APPENDIX A

ESSENTIAL FISH HABITAT DESCRIPTIONS AND FIGURES

The 40 federally managed species (23 temperate, 3 subtropical-tropical, and 14 highly migratory species [HMS]) and their designated Essential Fish Habitat (EFH) and/or Habitat Areas of Particular Concern (HAPC) found within the Study Area are described below. Specific EFH lifestages and/or HAPC found within the Study Area are highlighted in bold.

Temperate Water Fish and Invertebrate Species

- **Atlantic Cod (*Gadus morhua*)**

Management—Atlantic cod EFH is designated under Final Amendment #11 to the Northeast Multispecies Fisheries Management Plan (FMP) (NEFMC 1998). The Atlantic cod is managed as two separate stocks (Georges Bank and Gulf of Maine stocks) in U.S. waters (NEFMC 1998). The Georges Bank stock, whose southern distributional extent ranges into the Mid-Atlantic Bight (MAB), is the only stock that occurs within the Study Area (Mayo and O'Brien 2000).

Status—Both the Georges Bank and Gulf of Maine cod stocks are classified as overfished and overfishing is occurring (NMFS 2009d). The 2009 International Union for Conservation of Nature and Natural Resources (IUCN) Red List classifies Atlantic cod as vulnerable or facing a high risk of extinction.[1]

Distribution—The range of Atlantic cod extends to both sides of the northern Atlantic Ocean. In the western North Atlantic Ocean, this species is distributed from Greenland to Cape Hatteras, North Carolina (Fahay et al. 1999a).

Habitat Associations—Cod are a demersal (usually found within 2 m [6.6 ft] of the bottom) temperate species, which are found in waters ranging from 10 to 150 m (32.8 to 492.2 ft) off the northeastern U.S. coast. Cod prefer cobble or gravel shoals and water temperatures between 0°C and 10°C (32°F and 50°F) (NEFMC 1998; Klein-MacPhee 2002b). Adult cod are commonly found in deeper waters (600 m [1,968.6 ft]) (Cohen et al. 1990). Eggs are pelagic and larvae are found near the water surface moving to deeper waters with maturity (Fahay et al. 1999a; Klein-MacPhee 2002b; Lough 2004).

Life History—In the Study Area, cod are mostly non-migratory, but do undertake minor seasonal movements as water temperatures fluctuate. Cod typically move to the northern parts of their range as water temperatures warm in the summer and early fall (Cohen et al. 1990). Older fish also display vertical movements while searching for food (Klein-MacPhee 2002b). Spawning occurs on Georges Bank, in the Gulf of Maine, and over the inner half of the continental shelf off southern New England at night. Spawning occurs from November to April in waters with temperatures ranging from 0° to 12°C (32.0° to 53.6°F) and with depths of less than 50 m (164 ft) (Cohen et al. 1990; Fahay et al. 1999a).

Forage Species—Atlantic cod larvae feed on copepods, juveniles on crustaceans (sevenspine bay shrimp [*Crangon septemspinsoa*]), and adults primarily on fishes but also consume crustaceans and mollusks. Adult prey include: herring, sand lance (*Ammodytes* spp.), Atlantic mackerel, Atlantic rock crab (*Cancer orroratus*), longfin inshore squid, and northern shortfin squid (*Illex illecebrosus*) (Klein-MacPhee 2002b).

EFH Designations—(NEFMC 1998) (**Figure A-1**)

- Eggs—Designated EFH includes surface waters around the perimeter of the Gulf of Maine, Georges Bank, the eastern portion of the MAB continental shelf south to Long Island, New York, and within New England estuaries and embayments.

- Larvae—Designated EFH includes pelagic waters of the Gulf of Maine, Georges Bank, the eastern portion of the continental shelf off southern New England, and within southern New England estuaries and embayments.

- Juveniles—Designated EFH includes pelagic waters and bottom habitats with substrate of cobble or gravel in the Gulf of Maine, Georges Bank, MAB south to Long Island, New York, and within New England estuaries and embayments .

- **Adults**—Designated EFH includes bottom habitats with a substrate of rocks, pebbles, or gravel in the Gulf of Maine, Georges Bank, southern New England, MAB south to the Delaware Bay, and within New England estuaries and embayments.

- Spawning Adults—Designated EFH includes bottom habitats with a substrate of smooth sand, rocks, pebbles, or gravel in the Gulf of Maine, Georges Bank, MAB south to the Delaware Bay, and within New England estuaries and embayments.

HAPC Designations—Areas designated as HAPC for this species are located north of the Study Area on the northern flank of Georges Bank (NEFMC 1998).

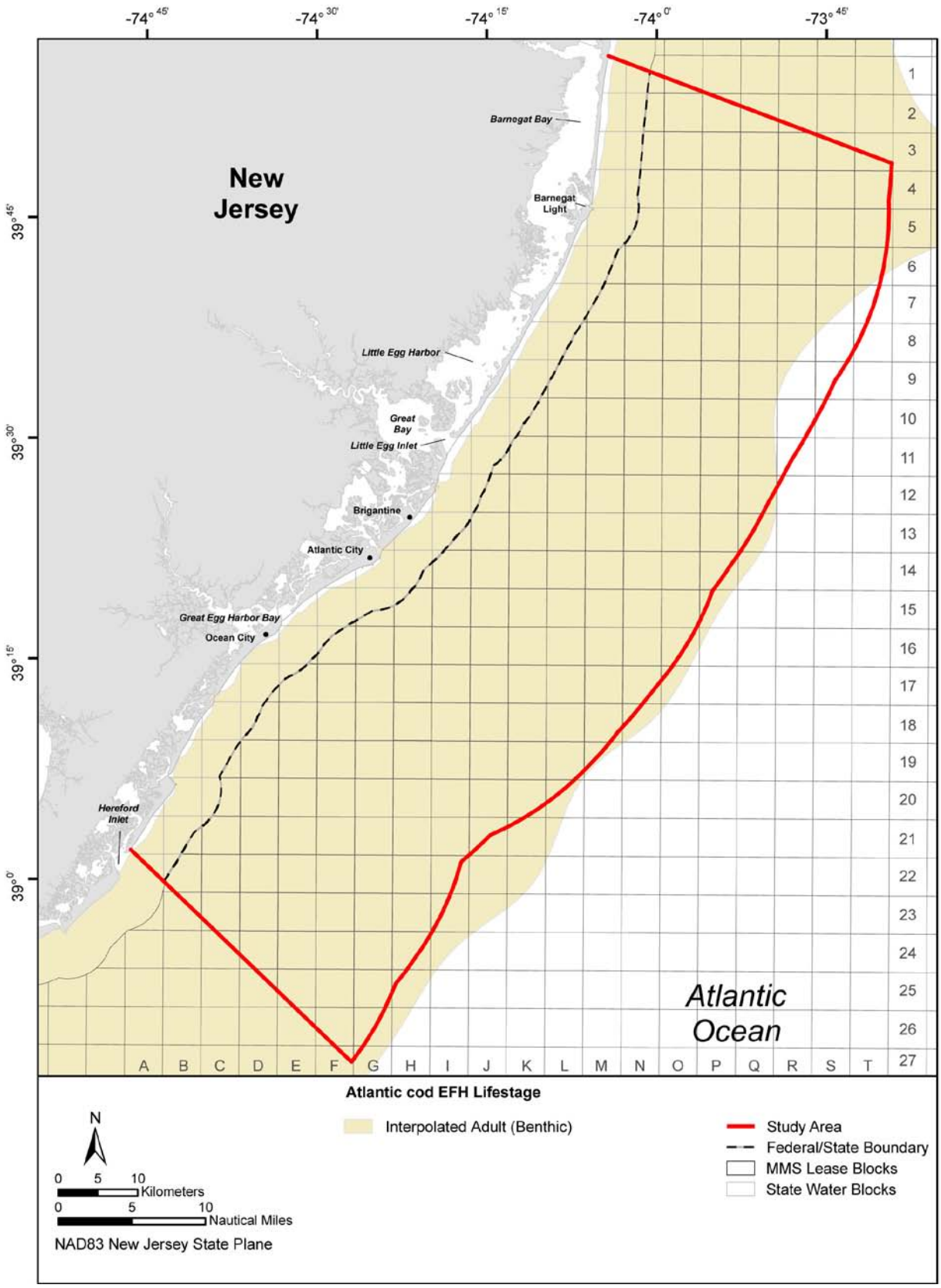

Figure A-1. Essential fish habitat designated in the New Jersey Study Area for adult lifestage of Atlantic cod. Source map (scanned): NEFMC (1998).

- **Atlantic Herring (*Clupea harengus*)**

Management—Atlantic herring EFH is designated by the New England Fishery Management Council (NEFMC) under the Atlantic Herring FMP (NEFMC 1998).

Status—Clupeids are among the most abundant and commercially important of the world's fishes. The Atlantic herring supports one the oldest and most important fisheries in the northwestern Atlantic (Overholtz 2000b). Atlantic herring are neither classified as overfished, nor is overfishing occurring (NMFS 2009d).

Distribution—Atlantic herring inhabits both sides of the North Atlantic Ocean in temperate and boreal waters (below 5°C [41°F]) (Munroe 2002). In the western North Atlantic Ocean, this species ranges from Labrador, Canada to Cape Hatteras, North Carolina (Overholtz 2000b).

Habitat Associations—Atlantic herring are a pelagic schooling species found at various depths depending on lifestage, season, and location. Eggs are demersal, adhesive, and deposited on a variety of benthic habitats including boulders, rocks, gravel, shell fragments, and on aquatic macrophytes typically in water depths ranging from 20 to 80 m (65.6 to 262.5 ft). Larvae are pelagic and either remain at or near spawning sites for extended periods (months) or are dispersed by local currents (Reid et al. 1999). Larvae prefer waters with temperatures ranging from 6° to 16°C (42.8° to 60.8°F), salinities of 32 practical salinity units (psu), and depths of 50 to 90 m (164 to 295 ft) (Reid et al. 1999). Juveniles have a preference for water temperatures below 10°C (50°F), a salinity range of 26 to 32 psu and depths of 15 to 135 m (49 to 443 ft). Adults typically are found in waters with temperatures below 10°C (50°F), depths of 20 to 130 m (65.6 to 426.5 ft), and salinities above 28 psu (NEFMC 1998; Stevenson and Scott 2005).

Life History—Atlantic herring spawn in well-mixed waters with tidal currents ranging from 2.8 to 5.6 kilometers per hour (kph; 1.7 to 3.5 miles per hour [mph]), temperatures below 15°C (59°F), depths of 20 to 90 m (66 to 295 ft), and a salinity range of 32 to 33 psu. Atlantic herring spawn over a variety of substrates including rocks, shells, pebbles, gravel, and clay (Reid et al. 1999; Munroe 2002). Spawning occurs from July to November in relatively shallow waters. Known spawning locations are southwestern Nova Scotia, Georges Bank/Nantucket Shoals, and the Gulf of Maine (Reid et al. 1999). Adult and juvenile herring undergo complex and extensive north-south and inshore-offshore migrations to spawn, feed, or overwinter. In addition, herring undertake diel vertical migrations in response to light intensity (Reid et al. 1999; Munroe 2002).

Forage Species—Atlantic herring are opportunistic filter feeders with larvae and juveniles preying primarily on zooplankton (copepods, cladocerns, and protozoans) and adults preying on crustaceans (euphausiids), mollusks, and chaetognaths (*Sagitta elegans*). This species feeds in the upper layers of the water with peak feeding activity occurring at dusk and dawn (Munroe 2002; Stevenson and Scott 2005).

EFH Designations—(NEFMC 1998) (**Figure A-2**)

- Eggs—Designated EFH includes bottom habitats with substrates of gravel, sand, cobble, and shell as well as aquatic macrophytes in the Gulf of Maine, Georges Bank, and New England estuaries and embayments.

- **Larvae**—Designated EFH includes pelagic waters and bottom habitats in the Gulf of Maine, Georges Bank, MAB south to New Jersey (approximately 40°N), and New England and mid-Atlantic estuaries and embayments.

- **Juveniles**—Designated EFH includes pelagic waters and bottom habitats in the Gulf of Maine, Georges Bank, MAB south to Cape Hatteras, North Carolina, and New England and mid-Atlantic estuaries and embayments including Barnegat Bay adjacent to the Study Area.

- **Adults**—Designated EFH includes the pelagic waters and bottom habitats from the Gulf of Maine, Georges Bank, MAB south to Cape Hatteras, North Carolina, and New England and mid-Atlantic estuaries and embayments including Barnegat Bay adjacent to the Study Area.

- **Spawning Adults**—Designated EFH includes bottom habitats with substrate consisting of gravel, sand, cobble, and shell fragments as well as aquatic macrophytes located in the Gulf of Maine, Georges Bank, MAB south to Cape Hatteras, North Carolina, and New England estuaries and embayments.

HAPC Designations—There are no HAPC identified for this species by the NEFMC. The Atlantic States Marine Fisheries Commission (ASMFC) has identified HAPC to include estuaries and embayments as important nursery grounds for juveniles.[2]

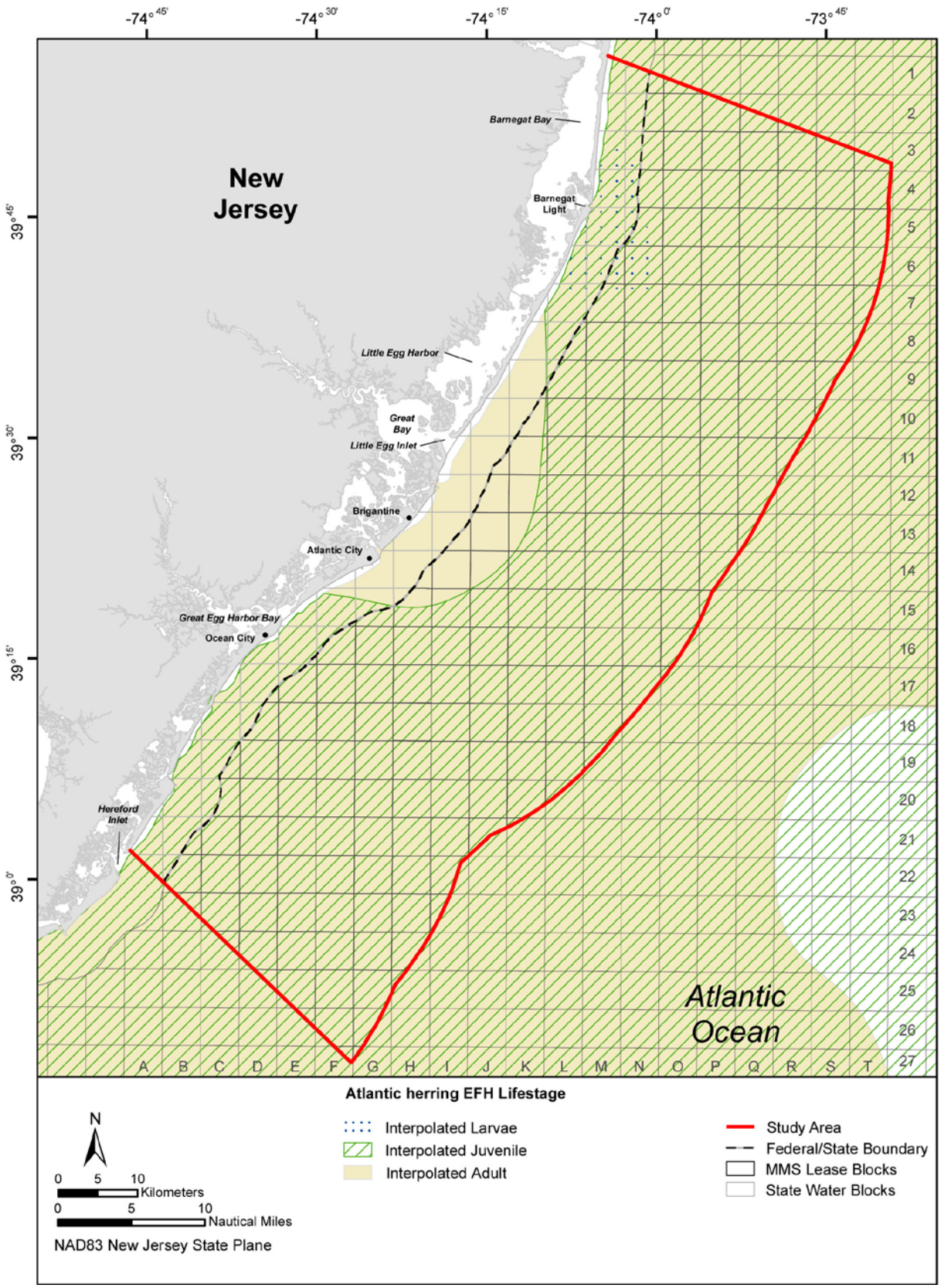

Figure A-2. Essential fish habitat designated in the New Jersey Study Area for all lifestages of Atlantic herring. Source map (scanned): NEFMC (1998).

- **Atlantic Mackerel *(Scomber scombrus)***

Management—The Middle Atlantic Fishery Management Council (MAFMC) designates EFH for the Atlantic mackerel through Amendment 8 to the Atlantic Mackerel, Squid, and Butterfish FMP (MAFMC 1998b).

Status—Atlantic mackerel are not classified as overfished, nor is overfishing occurring (NMFS 2009d).

Distribution—Atlantic mackerel inhabits the North Atlantic Ocean, including the Baltic, Black, and Mediterranean seas. In the western North Atlantic Ocean, their distribution ranges from Black Island, Labrador, Canada to Cape Lookout, North Carolina (Collette 2002).

Habitat Associations—Atlantic mackerel are fast-swimming, pelagic schooling fish primarily found in the open sea but rarely occur beyond the continental shelf. Eggs are pelagic and have been collected from shore to a depth of 15 m (49.2 ft) in water temperatures between 5°C and 23°C (41.0°F and 73.4°F). Larvae are found at depths between 10 m and 130 m (49.0 ft and 426.5 ft) in water temperatures between 6°C and 22°C (42.8°F and 71.6°F). Atlantic mackerel juveniles are generally found from shore to a depth of 320 m (1,049.9 ft) and in water temperatures between 4°C and 22°C (39.2°F and 71.6°F). Adults inhabit waters from shore to 381 m (1,250 ft) and have a temperature preference range 4° to 16°C (39.2°F to 60.8°F) (Studholme et al. 1999). This species primarily inhabits open waters and does not depend directly on the coastline or bottom waters during any of its lifestages (Collette 2002). Adults overwinter in deeper waters between 70 m and 200 m (229.7 ft and 656.2 ft) (Collette 2002).

Life History—Atlantic mackerel are serial spawners (spawning in bursts or pulses more than once in a spawning season) and utilize inshore areas to spawn (Collette 2002). Spawning occurs from April to July, peaking in mid-April off the Chesapeake Bay and in May off New Jersey and Long Island, when water temperatures begin to warm and are between 9°C and 14°C (48.2°F and 57.2°F) (Studholme et al. 1999; Collette 2002). In the southern Gulf of St. Lawrence, spawning occurs from the end of May to mid-August (Overholtz 2000a; Collette 2002).

Forage Species—Atlantic mackerel are opportunistic feeders that prey upon small fauna such as copepods and ichthyoplankton as larvae, small crustaceans (amphipods, mysid shrimp, decapod larvae, and euphausiids) as juveniles, and shrimp and fishes (silver hake, sand lance, herring, hake [*Urophycis* and *Merluccius* spp], and sculpin [Cottidae]) as adults (Studholme et al. 1999; Collette 2002).

EFH Designations—(MAFMC 1998b) (**Figure A-3**)

- Eggs—Designated EFH includes the pelagic waters found over the continental shelf in areas that comprise the highest 75% of the catch where Atlantic mackerel eggs were collected during the Marine Resources Monitoring, Assessment, and Prediction (MARMAP) ichthyoplankton surveys from the Gulf of Maine to Cape Hatteras, North Carolina. EFH is also designated within New England and mid-Atlantic estuaries and embayments.

- **Larvae**—Designated EFH includes the pelagic waters found over the continental shelf in areas that comprise the highest 75% of the catch where Atlantic mackerel larvae were collected in the MARMAP ichthyoplankton surveys from the Gulf of Maine to Cape Hatteras, North Carolina. EFH is also designated within New England and mid-Atlantic estuaries and embayments.

- Juveniles—Designated EFH includes the pelagic waters found over the continental shelf in areas that comprise the highest 75% of the catch where juvenile Atlantic mackerel were collected in the Northeastern Fisheries Science Center (NEFSC) trawl surveys, from the Gulf of Maine through Cape Hatteras, North Carolina. EFH is also designated within New England and mid-Atlantic estuaries and embayments.

- **Adults**—Designated EFH includes the pelagic waters found over the continental shelf; in areas that comprise the highest 75% of the catch where adult Atlantic mackerel were collected in NEFSC trawl surveys, from the Gulf of Maine to Cape Hatteras, North Carolina. EFH is also designated within New England and mid-Atlantic estuaries and embayments.

HAPC Designations—There are no HAPC identified for this species.

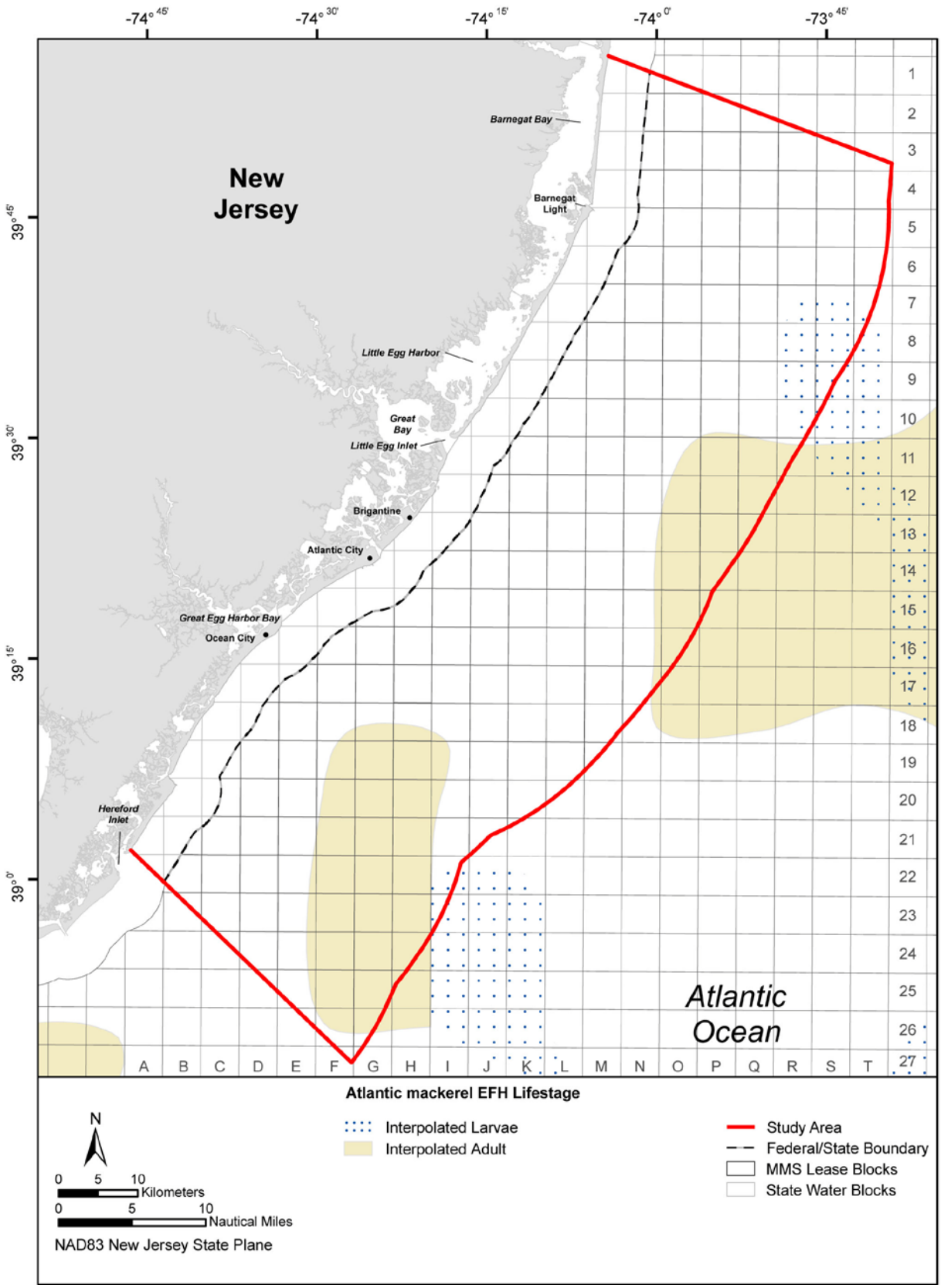

Figure A-3. Essential fish habitat designated in the New Jersey Study Area for larval and adult lifestages of Atlantic mackerel. Source map (scanned): MAFMC (1998b).

- **Atlantic Surfclam (*Spisula solidissima*)**

Management—Atlantic surfclam EFH is designated by the MAFMC under Amendment 12 to the Atlantic Surfclam and Ocean Quahog FMP of the MAFMC (1998a).

Status—Atlantic surfclam are not classified as overfished, nor is overfishing occurring (NMFS 2009d).

Distribution—Atlantic surfclam is distributed in the northwestern North Atlantic Ocean continental shelf waters from the southern Gulf of St. Lawrence, Canada to Cape Hatteras, North Carolina (Cargnelli et al. 1999b). Aggregations of this species are found on Georges Bank, south of Cape Cod, Massachusetts, off Long Island, New York, and southern New Jersey, and off the Delmarva Peninsula (Delaware Bay to the Chesapeake Bay) (Cargnelli et al. 1999b).

Habitat Associations—Eggs and larvae are dispersed by currents and settlement corresponds with the relaxation of upwelling events (Cargnelli et al. 1999b). Off New Jersey, high concentrations of Atlantic surfclam larvae is characterized by the initial arrival of warmer water during the episodic summer upwelling/downwelling events (Ma 2005; Ma et al. 2006b). Juvenile and adult lifestages are benthic and are found in sandy substrates at depths from 8 to 66 m (26.0 to 216.5 ft) (Cargnelli et al. 1999b).

Life History—Atlantic surfclams spawn inshore in late June and July and offshore in early fall usually in waters with temperatures warmer than 15°C (59°F) (Cargnelli et al. 1999b; Ma et al. 2006a). In Virginia, spawning occurs from May to the end in July (Cargnelli et al. 1999b). Atlantic surfclams are sedentary and do not migrate or exhibit seasonal movements (Ropes et al. 1982).

Forage Species—Atlantic surfclams are opportunistic filter feeders that as juveniles and adults feed upon plankton as small as four microns (µm; 157.5 microinches [µin.]) in diameter (ciliates and diatoms) (Cargnelli et al. 1999b).

EFH Designations—(MAFMC 1998a) (**Figure A-4**)

- **Juveniles and Adults**—Designated EFH includes substrates (to a depth of 1 m [3.3 ft] below the water-sediment interface) that encompass the highest 90% of catch during the NEFSC surflclam dredge surveys, from the eastern edge of Georges Bank and Gulf of Maine through Cape Hatteras, North Carolina.

HAPC Designations—There are no HAPC identified for this species.

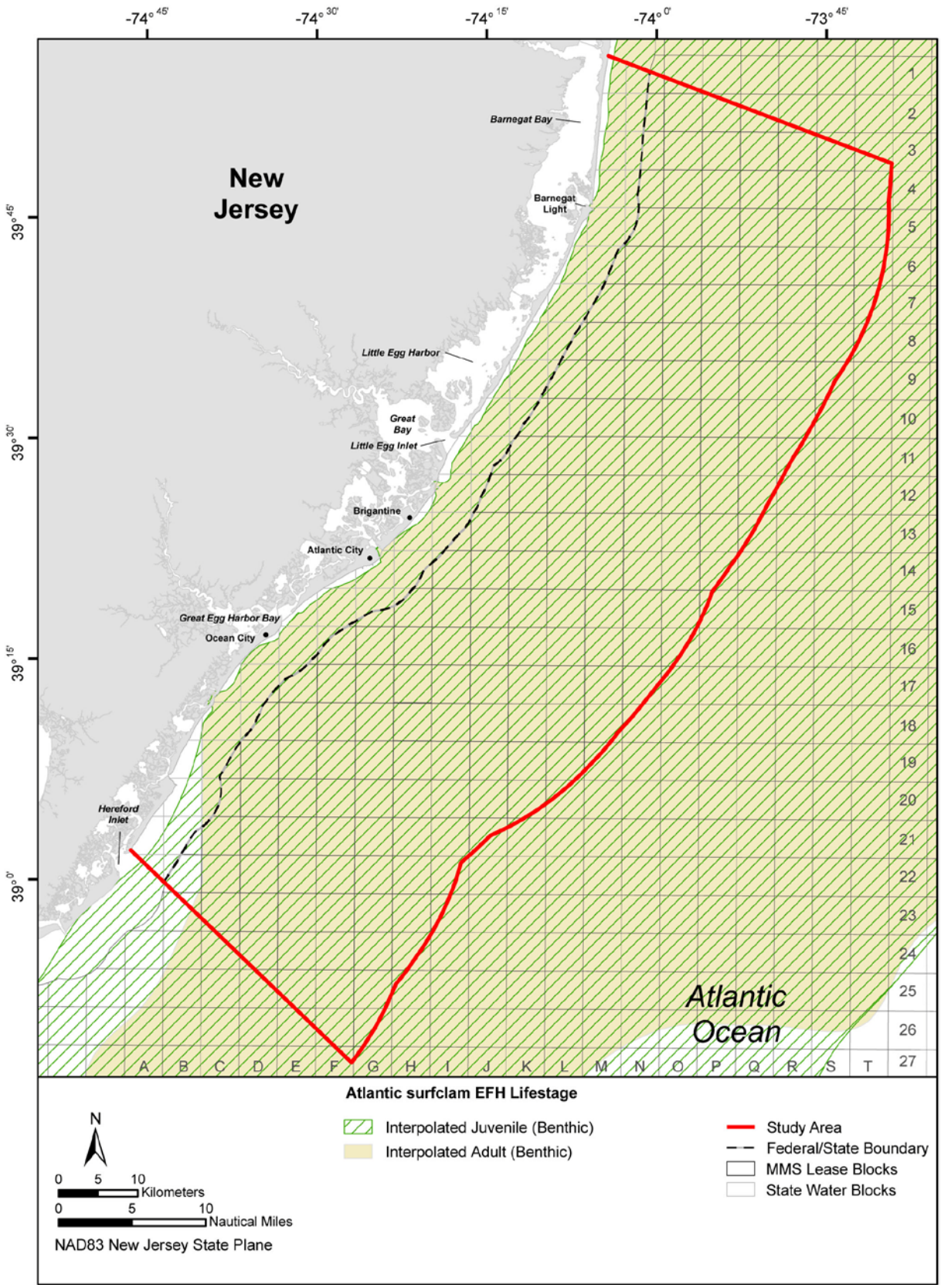

Figure A-4. Essential fish habitat designated in the New Jersey Study Area for all lifestages of the Atlantic surfclam. Source map (scanned): MAFMC (1998a).

- **Black Sea Bass (*Centropristis striata*)**

Management—Atlantic black sea bass are managed as two separate stocks divided north and south of Cape Hatteras, North Carolina. The northern stock has EFH designated by the MAFMC under Amendment 12 to the Summer Flounder, Scup, and Black Sea Bass FMP (MAFMC and ASMFC 1998b). The southern black sea bass stock, which occurs between Cape Hatteras, North Carolina and Cape Kennedy, Florida, is managed by the South Atlantic Fishery Management Council (SAFMC) and does not have EFH designated in the Study Area (SAFMC 1998).

Status—The northern black sea bass stock is not classified as overfished, nor is overfishing occurring (NMFS 2009d).

Distribution—Black sea bass are found from southern Nova Scotia and Bay of Fundy, Canada to Cape Canaveral, Florida, and in the Gulf of Mexico (Steimle et al. 1999c; Klein-MacPhee 2002f).

Habitat Associations—Black sea bass are usually found in deeper waters (up to 165 m [541 ft]) associated with structured habitats such as artificial reefs and shipwrecks on the continental shelf (Musick and Mercer 1977; Steimle et al. 1999c; Klein-MacPhee 2002f). Black sea bass also associate with multispecies fish assemblage that include scup and summer flounder (Steimle et al. 1999c; Klein-MacPhee 2002f). Adults and juveniles are common in estuaries with salinities greater than 12 psu (Klein-MacPhee 2002f). When inshore, black sea bass prefer hard bottom habitats around wrecks, while offshore they prefer ledges, banks, rocks, and coral habitats (Klein-MacPhee 2002f). Eggs are buoyant and found on the continental shelf from May to October, while larvae move to estuarine habitat, between New York and Virginia, to metamorphosize into juveniles. Larvae are initially benthic, but then become demersal and utilize structured inshore habitats such as sponge beds (MAFMC and ASMFC 1998b). Juveniles and adults usually prefer waters warmer than 6° C (42.8°F) (MAFMC and ASMFC 1998b; Drohan et al. 2007).

Life History—Black sea bass from the northern stock seasonally migrate from inshore to offshore, typically traveling in small schools depending on water temperatures (Klein-MacPhee 2002f). As coastal waters cool below 14°C (57.2°F) in the fall, black sea bass migrate south and offshore to overwintering areas in deeper waters between central New Jersey and North Carolina (Musick and Mercer 1977; Moser and Shepherd 2009). In the spring, as bottom waters warm above 7°C (44.6°F), black sea bass then migrate inshore into coastal shallow areas and bays in the MAB (Drohan et al. 2007). The southern stock of black sea bass is not known to make an extensive migration but may move away from shallow coastal areas during cold winters, especially in the Carolinas (Steimle et al. 1999c; Klein-MacPhee 2002f). The northern stock spawns on the continental shelf from May through October, peaking in June at depths from 18 to 45 m (59 to 148 ft), while the southern stock spawns in April and May (Musick and Mercer 1977; Klein-MacPhee 2002f).

Forage Species—Black sea bass larvae prey upon zooplankton, juveniles on crustaceans (lobster and crabs), and adults on mollusks (clams), worms, and small fishes (anchovy [Engraulidae], herring [Clupeidae], seahorse, pipefish [Syngnathidae], cusk-eel [Ophidiidae], scup, sand lance, and windowpane flounder) (Steimle et al. 1999c; Klein-MacPhee 2002f). Feeding activities increase after periods of spawning (Steimle et al. 1999c).

EFH Designations—(MAFMC and ASMFC 1998b) (**Figure A-5**)

- Eggs—Designated EFH includes mid-Atlantic estuaries.

- **Larvae**—Designated EFH includes the pelagic waters found over the continental shelf (from the coast out to the limits of the EEZ) in areas that encompass the highest 90% of the area where black sea bass larvae were collected in MARMAP surveys (Gulf of Maine to Cape Hatteras, North Carolina). EFH is also designated within New England and mid-Atlantic estuaries.

- **Juveniles**—Designated EFH includes the demersal waters over the continental shelf (from the coast out to the limits of the EEZ) in areas that encompass the highest 90% of the area where black sea bass juveniles were collected by the NEFSC surveys (Gulf of Maine to Cape Hatteras, North Carolina). EFH is also designated within New England and mid-Atlantic estuaries including, Barnegat Bay and the New Jersey Inland Bays adjacent to the Study Area.

- **Adults**—Designated EFH includes the demersal waters over the continental shelf (from the coast out to the limits of the EEZ) in areas that encompass the highest 90% of all the area where black sea bas s adul ts w ere c ollected b y NEFSC s urveys (Gulf of Mai ne t o C ape Hatteras, N orth Carolina). EFH is also designated within New England and mid-Atlantic estuaries including Barnegat Bay and the New Jersey Inland Bays adjacent to the Study Area.

HAPC Designations—There are no HAPC identified for this species.

