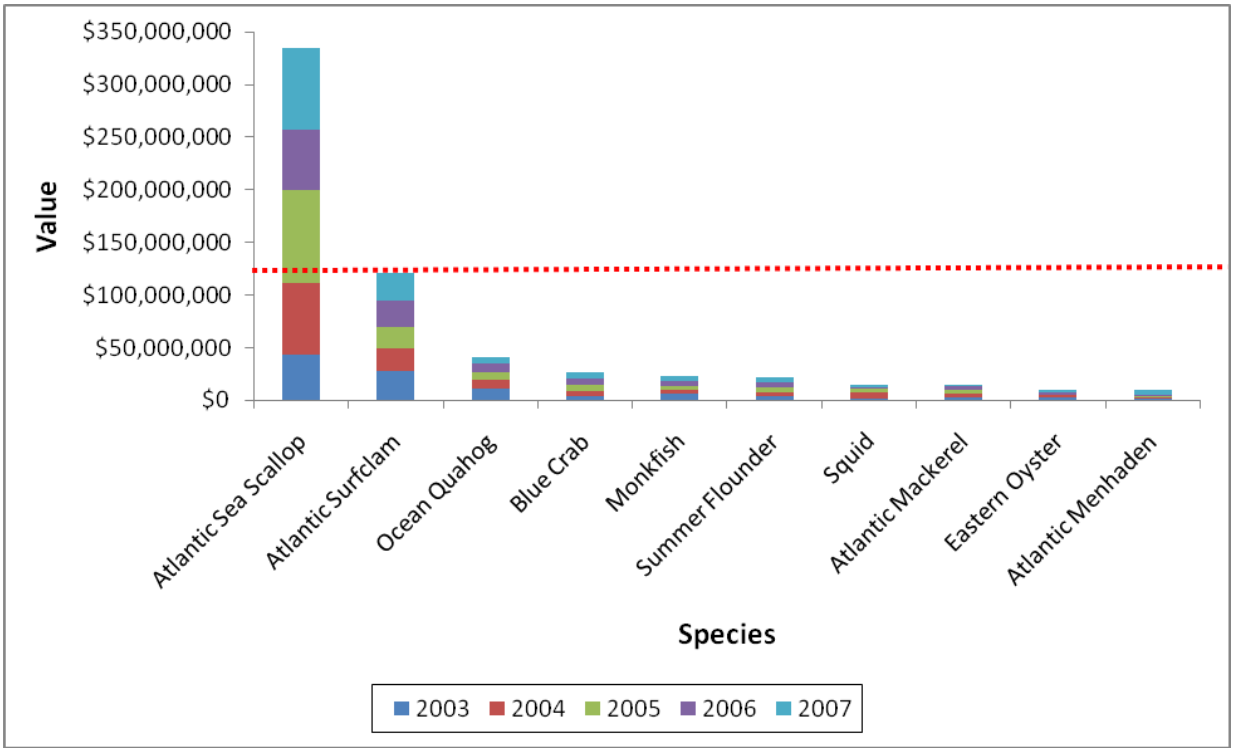

Figure 3-8. The most valuable ($US) commercial species landed in New Jersey from 2003 to 2007. The dotted line depicts the mean overall value.[2]

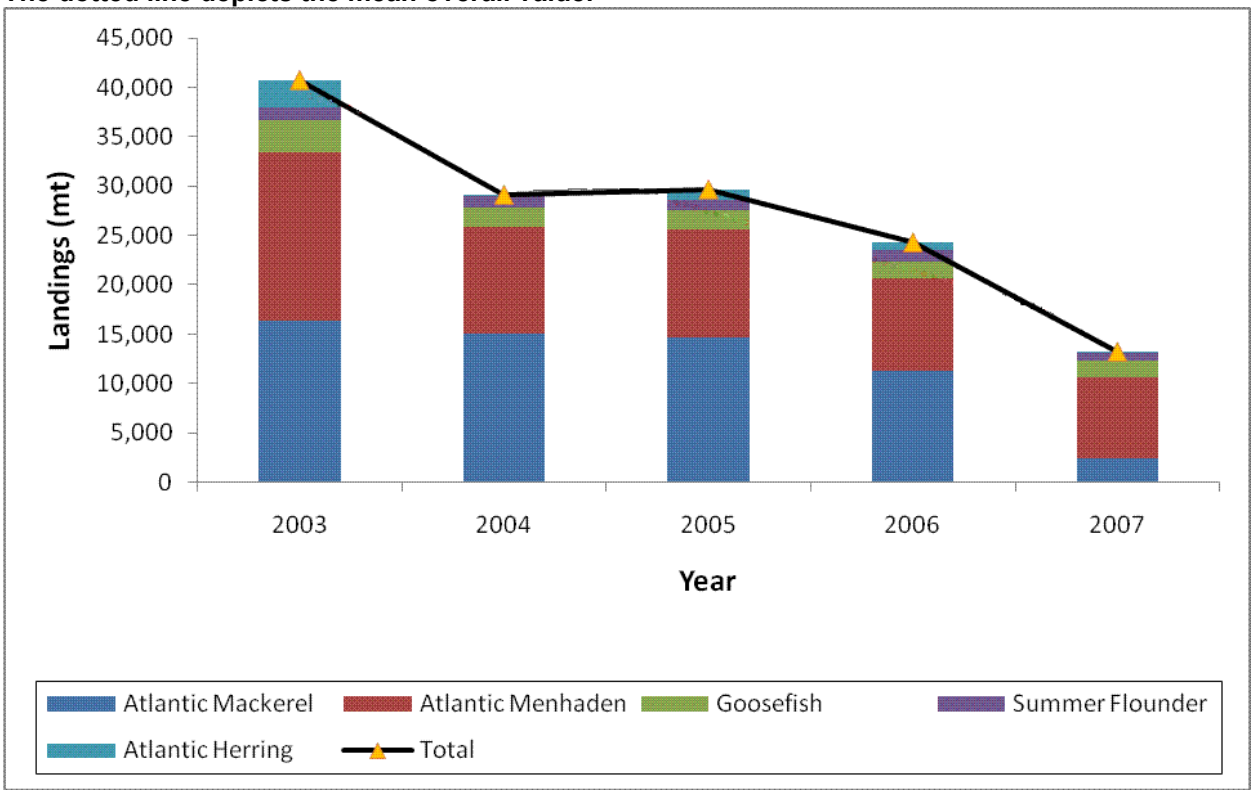

Figure 3-9. The most numerically (metric tons) dominant commercial fish species landed (metric tons) in New Jersey from 2003 to 2007.[2]

3.3.1 Northeast Multispecies Groundfish Fishery

The Northeast multispecies groundfish fishery is a group of demersal finfish (i.e., groundfish) that are generally found and taken by commercial fishing gears in mixed assemblages (NEFMC 2004). The groundfish species found within or in the vicinity of the Study Area include: Atlantic cod, ocean pout (*Zoarces americanus*), red hake, silver hake (whiting), windowpane flounder, winter flounder, witch flounder, and yellowtail flounder.

Historically, Atlantic cod has been the primary species targeted in the offshore groundfish fishery, which also included haddock and yellowtail flounder. The primary commercial fishing gear utilized in the groundfish fishery is the bottom trawl (**Figure 3-10**); however, sink gillnets and bottom longlines are also utilized (**Figure 3-11**).

To protect and better manage some species, the NMFS designates several seasonal and year-round closed areas in this fishery. For various reasons, these areas are closed to bottom otter trawls, sink gillnets, and bottom longlines during designated times, but often remain open for other types of fishing gear, such as scallop dredges, pelagic (drift) gillnets, purse seines, pots and traps, shrimp trawls, mid-water trawls, and others (NEFMC 2004).

3.3.2 Winter Trawl Fishery

The winter trawl fishery was traditionally a southern-based fishery (i.e., North Carolina), but it is active from Long Island, New York to Cape Lookout, North Carolina during September through April (Ross 1991). In general, the gear is deployed in coastal waters and dragged along the bottom at depth around 90 m (295 ft) (Ross and Moye 1989). The nearshore flounder fishery and deep-water trawl fishery (**Figure 3-10**) as well as the flynet (mid-water trawl) fishery are three sub-fishery components to this trawl fishery. Summer flounder dominates the nearshore and deep-water landings, while the weakfish, Atlantic croaker, and bluefish dominate the flynet (mid-water trawl) landings (Ross and Moye 1989).

3.3.3 Monkfish Fishery

The monkfish (i.e., goosefish: *Lophius americanus*) fishery was the most valuable finfish species landed in New Jersey during 2003 through 2008. Monkfish landings in New Jersey ranged from a low of 1,675 mt (1,843 T) in 2008 to a high of 3,259 mt (3585 T) in 2003 with a mean of 2,042 mt (2,246 T; **Figure 3-11**). Since 2003, landings of monkfish in New Jersey have declined 51% (1,584 mt [1,742 T]; NEFMC, MAFMC, and NMFS 2004; NEFMC and MAFMC 2006). Monkfish range from the Grand Banks, Canada to Cape Hatteras, North Carolina. Monkfish are demersal and occur at depths to 900 m (2,952 ft) and greater. Females live longer (12 to 14 years) than males (about seven years) and reach maturity at five and four years, respectively. Based on genetics, there is one species; however, since there is a difference on how the northern (Gulf of Maine and northern Georges Bank) and southern (southern Georges Bank and Middle Atlantic) fisheries are conducted, the fishery is managed as two separate stocks (Haring and Maguire 2008; Richards et al. 2008).The monkfish fishery was established in the late 1970s through the 1980s as a result of high demand from foreign markets and the loss of major target fishery stocks, such as Atlantic cod and haddock. The monkfish fishery is a derivative of the multispecies groundfish and scallop dredge fisheries. In fact, less than a third of the landings result from vessels targeting monkfish directly (NEFMC 1998c; NEFMC 1998b). The primary fishing gears that take monkfish are bottom trawls (**Figure 3-10**), sink gillnets (**Figure 3-12**), and dredges (**Figures 3-13** and **3-14**). The trawl fishery takes a significant number of monkfish in the canyons and steep edges of the continental shelf break in the northern portion of the MAB. From 2003 through 2007, monkfish were mostly (80%) taken with bottom trawls, but in the southern fishery monkfish were mostly taken with gillnets (NEFMC and NMFS 2000; NEFMC and MAFMC 2006; MAFMC 2008). Fishing landings occur year-round, but New Jersey landings are generally seasonal (i.e., beginning in November and extending through February and peaking in May and June {NEFMC, MAFMC and NMFS 2004; NEFSC 2005; NEFMC and MAFMC 2006; MAFMC 2008). Based on the 2007 monkfish stock assessment (NDPSWG 2007), population models suggest that the species is not overfished in either the northern or southern stock management areas.