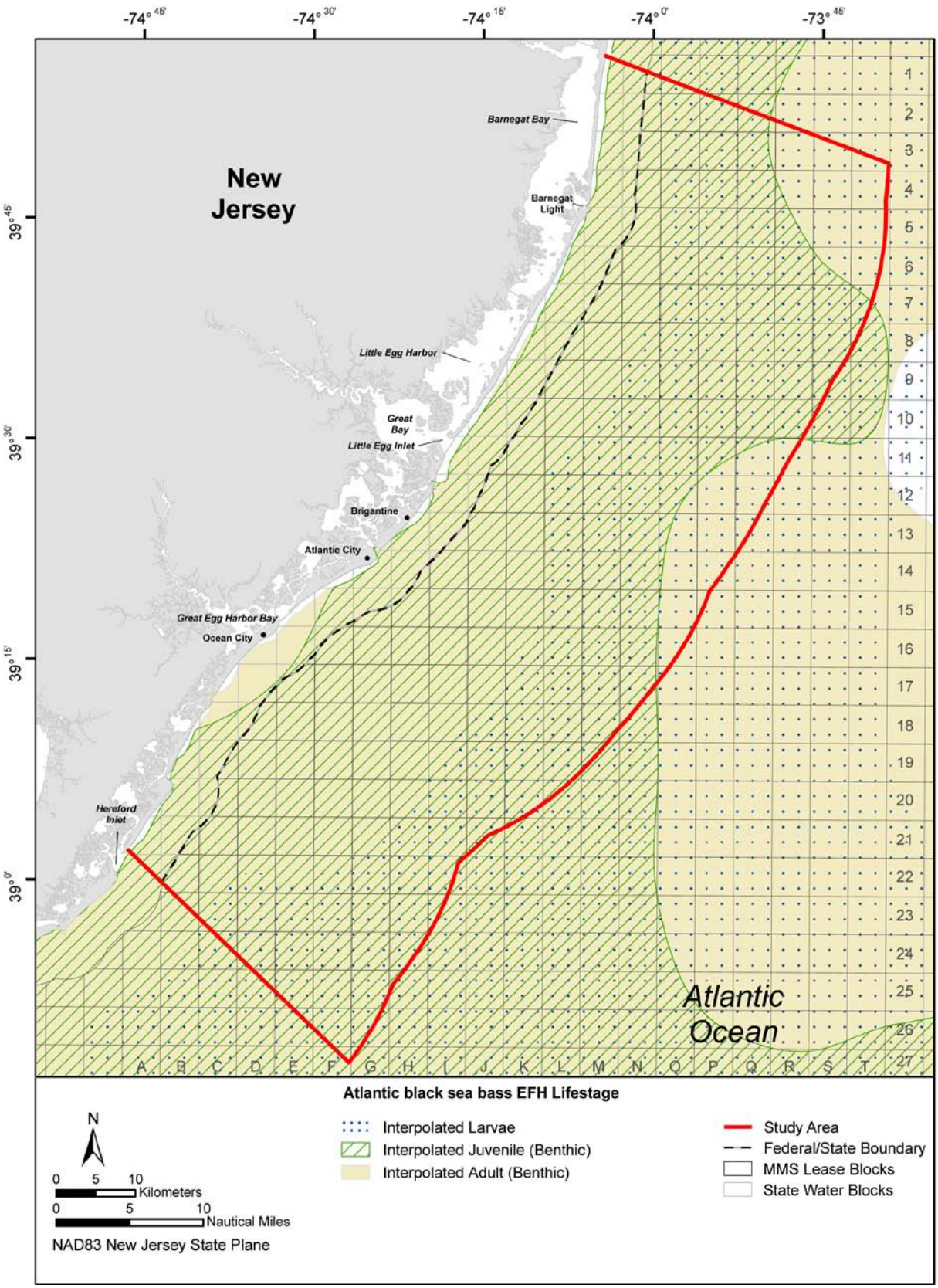

Figure A-5. Essential fish habitat designated in the New Jersey Study Area for all lifestages of black sea bass. Source map (scanned): MAFMC and ASMFC (1998a).

- **Bluefish (*Pomatomus saltatrix*)**

Management—East coast bluefish are managed as a single stock, with EFH designated under Amendment 1 to the Bluefish FMP developed by the MAFMC and the ASMFC (1998a).

Status—Bluefish are not classified as overfished, nor is overfishing occurring (NMFS 2009d).

Distribution—Bluefish are a schooling species found in most oceans of the world, except the eastern Pacific Ocean. This species lives in the waters over the continental shelf but may be found in brackish estuaries and nearshore waters (Klein-MacPhee 2002g). In the western Atlantic, bluefish range from Nova Scotia and Bermuda to Argentina, but is considered rare between southern Florida and northern South America (Fahay et al. 1999b).

Habitat Associations—Bluefish are a warm-water pelagic species that rarely are found in temperatures below 14°C (57.2°F). The species is found inshore in bays, beaches, and coastal habitats as well as offshore (Klein-MacPhee 2002g). Bluefish eggs and larvae are pelagic and are typically found in waters with temperatures above 18°C (64.4°F) and salinities greater than 30 psu between April and August (MAFMC and ASMFC 1998a). Similar to other offshore spawning species, larvae are transported from spawning grounds to nursery habitats via the Gulf Stream Current (Hare and Cowen 1996). Juveniles utilize estuarine habitat in the MAB in two distinct episodes: spring-spawned cohort (late May to June) and summer-spawned cohort (July to October) (Shepherd et al. 2006). There is recent evidence that select cohorts may exclusively use alternative habitats, such as ocean beaches, during the juvenile stage (Able et al. 2003; Wilber et al. 2003) and that at least two cohorts of presumably summer-spawned fish (larvae and juveniles) may not recruit to estuaries (Taylor et al. 2007). Adult bluefish utilize offshore and estuarine habitats with water temperatures above 16°C (60.8°F) (Fahay et al. 1999b). Adults are typically found in MAB estuaries from April to October (MAFMC and ASMFC 1998a; Shepherd and Packer 2006).

Life History—Adult bluefish are known to seasonally migrate generally following one of three patterns: north-south (between northern MAB and Florida and within MAB) and inshore-offshore (Florida) (Shepherd et al. 2006). Bluefish move north during the spring through summer and southward and offshore during the fall and winter, when their highest abundance is found off New York and coastal southern New England (Klein-MacPhee 2002g). Bluefish overwinter in the South Atlantic Bight (SAB), between Florida and the Gulf Stream or at the edge of the continental shelf in the MAB (Shepherd et al. 2006). Fluctuations in light levels and water temperature are the primary triggers for migrational movements, but offshore and inshore migrations occur because of prey availability (Klein-MacPhee 2002g). There are two discrete spawning events for western Atlantic bluefish: 1) a spring spawning event occurs near the edge of the continental shelf in the SAB during March through May and 2) a summer spawning event occurs over the mid-continental shelf in the MAB between June and August in waters with temperatures between 18°C and 25°C (64.4°F and 77°F) and salinities from 25 to 31 psu (Fahay et al. 1999b; Klein-MacPhee 2002g).

Forage Species—Bluefish are piscivorous with juveniles and adults feeding on a variety of fish species including Atlantic menhaden (*Brevoortia tyrannus*), herring, alewife (*Alosa pseudoharengus*), anchovy, eel (Anguilliformes), sculpin, killifish (Cyprinodontiforms), silverside (Atherinopsidae), croaker (Sciaenidae), scup, goby (Gobiidae), sand lance, butterfish, and mackerel (Scombridae). This species also feeds on invertebrates (shrimp, squid, crabs, polychaetes, and worms) (Fahay et al. 1999b; Klein-MacPhee 2002g).

EFH Designations—(MAFMC and ASMFC 1998a) (**Figure A-6**)

- **<u>Eggs</u>**—Designated EFH includes the pelagic waters located within the mid-shelf depths of the continental shelf (from the coast out to the limits of the EEZ) in areas that encompass the highest 90% of the area where bluefish eggs were collected by MARMAP surveys (Montauk Point, New York, south to Cape Hatteras, North Carolina). Designated EFH also includes the pelagic waters between Cape Hatteras, North Carolina, and Key West, Florida.

- **Larvae**—Designated EFH includes the pelagic waters (most commonly above 15 m [49.2 ft]) over the continental shelf (from the coast out to the limits of the EEZ) that encompass the highest 90% of the area where bluefish larvae were collected by MARMAP surveys (Montauk Point, New York, south to Cape Hatteras, North Carolina). Designated EFH also includes the "Slope Sea" (oceanic area located between the continental shelf and north wall of the Gulf Stream) and Gulf Stream Current between latitudes 29°N and 40°N to the limits of the U.S. EEZ. Additional EFH includes the waters south of Cape Hatteras, North Carolina, to Key West, Florida.

- **Juveniles**—Designated EFH includes the pelagic waters found over the continental shelf (from the coast out to the limits of the EEZ) in areas that encompass the highest 90% of the area where bluefish juveniles were collected by NEFSC trawl surveys (from Nantucket Island, Massachusetts, south to Cape Hatteras, North Carolina). Designated EFH also includes the "Slope Sea" (oceanic area located between the continental shelf and north wall of the Gulf Stream) and the Gulf Stream Current between latitudes 29°N and 40°N to the U.S. Additional designated EFH includes the waters south of Cape Hatteras, North Carolina, to Key West, Florida as well as all north Atlantic, mid-Atlantic, and southeast Atlantic estuaries.

- **Adults**—Designated EFH includes the pelagic waters found over the continental shelf (from the coast out to the limits of the EEZ) in areas that encompass the highest 90% of all the area where bluefish adults were collected by the NEFSC trawl surveys (from Cape Cod Bay, Massachusetts, south to Cape Hatteras, North Carolina). Additional designated EFH includes the waters from Cape Hatteras, North Carolina to Key West, Florida as well as all north Atlantic, mid-Atlantic, and southeast Atlantic estuaries.

HAPC Designations—There are no HAPC identified for this species by the MAFMC. The ASMFC has identified HAPC to include inshore areas and estuaries as important habitats for larvae and juveniles.[2]

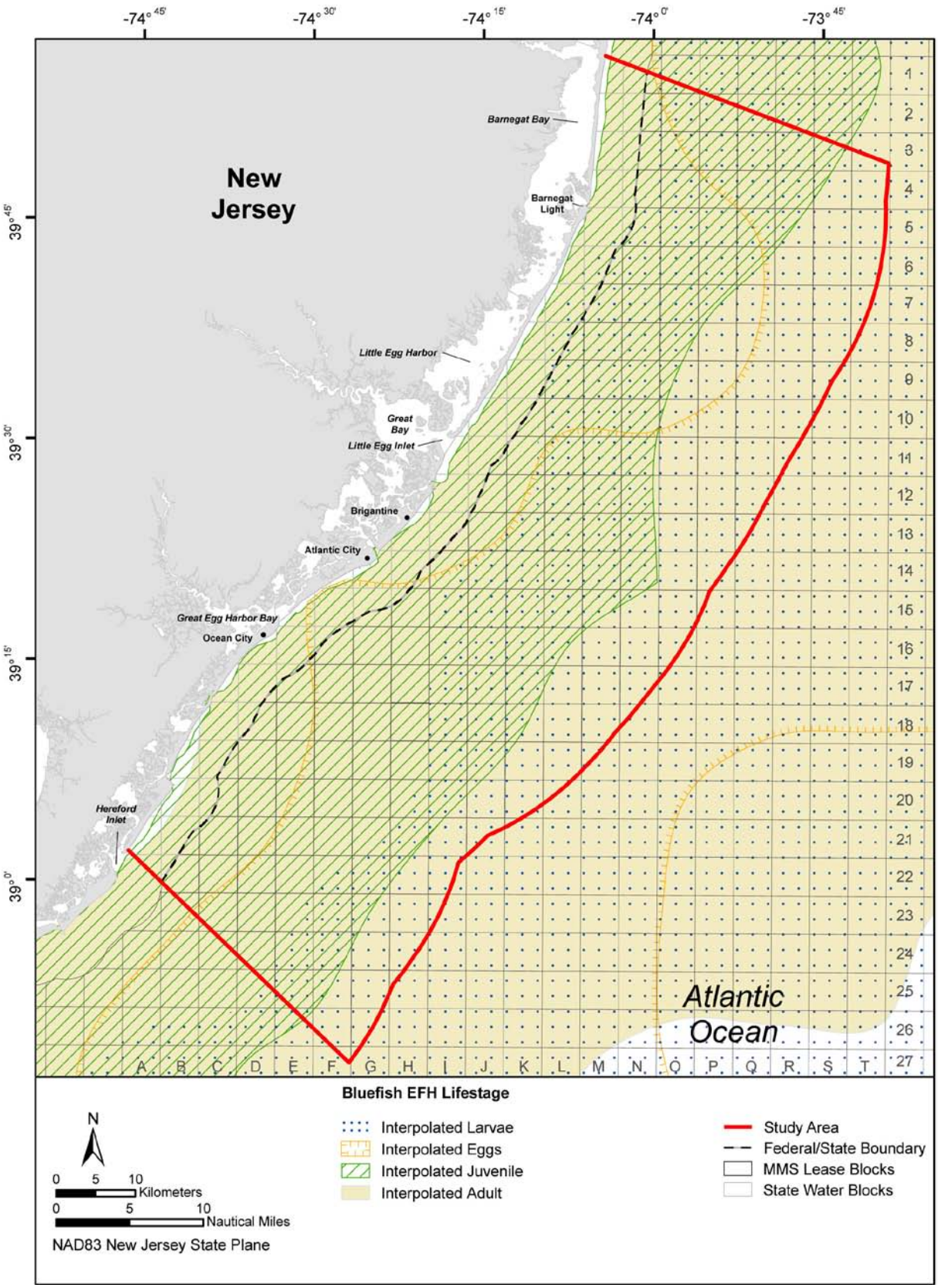

Figure A-6. Essential fish habitat designated in the New Jersey Study Area for all lifestages of bluefish. Source map (scanned): MAFMC and ASMFC (1998b).

- **Butterfish (*Peprilus triacanthus*)**

Management—Butterfish have EFH designated under Amendment 8 to the Atlantic Mackerel, Squid, and Butterfish FMP by the MAFMC (1998b).

Status—Butterfish are classified as overfished; however, overfishing is not occurring (NMFS 2009d).[3]

Distribution—In the western North Atlantic Ocean, butterfish range from the Gulf of St. Lawrence and the southern coast of Newfoundland, Canada to deeper waters of Florida. The species is common between Nova Scotia, Canada, and Cape Hatteras, North Carolina (Colton 1972; Klein-MacPhee 2002h).

Habitat Associations—All lifestages of the butterfish are common from the outer continental shelf to the lower, high salinity portions of bays and estuaries. Butterfish eggs are buoyant and pelagic and found throughout June and August (Waring and Murawski 1982; Klein-MacPhee 2002h). Eggs are generally found in surface waters with temperatures ranging from 6° to 26°C (42.8° to 78.8°F), salinities of 25 to 33 psu, and depths of 10 to 1,250 m (33 to 4,101 ft; most common in water of <200 m [656 ft]) (Cross et al. 1999). As larval butterfish develop, they become more nektonic (i.e., able to actively swim) than planktonic (i.e., passively floating) (Cross et al. 1999). Larval butterfish are often associated with large jellyfish and *Sargassum* and other flotsam (Waring and Murawski 1982; Cross et al. 1999; Klein-MacPhee 2002h). Larvae are found from April to December at temperatures between 4.4°C and 27.9°C (40°F and 82°F), salinities of 6.4 to 37.4 psu, and depths of 10 to 1,750 m (33.0 to 5,741.2 ft); most found in water <120 m [394 ft]) (Waring and Murawski 1982; Cross et al. 1999). As juveniles, butterfish depart shelters and begin schooling (Klein-MacPhee 2002h). They are found in a variety of areas, habitats, and conditions over sandy and muddy substrates, temperatures from 4.4° to 29.7°C (40.0° to 85.5°F), salinities from 3 to 37.4 psu, and depths from 10 to 330 m (33 to 1,083 ft; most often found in < 120 m [394 ft]) (Cross et al. 1999). Adult schools are found throughout the water column from surface waters to deep waters (420 m [1,378 ft]). They are found in a variety of benthic bottoms including sand, sand-silt, and mud substrates (Cross et al. 1999). They are eurythermal and euryhaline, tolerating temperatures from 4.4° to 29.7°C (40.0° to 85.5°F) and salinities from 3.8 to 33 psu (Cross et al. 1999; Klein-MacPhee 2002h).

Life History—Butterfish are broadcast spawners (Klein-MacPhee 2002h). Spawning occurs in nearshore waters of the MAB and SAB annually from late January to July (Rotunno and Cowen 1997). Butterfish are sensitive to temperature; spawning does not occur in waters less than 15°C (59°F) (Colton 1972). Butterfish north of Cape Hatteras, North Carolina, undergo seasonal migrations when water temperature changes with the season. In general, butterfish move northward and inshore in the summer and southward and offshore during the winter (Klein-MacPhee 2002h).

Forage Species—Butterfish juveniles and adults feed on a variety of invertebrates but primarily on tunicates, sea squirts, salps, and sea angels as well as small fish (Cross et al. 1999; Klein-MacPhee 2002h).

EFH Designations—(MAFMC 1998b) (**Figure A-7**)

- Eggs—Designated EFH includes the pelagic waters found over the continental shelf (from the coast out to the limits of the EEZ) in areas that encompass the highest 75% of the area where butterfish eggs were collected by the MARMAP surveys (from the Gulf of Maine through Cape Hatteras, North Carolina). EFH is also designated within New England and mid-Atlantic estuaries.

- Larvae—Designated EFH includes the pelagic waters found over the continental shelf (from the coast out to the limits of the EEZ) in areas that encompass the highest 75% of the area where butterfish larvae were collected by the NEFSC trawl surveys (from the Gulf of Maine through Cape Hatteras, North Carolina). EFH is also designated within New England and mid-Atlantic estuaries.

- **Juveniles**—Designated EFH includes the pelagic waters found over the continental shelf (from the coast out to the limits of EEZ) in areas that encompass the highest 75% of the area where butterfish juveniles were collected by NEFSC trawl surveys (shelf from the Gulf of Maine through Cape Hatteras, North Carolina). EFH is also designated in New England and mid-Atlantic estuaries including Barnegat Bay and New Jersey Inland Bays adjacent to the Study Area.

- Adults—Designated EFH includes the pelagic waters found over the continental shelf (from the coast out to limits of EEZ) in areas that encompass the highest 75% of the area where butterfish adults were collected by the NEFSC trawl surveys (from the Gulf of Maine through Cape Hatteras, North Carolina). EFH is also designated within New England and mid-Atlantic.

HAPC Designations—There are no HAPC identified for this species.

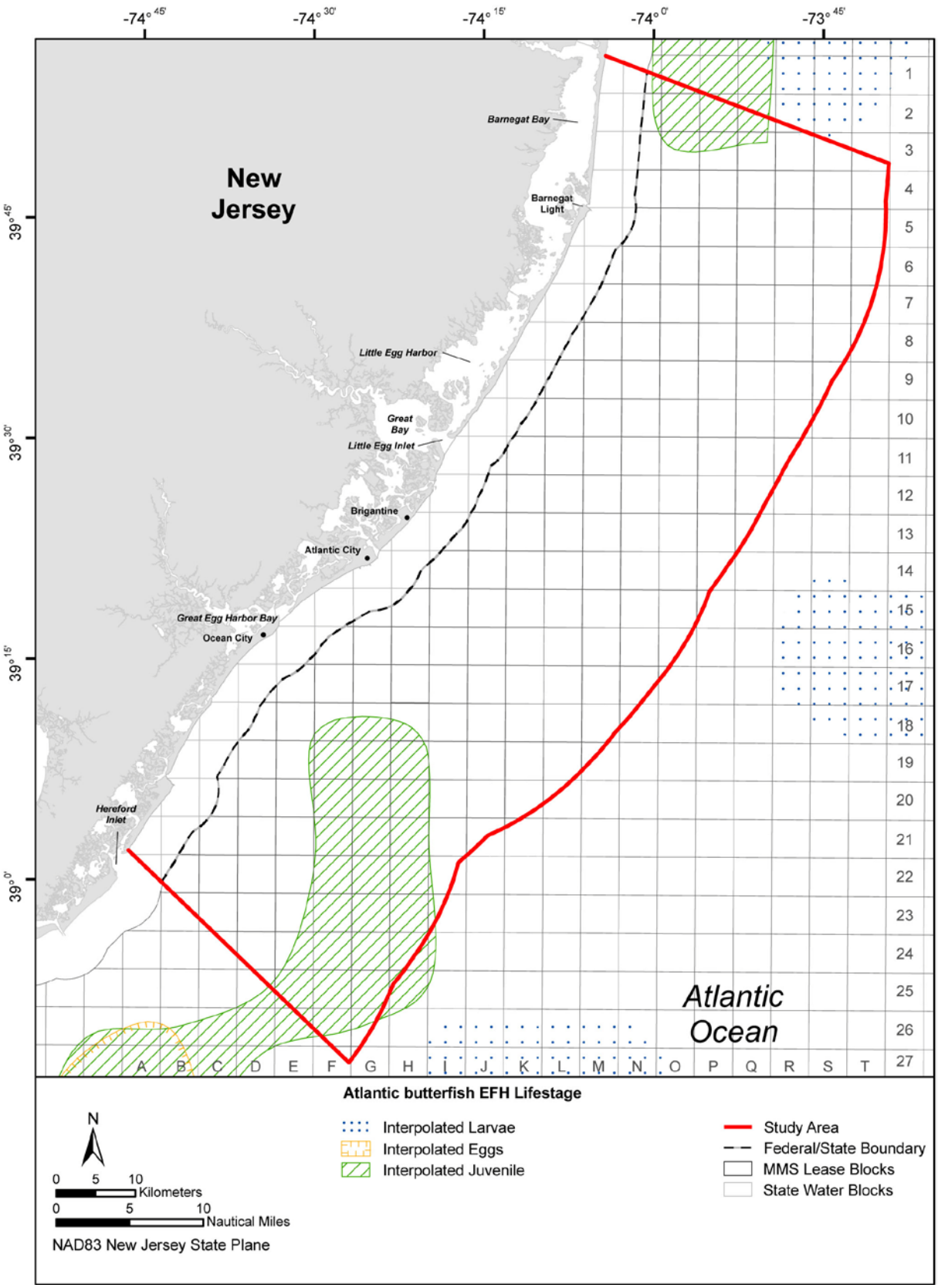

Figure A-7. Essential fish habitat designated in the New Jersey Study Area for larvae and juvenile lifestages of butterfish. Source map (scanned): MAFMC (1998b).

- **Clearnose Skate (*Raja eglanteria*)**

Management—Clearnose skate have EFH designated under the NEFMC Final FMP for the Northeast (NE) Skate Complex (NEFMC 2003a).

Status—Clearnose skate are neither classified as overfished, nor is overfishing occurring (NMFS 2009d).

Distribution—Clearnose skate are found along the eastern U.S. coast from the Nova Scotia Shelf to northeastern Florida; including the northern Gulf of Mexico (northwestern Florida to Texas) (McEachran and Musick 1975). In the western North Atlantic Ocean, clearnose skate are mostly found south of Cape Hatteras, North Carolina, but can also be found north of Cape Hatteras, North Carolina, during warmer months (McEachran and Musick 1975).

Habitat Associations—Clearnose skate are a demersal species that prefers mud and sand substrates along the continental shelf, but can also be found on rocky or gravel bottoms (Packer et al. 2003a). The species is found from shallow inshore waters out to depths of 330 m (1,049.9 ft); however, it is most abundant at depths less than 111 m (364 ft) (McEachran and Musick 1975; McEachran 2002). Juveniles and adults inhabit waters with temperatures ranging from 9° to 30°C (48.2° to 86.0°F) (Packer et al. 2003a).

Life History—Limited information is available regarding the species' spawning habitat; however, in Delaware Bay, incubation time for the egg capsules (known as "mermaid's purses") had been reported to be approximately three months, with spawning occurring in the spring (McEachran 2002; Packer et al. 2003a). As water temperatures begin to cool, individuals north of Cape Hatteras, North Carolina, move offshore and southward, while those south of Cape Hatteras do not usually move to deeper waters during the winter since water temperatures do not significantly fluctuate (McEachran and Musick 1975).

Forage Species—Clearnose skate juveniles and adults feed on a variety of invertebrate (shrimp, amphipods, mollusks, and squid) and fish species (anchovy, croaker, spot [*Leiostomus xanthurus*], tonguefish [*Symphurus* spp.], weakfish [*Cynoscion regalis*], and butterfish), with crabs being the primary component of their diet (McEachran 2002; Packer et al. 2003a).

EFH Designations—(NEFMC 2003a) (**Figure A-8**)

- Eggs—There is no information available on the offshore habitat association or distributions of the egg stage for this species. The following embayments and estuaries are designated as EFH for this lifestage: Hudson River/Raritan Bay and the Chesapeake Bay north and south of the Study Area.

- Larvae—No larval stage exists for this species. Upon hatching, they are fully developed juveniles.

- **Juveniles**—Designated EFH includes bottom habitats with substrates consisting of soft bottom along the continental shelf and rock or gravel bottom from the Gulf of Maine south along the continental shelf to Cape Hatteras, North Carolina. The following embayments and estuaries are designated as EFH: Hudson River/Raritan Bay and the Chesapeake Bay north and south of the Study Area.

- **Adults**—Designated EFH includes bottom habitats with a substrate of soft bottom along the continental shelf and rock or gravel bottom from the Gulf of Maine south along the continental shelf to Cape Hatteras, North Carolina. Various mid-Atlantic embayments and estuaries are designated as EFH including Barnegat Bay and New Jersey Inland Bays adjacent to the Study Area.

- Spawning A dults—Designated EFH includes the following estuaries and embayments: the Hudson River and Raritan Bay north of the Study Area.

HAPC Designations—There are no HAPC identified for this species.

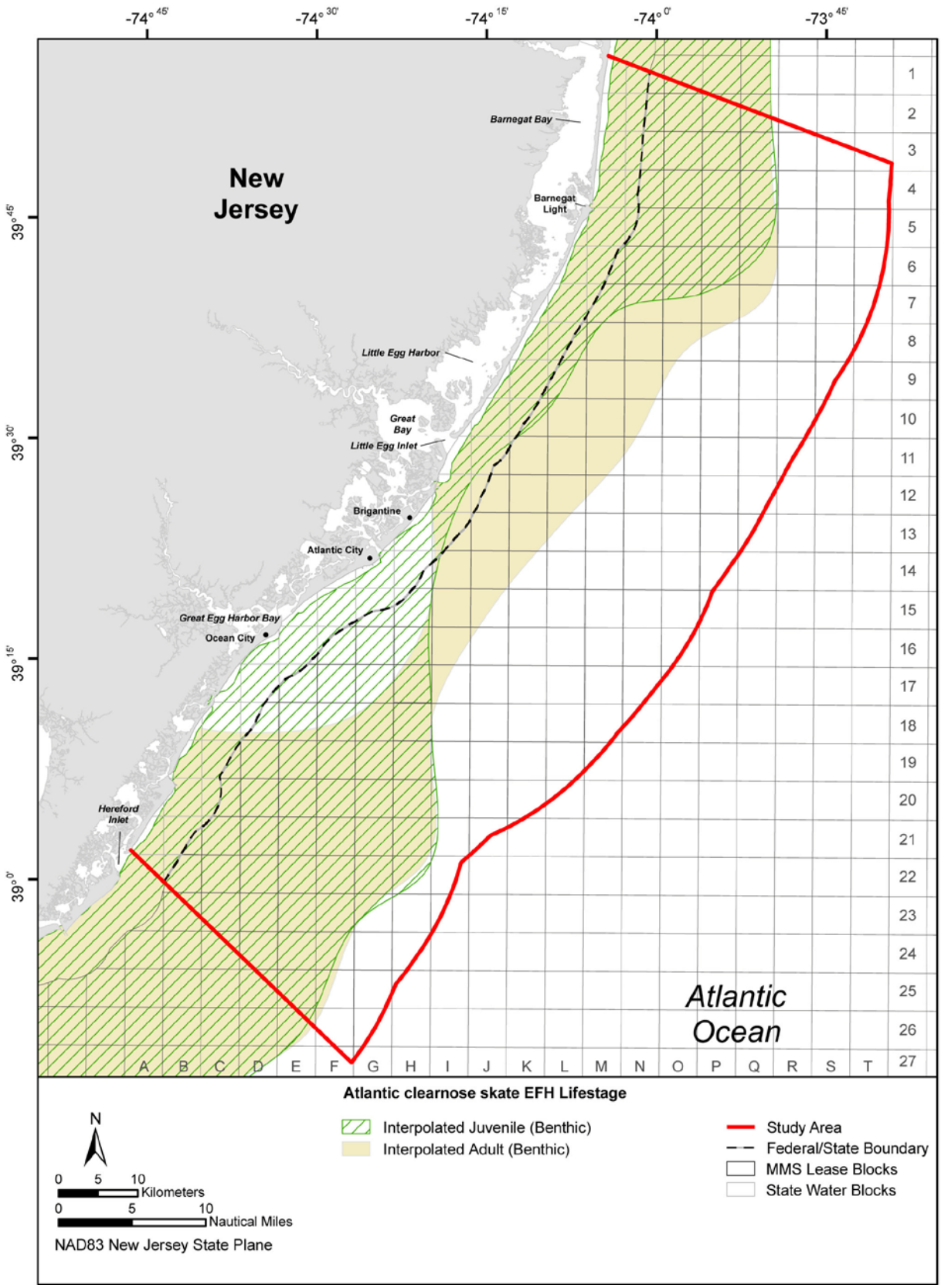

Figure A-8. Essential fish habitat designated in the New Jersey Study Area for all lifestages of clearnose skate. Source map (scanned): NEFMC (2003a).

- **Goosefish/Monkfish (*Lophius americanus*)**

Management—Goosefish currently have EFH designated under Amendment 1 to the Monkfish FMP and are separated into two stocks for management purposes (NEFMC 1998). The northern stock inhabits the Gulf of Maine and the northern Georges Bank. The southern stock ranges from southern Georges Bank to Cape Hatteras, North Carolina (Almeida et al. 1995; Richards 2000).

Status—Goosefish stock is neither classified as overfished, nor is overfishing occurring (NMFS 2009d).

Distribution—Goosefish range from the Gulf of St. Lawrence and Newfoundland, Canada to the east coast of Florida; however, they are uncommon south of Cape Hatteras, North Carolina (Wood 1982; Caruso 2002).

Habitat Associations—Goosefish release their eggs in long mucous veils that float at the surface exposing them to currents, wind, and waves (Wood 1982; Steimle et al. 1999a; Caruso 2002). Eggs are found inshore and offshore on the continental shelf from March to September in waters with temperatures ranging from 4° to 18°C (39.2° to 64.4°F) (Wood 1982; Steimle et al. 1999a). Larval goosefish are pelagic and found across the continental shelf at water temperatures ranging from 10° to 16°C (50.0° to 60.8°F) and depths of 30 to 90 m (98.5 to 295.0 ft) (Steimle et al. 1999a). After transition from larval to juvenile, goosefish become benthic. Juveniles are found in bottom habitats at temperatures of 3° to 19°C (37.4° to 66.2°F), salinities of 32.6 to 33.9 psu, and at depths of 25 to 182 m (82 to 597 ft) (Steimle et al. 1999a). Adult goosefish prefer hard sand, gravel and broken shell, pebble, and soft mud substrates at depths from just below the tide line to at least 900 m (2,952.9 ft), although large adults rarely occur below 400 m (1,312 ft) (Markle and Musick 1974; Almeida et al. 1995; Caruso 2002). They also prefer temperatures ranging from 0° to 24°C (32.0° to 75.2°F) and salinities of 30 to 36 psu (Almeida et al. 1995; Steimle et al. 1999a).

Life History—Goosefish spawn between spring and early fall, depending on latitude (Wood 1982). Spawning occurs from March to May off North Carolina, between May and June in the Gulf of Maine, and as late as September off Maine and in Canadian waters (Steimle et al. 1999a; Caruso 2002). Spawning occurs across the continental shelf throughout its range (Caruso 2002). Goosefish migrate inshore and offshore seasonally depending on the water temperatures. Larger goosefish (>20 cm [7.87 in.]) in the Gulf of Maine move offshore in the winter and spring to avoid cold coastal conditions, and return inshore as the coastal waters warm in the summer and fall (Steimle et al. 1999a). Conversely, smaller goosefish (<20 cm [7.87 in.]) in the Gulf of Maine and along the MAB remain inshore during the winter and spring and then move offshore during the summer and fall, presumably to avoid overly warm summer conditions (Wood 1982; Almeida et al. 1995; Steimle et al. 1999a). Richards et al. (2008) recently described an apparent northward or deep-water (>365 m [1,197.6 ft]) excursion from the southern MAB in mid-spring which had not been reported previously.

Forage Species—Goosefish larvae feed on zooplankton and juveniles on zooplankton, mollusks, and fish. Adults consume benthic prey, such as bony fishes (silver hake, red hake, American plaice [*Hippoglossaides platessoides*], little skate, sand lance, and herring species), cephalopods (squid), and elasmobranchs. They have also been recorded to feed on various seabird species (Bowman et al. 2000). This species uses its angling apparatus (modified first dorsal spine) to lure small fishes (Caruso 2002).

EFH Designations—(NEFMC 1998) (**Figure A-9**)

- **Eggs**—Designated EFH includes the surface waters from the Gulf of Maine, Georges Bank, and MAB south to Cape Hatteras, North Carolina.

- **Larvae**—Designated EFH includes the pelagic waters from the Gulf of Maine, Georges Bank, and MAB south to Cape Hatteras, North Carolina.

- **Juveniles**—Designated EFH includes bottom habitats that are a sand-shell mix, algae-covered rocks, hard sand, pebbly gravel, or mud from the outer continental shelf of the MAB south to Cape Hatteras, North Carolina, and all bottom areas of the Gulf of Maine.

- Adults—Designated EFH includes bottom habitats that are a sand-shell mix, algae-covered rocks, hard sand, pebbly gravel, or mud from the outer continental shelf of the MAB south to Cape Hatteras, North Carolina. It also consists of the outer perimeter of Georges Bank and all benthic areas of the Gulf of Maine.

- Spawning Adults—Designated EFH includes bottom habitats that are a sand-shell mix, algae-covered rocks, hard sand, pebbly gravel, or mud from the outer continental shelf of the MAB, the outer perimeter of Georges Bank, and all benthic areas of Gulf of Maine.

HAPC Designations—There are no HAPC identified for this species.

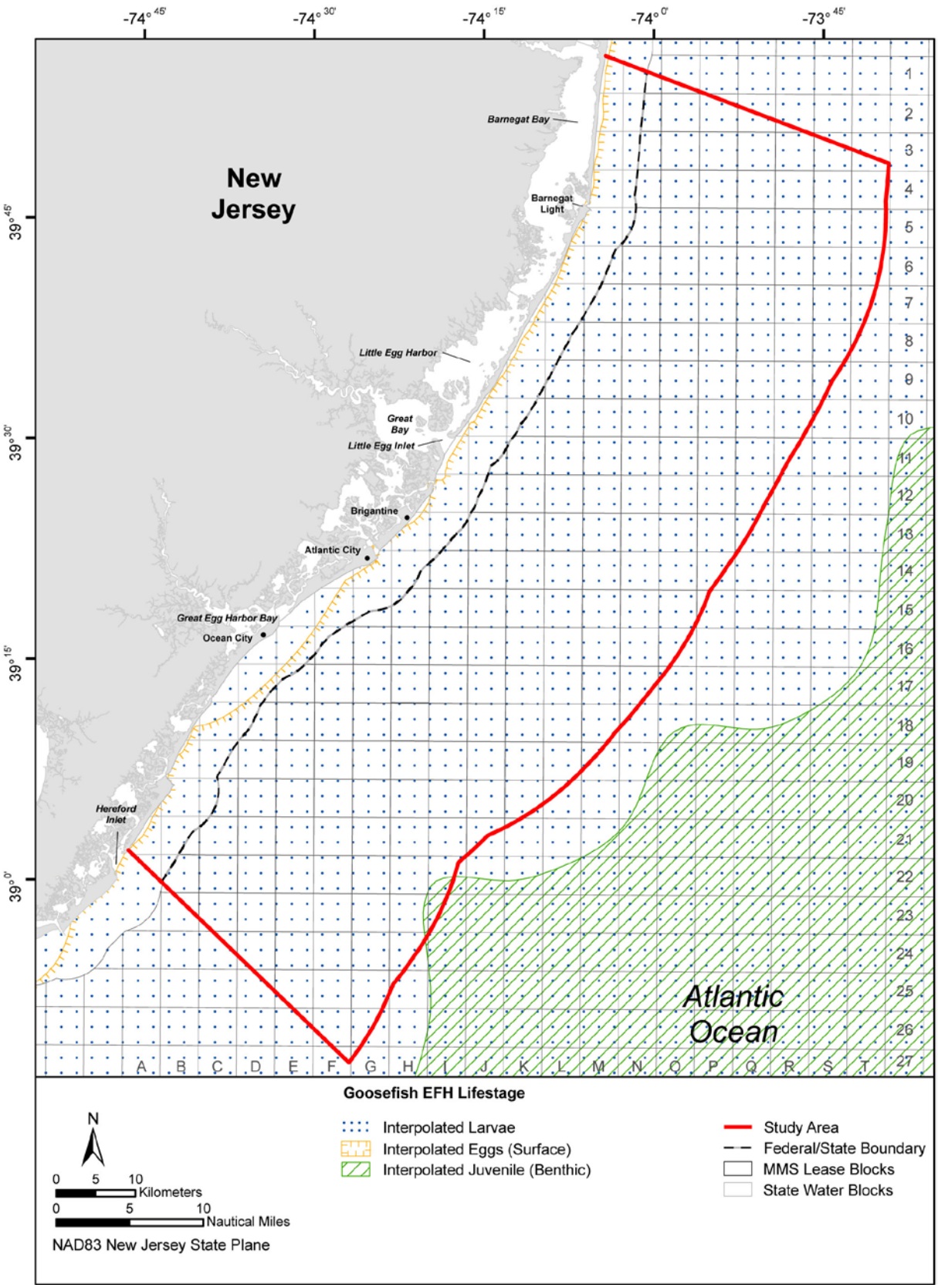

Figure A-9. Essential fish habitat designated in the New Jersey Study Area for eggs, larvae, and juvenile lifestages of goosefish. Source mapped (scanned): NEFMC (1998).