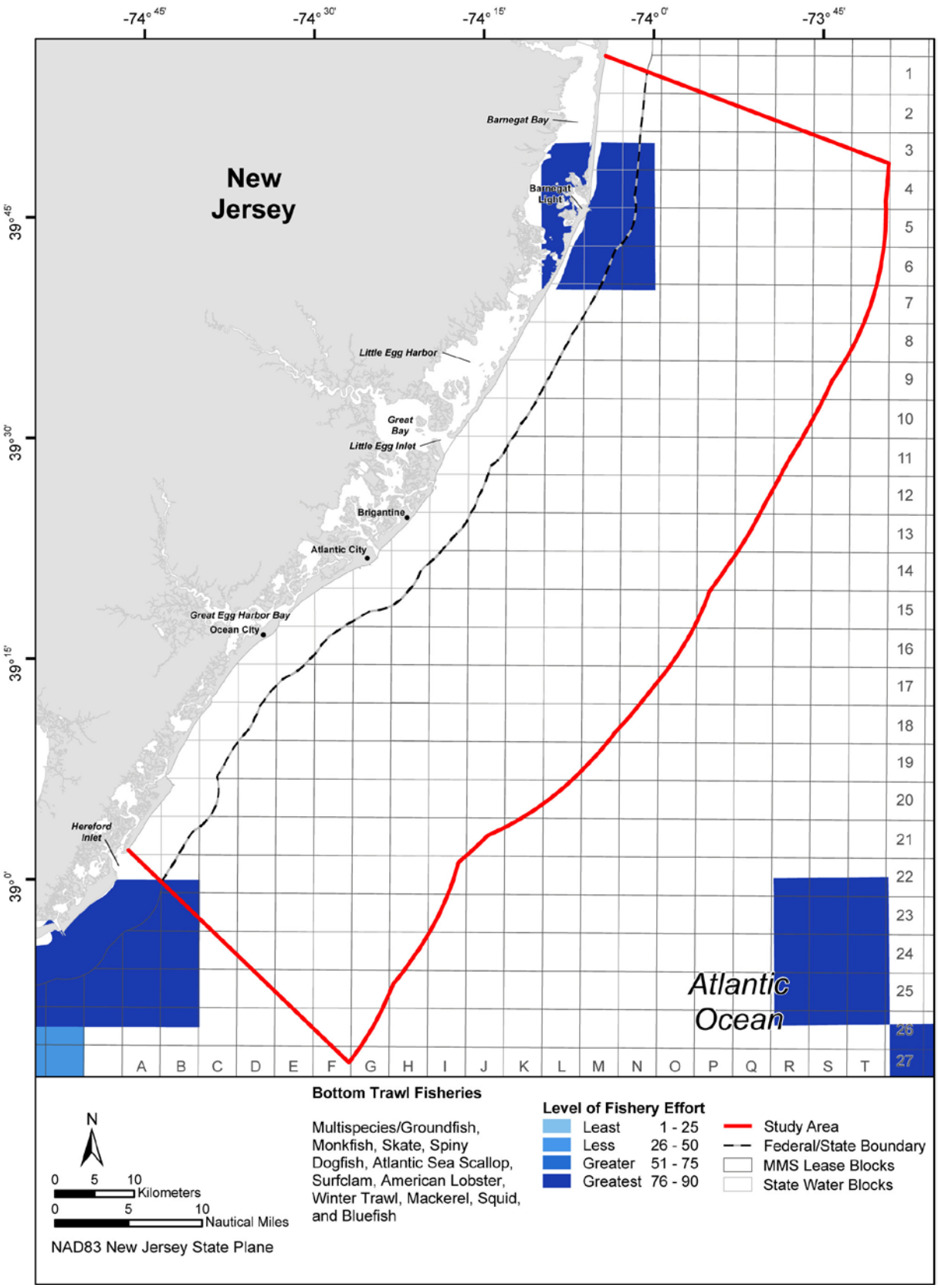

Figure 3-10. Fishing effort distribution of bottom trawl fisheries in the Study Area and vicinity from 1995 to 2001. Source data: NMFS (2003a). Source information: NEFMC(2003a).

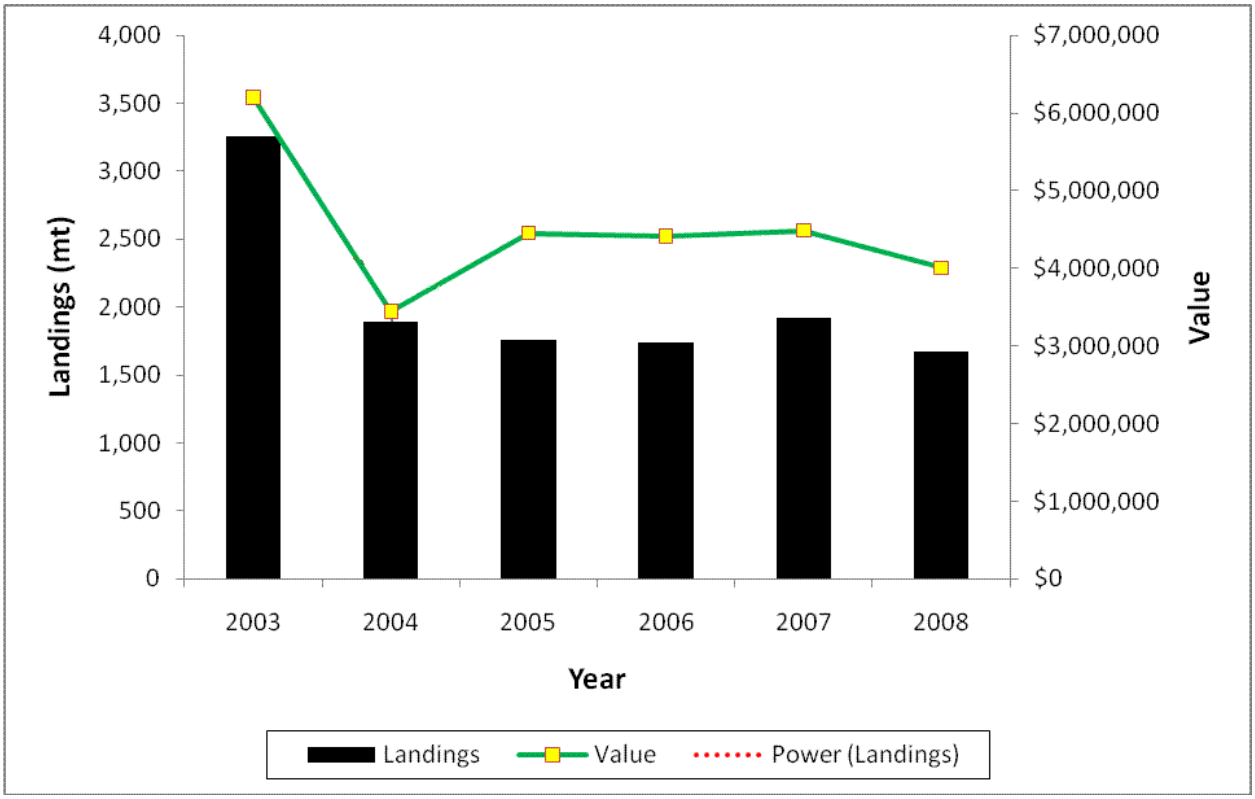

Figure 3-11. Monkfish commercial landings (metric tons) and value ($US) in New Jersey from 2003 to 2007.[2]

3.3.4 Skate Fishery

The seven species in the Northeast Region (Maine to Virginia) skate complex are distributed along the Atlantic coast of the northeast U.S. from the tide line to depths exceeding 700 m (2,296 ft). The seven species are: little skate (*Leucoraja erinacea*), winter skate (*L. ocellata*), barndoor skate (*Dipturus laevis*), thorny skate (*Amblyraja radiata*), smooth skate (*Malacoraja senta*), clearnose skate (*Raja eglanteria*), and rosette skate (*L. garmani*) (Sosebee et al. 2009). Of the seven skate species off the northeastern U.S., both the smooth and thorny skates are in overfished condition, barndoor, winter, and little skates are low in biomass, and clearnose and rosette skates have high biomass (NEFMC 2009).[3]

Skates are harvested for bait and human consumption. The bait fishery primarily supplies bait for lobster traps and the “wing” (fin) fishery supplies restaurants with skate for human consumption. Sometimes wing meat is sold to fish markets and restaurants as “scallop”. Similar to other fisheries within the Study Area, landings occur year-round, but peak landings primarily occur in summer. The directed “wing-meat” fishery is a relatively new, which was established during the 1990s after the decline of some primary groundfish species. Landings for the wing meat fishery mainly result from the bycatch in the groundfish, monkfish, and Atlantic sea scallop fisheries. Bottom trawls (**Figure 3-10**) are the main fish gear for skates (NEFMC 2003b), however, skates are also taken with sink gillnet gear (**Figure 3-12**).

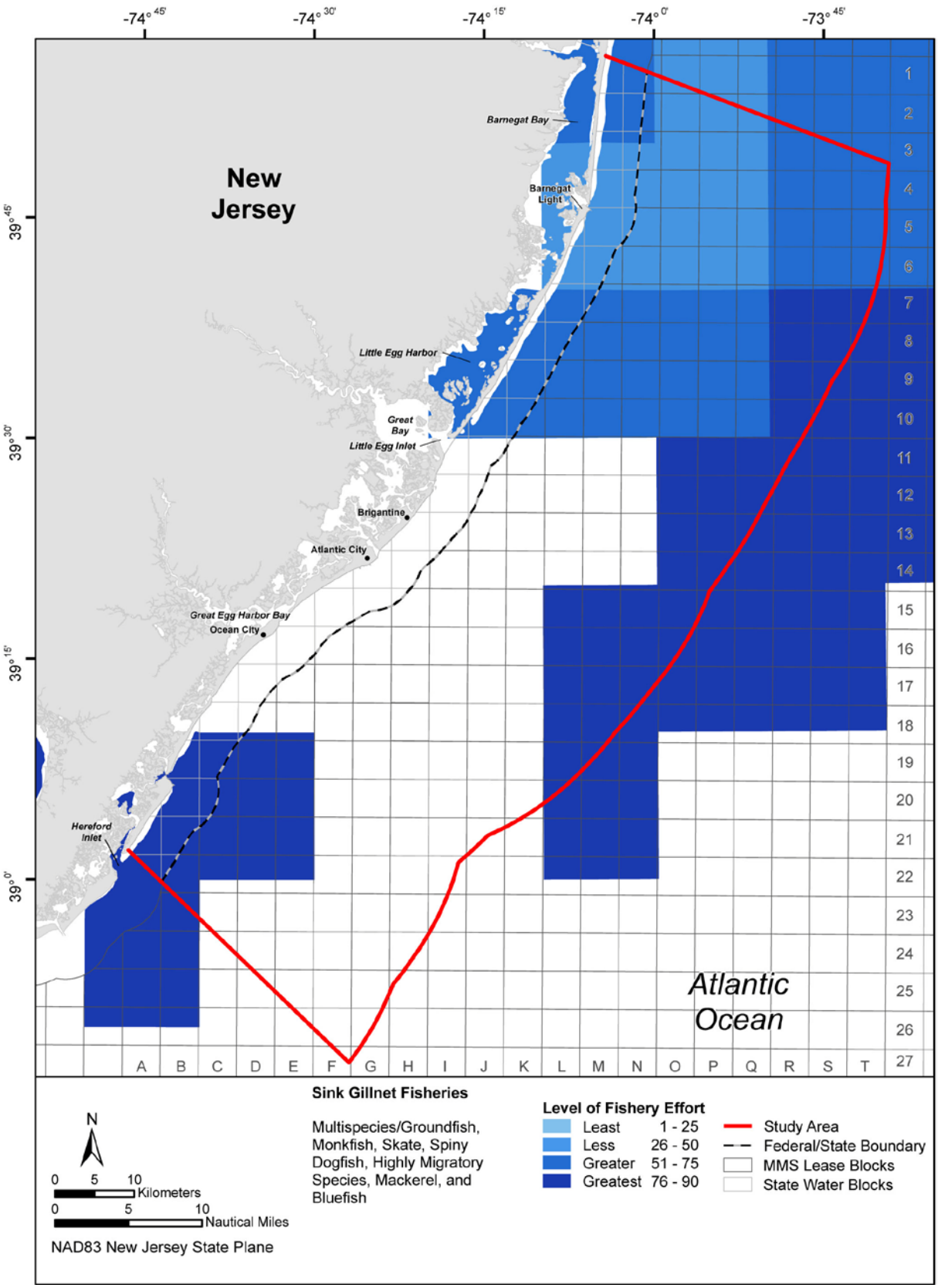

Figure 3-12. Fishing effort distribution of sink gillnet fisheries in the Study Area and vicinity from 1995 to 2001. Source data: NMFS (2003a). Source information: NEFMC(2003a).