- **Little Skate (*Leucoraja erinacea*)**

Management—Little skate EFH is designated under the NEFMC Final FMP for the NE Skate Complex (NEFMC 2003a).

Status—Little skate is neither classified as overfished, nor is overfishing occurring (NMFS 2009d).

Distribution—The little skate ranges from Nova Scotia to Cape Hatteras, North Carolina with its center of abundance occurring on Georges Bank and in coastal waters south to the mouth of the Chesapeake Bay (McEachran 2002; Packer et al. 2003c).

Habitat Associations—Little skate juveniles and adults typically utilize sand, gravel, or mud substrates (McEachran and Musick 1975; Packer et al. 2003c). They have been associated with microhabitat features including biogenic depressions and flats and during the day with their abundances increasing in the spring and fall (Packer et al. 2003c). Little skate are found at deep depths (384 m [1,260 ft]), but are most common at depths less than 111 m [364 ft], especially in the northern section of the MAB (McEachran and Musick 1975). Little skate eggs are found in waters with temperatures warmer than 7°C (44.6°F) and depths less than 27 m (88.6 ft), while juveniles prefer temperatures between 4°C and 15 °C (39.2°F and 59.0°F) and depths from shore to 137 m (449 ft) deep (NEFMC 2003a).

Life History—Egg cases, known as a "mermaid's purse," are found partially to fully developed year-round, but are most abundant from late October to January and from June to July (McEachran 2002; Packer et al. 2003c). Little skates do not undertake extensive seasonal migrations, but instead move inshore and offshore, along with north-south movements along the southern end of its range, in response to seasonal temperature changes (McEachran and Musick 1975). Little skate typically moves to deep waters in December and January and migrates to shallow waters in April and May (McEachran 2002).

Forage Species—Little skate juveniles and adults prey upon benthic invertebrates (shrimp, crabs, and worms) and fishes (herring, alewife, tomcod [*Microgadus tomcod*], silver hake, sculpin, silverside, Atlantic wolffish [*Anarhichas lupus*], sand lance, cunner [*Tautogolabrus adspersus*], winter flounder, and yellowtail flounder) (McEachran 2002; Packer et al. 2003c).

EFH Designations—(NEFMC 2003a) (**Figure A-10**)

- **Eggs**—Designated EFH includes bottom habitats with a sandy substrate from Georges Bank and MAB south to Cape Hatteras, North Carolina. Southern New England and mid-Atlantic embayments and estuaries are designated EFH.
- Larvae—No larval stage exists for this species. Upon hatching, they are fully developed juveniles.
- **Juveniles**—Designated EFH includes bottom habitats with a sand or gravel substrate from Georges Bank through the MAB to Cape Hatteras, North Carolina that encompass the highest 90% where this species was collected during NMFS trawl surveys. Southern New England and mid-Atlantic embayments and estuaries are designated EFH.
- **Adults**—Designated EFH includes bottom habitats with a sand, gravel, or mud substrate. It ranges from Georges Bank through the MAB to Cape Hatteras, North Carolina that encompass the highest 90% where this species was collected during NMFS trawl surveys. Southern New England and mid-Atlantic embayments and estuaries are designated EFH including Barnegat Bay and New Jersey Inland Bays adjacent to the Study Area.
- Spawning Adults—Designated EFH includes the following southern New England and mid-Atlantic embayments and estuaries: Buzzards Bay, Narragansett Bay, Long Island Sound, and Hudson River/Raritan Bay north of the Study Area.

HAPC Designations—There are no HAPC identified for this species.

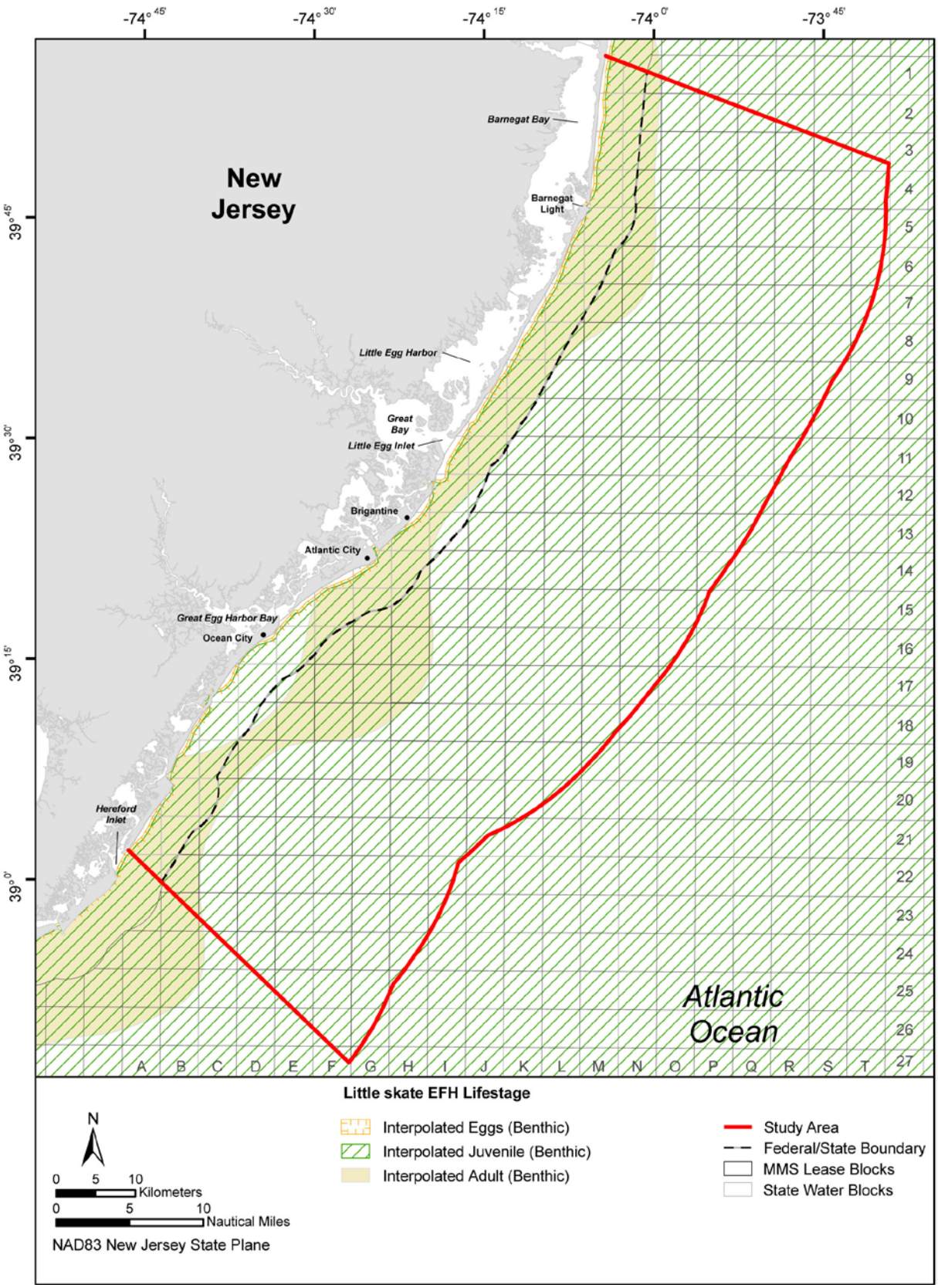

Figure A-10. Essential fish habitat designated in the New Jersey Study Area for all lifestages of little skate. Source map (scanned): NEFMC (2003a).

- **Longfin Inshore Squid (*Loligo pealei*)**

Management—The population of longfin inshore squid from southern Georges Bank to Cape Hatteras, North Carolina have EFH designated by MAFMC under Amendment 8 to the Atlantic Mackerel, Squid, and Butterfish FMP (MAFMC 1998b).

Status—Longfin inshore squid are neither classified as overfished, nor subject to overfishing (NMFS 2009d).

Distribution—This pelagic, schooling species is found across the continental shelf and slope from Newfoundland, Canada to the Gulf of Venezuela, South America. It is abundant from Georges Bank to Cape Hatteras, North Carolina (Lange 1982; Cargnelli et al. 1999c).

Habitat Associations— Longfin inshore squid are found on mud or sand/mud substrate in waters with temperatures warmer than 8°C (46.4°F) (Lange and Sissenwine 1980; Cargnelli et al. 1999c; Jacobson 2005). Demersal egg masses are commonly found attached to rocks and small boulders on sandy-muddy bottom and on aquatic vegetation in waters with temperatures colder than 8°C (46.4°F) (Cargnelli et al. 1999c). Larvae are pelagic and are found near the surface at temperatures between 10°C and 26°C (50.0°F and 78.8°F) (Vecchione 1981). Juveniles are usually found in the upper 10 m (33 ft) of the water column over water 50 to 100 m (164 to 328 ft) deep and prefer water temperatures ranging from 10° to 26°C (50.0° to 78.8°F) (Cargnelli et al. 1999c). Adults are found in waters over the continental shelf and upper continental slope to depths of 400 m (1,312 ft) (Cargnelli et al. 1999c). This species displays a diel migration pattern. It is typically demersal during the day and utilizes the water column at night (Vecchione 1981).

Life History—Longfin inshore squid seasonally migrate inshore and offshore as temperatures change; squid move offshore during late fall to overwinter along the edge of the continental shelf and moving inshore during the spring and early summer to spawn (Lange 1982; MAFMC 1998b). During winter and early spring when inshore waters are coldest, longfin inshore squid are most common along the outer edge of the continental shelf where waters are 9° to 13°C (48.2° to 55.4°F). The inshore movement to the shelf region begins when water temperatures start warming (MAFMC 1998b; Cargnelli et al. 1999c). Longfin inshore squid spawn from April to November (Cargnelli et al. 1999c) with peak spawning in May. Most eggs hatch during the summer around July (Lange and Sissenwine 1980).

Forage Species—Longfin squid juveniles feed on crustaceans (crabs, worms, and shrimp), while adults prey upon small fishes (silver hake, sand lance, anchovy, weakfish, silversides, mackerel, herring, and Atlantic menhaden) and squids. Longfin inshore squid have also been recorded engaged in cannibalism. While inshore, they prey primarily on fish, and when offshore, they feed upon fishes, squid, and crustaceans (Cargnelli et al. 1999c).

EFH Designations—(MAFMC 1998b; MAFMC 2008) (**Figure A-11**)

- **Eggs**—Designated EFH includes coastal and offshore bottom habitats from Georges Bank southward to Cape Hatteras, North Carolina.

- **Juveniles** (±8 cm [3.1 in.])—Designated EFH includes the pelagic waters found over the continental shelf in areas that comprise the highest 75% of the catch where juvenile longfin inshore squid were collected by the NEFSC trawl surveys (from the Gulf of Maine to Cape Hatteras, North Carolina).

- **Adults** (>8 cm [3.1 in.])—Designated EFH includes the pelagic waters found over the continental shelf in areas that comprise the highest 75% of the catch where recruited adult longfin inshore squid were collected by the NEFSC trawl surveys (from the Gulf of Maine to Cape Hatteras, North Carolina).

HAPC Designations—There are no HAPC identified for this species.

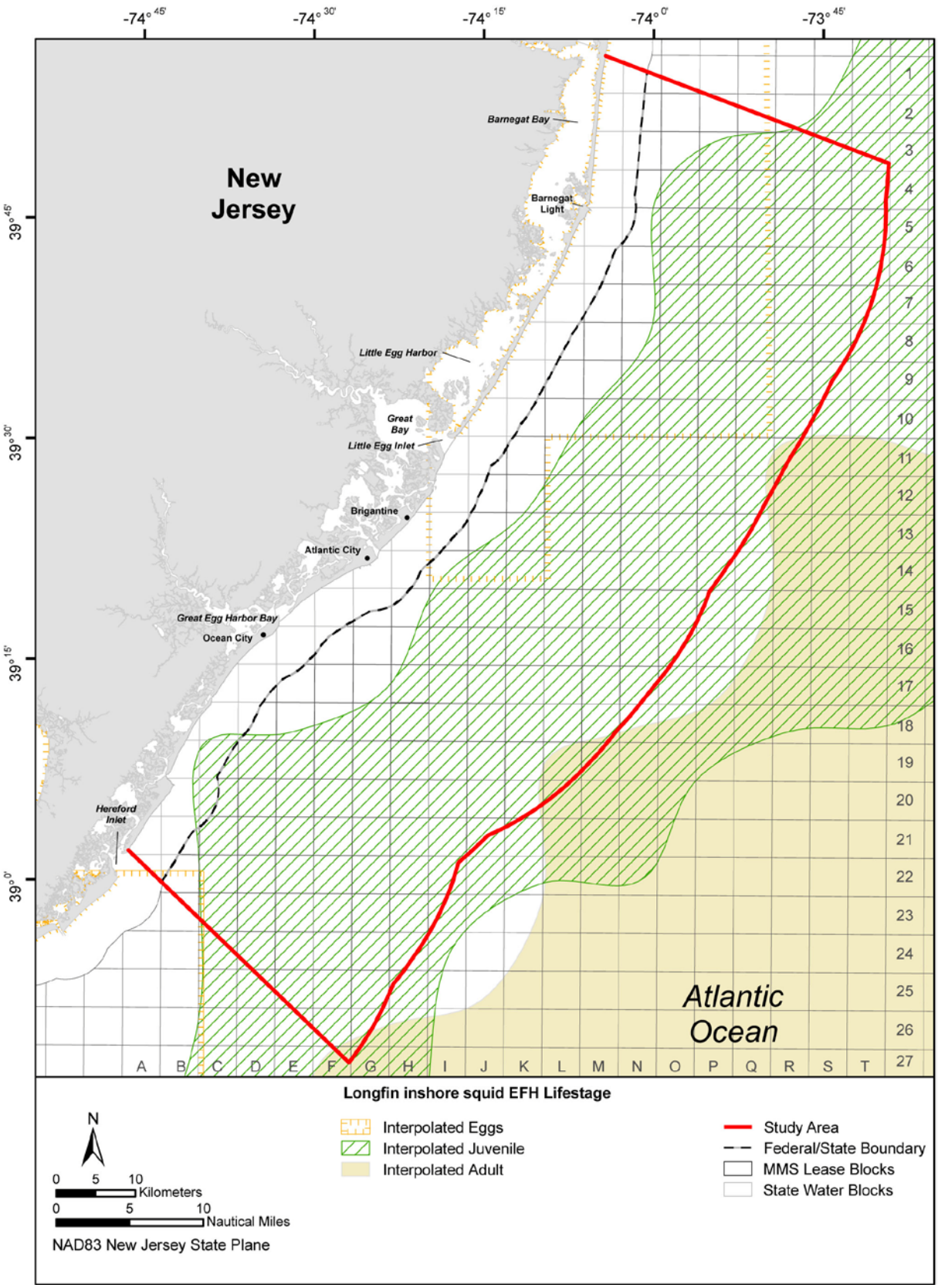

Figure A-11. Essential fish habitat designated in the New Jersey Study Area for all lifestages of longfin inshore squid. Source map (scanned): MAFMC (1998b, 2008).

- **Ocean Pout (*Zoarces americanus*)**

Management—EFH for the ocean pout is designated by the NEFMC under Final Amendment 11 to the Northeast Multispecies FMP (NEFMC 1998). Two separate stocks have been suggested based on stock identification studies. The first stock is found within the region of the Bay of Fundy and the northern Gulf of Maine, while the second stock ranges from Cape Cod Bay, Massachusetts south to Delaware (Wigley 2000).

Status—Ocean pout are classified as overfished; however, overfishing is not occurring (NMFS 2009d).[3]

Distribution—Ocean pout commonly are found from Labrador and the southern Grand Banks, Canada to Maryland (Dunaway 2001), but can also be found in the deeper, cooler waters south of Cape Hatteras, North Carolina (Steimle et al. 1999d).

Habitat Associations—Ocean pout lay demersal eggs in gelatinous clumps in sheltered areas where they are guarded and protected by either one or both sexes (Steimle et al. 1999d; Wigley 2000). Once the eggs hatch, larvae remain near the sheltered area throughout the duration of the transition stage. As juveniles, ocean pout disperse along the shallow, coastal waters. They are typically found in association with rocks and attached algae (Klein-MacPhee and Collette 2002). Adults are commonly found in deep, cooler waters (3° to 14°C [37.4° to 57.2°F]) of the continental shelf and the upper continental slope (Clark and Livingstone 1982; Steimle et al. 1999d).

Life History—Ocean pout spawning occurs in late summer through early winter. Peak spawning occurs in September and October and earlier (August through October) in the southern part of their range. Ocean pout spawn on hard bottom, sheltered areas (Klein-MacPhee and Collette 2002), including rock crevices, artificial reefs, and shipwrecks, at depths of less than 50 m (164 ft) and temperatures of 10°C (50°F) or colder (Clark and Livingstone 1982; Steimle et al. 1999d). Although ocean pout move seasonally within a region, this species is considered non-migratory (Klein-MacPhee and Collette 2002) and seasonal inshore/offshore movements are not extensive (Wigley 2000).

Forage Species—Ocean pout juveniles and adults prey primarily on mollusks, crustaceans (crabs), echinoderms (sand dollars, brittle stars, and sea urchins), and other invertebrates (polychaetes), and less commonly, on fishes and fish eggs (Steimle et al. 1999d). This species feeds primarily near the bottom during the daytime (Klein-MacPhee and Collette 2002).

EFH Designations—(NEFMC 1998) (**Figure A-12**)

- **Eggs, Larvae, and Adults**—Designated EFH includes primarily hard bottom habitats, on the continental shelf from the Gulf of Maine, Georges Bank, and MAB south to Delaware Bay. Southern New England estuaries and embayments are designated as EFH.

- **Juveniles**—Designated EFH includes bottom habitats consisting of smooth bottom near rocks or algae from the Gulf of Maine, Georges Bank, and MAB south to Delaware Bay. Southern New England estuaries and embayments are designated as EFH.

- **Spawning Adults**—Designated EFH includes bottom habitats with a hard bottom substrate including artificial reefs and shipwrecks from the Gulf of Maine, Georges Banks, and MAB south to Delaware Bay. Southern New England estuaries and embayments are designated as EFH.

HAPC Designations—There are no HAPC identified for this species.

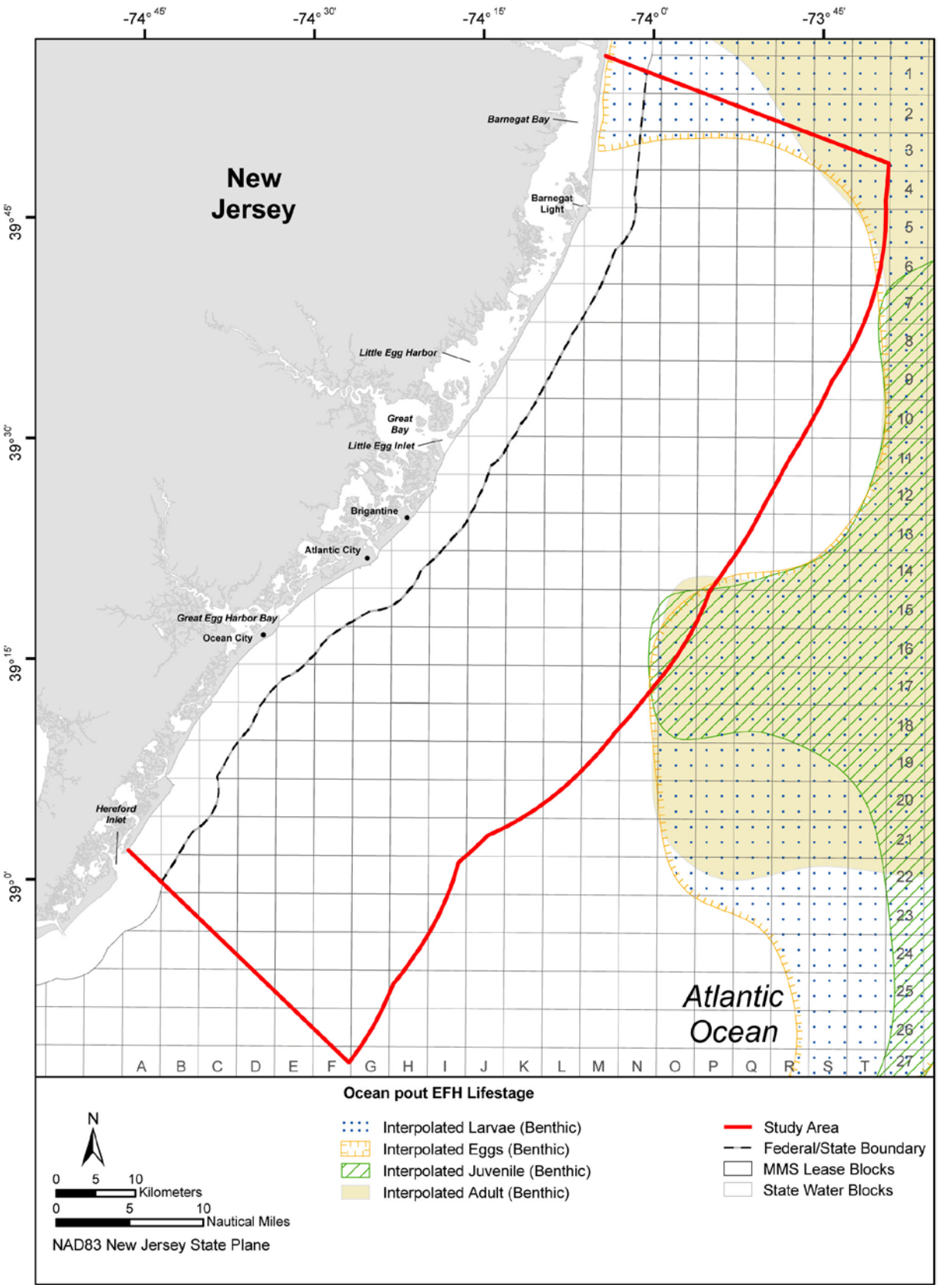

Figure A-12. Essential fish habitat designated in the New Jersey Study Area for all lifestages of ocean pout. Source map (scanned): NEFMC (1998).

- **Ocean Quahog (*Arctica islandica*)**

Management—Ocean quahog EFH is designated under Amendment 12 to the Atlantic Surfclam and Ocean Quahog FMP of the MAFMC (1998a).

Status—Ocean quahog is neither classified as overfished, nor is overfishing occurring (NMFS 2009d).

Distribution—The ocean quahog is found in temperate and boreal waters occurring on both sides of the north Atlantic (Serchuk et al. 1982). In the northwestern Atlantic Ocean, ocean quahog are found on the continental shelf from Newfoundland, Canada to Cape Hatteras, North Carolina (Mann 1982; Weinberg 2001).

Habitat Associations—Ocean quahog eggs and larval stages are planktonic and are subject to dispersal by currents (Cargnelli et al. 1999a). Following metamorphosis, juveniles settle to the bottom, displaying a preference for sand substrates in offshore waters, but also inhabit mud intertidal environments (Cargnelli et al. 1999a). Ocean quahog are generally found in waters with salinities ranging from 32 to 34 psu at depths between 45 m and 75 m (148 ft and 246 ft). Adults typically congregate in dense beds, just below the sediment surface. Ocean quahog prefers silty or fine to medium grade sand substrates as habitat (Serchuk et al. 1982; Cargnelli et al. 1999a).

Life History—Ocean quahog spawning is protracted. Spawning begins in the spring and ends in the fall. Ocean quahog display multiple spawning events which occur at the individual and population level (Mann 1982; Cargnelli et al. 1999a). The spawning season begins in late spring or early summer when water temperatures reach 13.5°C (56.3°F). Peak ocean quahog spawning occurs from August to early October (Serchuk et al. 1982). Adult quahogs do not exhibit seasonal movements (Serchuk et al. 1982).

Forage Species—Ocean quahogs are filter feeders that primarily consume phytoplankton (Cargnelli et al. 1999a).

EFH Designations—(MAFMC 1998a) (**Figure A-13**)

- **Juveniles and Adults**—Designated EFH includes bottom substrates (to a depth of 1 m [3.3 ft] below the water-sediment interface in areas) that encompass the top 90% of the NEFSC surfclam and ocean quahog dredge surveys (from the eastern edge of Georges Bank and the Gulf of Maine) throughout the Atlantic U.S. EEZ.

HAPC Designations—There are no HAPC identified for this species.

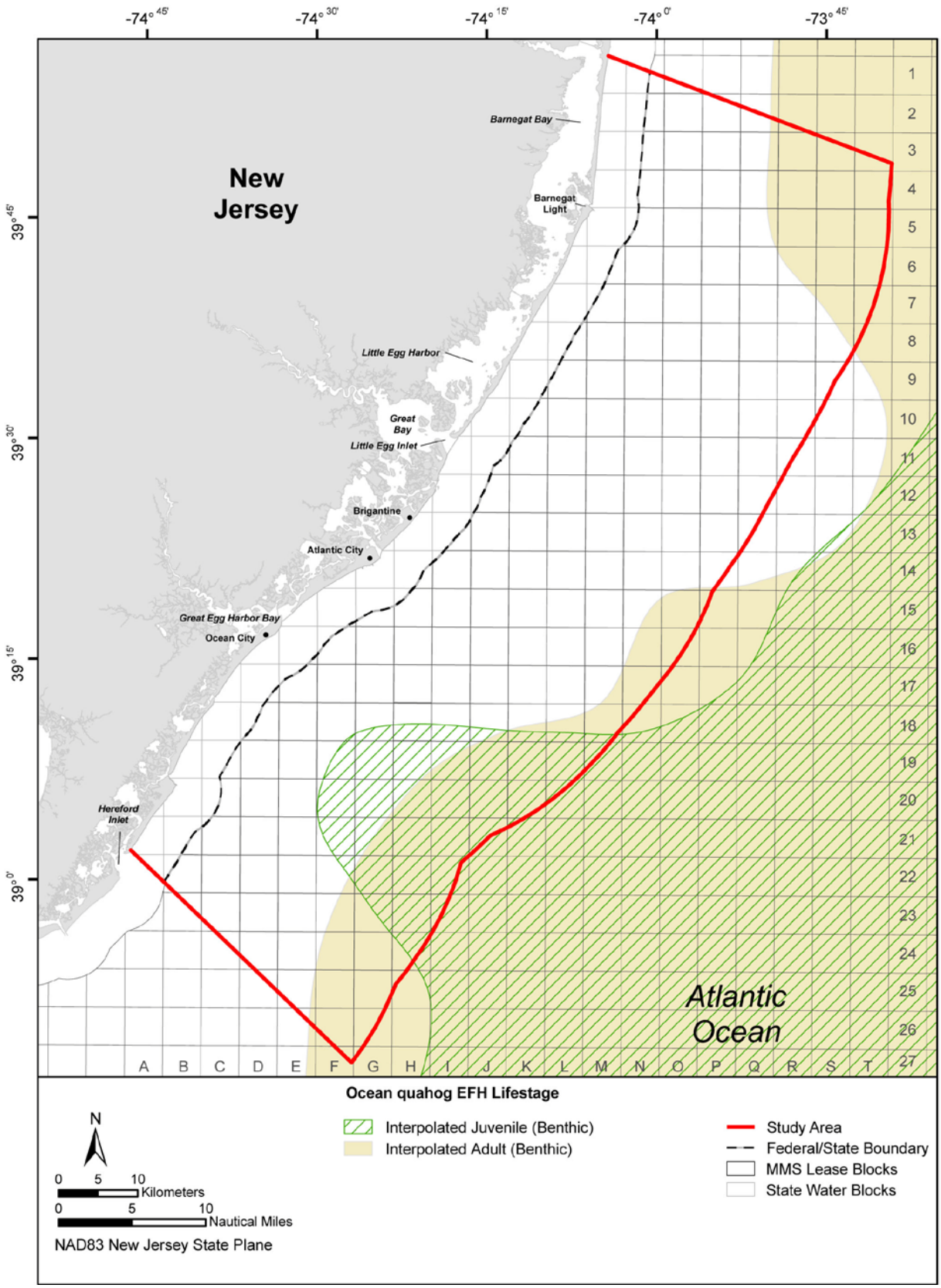

Figure A-13. Essential fish habitat designated in the New Jersey Study Area for all lifestages of the ocean quahog. Source map (scanned): MAFMC (1998a).

- **Red Hake (*Urophycis chuss*)**

Management—Red hake EFH is designated by the NEFMC under Final Amendment 11 to the Northeast Multispecies FMP (NEFMC 1998). The red hake is divided into two separate stocks (northern and southern separated by the central axis of Georges Bank) in U.S. waters (NEFMC 1999).

Status—Red hake (southern Georges Bank/mid-Atlantic) are not classified as overfished; however, it is undefined whether or not overfishing is occurring (NMFS 2009d).

Distribution—Red hake are found in the coastal waters off southern Newfoundland, Canada to North Carolina, with peak abundance occurring along Georges Bank, in the Gulf of Maine off Cape Cod, and in the northern MAB off Long Island, New York. In addition, all lifestages of red hake are also found in estuaries from southern Maine to the Chesapeake Bay (Steimle et al. 1999b).

Habitat Associations—Red hake eggs are pelagic and buoyant and are most common off Georges Bank, Canada, and southern New England coast during May and June (Klein-MacPhee 2002e). Larvae are found from May to December on Georges Bank and southern New England, but are most numerous during September and October (Klein-MacPhee 2002e). In the MAB, larvae are found in waters with temperatures ranging from 8° to 23°C (46.4° to 73.4°F) and at depths between 10 m and 200 m (32.8 ft and 656.0 ft) (Steimle et al. 1999b). Both eggs and larvae drift with the prevailing currents (Anderson 1982). Upon recruitment from the plankton to the benthos, juvenile red hake are commonly found in close association with benthic debris (e.g., shells, sponges, and rocks), which serve as shelters at depths of 40 to 50 m (131 to 164 ft) (Klein-MacPhee 2002e). Juvenile red hake prefer water temperatures between 4.2°C and 7.5°C (39.6°F and 45.5°F) and salinities of 31 to 32.8 psu. Adults prefer water temperatures ranging from 5° to 12°C (41.0° to 53.6°F) and salinities of 33 or 34 psu. Red hake prefer soft sediments and wide ranging depths between 35 m and 980 m (115.0 ft and 3,215.4 ft) (Steimle et al. 1999b; Klein-MacPhee 2002e).

Life History—Red hake spawning grounds include the southwest portion of Georges Bank, the continental shelf off southern New England, and eastern Long Island, New York. Spawning adults are commonly found in coastal bays between Narragansett Bay and Massachusetts Bay, but are uncommon to the north or the south of this range (Steimle et al. 1999b). Spawning occurs from April through November at water temperatures around 5° and 10°C (41° and 50°F) (Steimle et al. 1999b). Red hake undergo extensive seasonal migrations; they are found in coastal waters, typically less than 100 m (328 ft), during the warmer months and migrate further offshore (>100 m [328 ft]) during the colder months (Steimle et al. 1999b).

Forage Species—Red hake larvae prey upon copepods and other micro-crustaceans. Both juveniles and adults feed primarily on crustaceans (crab and shrimp) and other invertebrates (bivalves, squid, and worms) and secondarily on fishes (haddock (*Melanogrammus aeglefinus*), silver hake, sand lance, searobins [Triglidae], and mackerel) (Klein-MacPhee 2002e).

EFH Designations—(NEFMC 1998) (**Figure A-14**)

- **<u>Eggs</u>**—Designated EFH includes the surface waters from the Gulf of Maine, Georges Bank, and the continental shelf of the MAB south to Cape Hatteras, North Carolina.

- **<u>Larvae</u>**—Designated EFH includes the surface waters from the Gulf of Maine, Georges Bank, and the continental shelf of the MAB south to Cape Hatteras, North Carolina. New England and northern mid-Atlantic estuaries and embayments are designated as EFH.

- **<u>Juveniles</u>**—Designated EFH includes bottom habitats with substrates consisting of shell fragments, including areas with an abundance of live scallops from the Gulf of Maine, Georges Bank, and the continental shelf of the MAB south to Cape Hatteras, North Carolina. New England and mid-Atlantic estuaries and embayments are designated as EFH.

- Adults—Designated EFH includes bottom habitats in depressions with substrates consisting of sand and mud from the Gulf of Maine, Georges Bank, and the continental shelf of the MAB south to Cape Hatteras, North Carolina. New England and mid-Atlantic estuaries and embayments are designated as EFH.

- Spawning Adults—Designated EFH includes bottom habitats in depressions with substrates consisting of sand and mud from the Gulf of Maine, the southern edge of Georges Bank, and the continental shelf of the MAB south to Cape Hatteras, New England and northern mid-Atlantic estuaries and embayments are designated as EFH.

HAPC Designations—There are no HAPC identified for this species.

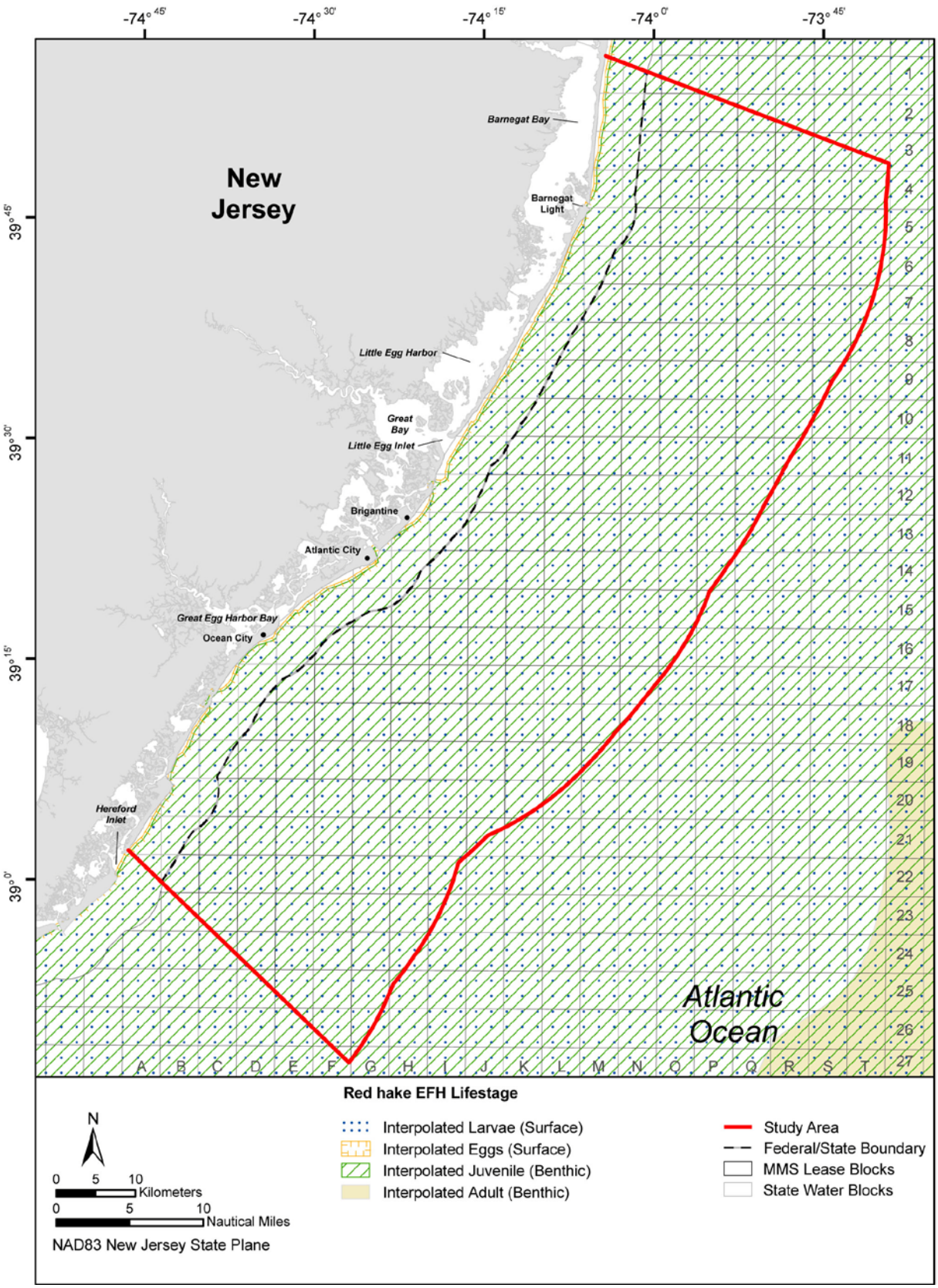

Figure A-14. Essential fish habitat designated in the New Jersey Study Area for egg, larval, and juvenile lifestages of red hake. Source map (scanned): NEFMC (1999b).

- **Scup (*Stenotomus chrysops*)**

Management—The scup fishery has EFH designated jointly by the MAFMC and the ASMFC under Amendment 12 to the Summer Flounder, Scup, and Black Sea Bass FMP (MAFMC and ASMFC 1998b).

Status—Scup are neither classified as overfished, nor is overfishing occurring (NMFS 2009d).

Distribution—Scup are a continental shelf species found in the western North Atlantic Ocean that occurs primarily from Cape Cod, Massachusetts to Cape Hatteras, North Carolina (Morse 1982). Scup have been reported as far north as the Bay of Fundy and Sable Island Bank, Nova Scotia (Steimle et al. 1999e; Klein-MacPhee 2002i) and as far south as Florida (Manooch III 1988).

Habitat Associations—During May through August, scup pelagic eggs are found in coastal waters of southern New England, including bays and sounds (Morse 1982; Steimle et al. 1999e). Larval scup are also pelagic and are found from May to September in coastal waters at temperatures ranging from 14° to 22°C (57.2° to 71.6°F). Both eggs and larvae are typically found in waters of less than 50 m (164 ft) in depth (Steimle et al. 1999e). During the transition of larvae into juveniles, the scup abandons the pelagic stage in favor of bottom habitats (Morse 1982). Juvenile scup prefer intertidal and subtidal habitats. During summer and fall, these areas include sand bottoms, mud bottoms, mussel beds, and eelgrass beds, while during winter and spring, juvenile scup are found on the continental shelf over habitats ranging from flat, open, sandy-silty bottoms to the heads of submarine canyons. Adult scup are commonly associated euryhaline waters with soft, sandy bottoms on or near structures including rock ledges, mussel beds, artificial reefs, and wrecks. Both juveniles and adults prefer waters with temperatures ranging between 5°C and 27°C (41.0°F and 80.6°F) (Steimle et al. 1999e).

Life History—In the MAB, scup spawn once a year during the daytime and typically close to shore from May to August, with peaks occurring in June and July (Morse 1982; Steimle et al. 1999e; Klein-MacPhee 2002i). Migration times and overwintering localities vary from year to year depending on water temperatures. Scup migrate out of the inshore waters to the warmer, deeper waters of the outer continental shelf ranging in depth from 70 to 180 m (230 to 591 ft) south of Hudson Canyon off New Jersey and along the coast from south of Long Island, New York to North Carolina (Terceiro 2001; Klein-MacPhee 2002i). Scup return to the inshore waters once the water temperatures begin to rise again in the spring (Steimle et al. 1999e). During the summer, scup are most common in most large estuaries and coastal areas (Klein-MacPhee 2002i).

Forage Species—Scup larvae prey upon zooplankton. Both juveniles and adults feed on benthic invertebrates (mollusks, crab, shrimp, squid, crustaceans, and worms) and small fishes but rarely feed any higher in the water column (Steimle et al. 1999e; Klein-MacPhee 2002i).

EFH Designations—(MAFMC and ASMFC 1998b) (**Figure A-15**)

- Eggs and Larvae—Designated EFH includes southern New England and mid-Atlantic estuaries and embayments.

- **Juveniles**—Designated EFH includes bottom waters from the coast out to the limits of the U.S. EEZ in areas that encompass the highest 90% of where juvenile scup were collected by the NEFSC trawl surveys (Gulf of Maine to Cape Hatteras, North Carolina). Southern New England and mid-Atlantic estuaries and embayments are designated EFH including Barnegat Bay and New Jersey Inland Bays adjacent to the Study Area.

- **Adults**—Designated EFH includes bottom waters from the coast out to the limits of the U.S. EEZ in areas that encompass the highest 90% of where juvenile scup were collected by the NEFSC trawl surveys (Gulf of Maine to Cape Hatteras, North Carolina). Southern New England and mid-

Atlantic estuaries and embayments are designated EFH including Barnegat Bay and New Jersey Inland Bays adjacent to the Study Area.

HAPC Designations—There are no HAPC identified for this species by the MAFMC. The ASMFC has identified HAPC to include sandy and weedy areas and structured habitats as important fishery nursery areas for juveniles.[2]

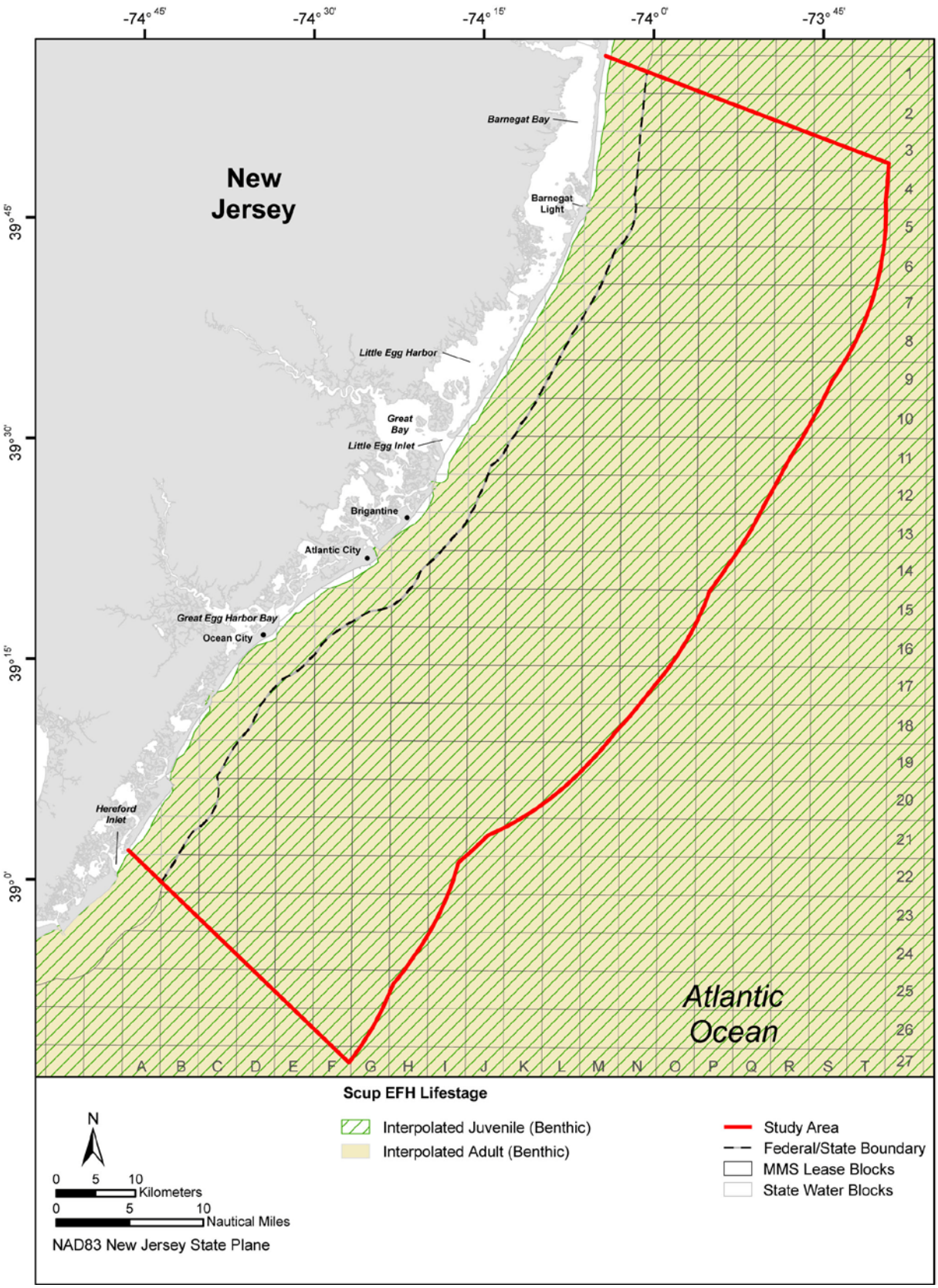

Figure A-15. Essential fish habitat designated in the New Jersey Study Area for juvenile and adult lifestages of scup. Source map (scanned): MAFMC and ASMFC (1998a).

- **Silver Hake/Whiting (*Merluccius bilinearis*)**

Management—Two main stocks are recognized in U.S. coastal waters: a northern stock within waters of the Gulf of Maine and the northern portion of Georges Bank and a southern stock inhabiting the southern portion of Georges Bank to the MAB (Helser 1996; Brodziak 2001). Both stocks have EFH designated by the NEFMC under Final Amendment 11 to the Northeast Multispecies FMP (NEFMC 1998).

Status—Silver hake are neither overfished, nor is overfishing occurring (NMFS 2009d).

Distribution—Silver hake are found in the northwestern Atlantic from the southern edge of the Grand Banks off Newfoundland, Canada, and the Gulf of St. Lawrence south to Cape Fear, North Carolina, along the continental shelf (Klein-MacPhee 2002d). They are most commonly found in the waters of the Gulf of Maine, the Scotian Shelf, Georges Bank, off Long Island, New York, and the southern edge of the Grand Banks (Morse et al. 1999).

Habitat Associations—Silver hake eggs are pelagic and drift with the prevailing currents. Eggs are typically observed at temperatures between 5 °C and 21°C (41.0°F and 69. 8°F) and over bottom depths of 10 to 1,250 m (33.0 to 4,101.2 ft) over the continental shelf but are most abundant at depths of 50 to 150 m (164 to 492 ft) (Lock and Packer 2004). The pelagic larval stage inhabits waters over the continental shelf between temperatures of 5°C and 16°C (41.0°F and 60.8°F) and at depths of 10 to 1,250 m (33.0 to 4,101.2 ft), although they are most common in depths of 50 to 130 m (164.0 to 426.5 ft) (Lock and Packer 2004). During the transition between larvae and juveniles, silver hake drop out of the plankton and settle into the benthic habitat (Steves and Cowen 2000; Lock and Packer 2004). While juvenile silver hake are found over a wide range of temperatures and depths on the continental shelf (Lock and Packer 2004), they display a preference for bottom temperatures between 8°C and 10°C (46.4°F and 50.0°F) and depths of 60 to 100 m (197 to 328 ft) (Steves and Cowen 2000). Adults have been observed in waters ranging from 3° to 18°C (37.4° to 64.4°F) in temperature, although they are most common between 7°C to 17°C (44.6°F and 62.6°F). Silver hake are nocturnal hunters, and during the day they are believed to rest on the bottom, on sand or pebbly bottom or on mud, but seldom over rocks. During the night, silver hake can be found throughout the water column in pursuit of prey with no limits to their vertical movements (Klein-MacPhee 2002d; Lock and Packer 2004).

Life History—During feeding and spawning, silver hake are often found in dense schools. Spawning extends throughout the year and peaks between May and August (Brodziak 2001; Klein-MacPhee 2002d). Primary spawning activity occurs along the southeastern and southern slopes of Georges Bank, around Nantucket Shoals, and south of Martha's Vineyard to Cape Hatteras, North Carolina (Klein-MacPhee 2002d). Silver hake migrate in response to seasonal changes in water temperatures. During the spring, silver hake migrate into shallow water where spawning takes place throughout late spring and early summer. When autumn arrives, the fish move back into the deeper waters of the Gulf of Maine and the outer continental shelf and slope waters (Brodziak 2001).

Forage Species—Silver hake feed on copepod larvae and younger copepodites. Both juveniles and adults prey upon crustaceans, fishes (anchovy, herring, lanternfish [Myctophidae], mackerel, sand lance, and butterfish), and squid (Klein-MacPhee 2002d; Lock and Packer 2004).

- ***EFH Designations***—(NEFMC 1998) (**Figure A-16**)

- **<u>Eggs and Larvae</u>**—Designated EFH includes the surface waters from the Gulf of Maine, Georges Bank, and the continental shelf of the MAB south to Cape Hatteras, North Carolina. Southern New England estuaries and embayments are designated as EFH.

- **<u>Juveniles, Adults, and Spawning Adults</u>**—Designated EFH includes bottom habitats off all substrates from the Gulf of Maine, on Georges Bank, and the continental shelf of the MAB south

to Cape Hatteras, North Carolina. Southern New England estuaries and embayments are designated as EFH.

HAPC Designations—There are no HAPC identified for this species.

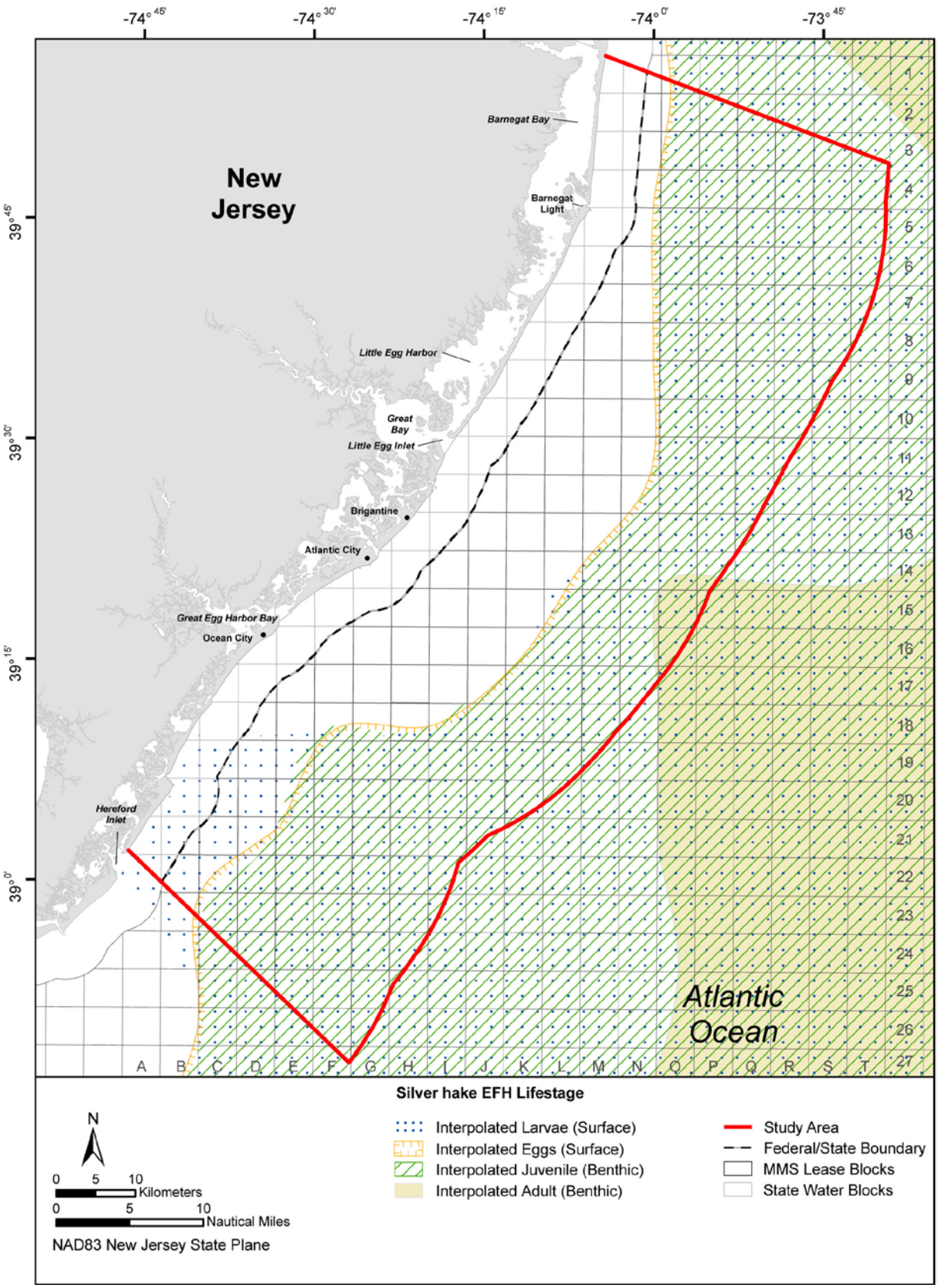

Figure A-16. Essential fish habitat designated in the New Jersey Study Area for all lifestages of silver hake. Source map (scanned): NEFMC (1999b).

- **Spiny Dogfish (*Squalus acanthias*)**

Management—Spiny dogfish have EFH designated under the joint management of the MAFMC and the NEFMC through the Spiny Dogfish FMP (MAFMC and NEFMC 1999).

Status—Spiny dogfish are neither classified as overfished, nor is overfishing occurring (NMFS 2009d). According to the 2009 IUCN Red List, spiny dogfish (Northwest Atlantic subpopulation) is classified as endangered.[4]

Distribution—In the western North Atlantic Ocean, the spiny dogfish ranges from Greenland to southern Florida and Cuba, but is most abundant between Newfoundland, Canada, and Georgia (Nammack et al. 1985).

Habitat Associations—Spiny dogfish are ovoviviparous and eggs develop internally (Burgess 2002). The offspring, known as pups, are born live as fully developed juveniles following a gestation period of two years (Cohen 1982). Both juvenile and adult spiny dogfish are epibenthic, but move throughout the water column. They inhabit nearshore shallow waters out to depths of 900 m (2,952.9 ft) along the inshore and offshore continental shelf (Burgess 2002; Stehlik 2007).

Life History—Spiny dogfish spawn in the winter in offshore waters (Cohen 1982; Burgess 2002). Parturition occurs between November and January in offshore wintering grounds but can occur as late as May in areas of colder temperatures (Nammack et al. 1985; McMillan and Morse 1999; Burgess 2002). Spiny dogfish migrate north in the spring and summer, typically north of Cape Cod, Massachusetts and return south again in the fall and winter, usually off of the North Carolina coast (McMillan and Morse 1999). Seasonal inshore-offshore migrations are also common for this species and are related to water temperature. Spiny dogfish overwinter in deeper offshore waters and move into the nearshore shallow waters during the summer (McMillan and Morse 1999; Burgess 2002).

Forage Species—Spiny dogfish are very aggressive piscivores that feed primarily on fishes, such as mackerel, herring, Atlantic menhaden, sand lance, capelin (*Mallotus villosus*), Atlantic wolffish, flatfish species, Atlantic cod, and haddock (Stehlik 2007). They also consume mollusks, crustaceans, and other invertebrates (Burgess 2002).

EFH Designations—(MAFMC and NEFMC 1999) (**Figure A-17**)

- **Juveniles**—Designated EFH includes the waters off the continental shelf in areas that encompass the highest 90% of the area where juvenile dogfish were collected by the NEFSC trawl surveys (Gulf of Maine through Cape Hatteras, North Carolina). New England estuaries and embayments are designated as EFH. Additional EFH is designated in waters with depths to 390 m (1,280 ft) south of Cape Hatteras, North Carolina, to Cape Canaveral, Florida.

- **Adults**—Designated EFH includes the waters over the continental shelf in areas that encompass the highest 90% of the area where adult dogfish were collected by the NEFSC trawl surveys (Gulf of Maine through Cape Hatteras, North Carolina). New England estuaries and embayments are designated as EFH. Additional EFH is designated in waters with depths to 450 m (1,476 ft) south of Cape Hatteras, North Carolina, to Cape Canaveral, Florida.

HAPC Designations—There are no HAPC identified for this species by the MAFMC and the NEFMC. The ASMFC has identified HAPC to include ocean bottom habitat and estuarine areas for refuge, foraging, or both.[2]

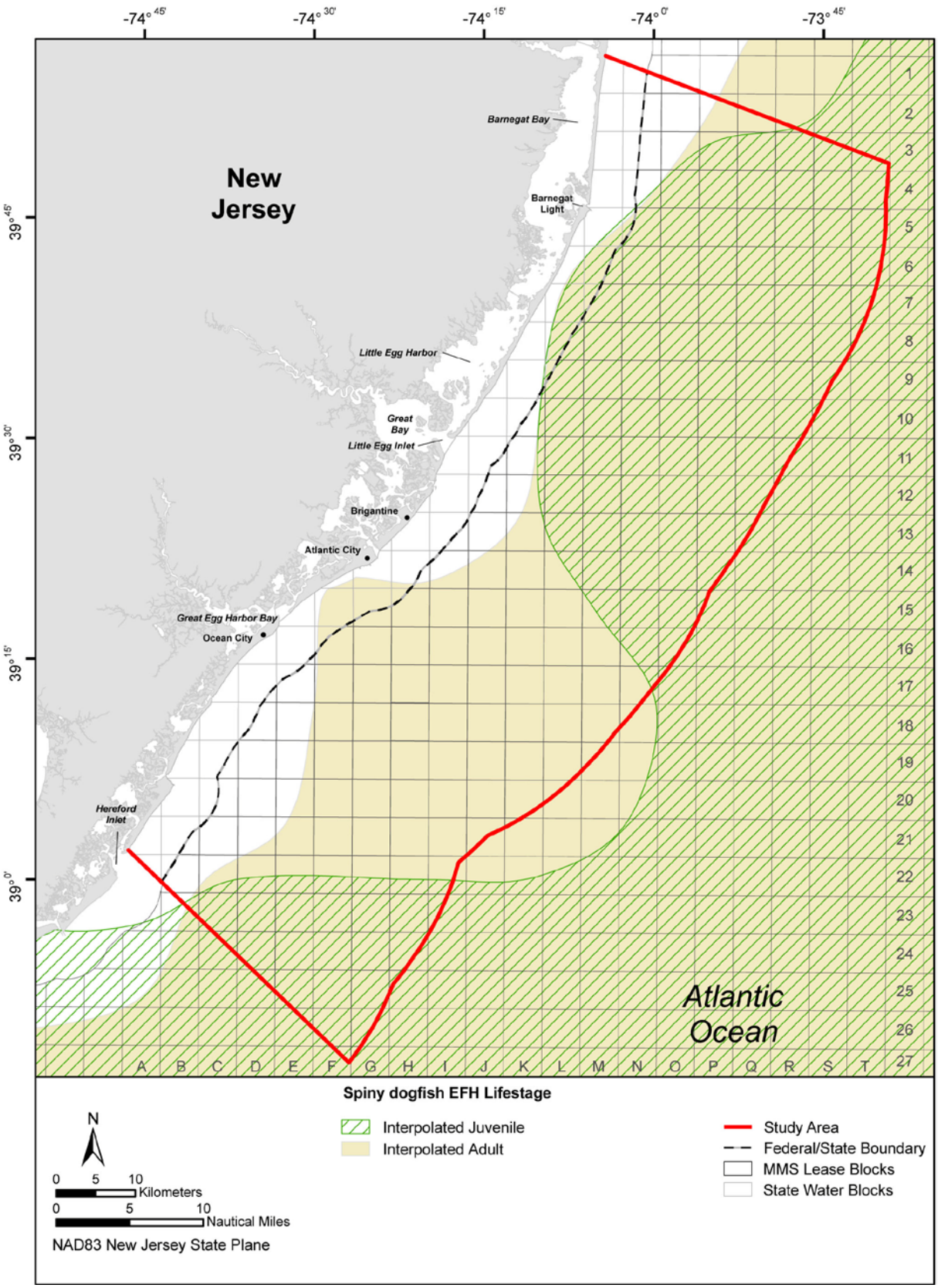

Figure A-17. Essential fish habitat designated in the New Jersey Study Area for all lifestages of spiny dogfish. Source map (scanned): MAFMC and NEFMC (1999).

- **Summer Flounder (*Paralichthys dentatus*)**

Management—The summer flounder stock has EFH jointly designated by the MAFMC and the ASMFC under Amendment 12 to the Summer Flounder, Scup, and Black Sea Bass FMP (MAFMC and ASMFC 1998b).

Status—Summer flounder are neither classified as overfished, nor is overfishing occurring (NMFS 2009d).

Distribution—Summer flounder range from Nova Scotia, Canada to Florida, but their occurrence north of Cape Cod, Massachusetts, and south of Cape Hatteras, North Carolina, is rare (Byrne and Azarovitz 1982; Klein-MacPhee 2002c).

Habitat Associations—Summer flounder eggs are pelagic and occur over the continental shelf in waters with temperatures ranging from 9° to 23°C (48.2° to 73.4°F), although the majority of eggs have been observed between 12°C to 19°C (53.6°F to 66.2°F). Eggs are most common in the MAB between Long Island, New York, and Cape Hatteras, North Carolina, within 46 km (24.8 NM) of shore (Byrne and Azarovitz 1982). The larvae are also pelagic and found primarily over the continental shelf. Larvae thrive in waters with temperatures between 0°C and 23°C (32.0°F and 73.4°F) but appear with the most frequency in waters between 9°C and 18°C (48.2°F and 64.4°F) (Byrne and Azarovitz 1982). Following the metamorphosis into juveniles, the summer flounder seek out inshore demersal habitats (Byrne and Azarovitz 1982). They display a preference for portions of estuaries containing sandy substrates or where there is a transition from fine sand to silt and clay, and water temperatures ranging between 3°C and 27°C (37.4°F and 80.6°F) (Packer et al. 1999). Adults share the same temperature preferences as the juveniles, but upon reaching maturity, move out of the estuaries and onto the continental shelf (Byrne and Azarovitz 1982; Packer et al. 1999).

Life History—Summer flounder have two distinct annual spawning periods. The first is also the most intense and occurs over the southern New England and mid-Atlantic regions during autumn and winter. The second spawning period occurs in the southern part of the Mid-Atlantic region in the spring (Berrien and Sibunka 1999). Female summer flounder continually produce egg batches throughout the spawning period (Klein-MacPhee 2002c). Summer flounder begin moving into the inshore waters of southern New England in April continue through July or August. Those fish that move inshore from the Chesapeake Bay north move offshore again in the fall. This offshore migration begins in September and by October or November, most of the summer flounder have left the northern part of their range (Klein-MacPhee 2002c).

Forage Species—Summer flounder's diet for larvae includes polychaete tentacles, harpactacoid copepods, and clams. Juveniles prey upon crustaceans, polychaetes, and invertebrate parts. Adults consume bony fish (sand lance, anchovy, herring, silver hake, and flatfish species), crustaceans, and squid (Packer et al. 1999; Klein-MacPhee 2002c). Summer flounder feed on benthos as well as throughout the water column to the surface (Klein-MacPhee 2002c).

EFH Designations—(MAFMC and ASMFC 1998b) (**Figure A-18**)

- **Eggs**—Designated EFH includes the pelagic waters found over the continental shelf in the highest 90% of the area where summer flounder eggs were collected during the MARMAP survey (Gulf of Maine to Cape Hatteras, North Carolina). Additional designated EFH is south of Cape Hatteras, North Carolina, to Cape Canaveral, Florida in waters over the continental shelf (from the coast to the limits of the EEZ) to depths of 110 m (361 ft).

- **Larvae**—Designated EFH includes the pelagic waters found over the continental shelf in the highest 90 % of the area where summer flounder larvae were collected during the MARMAP survey (Gulf of Maine to Cape Hatteras, North Carolina). Southern New England, mid-Atlantic, and southeast Atlantic estuaries and embayments are designated as EFH including Barnegat Bay and New Jersey Inland Bays adjacent to the Study Area. Additional designated EFH is nearshore

waters (to 81.5 km [44 NM] from shore) of the continental shelf (from the coast to the limits of EEZ) south of Cape Hatteras, North Carolina, to Cape Canaveral, Florida.

- **Juveniles**—Designated EFH includes the demersal waters over the continental shelf in the highest 90% of the area where juvenile summer flounder were collected by the NEFSC trawl survey (Gulf of Maine to Cape Hatteras, North Carolina). Southern New England, mid-Atlantic, and southeast Atlantic estuaries and embayments are designated as EFH including Barnegat Bay and New Jersey Inland Bays adjacent to the Study Area. Additional designated EFH is waters over the continental shelf (from the coast to the limits of the EEZ) to depths of 152 m (498.7 ft) south of Cape Hatteras, North Carolina, to Cape Canaveral, Florida.

- **Adults**—Designated EFH includes the demersal waters over the continental shelf in the highest 90% of the area where adult summer flounder were collected by the NEFSC trawl survey (Gulf of Maine to Cape Hatteras, North Carolina). Southern New England, mid-Atlantic, and southeast Atlantic estuaries and embayments are designated as EFH including Barnegat Bay and New Jersey Inland Bays adjacent to the Study Area. Additional designated EFH for this lifestage is waters over the continental shelf (from the coast to the limits of the EEZ) to depths of 152 m (498.7 ft) from Cape Hatteras, North Carolina, to Cape Canaveral, Florida.

HAPC Designations—For juvenile and adult lifestages, HAPC is considered to include all native species of macroalgae, seagrasses, and freshwater and tidal macrophytes, whether found as small aggregations or in beds, located within the adult and juvenile summer flounder EFH. Areas designated as HAPC for this species are adjacent to the Study Area (MAFMC and ASMFC 1998b). The ASMFC has identified HAPC as estuaries, bays, and harbors east and south of Cape Cod, Massachusetts as important juvenile habitat. In addition, there are other areas designated by the ASMFC north (Massachusetts) and south (North Carolina) of the Study Area.[2]

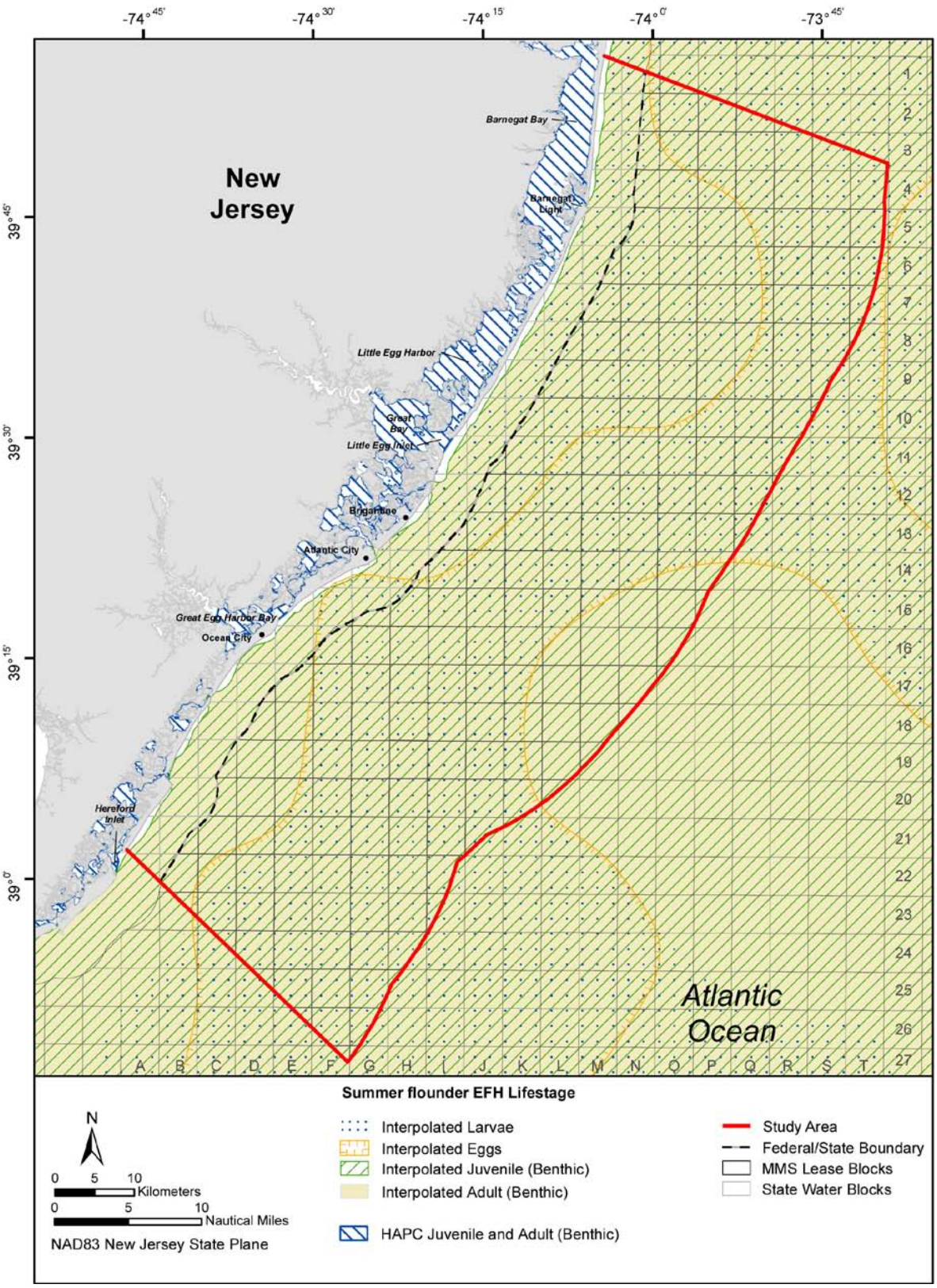

Figure A-18. Essential fish habitat and habitat areas of particular concern (HAPC) designated in the New Jersey Study Area for all lifestages of summer flounder. Source map (scanned): MAFMC and ASMFC (1998a).

- **Windowpane Flounder (*Scophthalmus aquosus*)**

Management—Windowpane flounder currently have EFH designated by the NEFMC through the Final Amendment 11 to the Northeast Multispecies FMP (NEFMC 1998). This species is managed as two stocks: a northern stock, located in the Gulf of Maine and Georges Bank region, and a southern stock, located in the MAB region (NEFMC 1998; NEFMC 2004)).

Status—Windowpane flounder (southern New England/mid-Atlantic stock) is classified as overfished; however, overfishing is not occurring (NMFS 2009d).[3]

Distribution—Windowpane flounder range throughout the western North Atlantic Ocean from the Gulf of St. Lawrence to Florida, but primarily is found between Georges Bank and the Chesapeake Bay (Morse and Able 1995).

Habitat Associations—Windowpane flounder eggs are primarily found throughout the high salinity areas of estuaries and the inner continental shelf in waters between 5°C to 20°C (41°F and 68°F) in temperature and less than 70 m (230 ft) in depth (Chang et al. 1999). Larval windowpane flounder start off as pelagic but settle to the bottom at approximately 10 mm (0.4 in.). They are found primarily in estuaries and on the nearshore continental shelf in waters with temperatures ranging from 3° to 19°C (37.4° to 66.2°F) and at depths of less than 70 m (230 ft) (Morse and Able 1995; Chang et al. 1999). Juveniles and adults are found in estuaries and throughout much of the continental shelf between depths of 5 m and 207 m (16.4 ft and 679.0 ft; most common in waters <50 m [164 ft]) and temperatures of 0° to 27°C (50.0° to 80.6°F) (Morse and Able 1995; Chang et al. 1999; Klein-MacPhee 2002a). Adults are euryhaline and can tolerate salinity ranges of 5.5 to 36.0 psu (Chang et al. 1999; Klein-MacPhee 2002a). Adult windowpane flounder prefer sandy substrates off southern New England and in the MAB but are also frequently observed on mud grounds in the Gulf of Maine (Chang et al. 1999).

Life History—Spawning occurs in the inner shelf waters between New Jersey and Cape Hatteras, North Carolina, in February or March. By April, spawning has expanded into the deeper waters and on to Georges Bank. The peak spawning period is between May and October (Klein-MacPhee 2002a) and spawning is completed by January (Morse and Able 1995). Spawning typically occurs in waters with temperatures of 6° to 17°C (42.8° to 62.6°F) (Klein-MacPhee 2002a). Windowpane flounder display limited seasonal movement (Morse and Able 1995). Based on trawl surveys, they are concentrated in shoal waters during the summer and early fall and migrate offshore for the winter and early spring as water temperatures decline (Dery and Livingstone 1982).