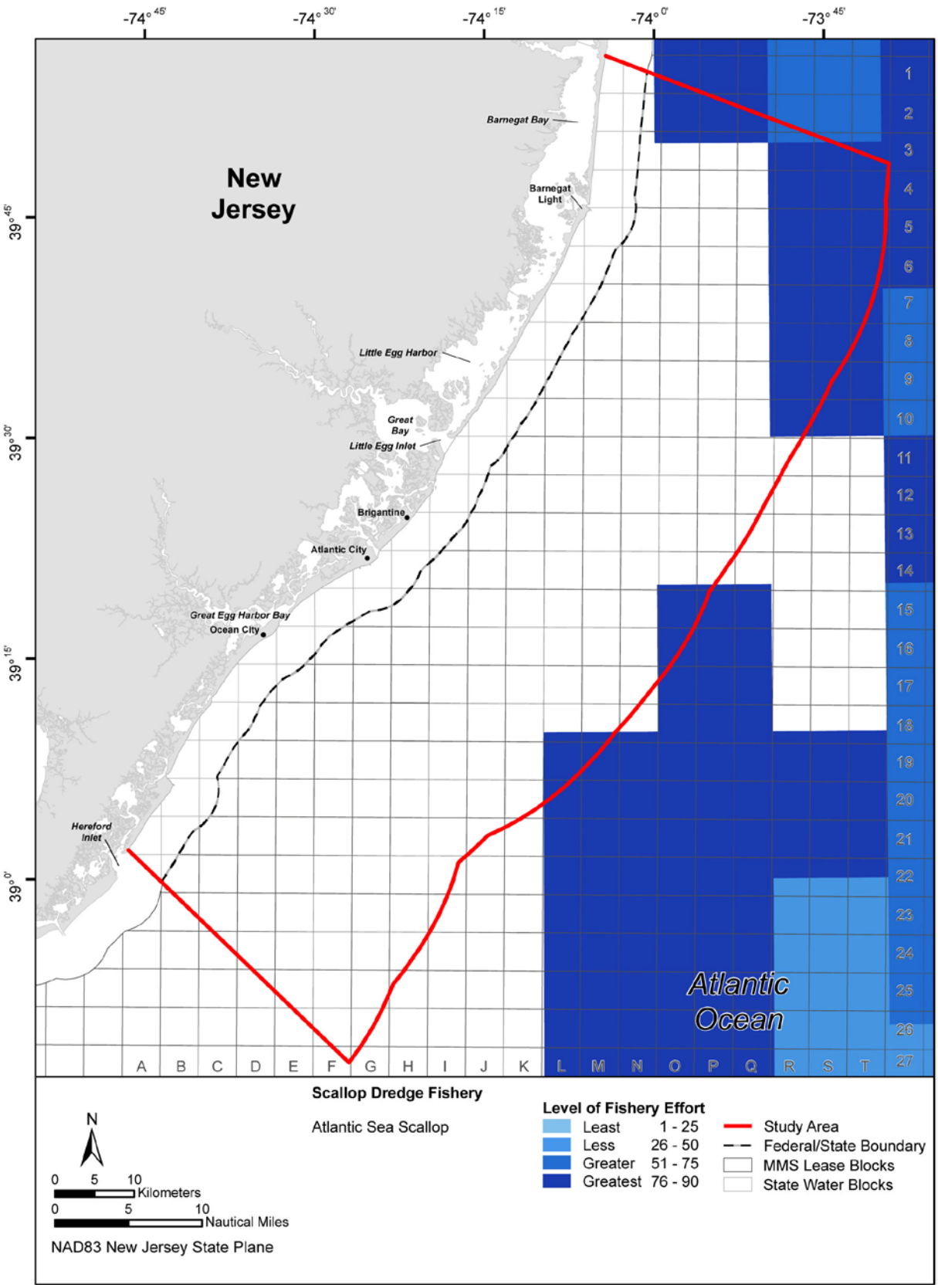

Figure 3-13. Fishing effort distribution of scallop dredge (Atlantic sea scallop) fisheries in the Study Area from 1995 to 2001. Source data: NMFS (2003a). Source information: NEFMC(2003a).

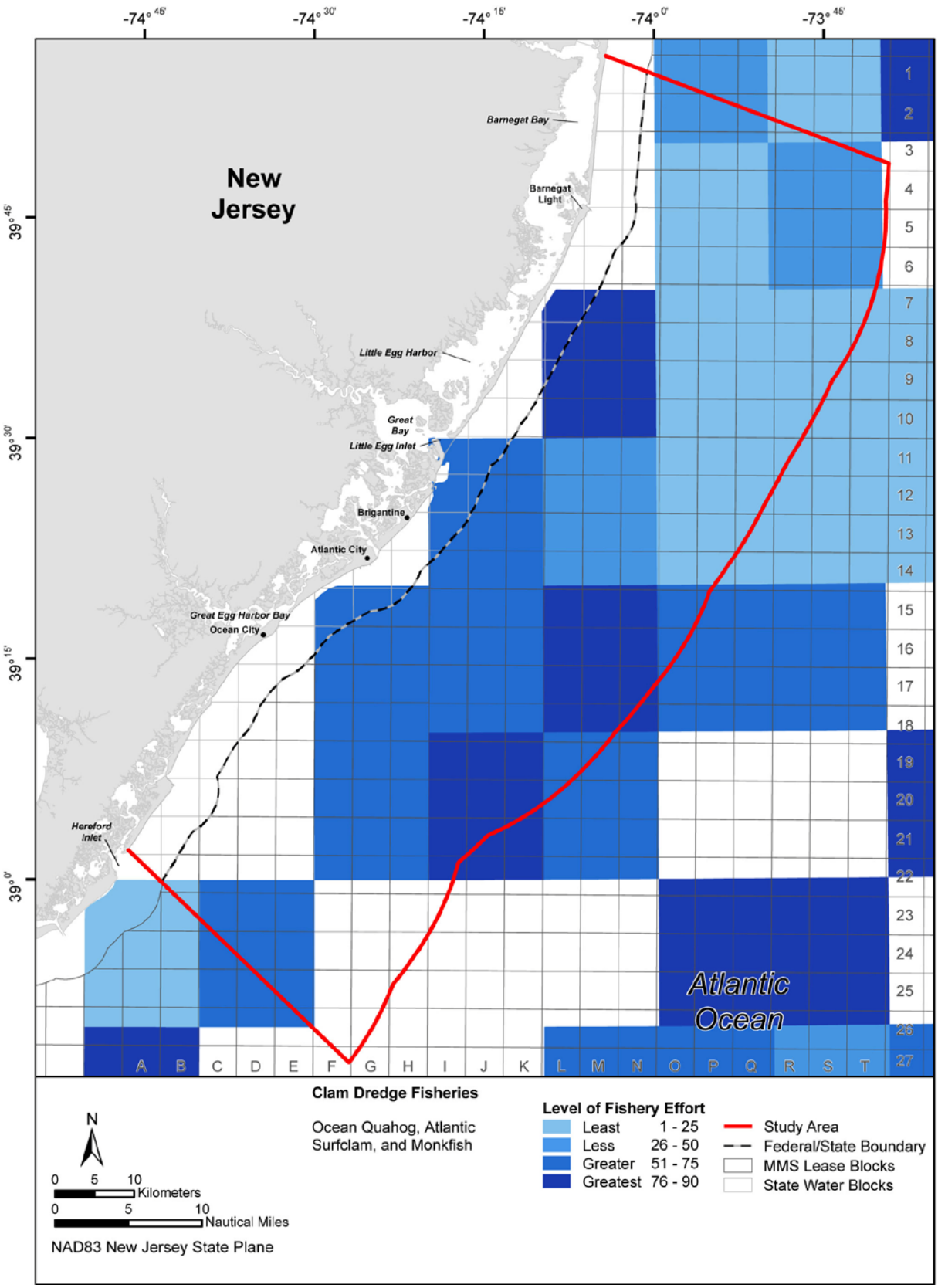

Figure 3-14. Fishing effort distribution of clam dredge fisheries in the Study Area and vicinity from 1995 to 2001. Source data: NMFS (2003a). Source information: NEFMC(2003a).

3.3.5 Spiny Dogfish Fishery

Spiny dogfish (*Squalus acanthias*) are distributed in the western North Atlantic from Labrador to Florida and are considered to be a unit stock (Burgess 2002). During the spring and autumn, spiny dogfish can be found in coastal waters between North Carolina and Southern New England. In summer, dogfish migrate northward to the Gulf of Maine Georges Bank region and into Canadian waters and return southward in the autumn and winter (Jensen 1965). Atlantic stocks of spiny dogfish are not overfished, and have rebuilt to a level above the target spawning stock biomass (SSB; 167,000 mt [184,034 T]) based on an updated conducted by the Northeast Fisheries Science Center (NEFSC) in 2008 that estimates SSB to be 194,600 mt (214,449 T). The Technical Committee reviewed the assessment and agreed that SSB is at a value greater than SSB_{target}, but cautioned that the determination of rebuilt status is based on current levels of stock abundance and SSB is projected to decline sharply around 2017 due to a persistent trend of low recruitment that began in 1997 (Vonderweidt et al. 2009a).

The spiny dogfish fishery was established in the mid-1970s for the same reasons previously discussed for monkfish and skate fisheries, which was related to declining stocks of cod and other important species. Generally, spiny dogfish are a bycatch in multispecies groundfish fisheries. Fishing gears that take spiny dogfish include bottom trawls (**Figure 3-10**), sink gillnets (**Figure 3-12**), and bottom longlines (MAFMC 1999). In the MAB region, landings peak in the fall and winter months, while landings from Maine to New York, peak in the spring and summer (ASMFC 2002).

3.3.6 Atlantic Sea Scallop Fishery

The Atlantic sea scallop (*Placopecten magellanicus*) fishery is among the most important and valuable fisheries in this region. In the MAB, scallops have been harvested since the 1800s (NEFMC 1993; NEFMC 2003a). Commercial vessels dredging with scallop rakes land the majority of Atlantic sea scallops (**Figure 3-13**), while a small percentage of the landings is attributed to vessels using bottom trawl gear (**Figure 3-10**) (NEFMC 1993). In addition, a significant percentage of landings are taken in the summer flounder and winter flounder fisheries. Depending on vessel size, fishing grounds, and weather conditions, fishing trips range in duration from a single day for small vessels to 22 days for large vessels (NEFMC 2003a). Atlantic sea scallops are mostly found in offshore waters in depths ranging from 9.3 to 247 m (30 to 800 ft) (Hart and Chute 2004). Fishing effort occurs year-round in the MAB, however, most landings are during April through September. The primary Atlantic sea scallop fishing ports are Cape May, New Jersey and Hampton, Virginia. Vessels from these ports are generally large and usually make extended trips to the scallop fishing grounds off New York and Virginia. Smaller inshore vessels range in length from 10 to 14 m (32.8 to 46.0 ft), while the larger vessels can exceed 30.5 m (100 ft) but are generally around 21 m (69 ft) long (NEFMC 2003a).

Biomass survey indices for both Georges Bank and Mid-Atlantic sea scallops were at or near their historical maximums in 2005. The combined survey index for 2005 was 7.8 kilograms (kg) per tow (17.2 lbs/tow). Well above the biomass target of 5.6 kg/tow (12.35 lbs/tow). Sea scallops were therefore not overfished in 2005. Fishing mortality has declined considerably from its peak in 1991. In 2005, fishing mortality was 0.22, slightly above the target fishing mortality rate of 0.2, but below the overfishing threshold 0f 0.24. Therefore, overfishing was not occurring in the sea scallop fishery in 2005 (Hart 2005).

3.3.7 Atlantic Surfclam Fishery

In terms of landings, Atlantic surfclam (*Spisula solidissima*) is the primary species harvested in New Jersey waters (**Figure 3-14**). The Atlantic surfclam ranges from the southern Gulf of St. Lawrence to Cape Hatteras, North Carolina. The largest concentrations of Atlantic surfclams are found off New Jersey and at Georges Bank. As such, most (85 to 100%) of the landings occur from the MAB (NMFS-NEFSC 2010). The waters of Georges Bank are closed to Atlantic surfclam fishing because of the potential threat of paralytic shellfish poisoning (Weinberg 2000). In the Mid-Atlantic region, most surfclams are found from the intertidal zone to 60 m (197 ft), with much lower concentrations found at depths greater than 40 m (131 ft) (Cargnelli et al. 1999a). Atlantic surfclam is capable of living up to 30 years and can reproduce at year one; full maturity is achieved at 2 years of age. Most Atlantic surfclams taken by the fishery have a

shell length between 10 and 12 centimeters (cm; 4 and 5 inches [in.]), which corresponds to an age of 5 years; however, recent information indicates that most of the surfclams landed were around 8 to 12 years old (NMFS-NEFSC 2010).The primary commercial fishing gear utilized to target Atlantic surfclam is the dredge. According to the current Atlantic surfclam stock assessment, the overall commercial landings from the EEZ during 1965 through 1983 ranged from a low of 6,000 mt (6,612 T) in 1970 to a high 34,000 mt (37,400 T) in 1974 with a mean of 17,000 mt (18,700 T) per year. Landings stabilized by 1983 due to quota management and varied between 19,000 and 25,000 mt (20,938 and 27,550 T) in later years. The recent Atlantic surfclam assessment indicates that the stock is not overfished nor is overfishing occurring. Atlantic surfclam biomass is moderately high and fishing mortality rates are relatively low. The stock was not overfished in 2008 because biomass 878,000 mt (967,556 T) exceeded the threshold level. As well, overfishing was not occurring during 2008 because the estimated fishing mortality rate (0.027) was less than the threshold level (NMFS-NEFSC 2010). Southern areas (Delmarva Peninsula and New Jersey) have experienced declines in biomass during recent years due primarily to poor recruitment and slow growth rates associated with warm water conditions (Weinberg 2005). Atlantic surfclam is managed as one stock despite the differences in biological characteristics, fishing effort, and population dynamics between regional areas (e.g., New England to southern Virginia) (NMFS-NEFSC 2010).