Forage Species—The main prey of the juvenile and adult windowpane flounder's diet are opossum shrimp (*Neomysis americana*), sevenspine bay shrimp, bony fishes (anchovy, snake eel, silver hake, tomcod, cusk-eel, killifish, silverside, pipefish, blackbelly rosefish [*Helicolenus dactylopterus*], sculpin, Atlantic striped bass (*Morone saxatilis*), sand lance, and flatfish species) and fish larvae (Chang et al. 1999; Klein-MacPhee 2002a). They have also been reported to feed on various other invertebrates, including squids, mollusks, worms, isopods, krill, and salps (Klein-MacPhee 2002a).

EFH Designations—(NEFMC 1998) (**Figure A-19**)

- **Eggs**—Designated EFH includes the surface waters around the perimeter of the Gulf of Maine, Georges Bank, and the MAB south to Cape Hatteras, North Carolina. New England and mid-Atlantic estuaries and embayments are designated as EFH including Barnegat Bay and New Jersey Inland Bays adjacent to the Study Area.

- **Larvae**—Designated EFH includes the pelagic waters around the perimeter of the Gulf of Maine, Georges Bank, and the MAB south to Cape Hatteras, North Carolina. New England and mid-Atlantic estuaries and embayments are designated as EFH including Barnegat Bay and New Jersey Inland Bays adjacent to the Study Area.

- **Juveniles**—Designated EFH includes bottom habitats consisting of mud or fine-grained sand around the perimeter of the Gulf of Maine, Georges Bank, and the MAB south to Cape Hatteras, North Carolina. New England and mid-Atlantic estuaries and embayments are designated as EFH including Barnegat Bay and New Jersey Inland Bays adjacent to the Study Area.

- **Adults and Spawning Adults**—Designated EFH includes bottom habitats consisting of substrate of mud or fine-grained sand around the perimeter of the Gulf of Maine, Georges Bank, and the MAB south to the Virginia-North Carolina border. New England and mid-Atlantic estuaries and embayments are designated as EFH including Barnegat Bay and New Jersey Inland Bays adjacent to the Study Area.

HAPC Designations—There are no HAPC identified for this species.

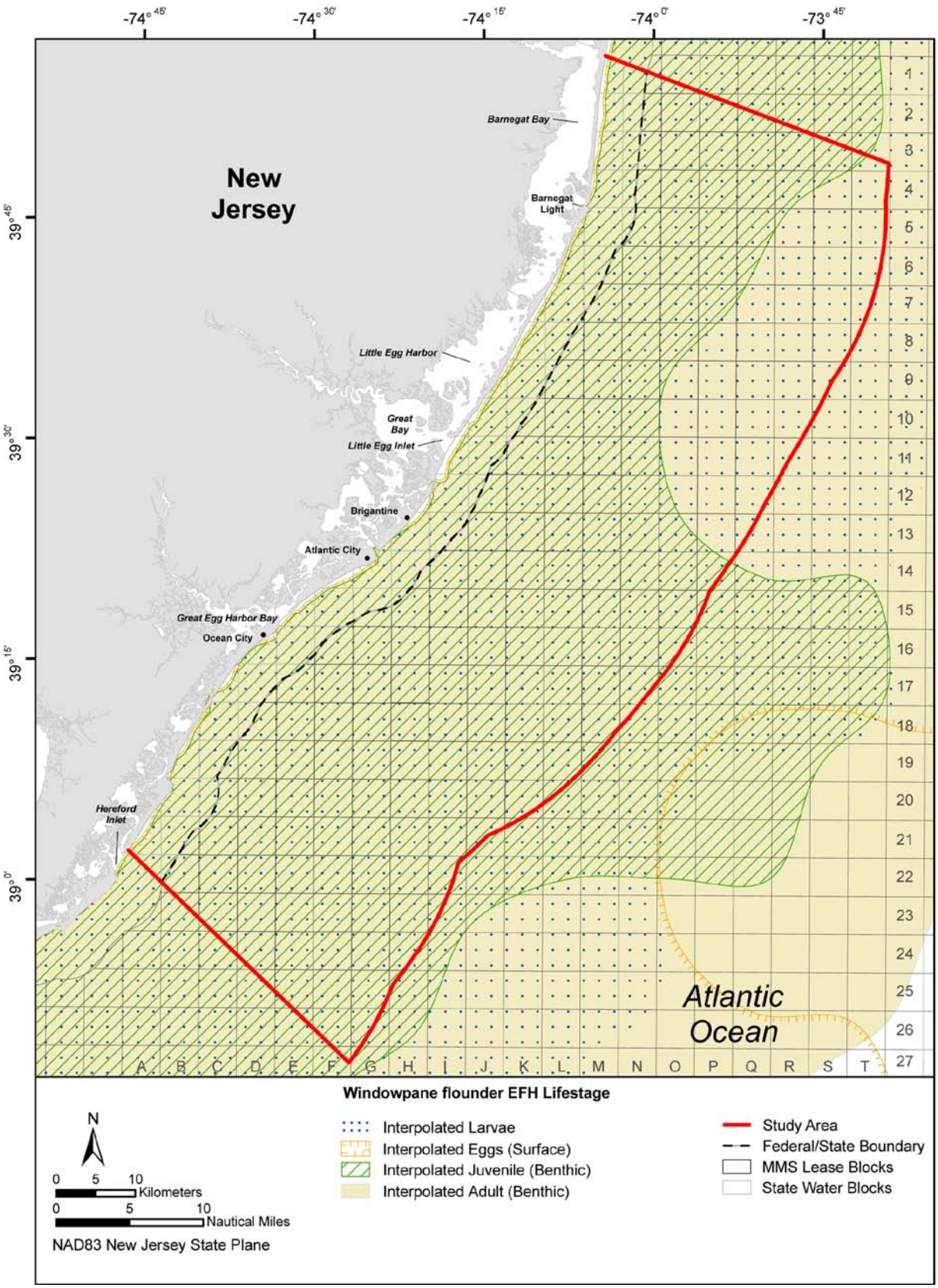

Figure A-19. Essential fish habitat designated in the New Jersey Study Area for all lifestages of windowpane flounder. Source map (scanned): NEFMC (1998).

- **Winter Flounder (*Pseudopleuronectes americanus*)**

Management—Winter flounder EFH is designated by the NEFMC under the Final Amendment 11 to the Northeast Multispecies FMP (NEFMC 1998).

Status—Winter flounder (southern New England/mid-Atlantic stock) are classified as overfished and overfishing is occurring (NMFS 2009d).[3]

Distribution—Winter flounder are distributed in the northwestern Atlantic from as far north as Labrador south to Georgia (McCracken 1963) with highest population densities are found between the Gulf of St. Lawrence and the Chesapeake Bay (Klein-MacPhee 2002c).

Habitat Associations—Winter flounder eggs are demersal and stick together in clusters. They are laid in estuaries, coves, and inlets in less than 5 m (16.4 ft) of water, at temperatures of 10°C (50°F) or less and salinities of 10 to 30 psu. Eggs occur on a variety of substrates including sand, muddy sand, mud, and gravel (Pereira et al. 1999). Larval winter flounder are negatively buoyant and sink when not swimming (Klein-MacPhee 2002c). They occur inshore, with the exception of Georges Bank and Nantucket Shoals, in waters ranging from 2.0° to 19.5°C (35.6° to 67.1°F) in temperature, salinities of 6 to 26 psu, and depths of 2 to 70 m (6.6 to 230.0 ft) depending on location (Pereira et al. 1999). Newly settled juvenile winter flounders are found in temperature ranges of 4° to 15°C (39.2° to 59.0°F) and are the most densely congregated over muddy substrates or fine-grained substrates. Older juveniles are found to a lesser extent in a variety of habitats, including mud-shell litter, marsh creeks, macroalgae, and eelgrass (Pereira et al. 1999; Klein-MacPhee 2002c). Adult winter flounder prefer water temperatures of 2.0° to 19.5°C (35.6° to 66.2°F) and salinities of 15 psu or greater (McCracken 1963; Pereira et al. 1999). They are found in a variety of habitats ranging from muddy sand, sand, clay, pebbles, and gravel inshore to hard bottom on the offshore banks (Klein-MacPhee 2002c).

Life History—Winter flounder are batch spawners, which spawn on sandy bottoms in shallow waters, estuaries, and coastal ponds (Pereira et al. 1999; Klein-MacPhee 2002c). Spawning occurs between January and May off southern New England and during November to April in the southern part of their range, from Delaware south (Klein-MacPhee 2002c). Winter flounder migrate out of the bays and the shore zone during the summer months south of Cape Cod, Massachusetts. North of Cape Cod, this movement pattern is not uniform in all areas. This migration has been correlated with an increase in temperature in excess of 15°C (59°F) in the inshore waters (McCracken 1963). In early fall, winter flounder reappear within the bays and estuaries once temperatures return to the preferred range (McCracken 1963).

Forage Species—Winter flounder juvenile and adults are opportunistic feeders, feeding primarily on benthic invertebrates (hydroids, shrimp, amphipods, mollusks, and worms) during the daytime. They have also been recorded to eat sand lances and fish eggs (Pereira et al. 1999; Klein-MacPhee 2002c).

EFH Designations—(NEFMC 1998) (**Figure A-20**)

- **Eggs**—Designated EFH includes bottom habitats consisting of sand, muddy sand, mud, and gravel on Georges Bank, inshore areas of the Gulf of Maine, and the MAB south to Delaware Bay. New England and mid-Atlantic estuaries and embayments are designated as EFH including Barnegat Bay and New Jersey Inland Bays adjacent to the Study Area.

- **Larvae**—Designated EFH includes the pelagic and bottom waters of Georges Bank, the inshore areas of the Gulf of Maine, and the MAB south to Delaware Bay. New England and mid-Atlantic estuaries and embayments are designated as EFH including Barnegat Bay and New Jersey Inland Bays adjacent to the Study Area.

- **Juveniles**—Designated EFH includes bottom habitats with mud or fine-grained sand located on Georges Bank, the inshore areas of the Gulf of Maine, and the MAB south to Delaware Bay. New England and mid-Atlantic estuaries and embayments are designated as EFH including Barnegat Bay and New Jersey Inland Bays adjacent to the Study Area.

- **Adults**—Designated EFH includes bottom habitats including estuaries with substrates consisting of mud, sand, and gravel on Georges Bank, inshore areas of the Gulf of Maine, and the MAB south to Delaware Bay. New England and mid-Atlantic estuaries and embayments are designated as EFH including Barnegat Bay and New Jersey Inland Bays adjacent to the Study Area.

- **Spawning Adults**—Designated EFH includes bottom habitats including estuaries with substrates consisting of sand, muddy sand, mud, and gravel on Georges Bank, inshore areas of the Gulf of Maine, and the MAB south to Delaware Bay. New England and mid-Atlantic estuaries and embayments are designated as EFH including Barnegat Bay and New Jersey Inland Bays adjacent to the Study Area

HAPC Designations—There are no HAPC identified for this species by the NEFMC. The ASMFC has identified HAPC to include spawning habitats (shallow areas <5 m [16.4 ft]) in the upper estuary, suitable coves, and river mouths; nursery habitats (in or near spawning and settlement areas), and estuaries important as foraging areas for adults.[2]

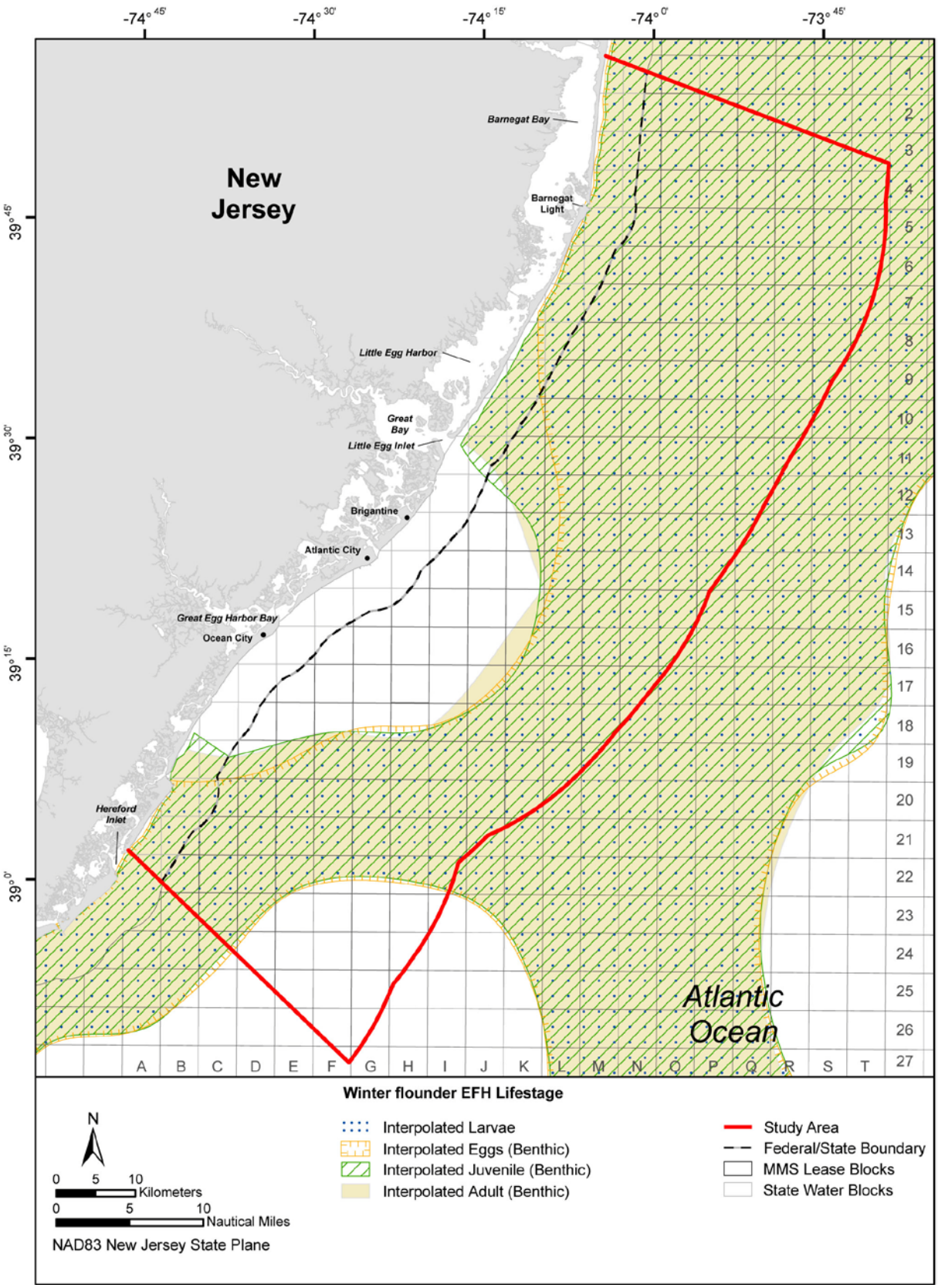

Figure A-20. Essential fish habitat designated in the New Jersey Study Area for all lifestages of winter flounder. Source map (scanned): NEFMC (1998).

- **Winter Skate (*Leucoraja ocellata*)**

Management—Winter skate has EFH designated by the NEFMC through the Final FMP for the NE Skate Complex (NEFMC 2003b).

Status—Winter skate are neither classified as overfished, nor is overfishing occurring (NMFS 2009d).

Distribution—Winter skates are found from southern Newfoundland and the southern Gulf of St. Lawrence to Cape Hatteras, North Carolina (McEachran and Musick 1975; McEachran 2002; Packer et al. 2003b).

Habitat Associations—Winter skates lay their eggs in capsules on the bottom (McEachran 2002; Packer et al. 2003b). Upon hatching, the skates are already fully developed juveniles (NEFMC 2003b). During the spring, the juvenile winter skates are most common in waters with temperatures of 4° to 5°C (39.2° to 41.0°F), salinities of 32 to 33 psu, and depths of 11 to 70 m (26 to 230 ft). In the fall, juveniles are typically observed in waters with temperatures of 7° to 16°C (44.6° to 60.8°F; peaks between 13°C and 15°C [55.4°F and 59.0°F]), salinities between 32 psu and 33 psu, and depths ranging from 21 to 80 m (69 to 262 ft) (Packer et al. 2003b). In spring, adult winter skates are most abundant in waters ranging from 4° to 6°C (39.2° to 42.8°F) in temperature, salinities of 33 psu, and depths of 31 to 60 m (102 to 197 ft), while during the fall, adults are most commonly distributed in waters with temperatures ranging from 11° to 15°C (51.8° to 59.0°F), salinities of 32 psu, and depths of 31 to 50 m (102 to 164 ft) (Packer et al. 2003b). Winter skates are most frequently found in habitats containing sandy to gravelly bottoms (McEachran 2002).

Life History—Female winter skates carrying fully formed egg capsules are present throughout the year but are most common during the summer and fall (McEachran 2002). Winter skates undergo seasonal movements in the southern portion of its range (McEachran and Musick 1975). Only during the winter months are winter skates abundant south of Delaware. In addition, they are more abundant during the winter than the rest of the year in inshore waters near Woods Hole, Massachusetts and in Massachusetts Bay (McEachran 2002).

Forage Species—Winter skate juveniles and adults prey primarily on benthic invertebrates, including squid, worms, crabs, krill, shrimp, bivalves, amphipods, echinoderms, and fishes (skates [Rajiidae], eels, herring, alewife, Atlantic menhaden, silver hake, red hake, tomcod, cod, smelt [*Osmerus mordax*], sculpins, redfish [*Sebastes* spp.], sand lance, cunner, butterfish, mackerel, summer flounder, and yellowtail flounder) (McEachran 2002; Packer et al. 2003b).

EFH Designations—(NEFMC 2003b) (**Figure A-21**)

- Eggs—Designated EFH includes southern New England and mid-Atlantic estuaries and embayments.

- Larvae—No larval stage exists for this species. Upon hatching, they are fully developed juveniles.

- **Juveniles**—Designated EFH includes bottom habitats consisting of sand and gravel or mud in Cape Cod Bay, on Georges Bank, and through the MAB to North Carolina. Southern New England and mid-Atlantic estuaries and embayments are designated EFH.

- **Adults**—Designated EFH includes bottom habitats consisting of sand and gravel or mud in Cape Cod Bay, on Georges Bank, and through the MAB to North Carolina. Southern New England and mid-Atlantic estuaries and embayments are designated EFH including Barnegat Bay and New Jersey inland bays adjacent to the Study Area.

- Spawning Adults— Designated EFH includes southern New England and mid-Atlantic estuaries and embayments.

HAPC Designations—There are no HAPC identified for this species.

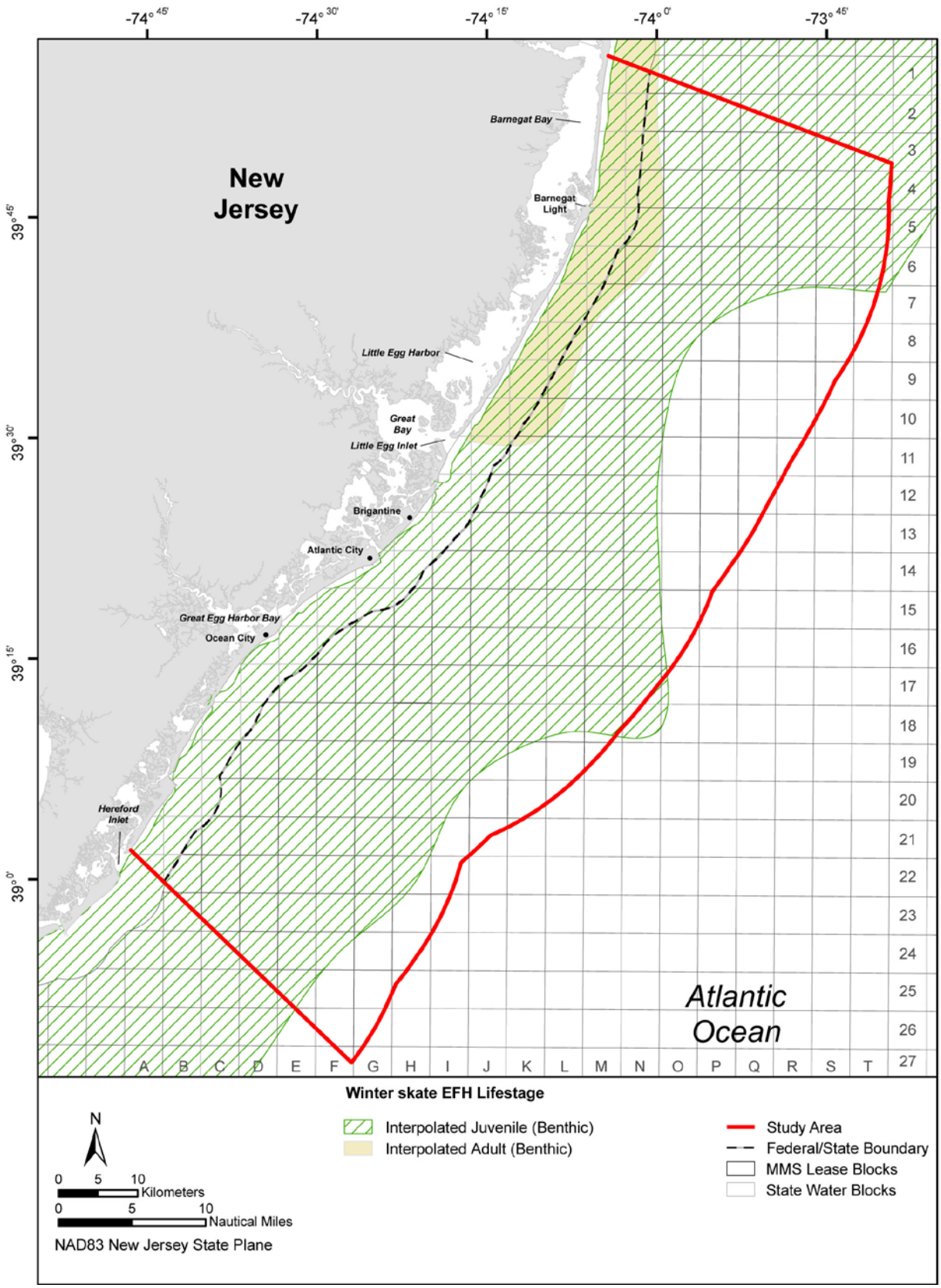

Figure A-21. Essential fish habitat designated in the New Jersey Study Area for all lifestages of winter skate. Source map (scanned): NEFMC (2003a).

- **Witch Flounder (*Glyptocephalus cynoglossus*)**

Management—Witch flounder EFH is designated by the NEFMC through the Final Amendment 11 to the Northeast Multispecies FMP (NEFMC 1998).

Status—Witch flounder are neither classified as overfished, nor is overfishing occurring (NMFS 2009d).

Distribution— Witch flounder occur on both sides of the Atlantic Ocean. In U.S. waters, this species occurs on or adjacent to Georges Bank and along the continental shelf edge and upper slope south to Cape Hatteras, North Carolina (Cargnelli et al. 1999d).

Habitat Associations—Witch flounder are benthic species exhibiting a preference for deep water (Cargnelli et al. 1999d). Juveniles and adults are found at depths of 20 to 1,565 m (65.6 ft to 5,134.8 ft), although the highest concentrations occur between 90 m and 300 m (295 ft and 984 ft) (Klein-MacPhee 2002c). Juvenile witch flounder tend to inhabit deeper waters than their adult counterparts (Cargnelli et al. 1999d). Both juveniles and adults prefer temperatures of 0° to 15°C (32° to 59°F) (Klein-MacPhee 2002c) and salinities of 31 to 36 psu (Cargnelli et al. 1999d). Substrate preferences for the species include mud, silt, clay, and muddy sand (Cargnelli et al. 1999d).

Life History—Spawning occurs from March to November and generally begins earlier in the southern portion of the range. The peak spawning period takes place between May and August (Brander and Hurley 1992). During spawning, witch flounder form dense aggregations that are concentrated around areas of cold water, typically in the range of 0° to 10°C (32° to 50°F) (Cargnelli et al. 1999d).

Forage Species—Witch flounder juveniles and adults feed primarily on polychaete worms but also consume echinoderms, squid, mollusks, amphipods, and isopods (Cargnelli et al. 1999d; Klein-MacPhee 2002c).

EFH Designations—(NEFMC 1998) (**Figure A-22**)

- **Eggs**—Designated EFH includes the surface waters of the Gulf of Maine, Georges Bank, and the MAB south to Cape Hatteras, North Carolina.

- **Larvae**—Designated EFH includes the surface waters to 250 m (820 ft) from the Gulf of Maine, Georges Bank, and the MAB south to Cape Hatteras, North Carolina.

- Juveniles—Designated EFH includes fine-grained substrates in the Gulf of Maine and along the shelf break region from Georges Bank south to Cape Hatteras, North Carolina.

- Adults and Spawning Adults—Designated EFH includes fine-grained substrates in the Gulf of Maine and along the shelf break region from Georges Bank south to the Chesapeake Bay.

HAPC Designations—There are no HAPC identified for this species.

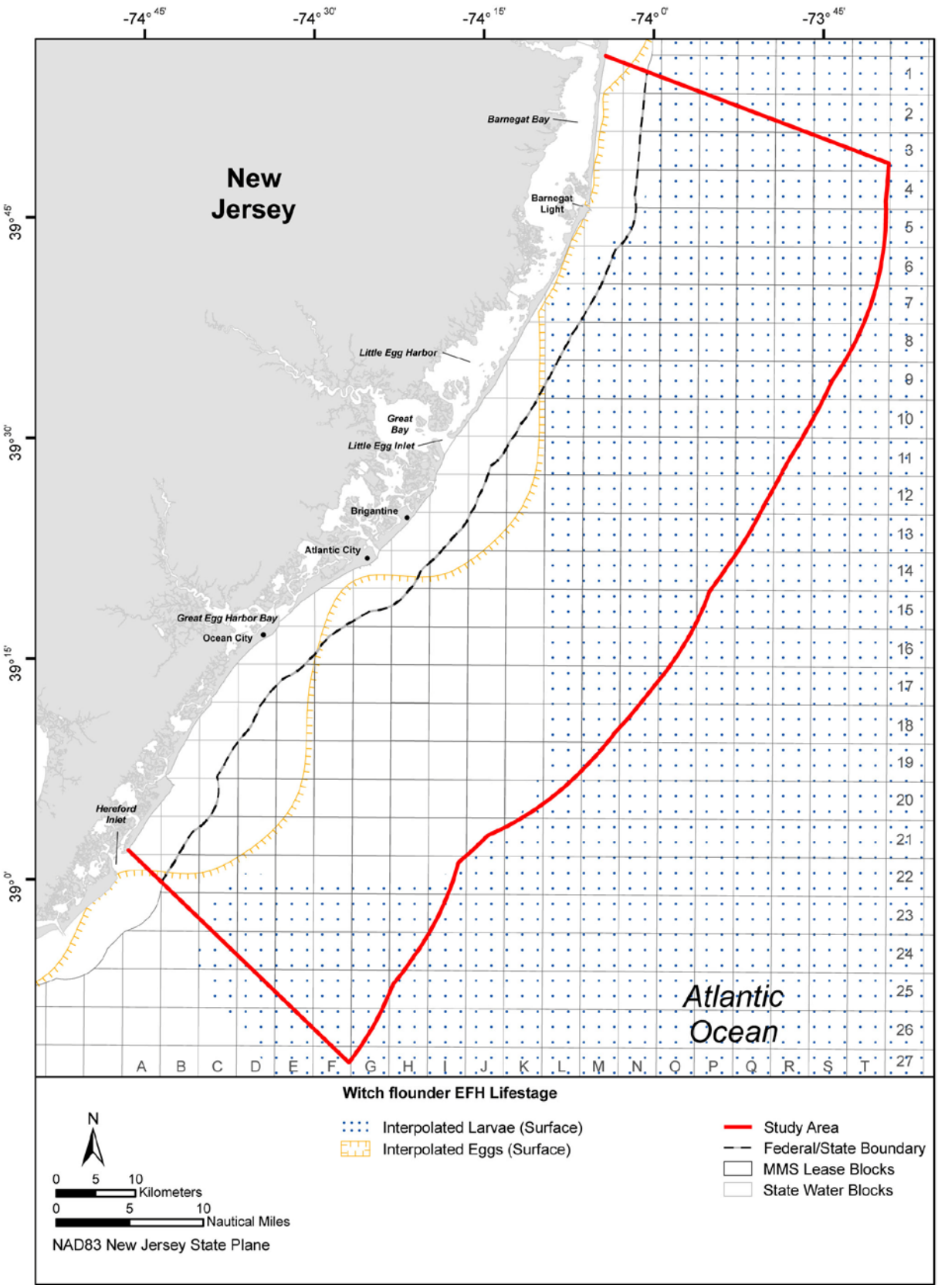

Figure A-22. Essential fish habitat designated in the New Jersey Study Area for egg and larval lifestages of witch flounder. Source map (scanned): NEFMC (1998).

- **Yellowtail Flounder (*Limanda ferruginea*)**

Management—Yellowtail flounder are managed by the NEFMC as five separate stocks (Nova Scotia, Georges Bank, southern New England, Cape Cod, Massachusetts, and the MAB) and have EFH designated under the Final Amendment 11 to the Northeast Multispecies FMP (NEFMC 1998).

Status—Yellowtail Flounder (southern New England/mid-Atlantic stock) are classified as overfished and overfishing is occurring (NMFS 2009d).[3] The 2009 IUCN Red List classifies yellowtail flounder as vulnerable, or facing a risk of extinction in the wild.[5]

Distribution—Yellowtail flounder are found between the south coast of Labrador and the Chesapeake Bay and occur with greatest frequency between southern New England and Georges Bank, on the Grand Bank, and around Sable Island off the Nova Scotia coast (Lux and Livingstone 1982).

Habitat Associations—Yellowtail flounder eggs are buoyant and remain suspended near the surface until hatching (Lux and Livingstone 1982; Johnson et al. 1999). They are found in waters with temperatures of 2° to 15°C (35.6° to 59.0°F) and depths of 10 to 750 m (33 to 2,461 ft; most common from 30 to 90 m [98 to 295 ft]) between February and September (Johnson et al. 1999). Eggs are found on the continental shelf off New Jersey and Long Island, New York, on Browns Bank, on Georges Bank, northwest of Cape Cod, Massachusetts, and in some years as far south as the Chesapeake Bay (Lux and Livingstone 1982; Johnson et al. 1999). Larval yellowtail flounder are pelagic and found during April through August in 5° to 17°C (41.0° to 62.6°F) water temperatures and between 10 m and 1,250 m (33.0 ft and 4,101.3 ft); most abundant between 10 m and 90 m (33 ft and 295 ft) (Lux and Livingstone 1982; Johnson et al. 1999). Juvenile yellowtail flounder prefer benthic habitats and are most commonly found in water temperatures of 2° to 17°C (35.6° to 62.6°F) and between 5 m and 125 m (16.4 ft and 410.0 ft) in depth (Johnson et al. 1999). Adult yellowtail flounder prefer sand and gravel substrates in waters ranging from 2° to 15°C (35.6° to 59.0°F) in temperature and depths of 10 to 100 m (33 to 328 ft) (Johnson et al. 1999; Klein-MacPhee 2002c).

Life History—Yellowtail flounder are batch spawners, spawning once a year primarily between March and July, with a peak around mid-May (Lux and Livingstone 1982; Klein-MacPhee 2002c). Little migration occurs between the five relatively distinct stocks of yellowtail flounder and each stock remains primarily within its fishing grounds (Johnson et al. 1999); however, there is evidence to suggest that some yellowtail flounder move considerable distances (Klein-MacPhee 2002c).

Forage Species—Amphipods, particularly *Erichthonius rubricornis*, are the primary component of the adult yellowtail flounder's diet. Juveniles prey on the sevenspine bay shrimp. They also consume other invertebrates (crustaceans) and small fishes (Johnson et al. 1999; Klein-MacPhee 2002c).

EFH Designations—(NEFMC 1998) (**Figure A-23**)

- **<u>Eggs</u>**—Designated EFH includes the surface waters of Georges Bank, Massachusetts Bay, Cape Cod Bay, and the MAB south to Delaware Bay. New England estuaries and embayments are designated EFH.

- **<u>Larvae</u>**—Designated EFH includes the surface waters of Georges Bank, Massachusetts Bay, Cape Cod Bay, and the MAB south to Chesapeake Bay. New England estuaries and embayments are designated EFH.

- **<u>Juveniles and Adults</u>**—Designated EFH includes bottom habitats consisting of sand or a combination of sand and mud on Georges Bank, the Gulf of Maine, and the MAB south to Delaware Bay. New England estuaries and embayments are designated EFH.

- **Spawning Adults**—Designated EFH includes bottom habitats consisting of sand or a combination of sand and mud on Georges Bank, the Gulf of Maine, and the MAB south to Delaware Bay. Some New England estuaries and embayments are designated EFH.

HAPC Designations—There are no HAPC identified for this species.

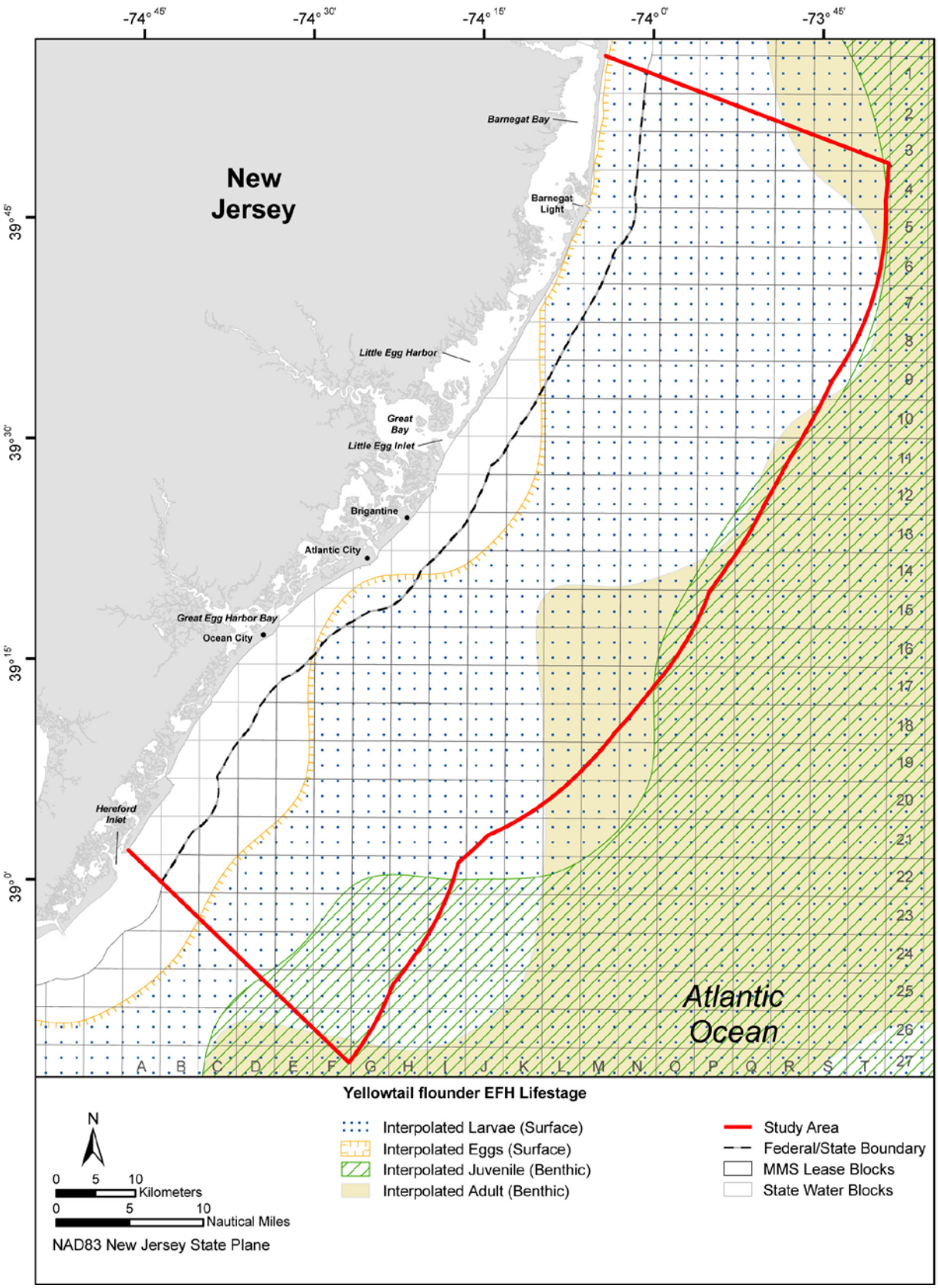

Figure A-23. Essential fish habitat designated in the New Jersey Study Area for all lifestages of yellowtail flounder. Source map (scanned): NEFMC (1998).

Subtropical-Tropical/Southeast Fish Species

- **Cobia (*Rachycentron canadum*)**

Management—Cobia off the southeast coast of the U.S. are managed jointly by the SAFMC and Gulf of Mexico Fishery Management Council (GMFMC); however, EFH in the Study Area is only designated by the SAFMC through the Final Habitat Plan for the South Atlantic Region (SAFMC 1998).

Status—Cobia are neither classified as overfished, nor is overfishing occurring (NMFS 2009d).

Distribution—Cobia are distributed world-wide throughout tropical, subtropical, and warm-temperate waters, with the exception of the eastern Pacific (Williams 2001). In the western Atlantic, cobia range from Massachusetts and Bermuda to Argentina but are most common along the U.S. coast south of Virginia and in the northern Gulf of Mexico (Franks et al. 1999; FMRI 2003).

Habitat Associations—Cobia eggs and larvae are pelagic and found at the surface within the upper meter of water (Ditty and Shaw 1992). Eggs occur between May and August and larvae are found from May to September across the continental shelf from the Gulf Stream to inshore inlets and bays (GMFMC and SAFMC 1985; Ditty and Shaw 1992; Franks et al. 1999). Eggs are found in surface water exceeding 20°C (68°F) in temperature and between 19 psu and 35 psu in salinity (Ditty and Shaw 1992). Developing larvae occupy waters with temperatures of 24.2° to 32.0°C (75.6° to 89.6°F), salinities between 18.9 psu and 37.7 psu, and depths of less than 100 m (328 ft) (Ditty and Shaw 1992). Juvenile and adult cobia are found in coastal bays and inlets and across the continental shelf. Juveniles occur at temperatures between 16.8°C and 25.2°C (62.2°F and 77.4°F) and at salinities of 30.0 to 36.4 psu. Adults prefer temperatures of 19.6° to 28.0°C (67.3° to 82.4°F), salinities ranging from 24.6 to 36.4 psu, and waters ranging in depth from nearshore shallows out to 70 m (230 ft) (GMFMC 1998). They are closely associated with any type of structure including artificial reefs, pilings, platforms, anchored boats, *Sargassum*, and flotsam (Bester 1999b; Williams 2001).

Life History—Spawning occurs in the daylight hours between April and September in estuarine or shelf waters (Ditty and Shaw 1992; CBP 2004). Cobia are batch spawners and form large aggregations during spawning (Bester 1999b; Williams 2001). Cobia undergo seasonal migrations. Following the spawning season, cobia migrate south to warmer offshore waters of the Florida Keys during the autumn and winter (CBP 2004). In the spring, they begin their migration north to the polyhaline/mesohaline waters of coastal Virginia and the Carolinas for the summer and to spawn (Williams 2001).

Forage Species—Cobia larvae mostly feed on copepods, while juveniles and adults prey upon demersal organisms, particularly crustaceans. Shrimp (i.e., mantis and penaeid), eels, and squid are consumed with the highest frequency. Several fish species have also been observed in the stomachs of cobia, including Spanish mackerel (GMFMC and SAFMC 1985). Cobia also are commonly seen in schools following sharks, turtles, and large rays as they feed, to scavenge food from the other animals (Williams 2001; CBP 2004).

EFH Designations—(SAFMC 1998) (**Figure A-24**)

- Larvae—The Gulf Stream is designated as EFH for this lifestage because it provides a mechanism for dispersal.

- **All Lifestages**—In the MAB and the SAB, designated EFH includes sandy shoals of capes and offshore bars, high profile rock bottoms, and barrier island (ocean side) waters from the surf zone to the shelf break but only from the edge of the Gulf Stream shoreward. In addition, high salinity bays, estuaries, seagrass habitat, and coastal inlets are also considered as EFH.

HAPC Designations—Areas designated as HAPC for this species are located south of the Study Area (SAFMC 1998).

- **King Mackerel (*Scomberomorous cavalla*)**

Management—King Mackerel are managed by the GMFMC and SAFMC. In the Study Area, King mackerel EFH is designated by the SAFMC under the Final Habitat Plan for the South Atlantic Region (SAFMC 1998).

Status—King mackerel are neither classified as overfished, nor is overfishing occurring (NMFS 2009d).

Distribution—King mackerel are commonly found along the continental shelf in the warmer waters of the western North Atlantic Ocean from North Carolina to Brazil, but occasionally reported as far north as Massachusetts (Collette 2002; Gold et al. 2002). This species is not usually found further offshore than the shelf break (GMFMC and SAFMC 1985).

Habitat Associations—King mackerel eggs are pelagic and occur in waters over depths of 35 to 180 m (115 to 591 ft) during the spring and summer (GMFMC 1998). Larvae occur over the middle and outer continental shelf off the eastern coast of the U.S. from May to November in waters ranging from 22° to 28°C (71.6° to 82.4°F) in temperature, salinities between 30 psu and 37 psu, and over bottom depths of 35 to 180 m (115 to 591 ft) (GMFMC and SAFMC 1985; Godcharles and Murphy 1986; GMFMC 1998). Juvenile and adult king mackerel can be found ranging from inshore waters to the shelf break, but are commonly found at depths of less than 80 m (262 ft). They prefer areas of temperatures greater than 20°C (68°F) and salinities between 32 psu and 36 psu. As adults, king mackerel rarely enter estuaries but feed upon estuarine dependent species (GMFMC 1998).

Life History—King mackerel are highly fecund serial spawners (Gledhill and Lyczdowski-Shultz 2000). They have a protracted spawning season that runs from May to October (Godcharles and Murphy 1986). King mackerel exhibit seasonal movements; during the summer, they migrate north and occur in the waters off Virginia and the Carolinas through fall. As the waters become cooler in the winter, they migrate south again to Florida (Godcharles and Murphy 1986; Schaefer and Fable 1994).

Forage Species—King mackerel (larvae, juveniles, and adults) feed on a variety of fish species including sardines (Clupeidae), Atlantic thread herring (*Opisthonema oglinum*), Atlantic menhaden, scads and jacks (Carangidae), snappers (Lutjanidae), mackerels, and grunts (Haemulidae). Invertebrate species such as shrimp and squid also make up a large portion of their diet (GMFMC and SAFMC 1985; Collette 2002).

EFH Designations—(SAFMC 1998) (**Figure A-24**)

- <u>Larvae</u>—The Gulf Stream is designated as EFH for this lifestage because it provides a mechanism for dispersal.

- **<u>All Lifestages</u>**—In the MAB and the SAB, designated EFH includes sandy shoals of capes and offshore bars, high profile rock bottoms and barrier island ocean side waters from surf zone to the shelf break but only in the region from the wall of the Gulf Stream shoreward. Additionally, all coastal inlets are designated as EFH.

HAPC Designations—Areas designated as HAPC for this species are located south of the Study Area (SAFMC 1998).

- **Spanish Mackerel (*Scomberomorous maculatus*)**

Management—Spanish mackerel are managed jointly by the SAFMC and the GMFMC. In the Study Area, Spanish mackerel EFH is only designated by the SAFMC under the Final Habitat Plan for the South Atlantic Region (SAFMC 1998).

Status—Spanish mackerel are neither classified as overfished, nor is overfishing occurring (NMFS 2009d).

Distribution—Spanish mackerel are abundant from the Chesapeake Bay south to the Gulf of Mexico; however, they occasionally occur as far north as the southern coast of New England (Collette 2002).

Habitat Associations—Spanish mackerel eggs are pelagic and usually occur over depths of less than 50 m (164 ft) along the inner continental shelf during the spring and summer (Godcharles and Murphy 1986; GMFMC 1998). Larvae occur in coastal waters with temperatures ranging from 20° to 32°C (68.0° to 89.6°F), salinities between 28 psu to 37 psu, and over depths of 9 to 84 m (29.5 to 276.0 ft; most abundant in waters < 50 m [164 ft]) (Godcharles and Murphy 1986; GMFMC 1998). They occur between May and September off the southeast U.S. coast (GMFMC and SAFMC 1985). Juvenile Spanish mackerel utilize a variety of habitats from low salinity estuaries to high salinity nearshore waters as nursery grounds (Godcharles and Murphy 1986). They prefer water temperatures greater than 25°C (77°F) and tolerate a wide range of salinities, typically greater than 10 psu (GMFMC 1998). Adults are surface feeders that form large schools of similar sized fish and often frequent nearshore coastal waters. They also frequently enter tidal estuaries, bays, and lagoons (GMFMC and SAFMC 1985). They are found in waters exceeding 20°C (68°F) and at depths of less than 75 m (246 ft) (GMFMC 1998).

Life History—Spanish mackerel have a protracted spawning season, which runs from April to September (GMFMC and SAFMC 1985; Godcharles and Murphy 1986). The onset of spawning progresses from south to north and occurs over the inner continental shelf in waters 12 to 34 m (39.0 to 111.5 ft) deep. Spawning starts in April off the Carolinas, in mid-June in the Chesapeake Bay, and from late August to September off the coasts of New Jersey and New York (Godcharles and Murphy 1986; Collette 2002). Spanish mackerel make seasonal migrations along the Atlantic coast. They are found of f Florida during the winter and migrate north as the waters warm. They occur off the Carolinas in April, off Virginia by May, and as far north as Narragansett Bay by July, in some years. They remain in the cooler northern waters until September before beginning their migration south again (GMFMC and SAFMC 1985).

Forage Species—Spanish mackerel (larvae, juveniles, and adults) feed primarily on small fishes, including round herring (*Etrumeus teres*), Atlantic menhaden, alewive, anchovies, false pilchard (*Harengula clupeola*), and mullets (*Mugil* spp.). This species also preys upon shrimp, crabs, and squid (GMFMC and SAFMC 1985; Collette 2002).

EFH Designations—(SAFMC 1998) (**Figure A-24**)

- Larvae—The Gulf Stream is designated as EFH for this lifestage as it provides a mechanism for dispersal.

- **All Lifestages**—In the MAB and the SAB, designated EFH includes sandy shoals of capes and offshore bars, high profile rock bottom, and barrier island (ocean side) waters from the surf zone to the shelf break but only from the Gulf Stream wall shoreward. Additionally, all coastal inlets are designated as EFH.

HAPC Designations—Areas designated as HAPC for this species are located south of the Study Area (SAFMC 1998). The ASMFC has identified HAPC to include spawning grounds and areas where eggs and larvae develop, and estuaries as important habitat and nursery areas, respectively.[2]

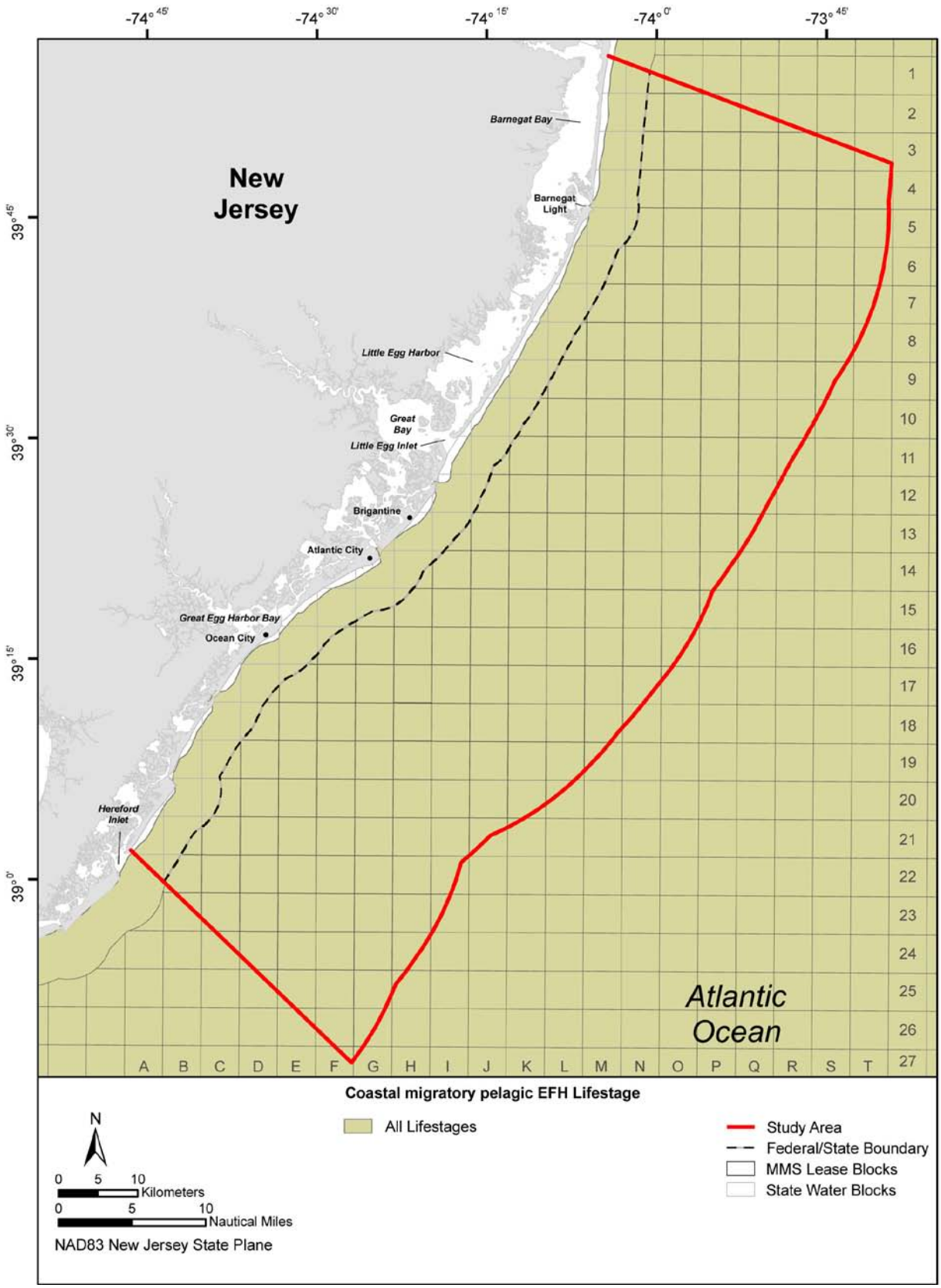

Figure A-24. Essential fish habitat designated in the New Jersey Study Area for all lifestages of coastal migratory pelagic species. Map adapted from: SAFMC (1998).

Highly Migratory Species

- **Albacore Tuna (*Thunnus alalunga*)**

Management—The albacore tuna is managed under the Tuna Management Unit (MU) through the Final Consolidated Atlantic HMS FMP (NMFS 2006a).

Status—This species consists of three separate stocks, the north and south Atlantic stocks and a Mediterranean stock (NMFS 2003). The Atlantic stocks are separated at 5° N with no evidence of mixing occurring between the two stocks (NMFS 1999b). According to the current NMFS stock assessment and fishery evaluation reports (NMFS 2009d), the north Atlantic stock is overfished with overfishing occurring; whereas the south Atlantic stock is not overfished and overfishing is not occurring.[3] The north Atlantic stock is listed by the 2009 IUCN Red List as vulnerable or facing a high risk of extinction in the wild,[6] however, the south Atlantic stock is classified as critically endangered or facing an extremely high risk of extinction in the wild.[7]

Distribution—Albacore tuna are distributed worldwide in temperate and subtropical waters of the Atlantic, Indian, and Pacific oceans (Gusey 1981; Collette and Nauen 1983). In the western Atlantic Ocean, this species occurs from New England to southern Brazil. Although widespread in the Caribbean Sea and off the coast of Venezuela, this species is absent from the Gulf of Mexico and the Straits of Florida. In the western Atlantic Ocean, the albacore ranges from 40°N to 45°N, to 40°S (Santiago and Arrizabalaga 2005).

Habitat Associations—The albacore tuna is an epipelagic and mesopelagic species that is typically found in waters with a temperature range of 15.6° to 19.4°C and in areas around thermal discontinuities, such as ocean fronts (NMFS 2006a). In the Atlantic Ocean, typically larger albacore tuna are found in cooler, deeper waters (up to 600 m) and can tolerate a wider temperature range (13.5° to 25.2°C) than younger, smaller individuals. Schools typically associate with other tuna species (skipjack, yellowfin, and bluefin) and floating objects, including *Sargassum* mats (Collette and Nauen 1983; NMFS 1999b; NMFS 2006a).

Life History—Albacore tuna undergo extensive seasonal horizontal movements (north to south and transoceanic migrations). In the western Atlantic Ocean, populations above 25°N migrate north starting in November, while those south of this region remain throughout the fall and winter in the warm waters of the eastern Caribbean and western tropical Atlantic (Gusey 1981). Albacore tuna also tend to aggregate near temperature discontinuities and migrate with water masses; however, they do not seem to cross temperature and oxygen gradient boundaries (Gusey 1981; Collette and Nauen 1983; NMFS 1999b; NMFS 2006a). This species spawns in the spring and summer in the western tropical Atlantic (NMFS 1999b; NMFS 2006a). They are assumed to spawn in waters around the Sargasso Sea and adjacent waters (Santiago and Arrizabalaga 2005).

Forage Species—Albacore tuna, as other tuna, are considered opportunistic feeders that prey on a diversity of fishes and invertebrates (NMFS 1999b; NMFS 2006a). Consoli et al. (2008) assessed feeding habits of the albacore tuna in the Mediterranean and found that this species was a top pelagic predator that consumed primarily medium-sized fish and secondarily cephalopods.

EFH Designations (NMFS 2009a; NMFS 2009b) [8] (**Figure A-25**)

- Spawning, eggs, and larvae—Currently, available information is insufficient for the identification of EFH for this lifestage within the U.S. EEZ.

- Juveniles (<90 cm [35.4 in.] fork length [FL])—EFH is designated as offshore waters along the Atlantic east coast from north of Cape Hatteras, North Carolina to Cape Cod, Massachusetts and along the mid-east coast of Florida.

- **Adults** (≥90 cm [35.4 in.] FL)—EFH is designated as offshore waters along the Atlantic east coast from North Carolina, south of Cape Hatteras to Cape Cod, Massachusetts, mid-east coast of Florida, central Gulf of Mexico, and Puerto Rico.

HAPC Designations—No HAPC are identified for this species.

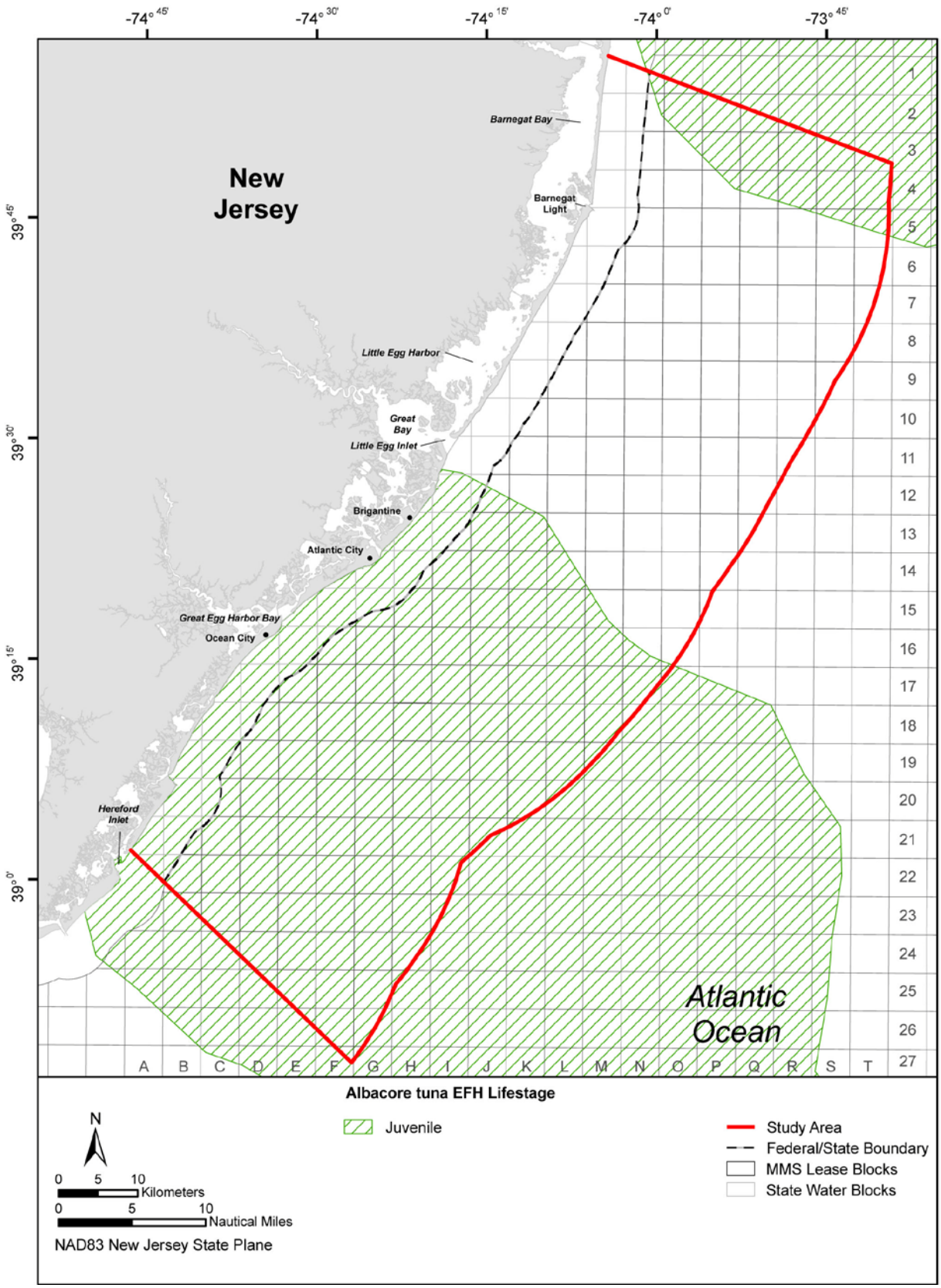

Figure A-25. Essential fish habitat designated in the New Jersey Study Area for juvenile lifestage of albacore tuna. Source data: NMFS (2009i).[8]

- **Atlantic Angel Shark (*Squatina dumeril*)**

Management—Atlantic angel shark is managed under the Prohibited Species MU through the Final Consolidated Atlantic HMS FMP (NMFS 2006a).

Status—The NMFS (1999b; 2006a) prohibits possession of this species as a precautionary measure due to the lack of biological data and its high susceptibly to exploitation. The 2009 IUCN Red List designates the Atlantic angel shark as data deficient to properly assess the population (Heupel and Carlson 2006).[9]

Distribution—Atlantic angel sharks inhabit temperate and subtropical waters in the northwestern Atlantic from Massachusetts to Florida Keys, the Gulf of Mexico, and the Caribbean Sea. It is common in the MAB from southern New England to the Maryland coast (Castro 1983).

Habitat Associations—This demersal shark species buries itself in the sand or mud in shallow waters of the northern part of its range, while in the southern part of its range, it inhabits deeper waters (up to 1,390 m [4,560.6 ft]) off the continental shelf (Castro 1983; Compagno 1984a).

Life History—This shark appears seasonally in shallow water, moving inshore in the spring and summer. Its winter grounds are not known as it disappears from shallow waters, presumably retreating to deeper water for the duration of winter (Castro 1983). It gives birth to live young (up to 16 pups in 1 litter) in the spring or early summer (Castro 1983). This species has a biennial reproductive cycle with gestation period of approximately 10 months (Baremore and Carlson 2004).

Forage Species—Atlantic angel shark is a demersal feeder, which often feeds on fishes, crustaceans, and bivalves (Compagno 1984a). Baremore et al. (2010) reported teleost fishes, especially Atlantic croaker (*Micropogonias undulates*), butterfish, and goatfishes (Mullidae) were most important prey items along with *Loligo* squid, mantis shrimp (*Lysosquilla* sp.), brown rock shrimp (*Sicyonia brevirostris*), and portunid crabs (Portunidae).

EFH Designations—(NMFS 2009a; NMFS 2009b) [8] (**Figure A-26**)

- <u>Neonate/Young-of-the-Year (YOY)</u> (≤31 cm [12.2 in.] Total Length [TL])— Currently, insufficient data is available to determine EFH for this lifestage.

- **<u>Juveniles and Adults</u>**—EFH is designated along the Atlantic coast from Cape Lookout, North Carolina to the mid-coast of New Jersey, localized areas off of eastern Louisiana, and from Mississippi to the Florida Panhandle in the Gulf of Mexico.

HAPC Designations—There are no HAPC identified for this species.

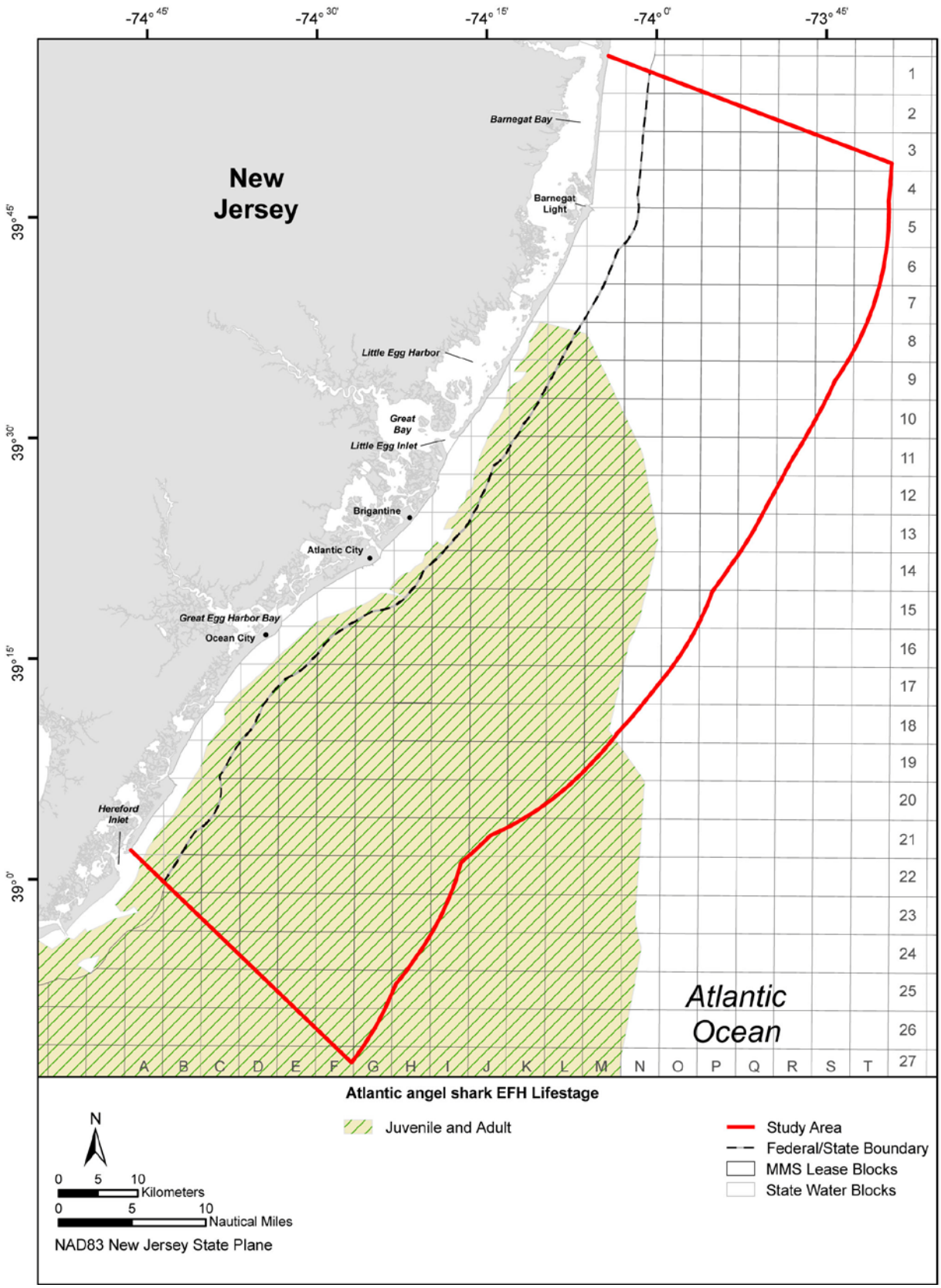

Figure A-26. Essential fish habitat designated in the New Jersey Study Area for juvenile and adult lifestages of Atlantic angel sharks. Source data: NMFS (2009).[8]

- **Blue Shark (*Prionace glauca*)**

Management—Blue shark is managed under the Pelagic Shark MU through the Final Consolidated Atlantic HMS FMP (NMFS 2006a).

Status—Currently, it is unknown whether blue shark is overfished or if overfishing is occurring (NMFS 2009d). Numerically, the blue shark is the top non-target species captured by the U.S. Atlantic pelagic longline fleet which may make it more vulnerable to overfishing (Beerkircher et al. 2002). Catch rate information from the North Atlantic suggests that this species may be declining (Campana et al. 2006; Aires-da-Silva et al. 2008). The 2009 IUCN Red List designates blue shark as lower risk/near threatened or likely to qualify for a threatened future in the near future.[10]

Distribution—Blue sharks have a world-wide distribution and are considered the widest-ranging shark species (Compagno 1984b). Even though its range extends into the tropics, it is commonly found in deeper, more temperate waters (Ferrari and Ferrari 2002). In the northwestern Atlantic, this shark is found from Newfoundland, Canada south to Argentina, South America (Compagno 1984b). There are no records of this shark in the Gulf of Mexico (Castro 1983).

Habitat Associations—Blue sharks inhabit waters from the surface to depths up to 600 m (1, 969 ft) (Nakano and Stevens 2008) and although this species is oceanic, it occasionally occurs close to shore at night or in areas where the continental shelf is narrow (Castro 1983; Compagno 1984b; Cooper 1999). This shark is also epipelagic being found in large aggregations close to the surface in temperate waters. It prefers relatively cool water, from 7° to 16°C (44.6° to 60.8°F) but can tolerate water as warm as 21°C (69.8°F) (Cooper 1999; NMFS 1999b; NMFS 2006a).

Life History—Little is known about the reproductive locations of this species in the Atlantic, but mating is believed to occur in late May and early June on the continental shelf off New England (Branstetter and Burgess 2002b). This species has a gestation period of 12 months producing a litter of 28 to 54 pups (Pratt 1979). Blue shark nurseries are believed to occur in the open oceanic waters of higher latitudes of their range (NMFS 1999b; NMFS 2006a). Blue sharks have complex migratory patterns related to reproduction and the distribution of prey that generally encompasses great distances. Castro (1983) reported a population of northwest Atlantic blue sharks migrating to northeastern South America, whereas Queiroz et al. (2005) found that 82% of tagged blue sharks in the northeast Atlantic traveled less than 1,000 km (539.6 NM) while the remaining 18 percent traveled longer distances to northwest Africa, central Atlantic, and the Bay of Biscay. In addition, its north-south movements seemed to be related to seasonal sea surface temperature (SST) variation. Kohler and Turner (2008) also reported that tagging studies demonstrated extensive movements in the Atlantic with numerous trans-Atlantic migrations, which were probably accomplished by swimming more slowly and utilizing the major current systems.

Forage Species—Blue sharks feed on small pelagic fishes (herrings, sardines, skates, lancetfish [*Alepisaurus* spp.], cod, bluefish, scup, butterfish, mackerel, and yellowtail flounder), invertebrates (squid, cuttlefish, and octopus), and seabirds, as well as scavenging on cetaceans (possibly as carrion) (Cooper 1999; Nakano and Stevens 2008). In the mid-Atlantic, squid are the primary component of the blue shark's diet (Branstetter and Burgess 2002b).

EFH Designations—(NMFS 2009a; NMFS 2009b) [8] (**Figure A-27**)

- Neonate (≤90 cm [35.4 in.] TL)—Designated EFH includes areas in the Atlantic Ocean off of New Jersey through Cape Cod, Massachusetts.

- **Juveniles** (91 to 220 cm [35.8 to 86.6 in.] TL)—Designated EFH includes localized areas in the Atlantic Ocean off the mid-coast of Florida, South Carolina, and the Gulf of Maine, and from Cape Hatteras, North Carolina to New England.

- **Adults** (≥221 cm [87 in.] TL)—Designated EFH includes localized areas in the Atlantic Ocean off Florida and Georgia and from South Carolina to the Gulf of Maine as well as localized areas off Puerto Rico and the U.S. Virgin Islands.

HAPC Designations—There are no HAPC identified for this species.

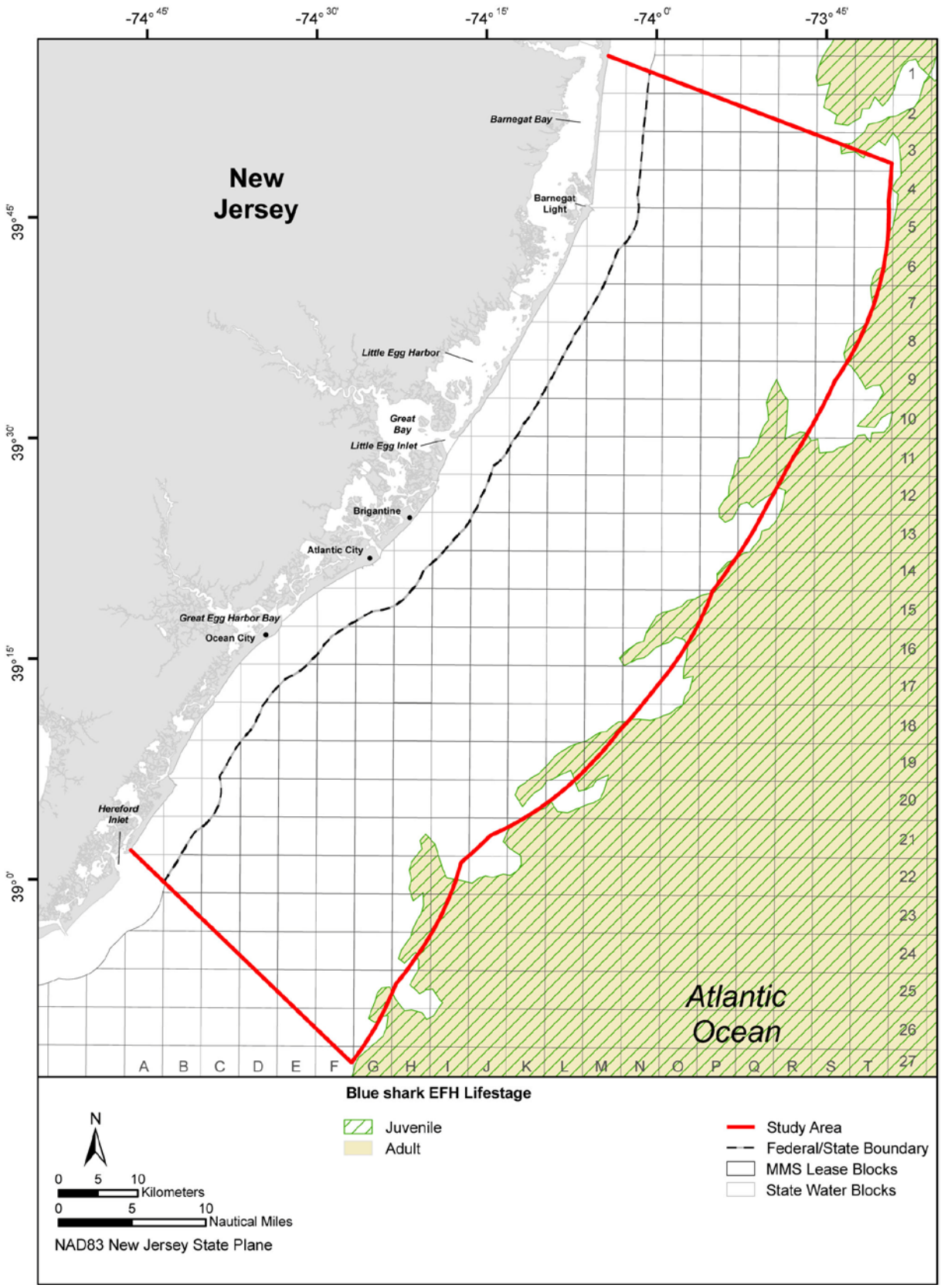

Figure A-27. Essential fish habitat designated in the New Jersey Study Area for all lifestages of blue sharks. Source data: NMFS (2009).[8]

- **Bluefin Tuna (*Thunnus thynnus*)**

Management—Bluefin tuna is managed under the Tuna MU through the Final Consolidated Atlantic HMS FMP (NMFS 2006a). They are managed as distinct western and eastern stocks separated by a management boundary at the 45°W meridian (Collette and Nauen 1983).