3.3.8 Ocean Quahog Fishery

Another important commercial species that is harvested in New Jersey waters is the ocean quahog (*Arctica islandica*). In the northeast Atlantic, ocean quahog range from Newfoundland, Canada to Cape Hatteras, North Carolina. Ocean quahog are found in waters ranging in depth from 8 to 400 m (26 to 1,312 ft) with most found between 25 and 95 m (82 and 312 ft) (Cargnelli et al. 1999b). A significant number of ocean quahog landings occur off New Jersey, New York, and coastal southern New England; mostly in the EEZ. Ocean quahog has an interesting biology; it is among the longest lived marine animals in the world. It is estimated that ocean quahog can live up to 200 years (NMFS-NEFSC 2009). The average shell length is between 70 millimeters (mm) and 110 mm (2.8 and 4.3 in.). Reproductive information is mostly lacking, but available information for Icelandic waters indicates that the female ocean quahog is mature between 40 mm and 88 mm (1.5 in. and 3.5 in.) in size. Because quahog are slow growing, this size range (40 to 88 mm [1.5 to 3.5 in.]), corresponds to an age of 2 to 61 years (Weinberg, 2001). Similar to the Atlantic surfclam fishery, the primary fishing gear utilized to target ocean quahog is the hydraulic dredge which use jets of water to dislodge ocean quahogs from the sediments (**Figure 3-14**). According to the current ocean quahog stock assessment, ocean quahog has been commercially harvested since the 1940s. Overall, total landings never exceeded 2,000 mt (2,200 T) of shucked meats until 1976, afterwards landings increased to about 14,000 mt (15,428 T) in 1979, peaked at 22,000 mt (24,244 T) in 1992, declined to about 15,000 mt (16,530 T) during 2000, and have averaged about 16,000 mt (17,632 T) of meats since 2000**.** The recent NEFSC assessment suggests that ocean quahog biomass remains relatively high and fishing mortality rates are relatively low. The stock is not overfished nor is overfishing occurring (NMFS-NEFSC 2009). Fishing effort in recent years (1996 to present) has declined 38% and the number of commercial vessels in 2008 was the lowest ever recorded. Because commercial landings have declined at the historical fishing grounds (Delmarva Peninsula and New Jersey), fishing effort has shifted to the north (Long Island region). Today, it is estimated that only 22% of the total fishing effort occurs in Delmarva Peninsula and New Jersey. Similar to Atlantic surfclam, ocean quahog is managed as one stock even though there are regional differences in biological characteristics, fishing effort, and population dynamics. New information indicates that ocean quahog recruitment has declined 65% since 1993. Given this estimate and because of their life history characteristics, the recent assessment stresses that ocean quahog are vulnerable to overfishing (NMFS-NEFSC 2009).

3.3.9 Atlantic Herring Fishery

Atlantic herring (*Clupea harengus*) are another important commercial species landed in New Jersey. In terms of New Jersey finfish landings, Atlantic herring ranked fifth during 2003 through 2007. Atlantic herring range from Labrador, Canada to Cape Hatteras, North Carolina. Although significant numbers of Atlantic herring are taken off New Jersey, more landings occur from northern waters (Georges Bank and Gulf of Maine). Atlantic herring range in age from two to seven years; most are two to three years old and

the age of maturity is four years old (ASMFC 1999). Atlantic herring are primarily taken by purse seine and mid-water trawls, but in Maine and Canada, Atlantic herring are also taken with fixed gear (i.e., traps and weir gear; Stevenson and Scott 2005). Atlantic herring are used as fertilizer, lobster bait, fish meal, and human consumption (canned, pickled, filleted, and oils). In general, fishing trips are only one day long, but some larger vessels (with freezers) have extended fishing trips that last five to seven days. Commercial landings have significantly fluctuated from 470,000 mt (517,000 T) in 1968 to 36,000 mt (39,600 T) in 1983 (Stevenson and Scott 2005). Commercial landings gradually increased from the mid 1980s through the 1990s and peaked at 133,000 mt (146,300 T) in 2001. In 2007, commercial landings of Atlantic herring were 72,973 mt (80,270 T); landings in New Jersey represented 3.8% (2,739.5 mt [3,014 T]) of the total landings. In 2005, the stock size was estimated to be about 1.0 million mt (1.1 million T); it is estimated that the stock size is above the biomass maximum sustainable yield {629,000 mt [691,900 T]) (Stevenson and Scott 2005).

The current stock assessment indicates that Atlantic herring is not overfished nor is overfishing occurring. Overall, the stock has been recovering since the 1980s and today the estimated stock is about the size of the 1960s. Fishing mortality rates have remained well below the fishing mortality maximum sustainable yield (F_{msy}) (0.27) for over a decade with a high of 0.20 in 2001 and a low of 0.14 in 2008. Stock biomass (2+) increased steadily from about 105,000 mt (115,720 T) in 1982 to 562,000 (619,324 T) in 2008 (Vonderweidt et al. 2009b; NEFMC 2010).

3.3.10 American Lobster Fishery

One example of a key pot/trap fishery for New Jersey is American lobster (*Homarus americanus*). American lobster ranges from Labrador, Canada to Cape Hatteras, North Carolina. American lobster is generally found in coastal nearshore waters at depths around 50 m (164 ft), but it can be found at deeper depths (~700 m [2,296 ft]). In nearshore waters, lobsters typically prefer rocky substrates for shelter; however, large concentrations of American lobster can also be found in mud substrates, which they use for burrowing. In offshore waters, lobsters are abundant along the continental shelf edge and near submarine canyons. American lobster has a complex life history, which consists of hatching from an egg, going through three planktonic larvae stages, metamorphosing into a juvenile, and reaching adult size around age five through eight (ASFMC 1997; Idoine 1998). The American lobster fishery is one of the most important and valuable commercial fisheries in the U.S. northeast. The U.S. lobster fishery is assessed and managed as three stocks: Gulf of Maine, Georges Bank, and Southern New England (ASMFC 2009b). Since its establishment in the 1940s and 1950s, it has greatly expanded and landings have increased from 10,522 mt (11,574 T) in 1950 to 40,281 mt (44,309 T) in 2008. In 2008, there were 287 mt (316 T) of American lobster landed in New Jersey, which represented 0.71% of the total landings. Most (79%) of the landings of American lobster occur in the State of Maine. Commercial fishing effort for American lobster has strong seasonality with most efforts in inshore shallow waters in summer and fall and away from inshore in spring and winter (Kerns et al. 2010). The offshore trap fishing grounds include areas on the continental shelf from Massachusetts to New Jersey and along the continental shelf break from Lydonia Canyon to Norfolk Canyon (NEFMC 1983). The nearshore fishery accounts for 80% of the landings while the offshore fishery accounts for remaining 20%. Fishing effort is year-round both offshore and inshore, with peak fishing occurring from May to December. The primary gear utilized to target American lobster is traps (i.e., lobster pots); however, some lobsters are also caught incidentally in bottom trawls (**Figure 3-15**).[2] Recent assessments suggest that the Southern New England stock is overfished but overfishing is not occurring. The rebuilding program was established in 2007 with the goal to have the stock rebuilt by 2022 (ASMFC 2010).[4]

3.3.11 Highly Migratory Species Fishery

In terms of commercial landings (2003 to 2007), HMS accounted for only about 8% of the total landings in New Jersey; however, HMS commercial fisheries are among the most lucrative fisheries given that these species have among the highest dockside value (price per pound) of any fish group (NMFS 2006). Moreover, the HMS fishing grounds (i.e., canyons) are some of the most productive in the fishery. Despite the economic value, HMS fisheries have struggled with competition from imports and rising fuel costs. According to NMFS, the U.S. is only landing about 50% of its authorized quota in recent years even

though the swordfish stock is considered rebuilt (Maguire et al. 2006). At one time, Barnegat Light was one the premier pelagic longline fishing ports on the east coast. Today, Barnegat Light, Atlantic City, and Cape May are still important fishing ports for pelagic longline vessels, but most have home ports in other states (e.g., New York, Rhode Island, and Massachusetts). As such, annual HMS commercial landings for New Jersey may not reflect the importance of these fishing grounds. Although HMS commercial fisheries are not specifically conducted within the Study Area, pelagic longline fishing vessels do set pelagic longline gear within the vicinity of the Study Area (~80 km or 50 mi). The primary species taken in the HMS fisheries include swordfish, five tuna species, and various species of pelagic sharks (e.g., shortfin mako shark [*Isurus oxyrinchus*]) and coastal sharks (e.g., blacktip shark [*Carcharhinus limbatus*]). Commercial landings of HMS (e.g., swordfish, yellowfin tuna [*Thunnus albacares*], and bigeye tuna [*T. obesus*]) from 2003 through 2007 ranged from 276 mt (304 T) in 2003 to 465 mt (512 T) in 2007. From 2007 to 2008, commercial landings of the yellowfin tuna decreased, while the bigeye tune remained constant (**Figure 3-16**). In general, landings for HMS during this period were stable.[2] The primary gear used to target HMS is pelagic longline gear, but bottom longlines, purse seines, handgear (handlines and harpoons), and gillnets (i.e., for sharks) also take HMS (NMFS 2010c). Fishing vessels set pelagic longline gear to target swordfish at sunset and retrieved gear around sunrise, while the opposite pattern is followed for tuna; gear is set at sunrise and retrieved in the afternoon before sunset. This longline fishery for tuna and swordfish is active year-round in the vicinity of the Study Area, but most of the commercial fishing effort is in the spring through fall. The fishing grounds are around 111.2 km (60 NM) or more from shore. The management of HMS is complicated and complex. In general, the NMFS HMS Management Division, in conjunction with its HMS Advisor Panel, implements the recommendations and resolutions made by the ICCAT based on the latest scientific and stock assessment information. In addition, NMFS also implements regulations to support various other international treaties and conventions associated with HMS issues. The NMFS HMS Management Division manages sharks as three separate groups: large coast sharks (LCS), small coastal sharks (SCS), and pelagic sharks (PS). Currently, there are 20 species of sharks that can be found within or in the vicinity of the Study Area. Of these, 12 are authorized to be landed and retained, while 6 are prohibited from being landed, traded, or sold (**Tables 3-3 and 3-4** Able 1992; NMFS 2010c).

3.3.12 Closed Areas

One method that fishery resource managers use to control fishing effort or protect particular fishery habitats is designating closed areas. To notify the public, NMFS publishes these closed areas in the Federal Register and also mails, faxes, and emails interested parties a public notice announcing such closures. Some of these designated closed areas are either permanent (e.g., closed year-round), seasonal, or temporary (designated as a rolling closure). Permanent closed areas change over the years in response to the status of fishery stocks, whereas seasonal and rolling areas are closed at certain times of the year. Usually, rolling closures persist for a finite duration and are then de-designated, or sometimes these closures are moved to another location to fulfill similar conservation or management goals. Besides for fish conservation management reasons, fishery resource managers also use closed areas for marine mammal conservation or protection purposes. For specific closures and associated regulations and policy, information is discussed under each individual marine mammal Take Reduction Plan (TRP), such as the Bottlenose Dolphin TRP, Atlantic Large Whale, TRP, and the Mid-Atlantic Harbor Porpoise TRP.[5] Moreover, fishery managers also close specific areas to certain commercial fishing gear or methods to protect fish stocks. For example, the Northeastern U.S. Closed Area (39 degrees [°] to 40° North [N] latitude and 68° to 74° West [W] longitude) is prohibited to pelagic longline fishing vessels using pelagic longline gear during the month of June each year. The purpose of this particular fishery closure is to maintain and recover localized fish populations to harvestable and sustainable levels (NMFS 2010c). As with any federal regulation, NMFS abides by the public review and comment process as specified by the National Environmental Policy Act (NEPA) before designating any closed area. In general, closed areas change over the years in response to the status of fishery stocks or updated scientific information.

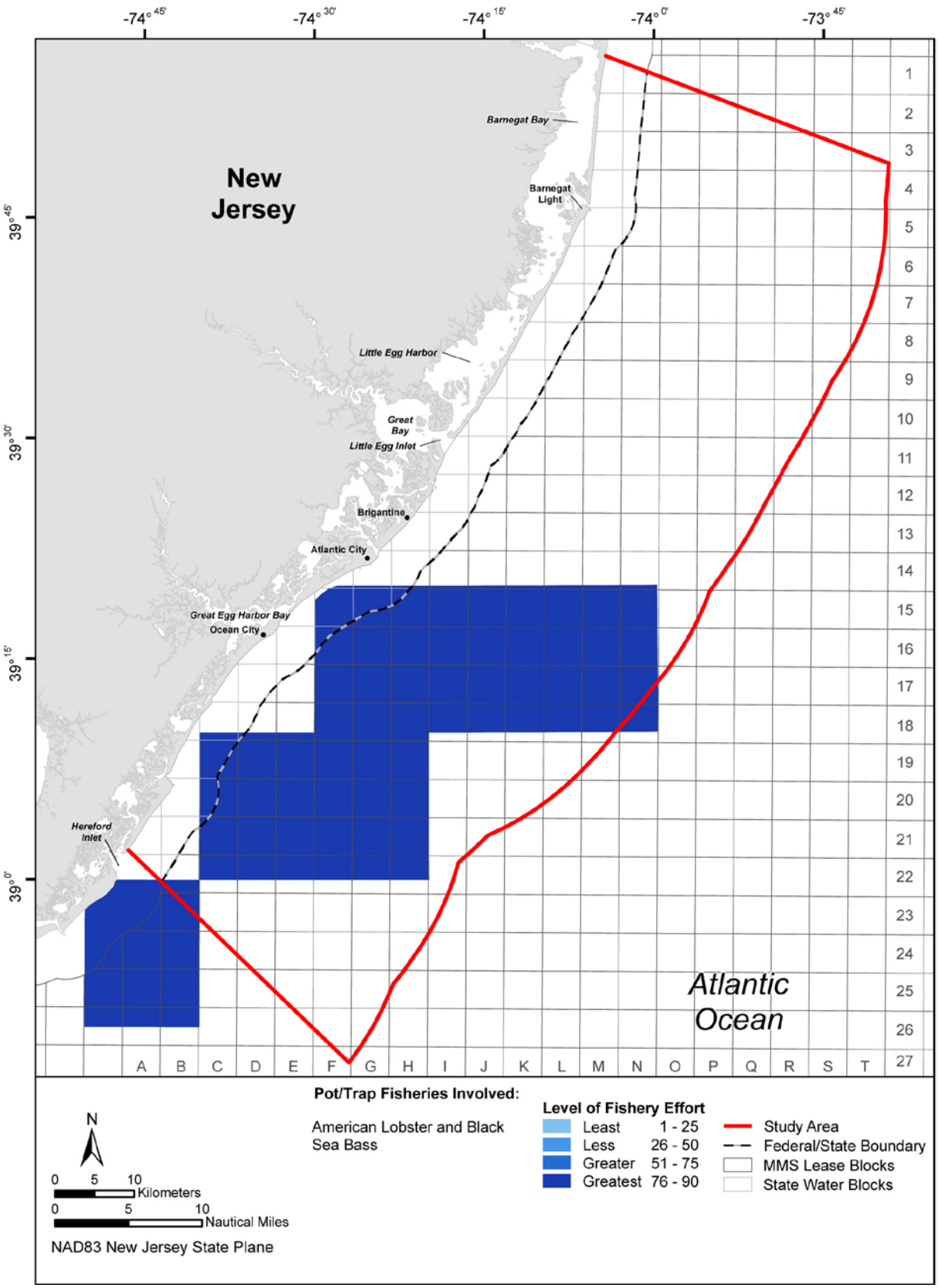

Figure 3-15. Fishing effort distribution of pot and trap fisheries in the Study Area and vicinity from 1995 to 2001. Source data: NMFS (2003a). Source information: NEFMC(2003a).

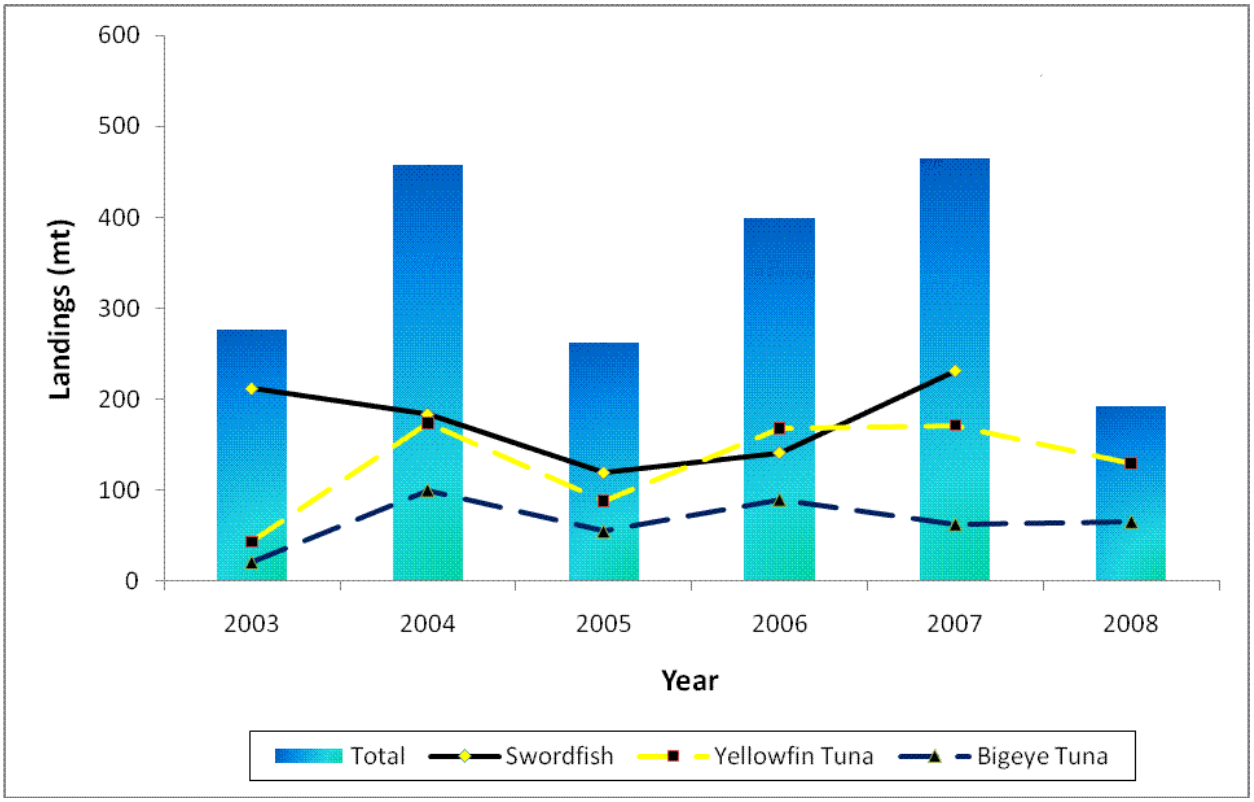

Figure 3-16. Commercial landings (metric tons) of swordfish, yellowfin tuna, and bigeye tuna in New Jersey from 2003 to 2008.[2]

Table 3-3. NMFS authorized shark species within the Study Area.

NMFS Management Group	Common Name	Scientific Name
Large Coastal Sharks (LCS)	Blacktip shark	*Carcharhinus limbatus*
	Great hammerhead shark	*Sphyrna mokarran*
	Lemon shark	*Negaprion brevirostris*
	Scalloped hammerhead shark	*Sphyrna lewini*
	Silky shark	*Carcharhinus falciformis*
	Smooth hammerhead shark	*Sphyrna zygaena*
Small Coastal Sharks (SCS)	Atlantic sharpnose shark	*Rhizoprionodon terraenovae*
	Bonnethead shark	*Sphyrna tiburo*
Pelagic Sharks (PS)	Blue shark	*Prionace glauca*
	Common thresher shark	*Alopias vulpinus*
	Porbeagle shark	*Lamna nasus*
	Shortfin mako shark	*Isurus oxyrinchus*

Source: (NMFS 2010c).

Table 3-4. NMFS prohibited shark species within the Study Area.

Common Name	Scientific Name
Atlantic angel shark	*Squatina dumerili*
Basking shark	*Cetorhinus maximus*
Dusky shark	*Carcharhinus obscures*
Sand tiger shark	*Carcharius Taurus*
Sandbar shark	*Carcharhinus plumbeus*
White shark	*Carcharodon carcharias*

Source: (NMFS 2010c)

3.3.13 Commercial Fishing Ports

There are five primary commercial fishing ports (Belford, Point Pleasant, Barnegat Light, Atlantic City, and Cape May) on New Jersey's coastline and a number of smaller ports on the Delaware (Port Norris), Barnegat, and Raritan bays. Only Barnegat Light and Atlantic City are located within the Study Area (**see Figure 3-19**).[6] Belford and Point Pleasant and Cape May are located to the north and south of the Study Area, respectively. Cape May is the largest of New Jersey fishing ports and one of the biggest on the East Coast in terms of landings and value. It is also the center of fish processing and freezing in New Jersey.[7] Barnegat Light is one of New Jersey's largest commercial fishing ports and is home to the Blue Water Fishermen's Association, one of the largest and most influential fishing organizations. This port is home to various tilefish (*Lopholatilus chamaeleonticeps*), state-of-the art scallop, smaller inshore gillnet, and pelagic longline vessels. The commercial fishing fleet targets a variety of species including spiny dogfish, weakfish, monkfish, tunas (yellowfin and bigeye), and swordfish. Viking Village, one of Bargnet's Light's two commercial docks, is one of the largest suppliers of fish and seafood on the Eastern Seaboard. NMFS estimates that Viking Village unloads and sells about 1,814,000 kg (4 million lbs) of fish per year. Atlantic City is primarily the home port to some of the larger commercial fishing vessels that target ocean quahog and Atlantic surfclam. In fact, this port is one of the largest suppliers of minced clams and clam strips. Atlantic scallops and black sea bass are also unloaded and sold in the port of Atlantic City. In terms of value, ocean quahog and Atlantic surfclam sales in 2006 was around $22 million. Overall, there are about 24 to 37 commercial fishing vessels that utilize the port of Atlantic City.[8] One of the smaller ports located in the Study Area is Sea Isle City. This small commercial fishing port has a small offshore longline fishery for tuna and swordfish, pot fisheries targeting lobster, conch, and black sea bass, and gillnetting for monkfish (McCay and Cieri 2000).

3.3.14 Commercial Fishing Vessels and Traffic

The waters off New Jersey and specifically the waters within the Study Area are active commercial fishing and vessel traffic areas; however, the number of fishing vessels that actively use the Study Area is unknown given that real time information is unavailable. Therefore, fishing vessel sightings within the Study Area were noted by scientific observers during shipboard marine mammal and seabird surveys between January 2008 and December 2009. Vessels within the Study Area were identified as fishing vessels according to the vessel type (e.g., trawler) and the gear onboard; however, because vessel sightings were only opportunistically noted during marine mammal and seabird surveys, scientific observers were unable to collect any additional information that would identify whether a vessel was traversing or actively fishing. In total, there were 549 fishing vessels sighted within the Study Area during 2008 through 2009. Overall, there were more (n = 33) fishing vessels sighted in 2008 than in 2009; 291 fishing vessels were sighted in 2008 and 258 in 2009. The average number of fishing vessels sighted within the Study Area was 46 per month. The least number of fishing vessels sighted were in January and December, while the greatest number was sighted in March and August (**Figure 3-17**). Most of the fishing vessels were sighted in the spring through the summer and the fewest in the fall through the winter. The highest concentration of vessels sighted encompassed two-thirds of the Study Area from Atlantic City to the northern part of Barnegat Bay (**Figure 3-18**).