Status—Bluefin tuna are classified as overfished and overfishing is occurring (NMFS 2009d).[3] The 2009 IUCN Red List classifies bluefin tuna (western Atlantic stock) as data deficient to properly assess the population;[11] however, the eastern Atlantic stock (*T. maccoyii*) is classified as critically endangered or facing an extremely high risk of extinction in the wild.[12]

Distribution—Bluefin tuna have a world-wide distribution in tropical and temperate waters, from Argentina and South Africa north to Labrador and northern Scandinavia in the Atlantic Ocean, including the Gulf of Mexico and the Caribbean Sea (Schultz 2004). In the western North Atlantic Ocean, bluefin tuna range from 0°N to 45°N, but have been reported as far north as 55°N (Collette and Nauen 1983; Vinnichenko 1996; NMFS 1999b; NMFS 2006a).

Habitat Associations—This species can tolerate a considerable range of temperatures and has been observed to depths greater than 1,000 m (3,281 ft) (Block et al. 2001). Although bluefin tuna are epipelagic and usually oceanic, they often occur over continental shelf waters and in embayments during the summer months (Collette 2002). Fertilized eggs are buoyant (Collette 2002). Larvae are believed to associate with Gulf Stream along the continental shelf in regions of upwelling (NMFS 1999b; NMFS 2006a) which, together with upwelling nutrients, provide an area favorable for maximum growth and retention of food (McGowan and Richards 1989). Larvae have been confirmed from the Gulf of Mexico (NMFS 2009a) and have been found as far north as the Carolinas (McGowan and Richards 1989). Juveniles typically inhabit regions off the continental shelf, from North Carolina to Rhode Island, in waters with depths less than 40 m (131 ft) and temperatures greater than 20°C (68°F) in the summer (June and July) (Schuck 1982; Brill et al. 2002). Juveniles, along the continental shelf, utilize the entire water column including the benthic habitat but spend the majority of their time near the surface (Brill et al. 2002). Bluefin tuna are often found in mixed schools with skipjack tuna, consisting of similarly sized individuals. Larger individuals move into higher latitudes than do smaller fish (NMFS 2009a).

Life History—The western North Atlantic bluefin tuna spawns from mid-April to mid-June in the Gulf of Mexico, the Florida Straits, western edge of the Bahamas Banks, and along the eastern portion of the Florida current at temperatures of 24.9° to 29.5°C (76.8° to 85.1°F) (Gusey 1981; Collette and Nauen 1983; NMFS 1999b; Block et al. 2005). The Gulf of Mexico spawning site is considered the primary spawning area of the northwest Atlantic stock (Mather et al. 1995; Block et al. 2001). Presumed breeding bluefin tuna prefer continental slope waters with moderate SST, eddy kinetic energy, and wind speeds and low surface chlorophyll concentrations (Teo et al. 2007).

The adult bluefin tuna moves seasonally from offshore spawning grounds in the Gulf of Mexico through the Straits of Florida to waters overlying the continental shelf, slope, and Gulf Stream waters of the SAB, MAB, the Gulf of Maine, and the Nova Scotia shelf (Block et al. 2005). By early spring and summer, they move to their inshore seasonal feeding grounds along the New England continental shelf (Jeffreys Ledge, Stellwagen Bank, Cape Cod Bay, Great South Channel, and south of Martha's Vineyard) (Gusey 1981; Schuck 1982; Block et al. 2001; Chase 2002). Wilson and Block (2009) identified the following key potential North Atlantic foraging habitats: northwest Atlantic (Gulf of Maine/Scotian Shelf, Grand Banks, and Flemish Cap), off Florida and in the Bahamas, and northeast Atlantic.

Data on the southerly three-way movements of adults from these feeding areas to wintering areas and back to breeding areas (Gulf of Mexico/Florida Straits) are limited. It has been postulated that juveniles have a shorter two-way movement from feeding to wintering areas (Mather et al. 1995; Chase 2002). Recently, mixed-stocked analysis indicated that approximately 60 percent of the adult bluefin tuna collected in foraging areas of the U.S. Atlantic Ocean originated from the eastern

nursery, suggesting that substantial trans-Atlantic movement of adults occur from east to west (Rooker et al. 2007).

Forage Species—Bluefin tuna larvae feed upon zooplankton and other larval fishes (McGowan and Richards 1989). Adults are opportunistic feeders preying upon variety of schooling fishes (anchovies, sauries [Scomberessocidae], and hakes), pelagic crustaceans, cephalopods, and benthic invertebrates including the following: silver hake, Atlantic mackerel, Atlantic herring, krill, sand lance, and squid (Schuck 1982; NMFS 1999b; Estrada et al. 2005; NMFS 2006a; Butler et al. 2010).

EFH Designations—(NMFS 2009a; NMFS 2009b)[8] (**Figure A-28**)

- Spawning, Eggs, and Larvae—Designated EFH includes the Gulf of Mexico from the 100 m (328.1 ft) contour to the EEZ, continuing to the mid-east coast of Florida.

- **Juveniles** (<231 cm [90.9 in.] FL)—Designated EFH includes the waters of North Carolina, south of Cape Hatteras to Cape Cod, Massachusetts.

- Adults (>231 cm [90.9 in.] FL)—Designated EFH are includes the pelagic waters of the central Gulf of Mexico, mid-east coast of Florida, North Carolina from Cape Lookout to Cape Hatteras, North Carolina and New England from Connecticut to the mid-coast of Maine.

HAPC Designations—Areas designated as HAPC for this species are located south of the Study Area in the Gulf of Mexico (NMFS 2009c).

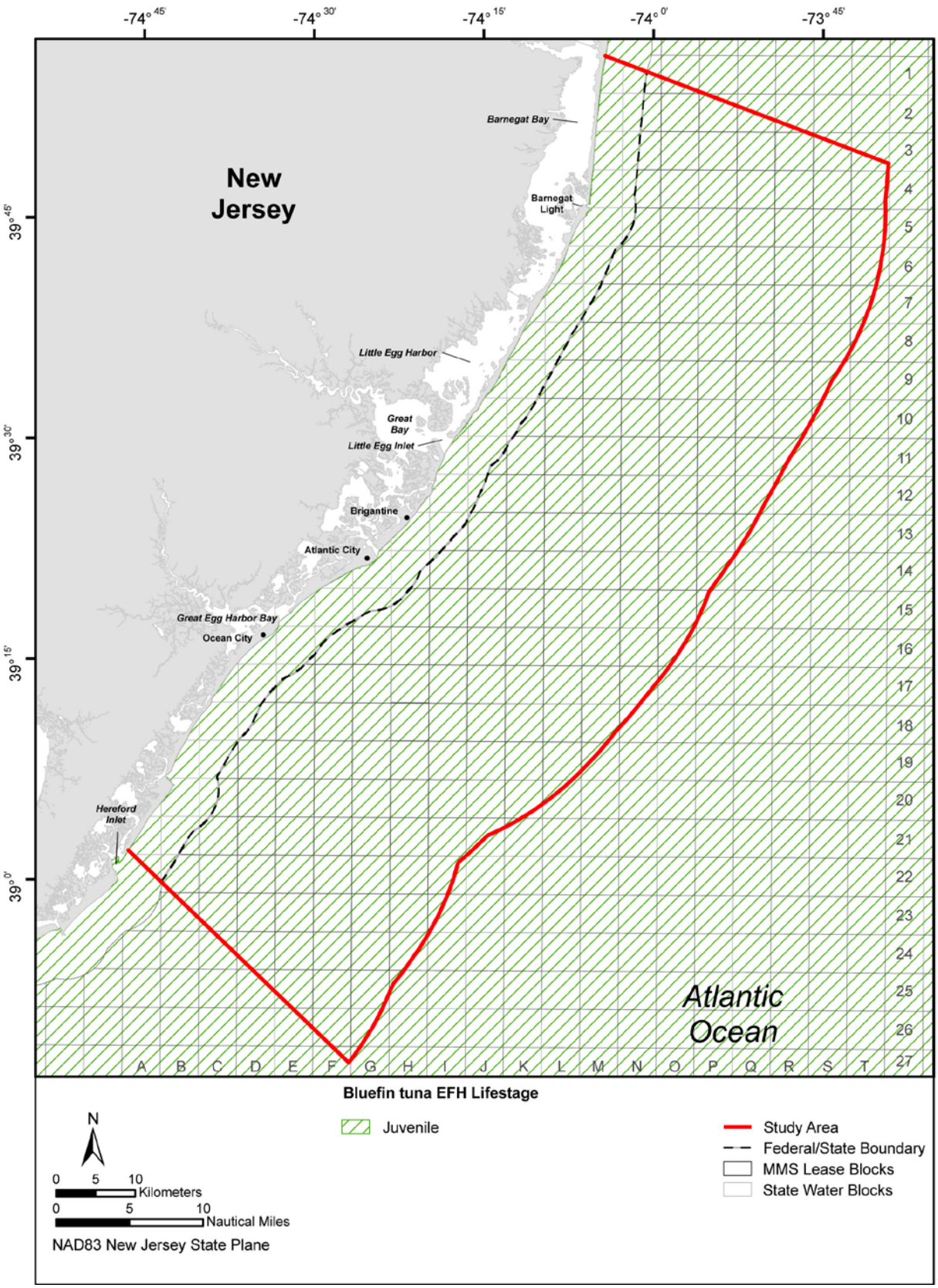

Figure A-28. Essential fish habitat designated in the New Jersey Study Area for juvenile lifestage of bluefin tuna. Source data: NMFS (2009).[8]

- **Dusky Shark (*Carcharhinus obscurus*)**

Management—Dusky shark is managed under the Prohibited Species MU through the Final Consolidated Atlantic HMS FMP (NMFS 2006a).

Status—Currently, dusky shark is classified as overfished and overfishing is occurring (NMFS 2009d).[3] This species is often taken as bycatch in both bottom and pelagic longline fisheries making vulnerable to overfishing (NMFS 2009a). Dusky sharks are listed as a prohibited species to assist with rebuilding the population status. Under the Endangered Species Act (ESA) classification system, dusky shark are currently identified as a species of concern (formerly a candidate species) by NMFS (2004; 2006b). The 2009 IUCN Red List classifies dusky shark (Northwest Atlantic and Gulf of Mexico subpopulation) as vulnerable or facing a high risk of extinction in the wild in the medium-term future.[13]

Distribution—Dusky sharks are wide-ranging. They are distributed in warm-temperate and tropical continental waters throughout the world and can be found in the western North Atlantic Ocean from southern Massachusetts and the Georges Bank southward to the northern Caribbean Sea and Gulf of Mexico to Nicaragua and southern Brazil (Compagno 1984b; Castro 1993).

Habitat Associations—Dusky sharks are coastal pelagics found from the surf zone to offshore waters. They are found from surface waters to depths of 400 m (1,312 ft) (Compagno 1984b; Branstetter and Burgess 2002b). Major nursery areas have been identified in coastal waters from South Carolina coast to Massachusetts (Castro 1993; McCandless et al. 2002).

Life History—In the western North Atlantic Ocean, dusky shark mating occurs in the spring and birth to live young is from late winter to summer (Compagno 1984b). In Bulls Bay, North Carolina, dusky sharks typically give birth from April to May, while in the Chesapeake Bay it occurs in June and July (Castro 1993). Females mate in alternate years as a result of their long gestation period (9 to 16 months) (Compagno 1984b). It is believed that the dusky shark has a gestation period of about 16 months (NMFS 2009a). They produce a litter of six to 14 pups (Castro 1983). The dusky shark undertakes long seasonal, temperature-related migrations. On both coasts of the U.S., this species migrates northward in summer as the waters warm and retreats southward in fall as water temperatures decline (Compagno 1984b; NMFS 2003).

Forage Species—Dusky sharks feed on bony fish (eels, Atlantic menhaden, herring, anchovies, hakes, goosefish, black sea bass, scup, croakers, bluefish, sand lance, mackerels, tunas, and flatfish species), other sharks, crustaceans, and squid (Branstetter and Burgess 2002b).

EFH Designations—(NMFS 2009a; NMFS 2009b) [8] (**Figure A-29**)

- **<u>Neonate/Young-of-the Year (YOY)</u>** (<121 cm [47.6 in.] FL)—Designated EFH includes areas along the Atlantic east coast of Florida to the mid-coast of Georgia and South Carolina to southern Cape Cod, Massachusetts.

- **<u>Juveniles and Adults</u>**—Designated EFH includes localized areas in the central Gulf of Mexico, southern Texas, the Florida Panhandle, the mid-west coast of Florida, and the Florida Keys and localized areas along the Atlantic coast of Florida and South Carolina to southern Cape Cod, Massachusetts.

HAPC Designations—There are no HAPC identified for this species.

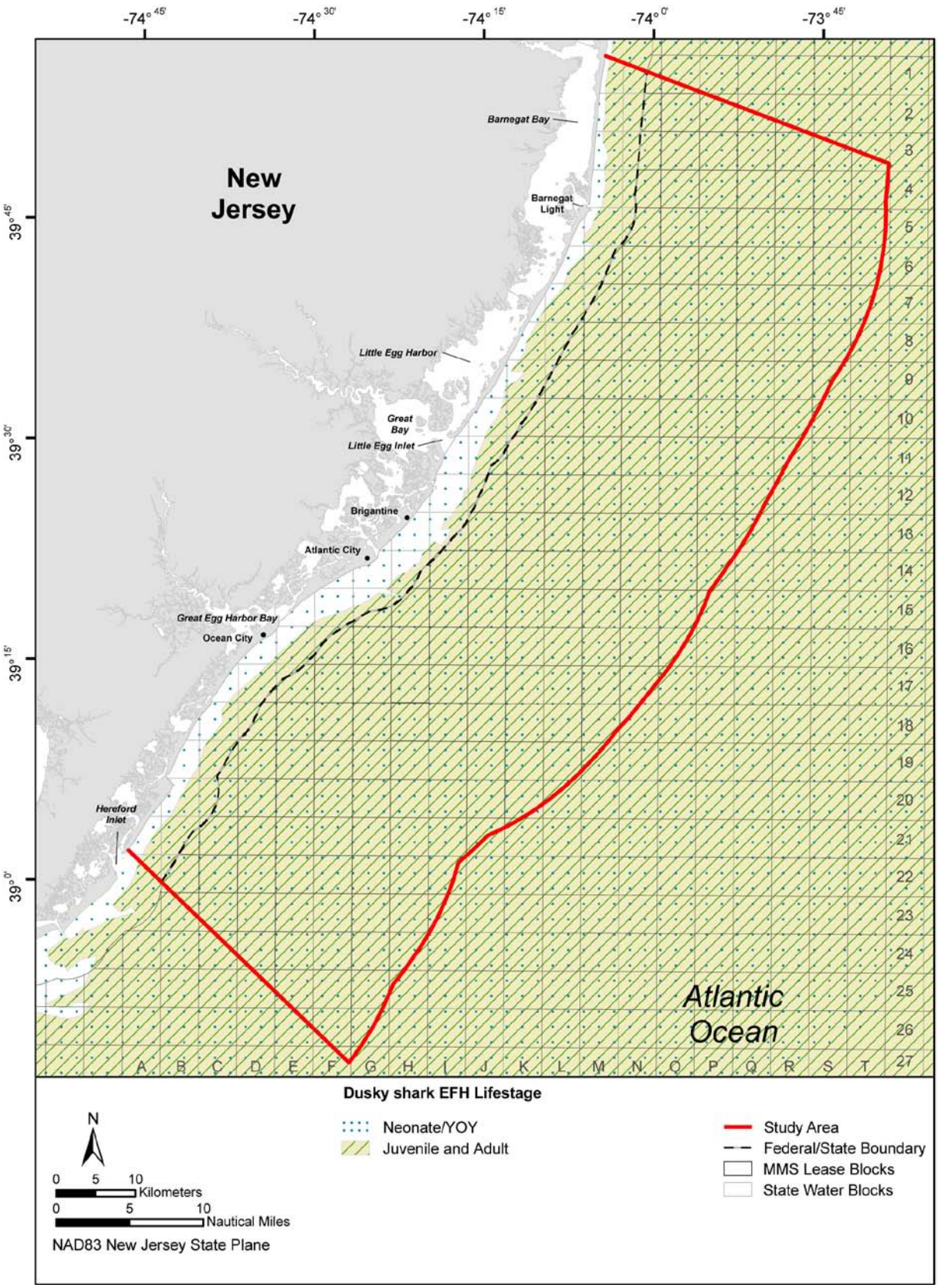

Figure A-29. Essential fish habitat designated in the New Jersey Study Area for all lifestages of dusky sharks. Source data: NMFS (2009).[8]

- **Longbill spearfish (*Tetrapturus pfluegeri*)**

Management—The longbill spearfish is managed under the Billfish MU through the Final Consolidated Atlantic HMS FMP (NMFS 2006a).

Status—This species is neither overfished nor subject to overfishing (NMFS 2009d). The longbill spearfish is not a target species, and retention is prohibited in the U.S. EEZ when it is taken as bycatch of the tuna and swordfish longline fisheries (NMFS 2009a).

Distribution—The longbill spearfish ranges from 40 °N to 35 °S in the Atlantic and occurs in the western Atlantic Ocean from Georges Bank south through the Gulf of Mexico to Brazil (Manooch III 1988; NMFS 1999a).

Habitat Associations—Little is known about the habitat associations of this species (Nakamura 1985; de Sylva and Breder 1997). Longbill spearfish are an epipelagic, oceanic species usually inhabiting waters above the thermocline and are found further offshore than other billfish species (Nakamura 1985). Larvae have been collected near the mid-Atlantic Ridge from December to February, and in the Caribbean (NMFS 1999a).

Life History—Few data exist on reproductive behavior or locations for this species, but spawning is thought to occur in widespread areas in the tropical and subtropical Atlantic Ocean (Nakamura 1985), well offshore, from November through May (Manooch III 1988; de Sylva and Breder 1997).

Forage Species—Longbill spearfish, which are surface feeders, prey primarily on pelagic fishes (anchovy and dolphinfish [*Coryphaena* spp.]) and squid (NMFS 1999a). Feeding occurs during both daylight and night hours, and it is not known if this species uses its bill to aid in capturing prey (Manooch III 1988).

EFH Designations—(NMFS 2009a; NMFS 2009b) [8] (**Figure A-30**)

- Spawning, Eggs, and Larvae—Currently, insufficient data is available to determine EFH for these lifestages.

- **Juveniles/Subadults and Adults**—Designated EFH includes the central Gulf of Mexico through eastern Louisiana to the Florida Panhandle, the Atlantic Ocean from the Florida Keys to the mid-east coast of Florida and localized areas from northern Florida to Cape Cod, Massachusetts, with concentration from North Carolina to Delaware, and Puerto Rico to the Virgin Islands.

HAPC Designations—No HAPC are identified for this species.

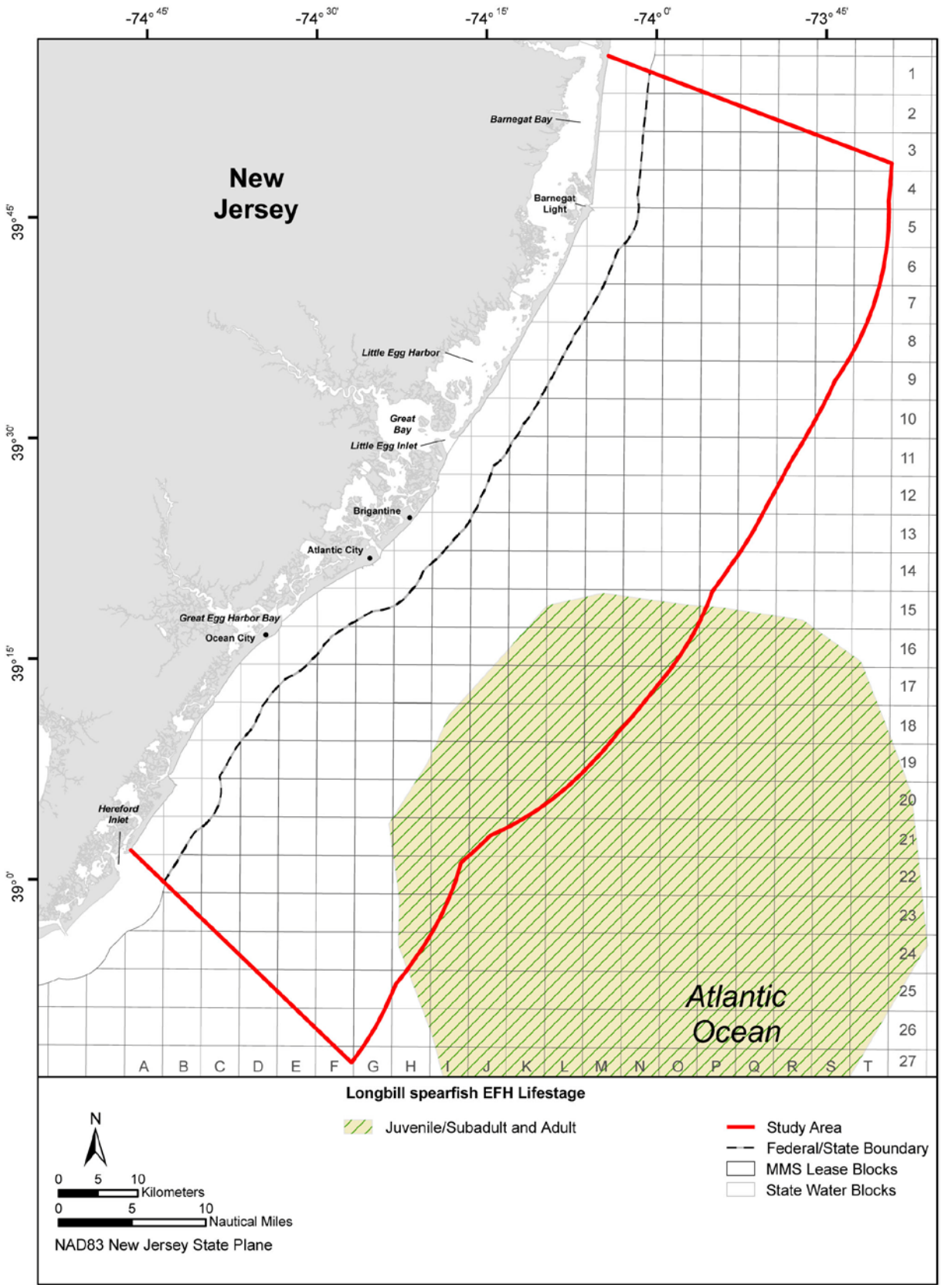

Figure A-30. Essential fish habitat designated in the New Jersey Study Area for juvenile and adult lifestages of longbill spearfish. Source data: NMFS (2009).[8]

- **Sand Tiger Shark (*Carcharias taurus*)**

Management—Sand tiger shark is managed under the Prohibited Species MU through the Final Consolidated Atlantic HMS FMP (NMFS 2006a).

Status—The sand tiger shark does not have an overfished status nor is it subject to overfishing (NMFS 2009d). However, this species is extremely vulnerable to overfishing because it congregates in coastal areas in large numbers during mating season (NMFS 2009d). The sand tiger shark receives full protection from harvest on the Atlantic coast. In 1997, NMFS prohibited possession of this species in U.S. Atlantic waters (NMFS 2008a). Under the ESA classification system, the Atlantic and Gulf of Mexico populations of the sand tiger shark are currently identified as a species of concern (formerly a candidate species) by NMFS (2004; 2006b). The 2009 IUCN Red List classifies sand tiger shark as vulnerable or facing a high risk of extinction in the wild in the medium-term future.[14]

Distribution—Sand tiger sharks are known to have broad inshore distribution in tropical and warm-temperate waters throughout the world but are nonexistent in the eastern Pacific Ocean (Castro 1983; Branstetter and Burgess 2002a). In the western Atlantic, the sand tiger shark occurs from the Gulf of Maine to Florida, the northern Gulf of Mexico, the Bahamas, and Bermuda and southward to Argentina (Castro 1983; Compagno 1984a). In warmer months, this species is common from Cape Cod, Massachusetts to Delaware Bay (Castro 1983).

Habitat Associations—Sand tiger sharks are demersal sharks primarily found in shallow bays (4 m [13.1 ft]) and around coral or rocky reefs (depths <20 m [65.6 ft]) but also are found to depths to 191 m (627 ft) over the continental shelf (Castro 1983; Compagno 1984a; NMFS 1999b; Branstetter and Burgess 2002a). Neonate and juvenile sand tiger sharks utilize estuarine waters as nurseries from Massachusetts to South Carolina including Narrangansett Bay, Rhode Island and Sandy Hook, New Jersey and Delaware and Chesapeake bays, north and south of the Study Area (McCandless et al. 2002; NMFS 2006a). Mature sand tiger males and juveniles occur between Cape Cod, Massachusetts and Cape Hatteras, North Carolina, while mature and pregnant females inhabit the more southern waters between Cape Hatteras and Florida (Gilmore 1993).

Life History—Sand tiger sharks have an extremely limited reproductive potential, producing only two litter per year (NMFS 2009a). This species mates in the winter and spring with parturition believed to occur in winter (late October to end of November) in the southern portion of its range (NMFS 1999b; Branstetter and Burgess 2002a). In Florida, sand tiger sharks are born from November to February (Castro 1983), whereas Lucifora et al. (2002) reported in North America they gave birth in March and April. Sand tiger sharks are migratory in the northern portion of its range moving northward and inshore during the summer to nurseries and south to deeper waters in the fall and winter (Castro 1983; Compagno 1984a).

Forage Species—Sand tiger sharks are a generalized feeder, consuming a variety of teleost and elasmobranch prey (Gelsleichter et al. 1999). They feed primarily on fishes (skates, goosefish, searobins, scup, spot, bluefish, and butterfish), specifically summer flounder, as well as invertebrates (lobster, crab, and squid) (Branstetter and Burgess 2002a).

EFH Designations—(NMFS 2009a; NMFS 2009b) [8] (**Figure A-31**)

- **<u>Neonate/YOY</u>** (≤129 cm [50.8 in.] TL)—Designated EFH includes areas along the Atlantic east coast from northern Florida to Cape Cod, Massachusetts.

- **<u>Juveniles</u>** (130 to 229 cm [51.2 to 90.2 in.] TL)—Designated EFH includes localized areas along the mid-east coast of Florida and South Carolina and from North Carolina to the mid-New Jersey coast in the Atlantic.

- **Adults** (≥230 cm [90.6 in.] TL)—Designated EFH includes localized areas along the mid and northern east coast of Florida, South Carolina, and southern North Carolina, and from Cape Lookout, North Carolina to Southern New Jersey in the Atlantic.

HAPC Designations—There are no HAPC identified for this species.

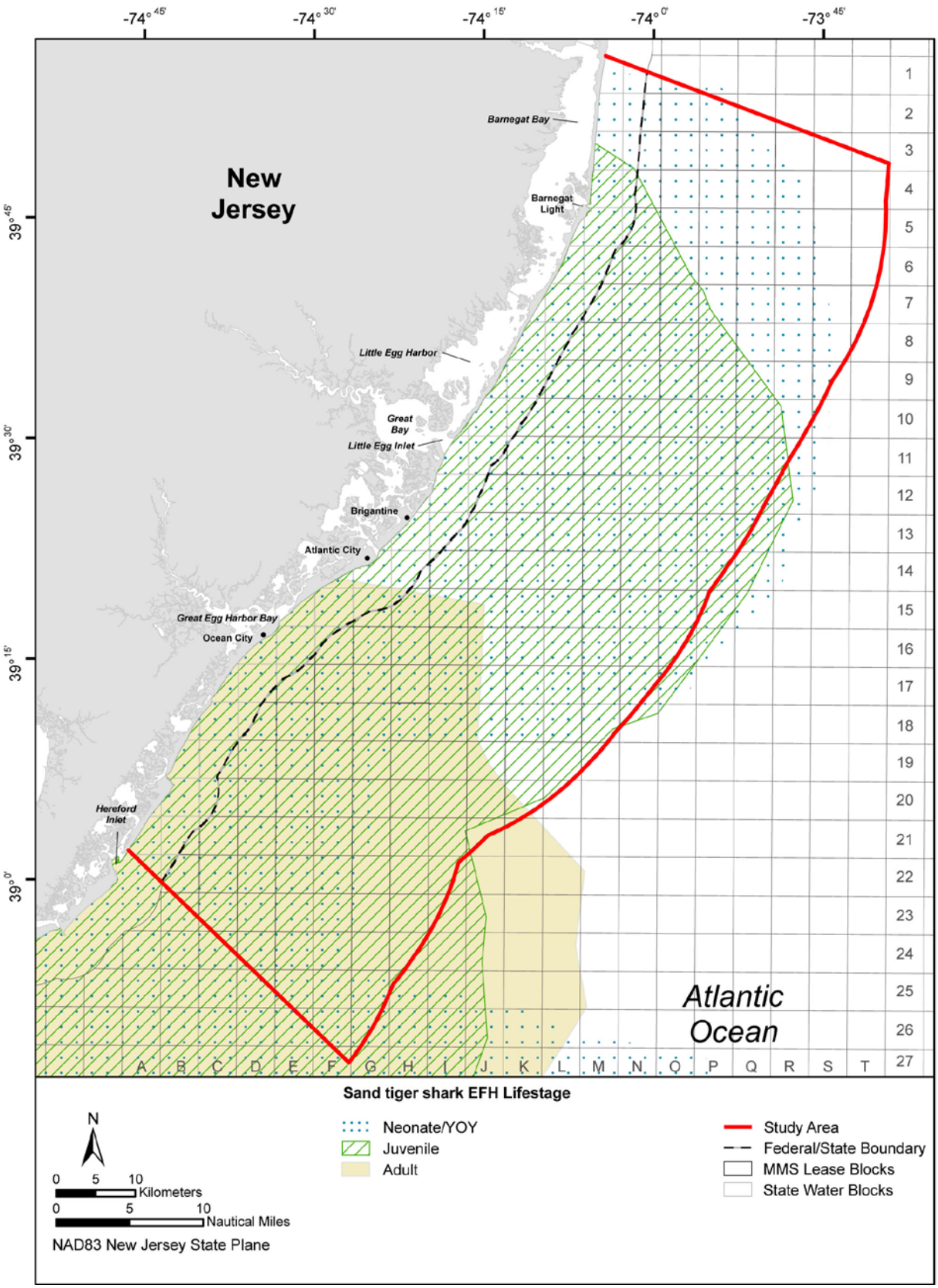

Figure A-31. Essential fish habitat designated in the New Jersey Study Area for all lifestages of sand tiger sharks. Source data: NMFS (2009).[8]

- **Sandbar Shark (*Carcharhinus plumbeus*)**

Management—Sandbar shark is managed under the Large Coastal Shark MU through the Final Consolidated Atlantic HMS FMP (NMFS 2006a).

Status—Sandbar sharks are overfished and are subject to overfishing (NMFS 2009d).[3] It is considered highly vulnerable to overfishing because of its slow maturation and heavy fishing pressure, as evidenced in the catch-per-unit-effort (CPUE) declines in U.S. fisheries (NMFS 2009a). With the implementation of Amendment 2 to Consolidated HMS FMP (NMFS 2008b), the fishing mortality on sandbar sharks was greatly reduced by prohibiting this species from retention in recreational fishery and only allowing directed fishing under the auspices of the shark research fishery. The 2009 IUCN Red List classifies the northwest Atlantic stock as a lower risk/near threatened.[15]

Distribution—Sandbar sharks are cosmopolitan in distribution, found in shallow coastal waters from Cape Cod, Massachusetts, southward to Brazil, including the western Gulf of Mexico and Caribbean Sea but are most common from South Carolina to Florida and in the eastern Gulf of Mexico (Castro 1983; Branstetter and Burgess 2002b; Conrath and Musick 2007).

Habitat Associations—This bottom-dwelling species is found in warm temperate to subtropical waters over the continental shelf and in deep water adjacent to the shelf break. Sandbar sharks are found in water depths ranging from the intertidal zone to 280 m (919 ft) during migration, but are common in 20 to 53 m (65.6 to 174.0 ft) depths (Compagno 1984b; Knickle 1999a). Sandbar sharks avoid surf zones, coral reefs, or rough benthic substrates, preferring smooth substrates (Castro 1983; Compagno 1984b). It is common in inshore areas with mud or sand subtrates such as estuaries, river mouths, and harbors but does not enter freshwater (Compagno 1984b).

Life History—Sandbar shark is a slow-growing species, with about a one year gestation period and a biennial reproduction producing a litter of 1 to 14 pups (NMFS 2009a). This species is reported to make extensive seasonal migrations, where it moves to the northern part of its range in the summer and the southern part during the winter (Castro 1983). Seasonal temperature changes are the primary trigger for the migration; however, oceanographic features also influence this behavior (Compagno 1984b). Male sandbar sharks typically migrate earlier in the year and to deeper waters than females (Knickle 1999a). In the northwest Atlantic, mating occurs from May to June with young being born from March to August after a gestation period of approximately one year (Castro 1983; Knickle 1999a; NMFS 1999b). This species segregates by sex with large females dominating shallow, nursery areas from Martha's Vineyard, Massachusetts to Cape Canaveral, Florida, as well as the Gulf of Mexico (Castro 1983, 1993; McCandless et al. 2002). Great Bay, New Jersey, Delaware Bay, the Chesapeake Bay, and waters off Cape Hatteras, North Carolina are important primary and secondary nursery grounds in the mid-Atlantic (Branstetter and Burgess 2002b; McCandless et al. 2002). Primary nurseries are where parturition occurs and where neonate and young-of-the-year (YOY) sharks are present, whereas secondary nurseries are generally used by older sharks following departure from primary nurseries (McCandless et al. 2002).

Forage Species—Juvenile sandbars feed on blue crabs (*Callinectes sapidus*), mantis shrimp (*Squilla empusa*), Atlantic menhaden, summer flounder, and miscellaneous sciaenid fishes (Grubbs et al. 2005). Adults feed on benthic prey, such as finfishes (eels, skates, rays, and dogfish), invertebrates (squid, octopus, bivalves, shrimp, and crabs), and sea turtles as well as seabirds. They feed all day, but are most active at night (Knickle 1999a).

EFH Designations—(NMFS 2009a; NMFS 2009b) [8] (**Figure A-32**)

- **<u>Neonate/YOY</u>** (≤78 cm [30.7 in.] TL)—Designated EFH includes localized coastal areas on the Florida Panhandle, Atlantic coastal areas localized along Georgia and South Carolina, and from Cape Lookout, North Carolina to Long Island, New York.

- **Juveniles** (79 to 190 cm [31.1 to 74.8 in.] TL)—Designated EFH includes localized areas along the Atlantic coast of Florida, South Carolina, and south North Carolina, and from Cape Lookout, North Carolina to southern New England.

- **Adults** (≥191 cm [75.2 in.] TL)—Designated EFH includes a localized area off of Alabama and coastal areas from the Florida Panhandle to the Florida Keys in the Gulf of Mexico as well as Atlantic coastal areas throughout Florida to southern New England.

HAPC Designations—HAPC has been designated in shallow areas and at the mouth of Great Bay, New Jersey; lower and middle Delaware Bay, Delaware; lower Chesapeake Bay, Maryland; and near the Outer Banks, North Carolina, and in areas of Pamlico Sound and adjacent to Hatteras and Ocracoke islands (North Carolina) and offshore of these barrier islands, since they represent important nursery and pupping grounds (NMFS 2009a). A portion of Great Bay, New Jersey, HAPC extends within the boundaries of the Study Area, while the HAPC of middle and lower Delaware Bay is found south of the Study Area.