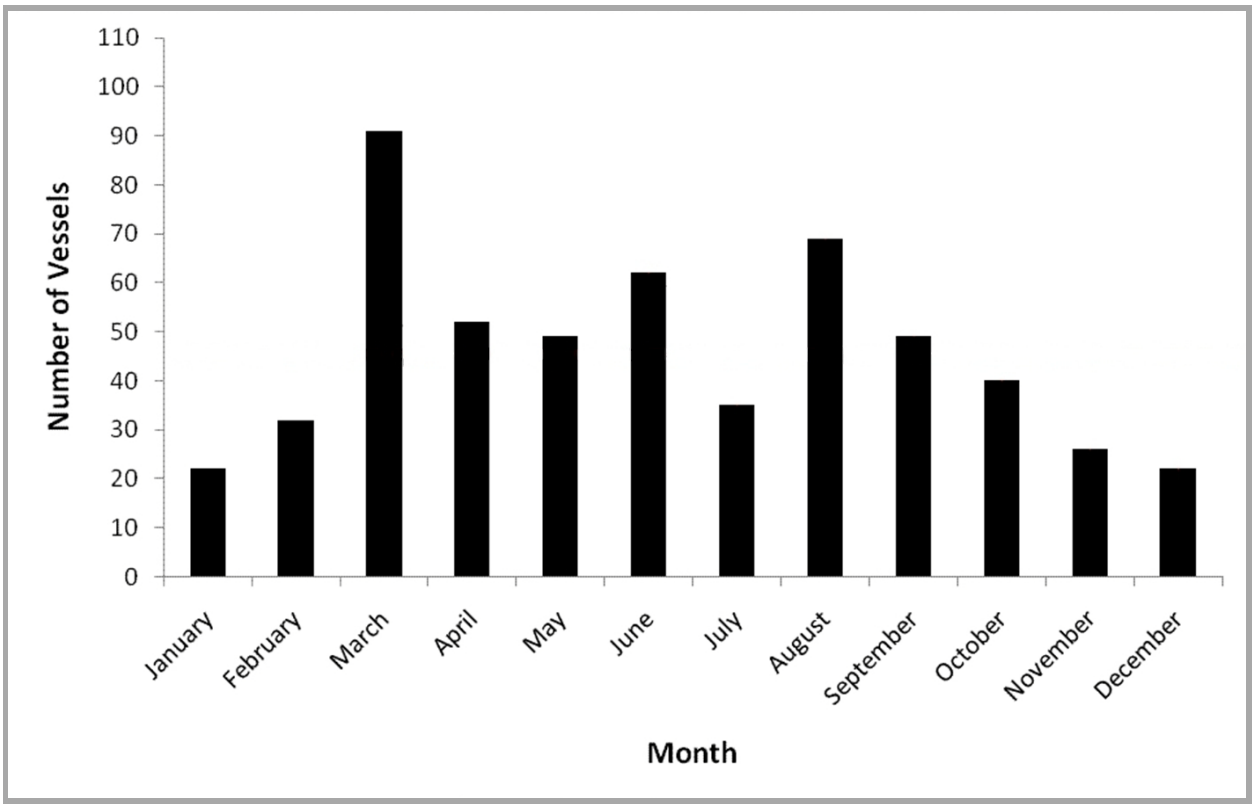

Figure 3-17. The total number of fishing vessels opportunistically sighted within the Study Area from January 2008 to December 2009.

3.4 RECREATIONAL FISHERIES

The goods and services associated with recreational fishing have an important economic impact to local and regional communities (Preble 2001). Recreational fishing within and in the vicinity of the Study Area is an important social and economic activity. According to the New Jersey Anglers Association (NJAA), the largest recreational fishing anglers association in the state, there are about 75 fishing clubs and around 30,000 active members in New Jersey (pers. comm., Bruce Smith, New Jersey Anglers Association, 5 February 2010). Currently, mandatory recreational angler reporting requirements were not imposed by state and federal agencies for any marine species accept for those anglers (non-tournament and tournament) targeting HMS in federal waters of the Atlantic, Gulf of Mexico, and U.S. Caribbean (NMFS 2010a). Most established recreational fishing programs (Marine Recreational Information Program [MRIP]) in the U.S. were only voluntary, however, under a new federal law, effective 1 January 2010, saltwater anglers will be required to register with the new NMFS National Saltwater Angler Registry. The National Saltwater Angler Registry is part of an improved data program of the MRIP to help protect the long-term sustainability of recreational fishing by conducting surveys of saltwater fishermen to determine how often they fish. [9]

The annual number of angler trips in New Jersey from 2003 through 2007 ranged from 6.5 million in 2004 to 7.4 million in 2007.[9] Besides private vessels, New Jersey's recreational fleet also consists of about 100 party and 300 charter boats, which are docked near all the major inlets and bays. In fact, the New Jersey charter and party vessel fishing fleet is the largest on the east coast providing employment and economic stimulus to local coastal communities (Giordano et al. 2008). Many charter and party vessel captains take anglers to fish throughout the Study Area on a regular basis. In general, charter outfitters offer fishing opportunities and professional services to those who do not own their own vessels or fishing equipment.

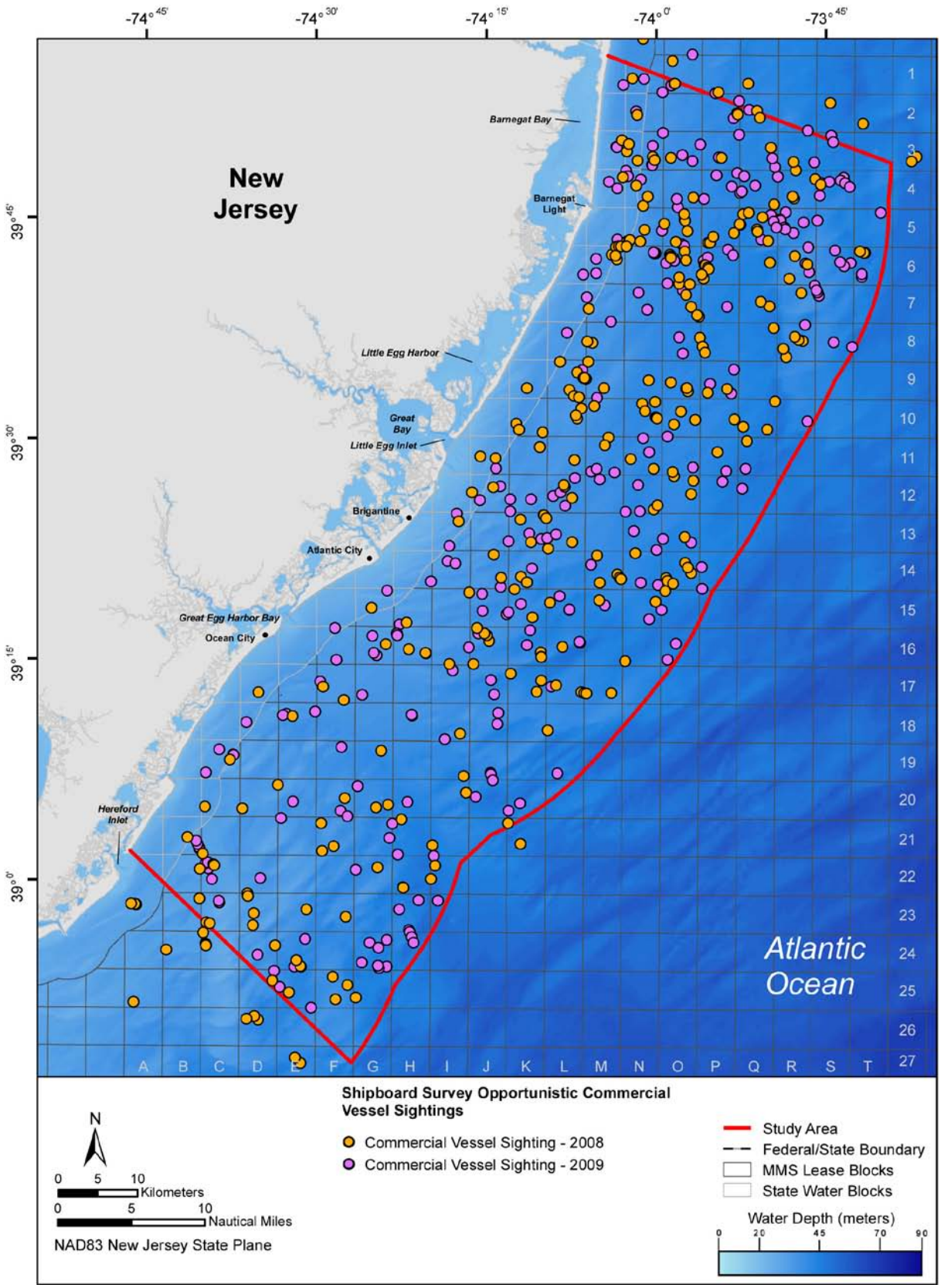

Figure 3-18. The distribution of fishing vessels opportunistically sighted within the Study Area from January 2008 to December 2009.

Depending on the weather, target species, and season, charter and party boats sail daily. Typically, a single group of anglers hires a captain of a charter boat on a per-trip basis (half or full-day), while party boats usually take anglers fishing at three regularly scheduled times (morning, afternoon, and evening). Party boat anglers pay a flat rate per person (~$45 per person for 4 to 6 hours of fishing), which is usually less than if they chartered a vessel ($900 to $1,000 per day). Party boats range in length from 18.2 m (59.7 ft) to 30.5 m (100 ft); some of these vessels are large enough to carry up to 150 anglers. Charter boats are typically smaller in size than party boats; vessels range in length from 7.6 m (25 ft) to 18.3 m (60 ft) and usually do not carry more than 6 to 8 anglers. Regardless of vessel type, the common fishing techniques are chumming, wreck/bottom fishing, drifting, and jigging. Because of size and the number of anglers, the technique of trolling is restricted to private and charter vessels (Levesque and Kerstetter 2007). Charter and party boats generally fish further offshore than many privately owned vessels, due to the high cost of owning and maintaining a larger personal fishing vessel.

3.4.1 Fishing Locations

Among the most important strategies of recreational fishing is targeting specific species is identifying locations where targeted species are abundant. Target species are found in particular locations based on habitat, seasonal behaviors (e.g., spawning) and life history stages, and anglers generally have different favorite hotspot that reflect this. Information on hotspot locations is generally scare because most fisheries management data collection programs focus on the amount caught, size composition, and fishing effort (e.g., number caught per hour) for a species, not necessarily where fishing is taking place. Also, available studies suggest that identifying hotspots is often difficult because anglers are reluctant to divulge this valuable information; in Florida, for example, some fishing captains actually offer their hotspot locations for sale.

Given the voluntary status of recreational fishing information, most anglers prefer to remain anonymous and usually do not assist with submitting any additional information to researchers regarding specific fishing locations. Nonetheless, one method of identifying recreational fishing hotspots is to utilize historical fishing charts. Two such historical comprehensive fish charts for New Jersey were completed by Freeman and Walford (1974) and Long et al. (1982); however, some of this historical data may not be appropriate in quantifying the current spatial distribution of recreational fisheries. For that purpose, this historical data was incorporated with marine recreational fishing hotspots gathered from global positioning system (GPS) detailed fishing and dive charts (Saltwater Directions 2003a, 2003b, 2003c) and NJDEP Geographic Information System (GIS) websites (NJDEP 2008b).[10]

Within and adjacent to the Study Area (**Figure 3-19** and **Table 3-5**), fishing hotspots (143 in the Study Area and 14 adjacent to the Study Area) included areas with some type of structural feature, such as shoals, ridges, lumps, banks, ship wrecks, and reefs (artificial and natural: rocks). Each of these structural features provide prime fishing sites for anglers targeting specific species, such as Atlantic striped bass and bluefish around shoals; bluefish and flounder near ridges; black sea bass and tautog around shipwrecks/reefs (Saltwater Directions 2003a, 2003b, 2003c). Man-made fishing sites included piers, docks, rock and concrete jetties, and beach groins. Among the most popular fishing sites are artificial reefs. The New Jersey Artificial Reef Program is one of the largest on the east coast consisting of over 1,000 reefs and 100 vessels; the network consists of 15 ocean sites located from Sandy Hook to Cape May (NJDEP 1999; NJDEP 2000; NJDEP 2008a; NJDEP 2008b). Reefs are constructed from a variety of materials including ships and barges, concrete demolition debris, dredge rock, concrete-ballasted tire units, and other dense materials. In addition, because hydrographic features also concentrate fish, recreational anglers often target locations with strong currents that are rich with nutrients, which are sometimes associated with natural structures (Freeman and Walford 1974; Long et al. 1982).

3.4.2 Recreational Fishing Effort

Recreational fishing off New Jersey consists of anglers targeting various species with certain fishing gears including, but not limited to, seines, pots/traps, and hook-and-line. Similar to most regions, hook-and-line is by the most common gear used by recreational anglers fishing off New Jersey (ASMFC 2008b). Recreational fishing effort can be classified as inshore or offshore activity. Inshore recreational

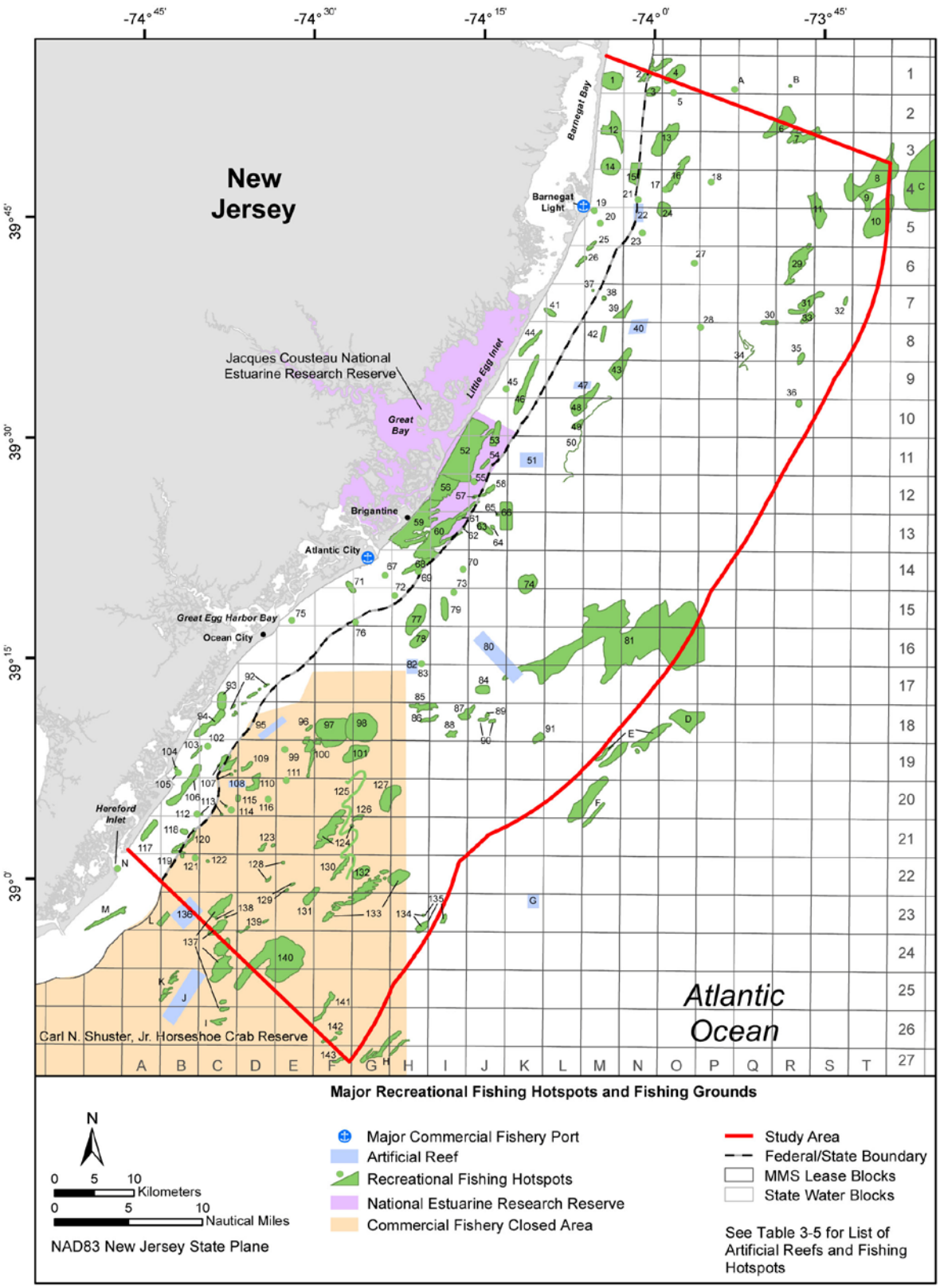

Figure 3-19. Major commercial fishing ports and recreational fishing hotspots found in the Study Area and vicinity. Source information: NEFMC (2003a). Map adapted from: Freeman and Walford (1974), Long et al. (1982), Saltwater Directions (2003a; 2003b; 2003c), and NJDEP (2008b).[10]

Table 3-5. Major fishing hotspots found within or adjacent to the Study Area.

Fishing Hotspots in the Study Area					
1	Seaside Park	2	Big Wreck Lump	3	Ledges
4	Morris Treasy	5	Old Freighter	6	Tolten Lump
7	Tolten Hole South	8	Oles Lump	9	Ollie's Hole
10	Ollie's Lump	11	Range Buoy	12	Cedar Creek
13	Clam Beds	14	North Pounds	15	Clam Beds
16	Ralph's Lump	17	Several Sunken Barges	18	Remains of Cornelius Hargraves and Vizcaya Wrecks
19	Several Sunken Barges	20	Barnegat Inlet Rough Water Entrance	21	Summer Wreck
22	Barnegat Light Reef Site	23	Bow of Former Tanker Gulftrade	24	Barnegat Ringe Buoy
25	Loveladies Lump	26	Sandy Island Lump	27	San Saba Wreck
28	Great Issac Wreck	29	Barnegat Ridge North	30	West Hole
31	Barnegat Ridge South	32	Cod Lump	33	South Hole
34	No Name	35	11 Fathom Lump	36	J-Lump
37	Harvey Cedars Lump	38	Harvey Cedars Hole	39	Fingers
40	Garden State North Reef Site	41	Ship Bottom Sewer Line	42	Tires
43	Fingers	44	Brant Beach Lump	45	Beach Haven Lumps
46	Pound Piles	47	Garden State South Reef Site	48	Ceddies Ridge
49	Pinnacle	50	60' Edge	51	Little Egg Reef Site
52	Little Egg Inlet	53	No Name	54	Atomic Lump
55	"LE" Buoy	56	Wreck Inlet	57	South East Lump
58	D Buoy	59	Brigantine Hotel	60	Brigantine Shoal
61	Little Beach Lump	62	4BS Lump	63	2BS Lump
64	Carlson Wreck	65	Wreck Buoy	66	Wreck Buoy
67	Shoaling near Absecon Inlet	68	Black Buoy Slope	69	Long Narrow Shoal
70	Long Narrow Shoal	71	Atlantic City Sewer Line	72	Inshore Ridge
73	Pet Wreck	74	The Wall	75	Great Egg Harbor Inlet
76	Scattered Wreckage	77	South East Wreck	78	Dift Spot
79	No Name	80	Atlantic City Reef Site	81	Lobster Hole
82	Great Egg Reef Site	83	American Oil Wreck	84	Lobster Pots
85	Dog Lump	86	The Chicken	87	Hambone
88	The Ham	89	Teardrop	90	Triple Lumps
91	Atlantic City Bluefish Lump	92	Cuma Lumps	93	Corson Inlet
94	Deep Hole	95	Ocean City Reef Site	96	Coral Bottm
97	Inshore Stone Beds	98	Stone Beds	99	Bell Wreck
100	Breakfast Table	101	Mus R.?.	102	Shoaling Ridges off Sea Isle City

Table 3-5 (*continued*). Major fishing hotspots found within or adjacent to the Study Area.

Fishing Hotspots in the Study Area					
103	No Name	104	Seven Mile Beach	105	Townsends Inlet
106	Chinese Wreck	107	Sea Isle Lump	108	Townsends Inlet Reef
109	The Lump	110	Catalunya	111	Wreck
112	Wreck	113	Clear mar	114	Wrecked Barge Wayne
115	Sea Isle Shoal	116	Avalon Shoal	117	Stone Harbour
118	No Nmae	119	Coral.?.	120	Peacock Shoals
121	Sandy Lump	122	White P Boat	123	Shutes Shoal
124	1st Jump	125	The Fingers	126	Tuna Lumps
127	Meat Grounds	128	M. Lump	129	Middle Grounds
130	2nd Jump	131	No Name	132	Sylvester's
133	Sea Isle Ridge	134	High Bottom	135	Scallop Bottom
136	Wildwood Reef Site	137	Five Fathom Bank	138	No Name
139	Pep's Lump	140	Mussel and Coral Beds	141	North East Lump
142	Middle Lump	143	East Lump		
Fishing Hotspots adjacent to the Study Area					
A	Old crane barge	B	Tolten Hole North	C	Mako Hole
D	Oyster Creek Spot	E	120 Foot Hole	F	Atlantic City Ridge
G	Deepwater Reef Site	H	No Name	I	South Shoal
J	Cape May Reef Site	K	No Name	L	Coral Beds
M	Taylor Slough	N	Deepwater Reef		

Source: Freeman and Walford (1974); Long et al. (1982); Saltwater Directions (2003a; 2003b; 2003c); NJDEP (2008b) [10]

fishing (<4.8 km [3.0 mi]) involves fishing from boats, beaches, marshes, and man-made structures (e.g., jetties, docks, and piers), while offshore fishing (>4.8 km [3.0 mi]) involves using larger private boats, rental boats, charter or party boats. From 2003 through 2007, there were almost 35 million fishing trips conducted in New Jersey waters. Overall, most saltwater anglers fished from private or rental vessels (54%) followed by shore (37%) and party or charter (9%) vessels (**Figure 3-20**). Regardless of the fishing mode, most (90.5%) recreational fishing trips were within 4.8 km (3.0 mi) from shore and most were in the spring (75%) (**Figure 3-21**). While fishing occurs year-round in New Jersey, there is clearly much more activity in the warmer months (June through August) when more than 20 species are actively fished by recreational fishermen (St. Martin et al. 2005; Daetsch et al. 2006).

3.4.3 Recreational Catch Characteristics

Recreational anglers target a variety of fish along its 193.2 km (120 mi) of coastline and offshore waters; the species that anglers target depend on the season, fishing location, and daily movement patterns. Some species, such as mackerel are found off New Jersey seasonally, while others (winter flounder) are found year-round. Although recreational fishing is a year-round activity, most anglers target specific species at certain times. In the spring, many anglers target Atlantic striped bass, bluefish, or summer flounder (fluke). Anglers also target tautog, black sea bass, and weakfish during spring (ASMFC 2008b). Just outside of the Study Area, there are several famous tuna fishing grounds, such as the Mud Hole. The Mud Hole is a deep trench that is located around 48.3 to 64.4 km (30 to 40 mi) offshore in 77.2 m (250 ft) of water. Offshore anglers fishing this area have been known to catch bluefin and yellowfin tunas as well as sharks. Another popular offshore location is Barnegat Ridge, which is located 25.8 km (16 mi) from

shore. At this fishing spot, anglers have the opportunity to catch bluefin tuna, little tunny (*Euthynnus alletteratus*), Atlantic bonito, and dolphinfish (*Coryphaena* spp.; ASMFC 2008b). In general, these offshore areas are pursued by anglers during late summer. Anglers also target many inshore fish from shore such as Atlantic striped bass, weakfish, and winter flounder (ASMFC 1994). According to NMFS (MRIP), the primary species landed from 2003 to 2007 was summer flounder. Summer flounder landings represented 40.8% of the total landings, while bluefish and black sea bass represented 18.9% and 18.2%, respectively (**Figure 3-22**).

Most of the seasonal round of recreational fishing is based on regulations and ability to fish for certain species at certain times of the year (St. Martin et al. 2005). Regulations often change annually as is reflected in the proposed changes for the 2010 recreational harvest of summer flounder (fluke), winter flounder, weakfish, black sea bass, and coastal sharks. These new rules are implemented for New Jersey in compliance with the ASMFC's management plans for these species. They aimed at providing adequate protection to these fish stocks and may involve changes to the size, season, and/or possession limits.[11]

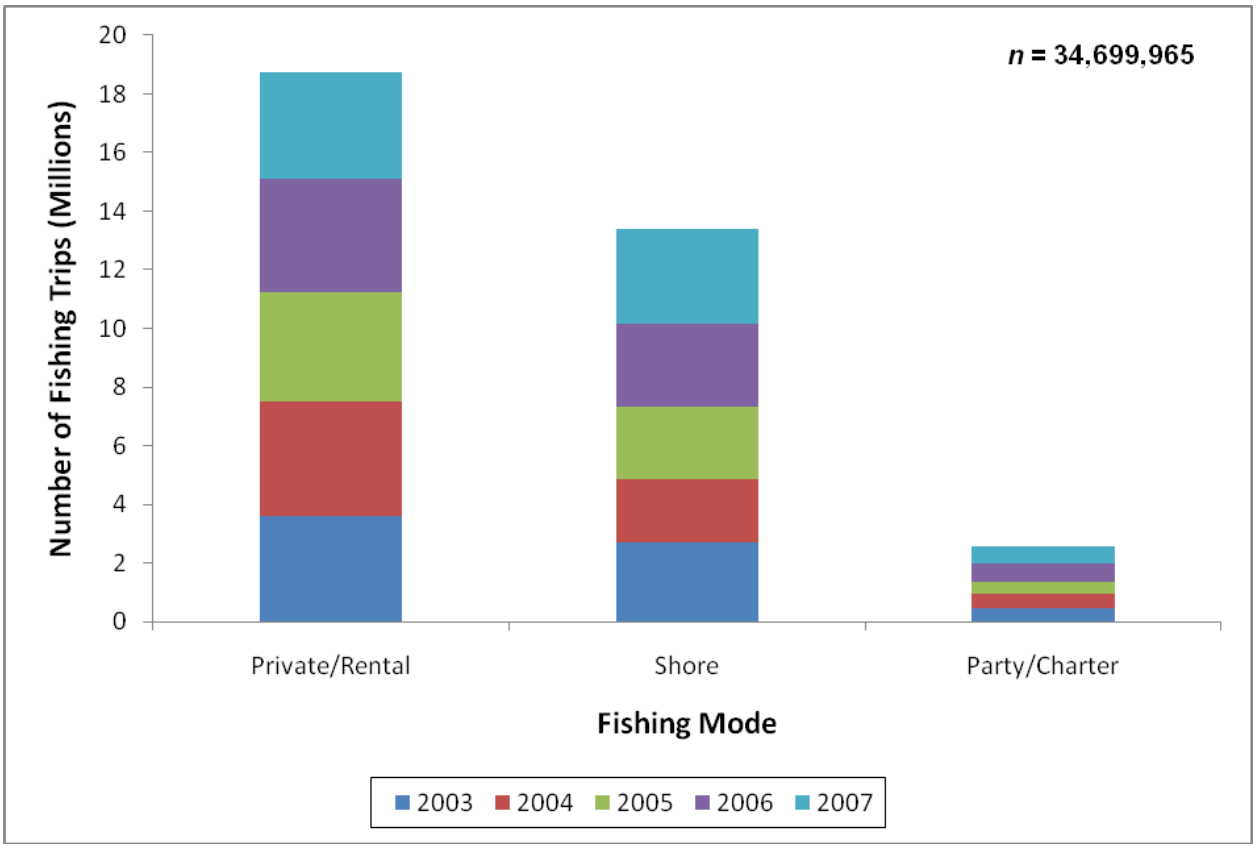

Figure 3-20. The total number of recreational fishing trips off New Jersey from 2003 to 2007 according to fishing mode (private/rental, shore, and party/charter boat).[9]

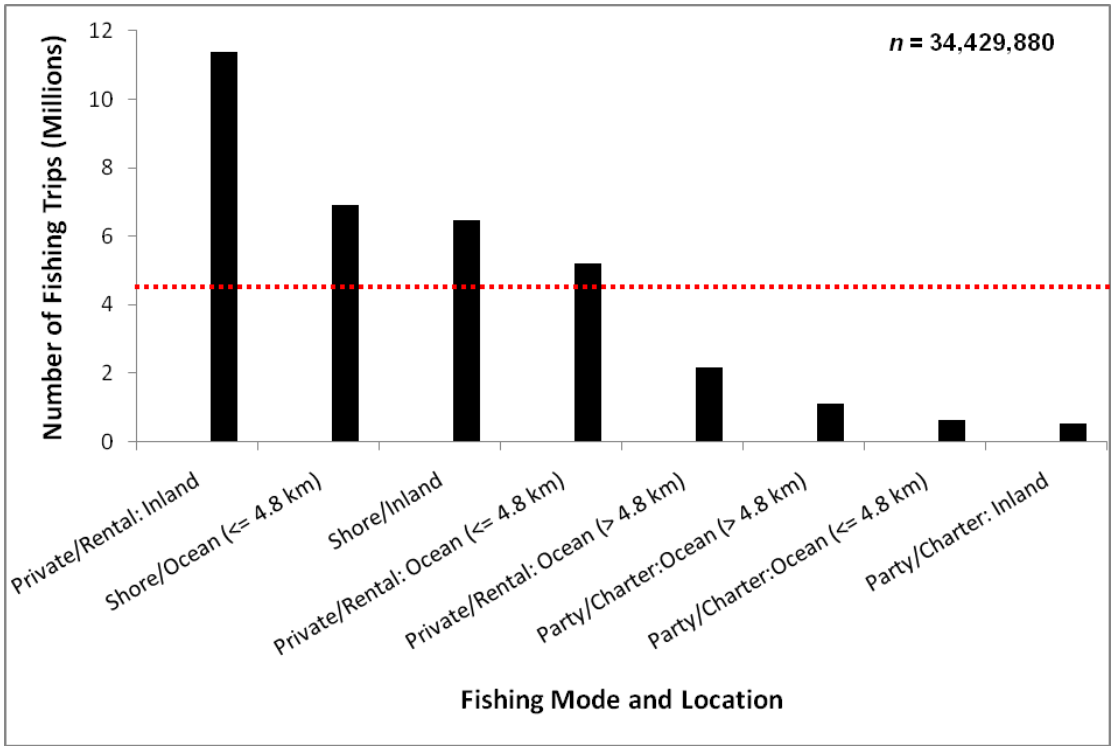

Figure 3-21. The number of recreational fishing trips by the three modes (private/rental, shore, and party/charter boat) in the waters off New Jersey from 2003 to 2007. The dotted line depicts the annual mean total number of fishing trips.[9]

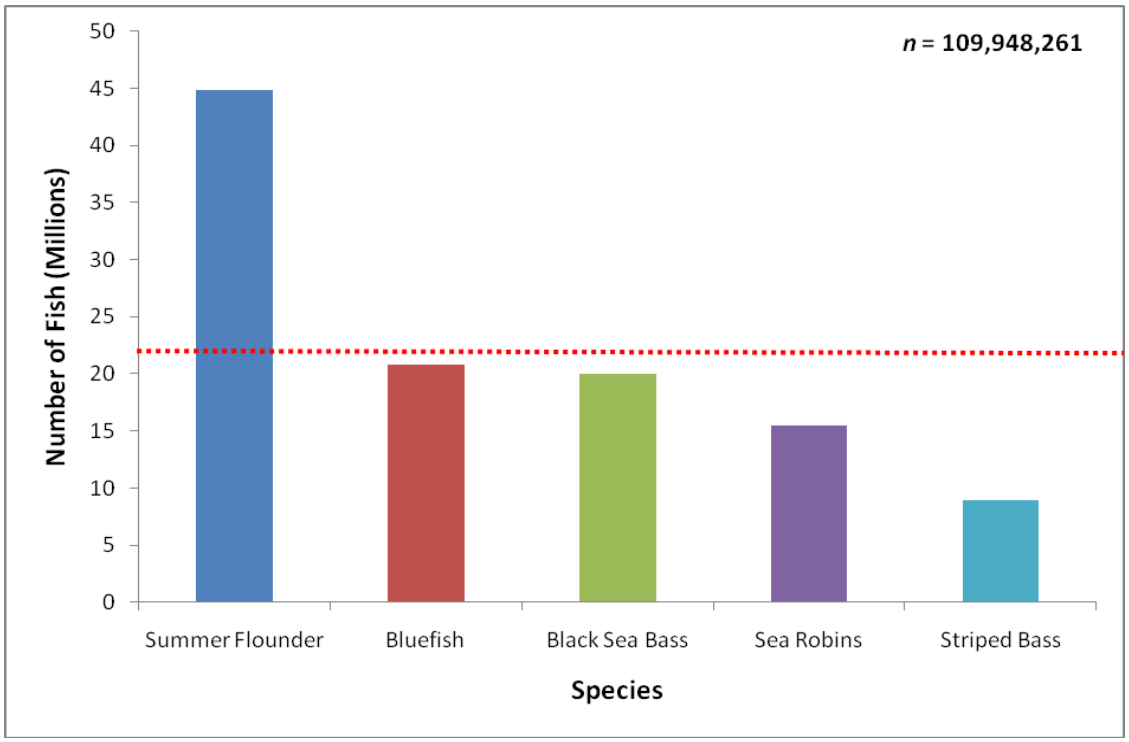

Figure 3-22. Primary fish species caught by recreational anglers fishing in the waters off New Jersey from 2003 to 2007. The dotted line represents the annual mean total number of fish landed by anglers.[9]

3.4.4 Fishing Tournaments

Organized saltwater fishing tournaments are popular public events that take place in New Jersey waters within or in the vicinity of the Study Area. Given the inclement winter weather, most recreational saltwater fishing tournaments take place in summer; often on the weekends. Many fishing tournaments are economically important to local cities or towns. Anglers often travel from other locations to fish in these tournaments, requiring them to stay for duration of the event and contribute to local economies via utilization of hotels, eateries, gas, and marine supply and fishing outfitters. Aside from for the sport and trophies, many anglers participate in these tournaments because of the substantial prizes that are given to the winners; many are monetary (Levesque and Kerstetter 2007). Some of the most popular and economically valuable tournaments in the U.S. are specifically directed at HMS (e.g., billfish, swordfish, tuna, and sharks). In general, organizations and companies usually sponsor each fishing tournament and prizes are given for the largest and the greatest number of fish caught of a given species. Depending on the fishing tournament, participants either target inshore or offshore species. Generally, each fishing tournament has its own set of rules, which includes time limits and geographical boundaries. Based on these rules, anglers then choose fishing sites according to the species targeted, experience, and the extended weather forecast.

The number of fishing tournaments in a given area changes each year, even though some have an extensive history. It is difficult to estimate the overall economic importance of these tournaments to a given area considering fishing tournaments depend on many factors, such as the economy, sponsorship, and weather. Although most tournaments are annual events, the list of scheduled tournaments identified below is not static (**Table 3-6**). Each year, some fishing tournaments may be cancelled due to the lack of participation and support, or new tournaments may be organized. It should be noted that the exact dates and weigh-in locations of annual tournaments will vary slightly from year to year, but many take place at the same place and location every year. In addition, each fishing tournament may or may not set geographical boundaries; thus, even though an event's weigh-out is in a particular location this does not necessarily suggest that fishing cannot take place in another area away from the actual weigh-in location.

Table 3-6. A list of selected New Jersey recreational saltwater fishing tournaments occurring within or in the vicinity of the Study Area in 2009.[12, 13, 14]

Event Date	Weigh-in Location	Event Name
May 1-2, 2009	Cape May, New Jersey	8th Annual South Jersey/ASA Spring Striper Tournament
May 8-9, 2009	Sandy Hook, New Jersey	ASA Striper Tournament
June 6, 2009	Atlantic City, New Jersey	Greater Atlantic Bluefish
June 11-14, 2009	Cape May, New Jersey	29th Annual South Jersey Shark, Mako, Blue, Thresher Tournament
June 13, 2009	Forked River, New Jersey	Forked River Tuna Club Spring Shoot-Out Tuna
June 27-28, 2009	Clark's Landing, New Jersey	Mako Mania
July 8-12, 2009	Cape May, New Jersey	20th Annual Ocean/Viking Marlin, Tuna, Wahoo
July 15-18, 2009	Cape May, New Jersey	8th Annual Mid-Atlantic Tuna Tournament
July 24-25, 2009	Avalon, New Jersey	Jersey Shore Classic

Table 3-6 (*continued*). A list of selected New Jersey recreational saltwater fishing tournaments occurring within or in the vicinity of the Study Area in 2009.[12,13,14]

Event Date	Weigh-in Location	Event Name
August 15-23, 2009	Forked River, New Jersey	Forked River Tuna Club Annual Tuna Tournament
August 16-21, 2009	Cape May, New Jersey	18th Annual Mid-Atlantic $500,000 Tuna, Wahoo Tournament
August 23-29, 2009	Atlantic City, New Jersey	Tuna Stakes Invitational
October 4, 2009	Island Beach State Park, New Jersey	Governor's Surf Fishing Bluefish, Blackfish Tournament
October 17-22, 2009	Forked River, New Jersey	Forked River Tuna Club Striped Bass, Bluefish Tournament
November 6-7, 2009	Cape May, New Jersey	9th Annual South Jersey Marina's Big Striped Bass Open

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