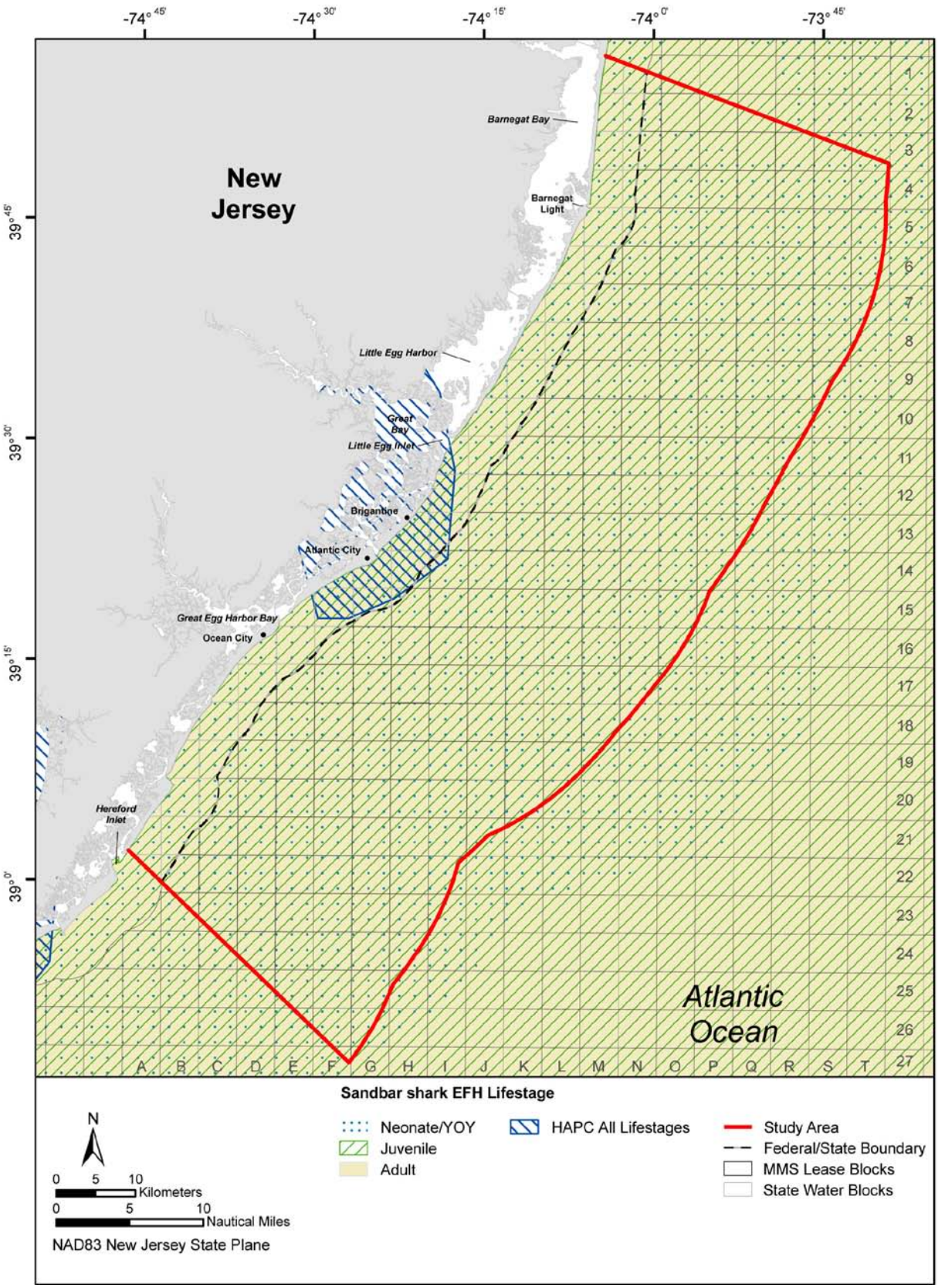

Figure A-32. Essential fish habitat and habitat areas of particular concern (HAPC) designated in the New Jersey Study Area for all lifestages of sandbar sharks. Source data: NMFS (2009).[8]

- **Scalloped Hammerhead (*Sphyrna lewini*)**

Management—Scalloped hammerhead shark is managed under the Large Coastal Shark MU through the Final Consolidated Atlantic HMS FMP (NMFS 2006a).

Status—Scalloped hammerhead shark is neither overfished nor subject to overfishing (NMFS 2009d). It considered vulnerable to overfishing because its schooling habit in coastal areas makes it extremely vulnerable to gillnet fisheries (Hayes et al. 2009; NMFS 2009a). Scalloped hammerheads have a high potential for exploitation due to their late age at maturity, relatively small reproductive output, and long lifespan characteristics (Piercy et al. 2007). The 2009 IUCN Red List classifies the scalloped hammerhead (Northwest and Western Central Atlantic subpopulation) as endangered.[16]

Distribution—Scalloped hammerheads are coastal and semi-oceanic pelagic species that occur in warm-temperate to tropical waters worldwide over the continental shelf and slope (Castro 1983; Compagno 1984b). In the western Atlantic, the scalloped hammerhead range extends from New Jersey to Uruguay, as well as the Gulf of Mexico and the Caribbean Sea (Bester 1999a).

Habitat Associations—Scalloped hammerheads are found from the surface to depths of 275 m (902 ft). It is found close to shore, in bays and estuaries, and prefers water temperatures of at least 22°C (71.6°F) (Castro 1983; Compagno 1984b). More recent work found this species occurred over a temperature range from 18° to 31°C (32.1° to 57.6°F) and a salinity range of 20 to 37 psu (NMFS 2009a). Typically, scalloped hammerhead sharks spend the day close to shore and move to deeper waters at night to feed (Bester 1999a). Tagging data indicates that scalloped hammerheads use offshore oceanic habitats, but do not regularly roam across large distance (Kohler and Turner 2001). Rather, individuals appear to disperse readily across continental shelves and utilize discrete coastal nursery areas (Duncan et al. 2006).

Life History—Scalloped hammerheads give birth once a year in the summer starting around June, in shallow coastal nurseries from Virginia to the Gulf of Mexico (Castro 1983; McCandless et al. 2002). Their reproductive cycle is annual (Castro 1983) with a gestation period of 9 to 10 months possibly extending to 12 months after which they produce a large litter (>30) (Castro 1983; Compagno 1984b; Branstetter 1987). Primary and secondary nursery areas have been identified south of Study Area in estuarine and nearshore waters along the southeast Atlantic coast (e.g., South Carolina) and in the Gulf of Mexico (McCandless et al. 2002). Important feeding areas include extensive sand-shell plain of Southeast Shoal, deeper waters of the Canaveral Bight, and shelf transition zone directly south of Canaveral Bight (Adams and Paperno 2007). This species forms large schools when it migrates seasonally north to south along the eastern U.S coast (NMFS 1999b; NMFS 2006a).

Forage Species—Scalloped hammerhead sharks consume a wide variety of small fishes (e.g., menhaden [*Brevoortia* spp.]), as well as invertebrates (shrimp) and have been reported feeding only at night (Compagno 1984b; Adams and Paperno 2007).

EFH Designations—(NMFS 2009a; NMFS 2009b) [8] (**Figure A-33**)

- <u>Neonate/YOY</u> (≤60 cm [23.6 in.] TL)—Designated EFH includes coastal areas in the Gulf of Mexico from Texas to the southern west coast of Florida and the mid-east coast of Florida to southern North Carolina along the Atlantic coast.

- **<u>Juveniles</u>** (61 to 179 cm [24.0 to 70.5 in.] TL)—Designated EFH includes coastal areas in the Gulf of Mexico from the southern to mid-coast of Texas, eastern Louisiana to the southern west coast of Florida, and Florida Keys, offshore areas from mid-coast of Texas to eastern Louisiana, and along the Atlantic east coast of Florida to New Jersey.

- **<u>Adults</u>** (≥180 [70.9 in.] TL)—Designated EFH includes coastal areas in the Gulf of Mexico along the southern coast of Texas and eastern Louisiana through the Florida Keys, off shore areas from

southern Texas to eastern Louisiana, and along the Atlantic coast of Florida to Long Island, New York.

HAPC Designations—There are no HAPC identified for this species.

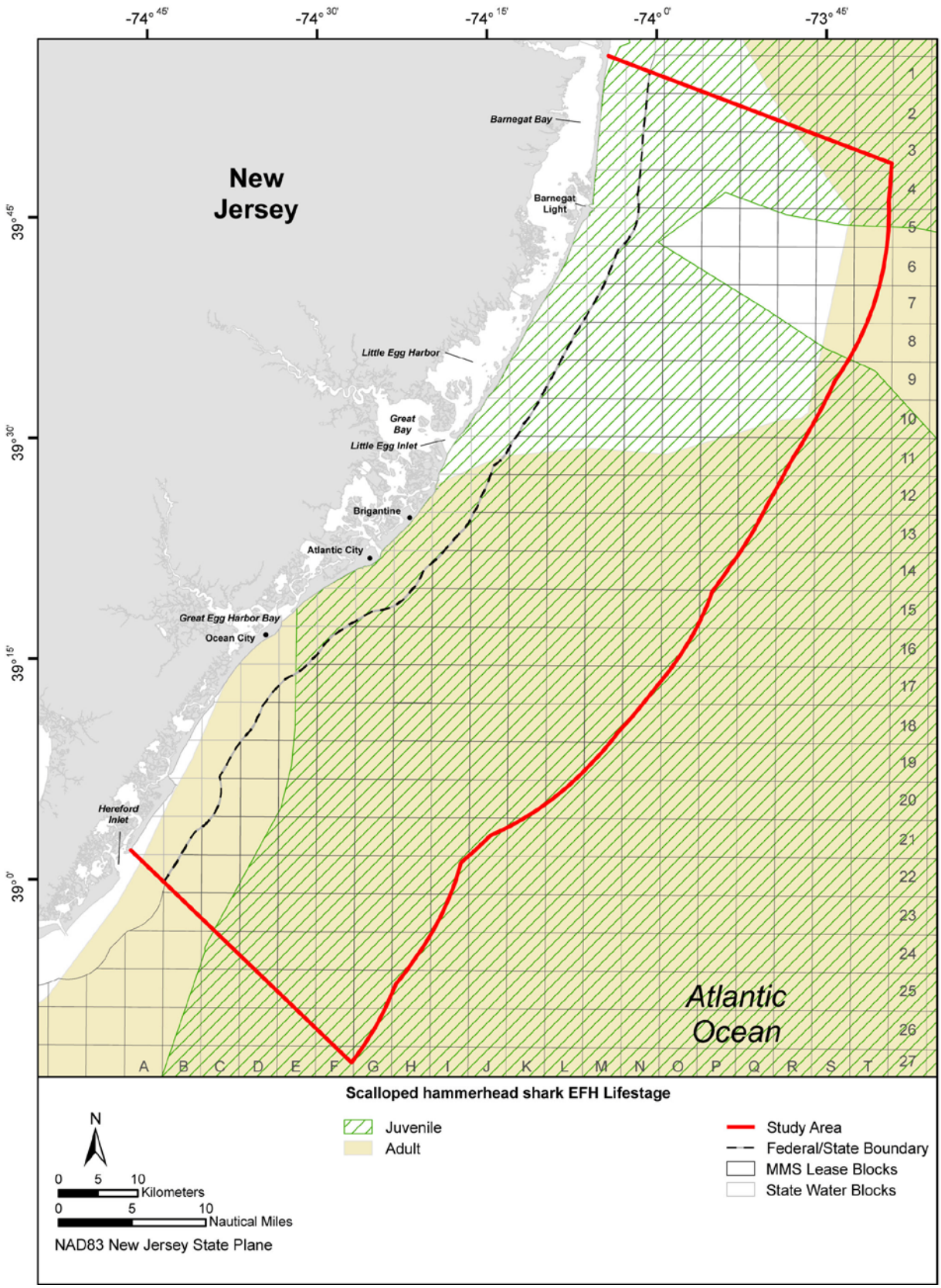

Figure A-33. Essential fish habitat designated in the New Jersey Study Area for juvenile and adult lifestages of scalloped hammerhead sharks. Source data: NMFS (2009).[8]

- **Shortfin Mako Shark (*Isurus oxyrinchus*)**

Management—Shortfin mako shark is managed under the Pelagic Shark MU through the Final Consolidated Atlantic HMS FMP (NMFS 2006a).

Status—Shortfin mako shark is not classified as overfished but is subject to overfishing (NMFS 2009d).[3] This species is a common bycatch in tuna and swordfish fisheries and has shown a 38 percent decline in the northwest Atlantic between 1992 and 2005 (Baum and Blanchard 2009). The 2009 IUCN Red List classifies shortfin mako shark (Atlantic subpopulation) as vulnerable.[17]

Distribution—Shortfin mako shark has a world-wide distribution. In the western North Atlantic Ocean, it ranges from the Grand Banks, Newfoundland, and Gulf of Maine southward to Uruguay and northern Argentina, including Bermuda, the Gulf of Mexico, and the Caribbean (Schultz 2004). It is common offshore from Cape Cod, Massachusetts, to Cape Hatteras, North Carolina (Castro 1983).

Habitat Associations—Shortfin mako shark is found in warm-temperate to tropical waters around the world, but is rarely found in water temperatures lower than 16°C (60.8°F) (Compagno 1984a). Like other lamnid sharks, this species, is endothermic using a heat-exchange circulatory system to maintain muscle visceral temperatures above that of the surrounding seawater allowing a higher level of activity (Bernal et al. 2001). Shortfin mako shark is an active offshore littoral and epipelagic species found from the surface to depths of 152 m (498.7 ft), but has been recorded as deep as 740 m (2,427.9 ft) (Compagno 1984a; Passarelli et al. 1999).

Life History—Tagging data suggests that within the northern extent of its range, this species follows the movement of warm-water masses towards the poles in the summer (Compagno 1984a; Kohler et al. 1998). Results from tagging study in the northwest Atlantic showed that shortfin mako make extensive movements of up to 4,542 km (2,451 NM) with 36% of recaptures caught at greater than 556 km (305 NM) from their tagging site (Stevens 2008). Similar to other sharks, reproduction does not occur annually. Shortfin mako shark is ovoviviparous and oophagus, has a 2 or 3 year reproductive cycle, a gestation period of approximately 15 to 18 months, and a late winter to mid-spring parturition with a litter size of 4 to 25 pups (Mollet et al. 2000; Compagno 2002; Maia et al. 2007). Locations of nursery areas have not been identified, but are hypothesized to be located within deep tropical waters (NMFS 1999b; NMFS 2006a). In the eastern north Atlantic, it is presumed that the Straits of Gibraltar are nursery grounds (Buencuerpo et al. 1998; Tudela et al. 2005).

Forage Species—Shortfin mako sharks prey upon a variety of fast-moving pelagic fishes including: swordfish, tuna, mackerel, bluefish, and other sharks (Passarelli et al. 1999) as well as clupeids, needlefishes, crustaceans, and cephalopods (Maia et al. 2006). In the western North Atlantic, bluefish are the primary prey species (Passarelli et al. 1999; Wood et al. 2009).

EFH Designations—(NMFS 2009a; NMFS 2009b) [8] (**Figure A-34**)

- **<u>Neonate/YOY, Juveniles, and Adults</u>**—Designated EFH includes localized areas in the central Gulf of Mexico and the Florida Keys, in the Atlantic Ocean off of Florida, South Carolina, and Maine, and from Cape Lookout, North Carolina through southern New England.

HAPC Designations—There are no HAPC identified for this species.

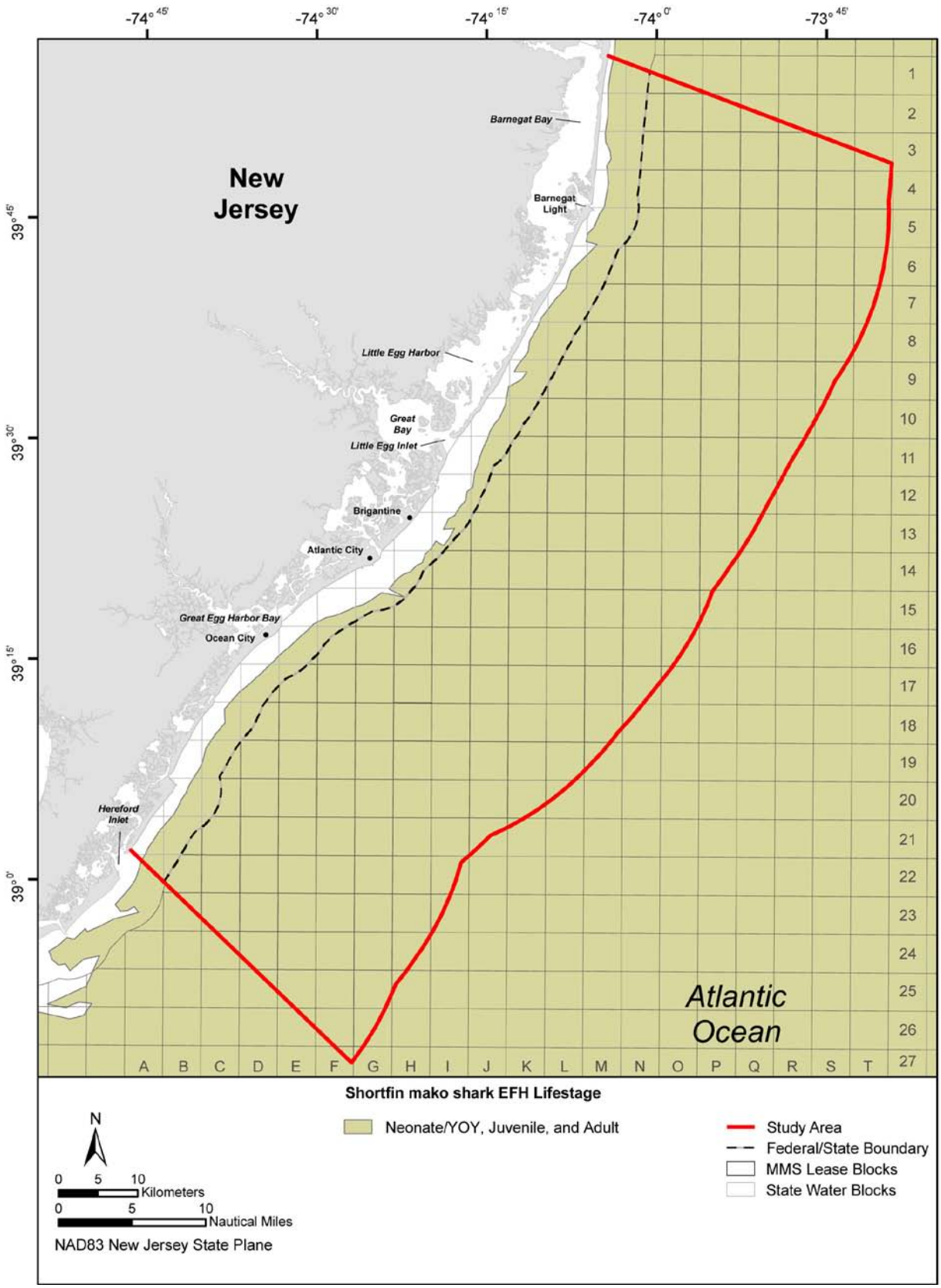

Figure A-34. Essential fish habitat designated in the New Jersey Study Area for all lifestages of shortfin mako sharks. Source data: NMFS (2009).[8]

- **Skipjack Tuna (*Katsuwonus pelamis*)**

Management—Skipjack tuna is managed under the Tuna MU through the Final Consolidated Atlantic HMS FMP (NMFS 2006a).

Status—Skipjack tuna is not overfished nor is overfishing occurring (NMFS 2009d).

Distribution—Skipjack tuna is circumglobal in tropical and warm-temperate waters, generally limited by the 15°C (59°F) isotherm. In the northwest Atlantic, the skipjack typically ranges as far north as Newfoundland (Vinnichenko 1996) and as far south to Brazil (NMFS 1999b; Schultz 2004).

Habitat Associations—Skipjack tuna are an epipelagic, oceanic species that moves at the surface during the day and descends to depths of 260 m (853 ft) at night (Collette and Nauen 1983). Aggregations of skipjack tuna are associated with convergence zones and other hydrographic fronts. Adult skipjack tuna prefer waters with a temperature range of 14.7° to 30.0°C (58.5° to 86.0°F) (Collette 2002). Skipjack tuna exhibit a strong tendency to school in surface waters with birds, whales, sharks, and other tuna species, as well as drifting objects (Collette and Nauen 1983).

Life History—Near the equator the skipjack tuna spawn year-round, while at northern latitudes spawning is restricted to warmer months, from spring to early fall (Gardieff 1999; NMFS 1999b). Larvae have been collected off the east coast of Florida from October to December and in the Gulf of Mexico and Florida Straits from June to October (NMFS 1999b).

Forage Species—Skipjack tuna are opportunistic feeders that prey upon fish (herring, anchovies, and sardines), cephalopods, and crustaceans with peak feeding occurring at dawn or dusk (visual feeders) (Gardieff 1999; NMFS 1999b). Additionally, *Sargassum* and species associated with *Sargassum* have been recorded in their stomachs (NMFS 1999b; NMFS 2006a). Cannibalism is also considered common (Gardieff 1999).

EFH Designations—(NMFS 2009a; NMFS 2009b) [8] (**Figure A-35**)

- <u>Spawning, Eggs, and Larvae</u>—Designated EFH includes the offshore waters in the Gulf of Mexico to the EEZ and portions of the Florida Straits.

- **<u>Juveniles/Subadults</u>** (<45 cm [17.7 in.] FL)—Designated EFH includes localized areas in the central Gulf of Mexico from Louisiana through the Florida Panhandle and in the Atlantic off of Georgia, South Carolina, and North Carolina to Maryland, and from Delaware to Cape Cod, Massachusetts and southern east coast of Florida through the Florida Keys.

- **<u>Adults</u>** (≥45 cm [17.7 in.] FL)—Designated EFH includes the central Gulf of Mexico off of Texas through Florida and localized areas in the Atlantic Ocean off of South Carolina and the northern east coast of Florida, and from Cape Hatteras, North Carolina to Cape Cod, Massachusetts the southern east coast of Florida through the Florida Keys.

HAPC Designations—There are no HAPC identified for this species.

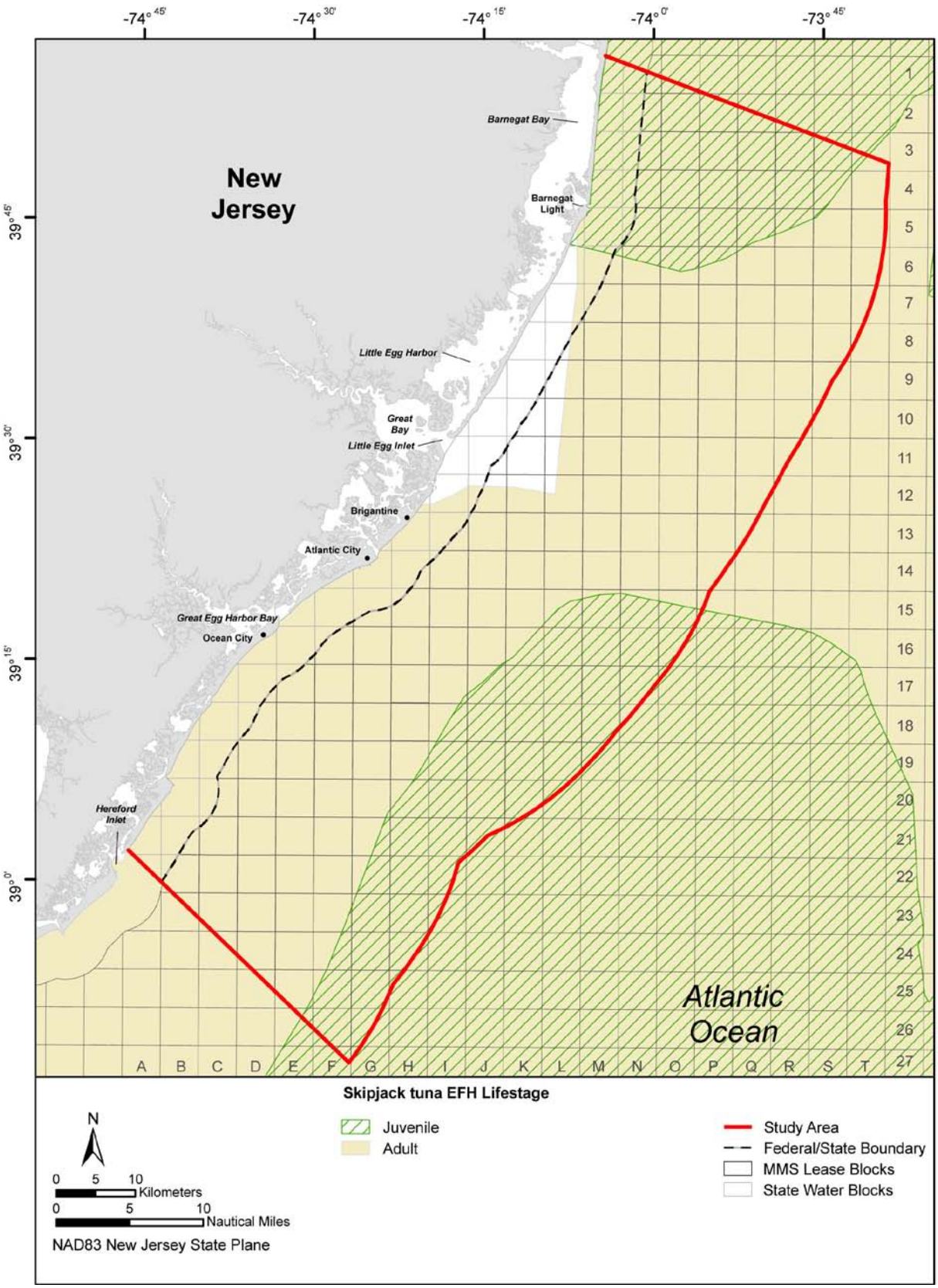

Figure A-35. Essential fish habitat designated in the New Jersey Study Area for juvenile and adult lifestages of skipjack tuna. Source data: NMFS (2009).[8]

- **Thresher shark (*Alopias vulpinus*)**

Management—The common thresher shark is managed under the Pelagic Shark MU through the Final Consolidated Atlantic HMS FMP (NMFS 2006a).

Status—The common thresher shark does not have an overfished status nor is it subject to overfishing (NMFS 2009d). This species is moderately productive, and the most productive of all threshers (Cortés 2008; Smith et al. 2008a), but nonetheless has demonstrated its vulnerability under intensive harvest. The 2009 IUCN classifies the thresher shark as vulnerable due to its apparent decline in abundance in this region and high fishing pressure from pelagic fleets.[18]

Distribution—The common thresher shark is distributed circumglobally in the Atlantic, Pacific, and Indian oceans and in the Mediterranean (Compagno 1984a; Tricas et al. 1997; Compagno 2002). In the northwest Atlantic, common thresher sharks occur from Nova Scotia to Argentina, including the Gulf of Mexico (Branstetter and Burgess 2002c).

Habitat Associations—This species is most frequently encountered in temperate waters and the most coastal of all thresher sharks (Compagno 2002) and usually occurs within 72 to 135 km (40 to 75 miles) of land (Strasburg 1958; Litvinov 1990) in temperate and occasionally tropical seas over continental and insular shelf and slopes (Compagno 1984a). Juveniles inhabit coastal bays and nearshore waters, whereas adults are more common over the continental shelf but also occur in oceanic waters beyond the shelf break (Jordan 1999; Goldman and members of the Shark Specialist Group 2001; Branstetter and Burgess 2002c). They are commonly observed at the surface but are known to inhabit depths of up to 550 m (1,840.5 ft) (Jordan 1999).

Life History—The common thresher shark appears to have a seasonal reproductive cycle in various parts of its range; for example, mating presumably taking place during midsummer in the northeastern Atlantic (Moreno et al. 1989), with an estimated gestation period of about nine months (Goldman 2005). Birth is thought to occur in the spring months in the northeastern Atlantic (Moreno et al. 1989) with this ovoviviparous species producing a litter of two to four pups (Smith et al. 2008b). The common thresher in the North Hemisphere apparently undertakes inshore and northerly coastal migrations during the warm season (~April to August) in the eastern and western Atlantic (Moreno et al. 1989).

Forage Species—The common thresher preys on invertebrates (squid and pelagic crabs) and small schooling fishes such as anchovy, hake, sardine, and small mackerels (Preti et al. 2001; Smith et al. 2008b). Feeding is often associated with areas characterized by high biological productivity and the presence of strong frontal zones separating regions of upwelling and adjacent areas, and strong horizontal and vertical mixing of surface and subsurface waters – habitats conducive to production and maintenance of schooling pelagic prey (Smith et al. 2008b).

EFH Designations—(NMFS 2009a; NMFS 2009b) [8] (**Figure A-36**)

- **Neonate/YOY, Juveniles, and Adults**—Designated EFH includes localized areas in the Atlantic Ocean off the mid-coasts of Florida, Georgia, South Carolina, and the Gulf of Maine, and from North Carolina through Cape Cod, Massachusetts as well as localized areas in central Gulf of Mexico and Florida Keys.

HAPC Designations—There are no HAPC identified for this species.

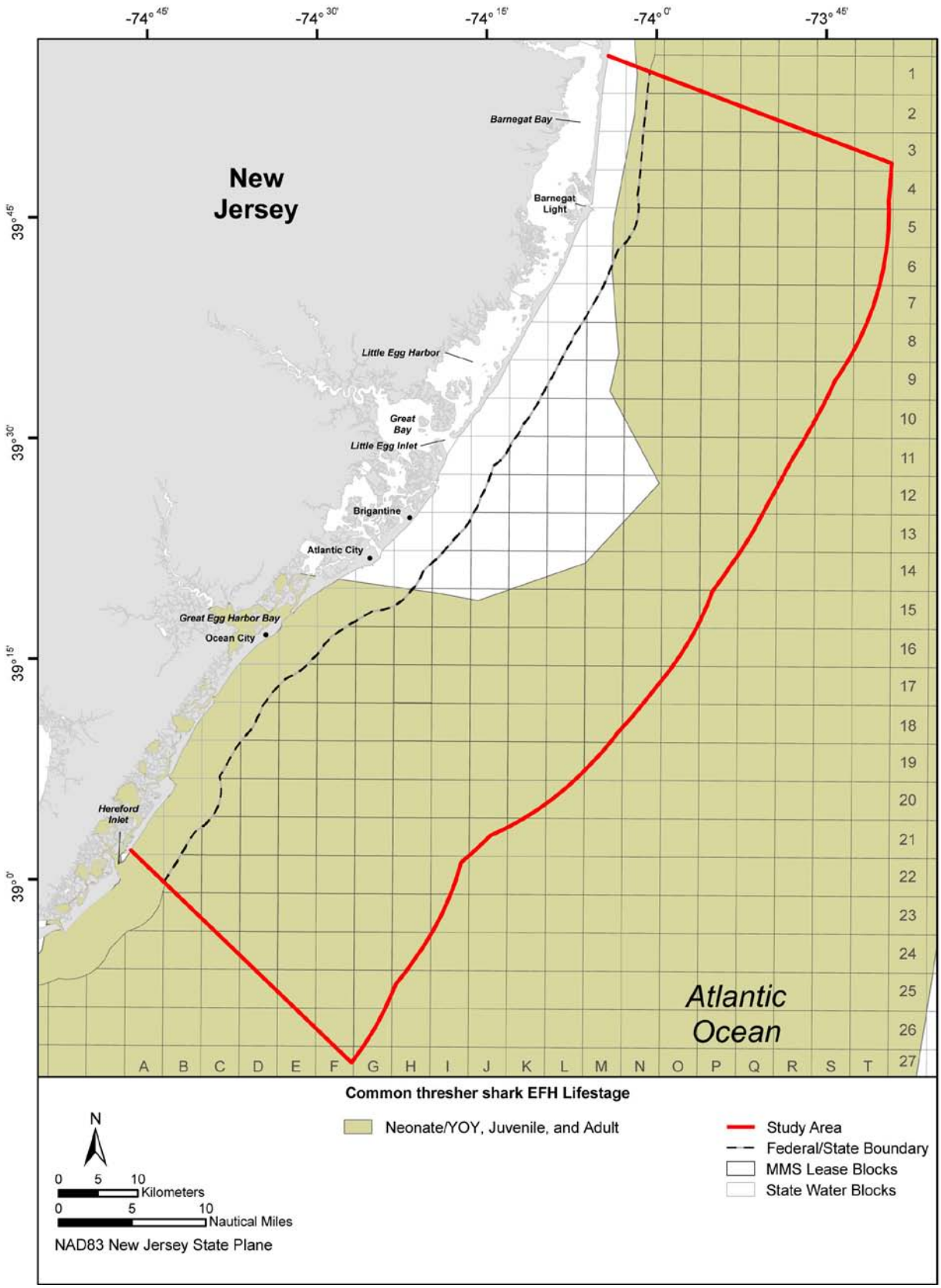

Figure A-36. Essential fish habitat designated in the New Jersey Study Area for all lifestages of common thresher sharks. Source data: NMFS (2009).[8]

- **Tiger Shark (*Galeocerdo cuvier*)**

Management—Tiger shark is managed under the Large Coastal Shark MU through the Final Consolidated Atlantic HMS FMP (NMFS 2006a).

Status—Currently, tiger sharks are not classified as overfished nor is overfishing occurring (NMFS 2009d). The 2009 IUCN Red List classifies tiger shark as lower risk/near threatened.[19]

Distribution—Tiger sharks are found throughout the temperate and tropical coastal waters of the world, with the exception of the Mediterranean Sea (Knickle 1999b; Natanson et al. 1999). In the North Atlantic, this species ranges from Cape Cod, Massachusetts to Uruguay, including the Gulf of Mexico, Bermuda, and the islands of the Caribbean (Randall 1992). It is rarely encountered north of the MAB (Skomal 2007) and is a year-round resident in the coastal waters of Florida (Natanson et al. 1999).

Habitat Associations—Tiger sharks are present over a wide variety of marine habitats but display a preference for cloudy or turbid coastal waters (Compagno 1984b; Knickle 1999b; Ferrari and Ferrari 2002). They are found across the continental shelf, as well as in estuaries, harbors, and inlets, from surface waters to depths of up to 350 m (1,148 ft) (Compagno 1984b; Knickle 1999b). They prefer waters with temperatures exceeding 18˚C (64.4°F) (Branstetter and Burgess 2002b). Tiger sharks are nocturnal, hunting in shallow waters of bays, estuaries, and lagoons, then returning to deeper waters during daylight hours (Compagno 1984b; Tricas et al. 1997; Ferrari and Ferrari 2002).

Life History—This species partakes in extensive migrations throughout the north Atlantic: seasonal - from Cuba to Nova Scotia and transoceanic - traveling distances of 2,300 km (1,241.1 NM) from Cuba to Africa (Natanson et al. 1999; Ferrari and Ferrari 2002; Driggers et al. 2008). Tiger sharks are ovoviviparous. In the northern hemisphere, mating takes place between March and May and pupping is reported to occur from April to June of the following year (Compagno 1984b; Knickle 1999b). Gestation period appears to be about 1 year producing large litters, usually consisting of 35 to 55 pups (Castro 1983; NMFS 2009a). Areas of high tiger shark neonate occurrence are considered important pupping areas within a range extending from 27° to 35°N, south of the Study Area (Driggers et al. 2008).

Forage Species—Tiger sharks feed on a wider variety of prey than most other shark species, including other sharks, skates, fishes (goosefish and bluefish), squid, horseshoe crab (*Limulus polyphemus*), crab, conch, birds, marine mammals, and sea turtles (Branstetter and Burgess 2002b). They also have the propensity to consume 'garbage' of human origin, including plastics, metal, sacks, kitchen scraps, and almost any other item discarded in the sea (Randall 1992).

EFH Designations—(NMFS 2009a; NMFS 2009b) [8] (**Figure A-37**)

- Neonate/YOY (≤204 cm [80.3 in.] TL)—Designated EFH includes the Gulf of Mexico off Texas, western Louisiana, and the Florida Panhandle and in the Atlantic Ocean from the mid-east coast from Florida to New England.

- **Juveniles** (205 to 319 cm [80.7 to 125.6 in.] TL)—Designated EFH includes the central Gulf of Mexico off Texas and Louisiana and from Mississippi through the Florida Keys and along the Atlantic east coast from Florida to New England.

- **Adults** (≥320 cm [126 in.] TL)—Designated EFH includes the Gulf of Mexico from Texas to the west coast of Florida and the Florida Keys and along the Atlantic east coast from Florida to southern New England.

HAPC Designations—There are no HAPC identified for this species.

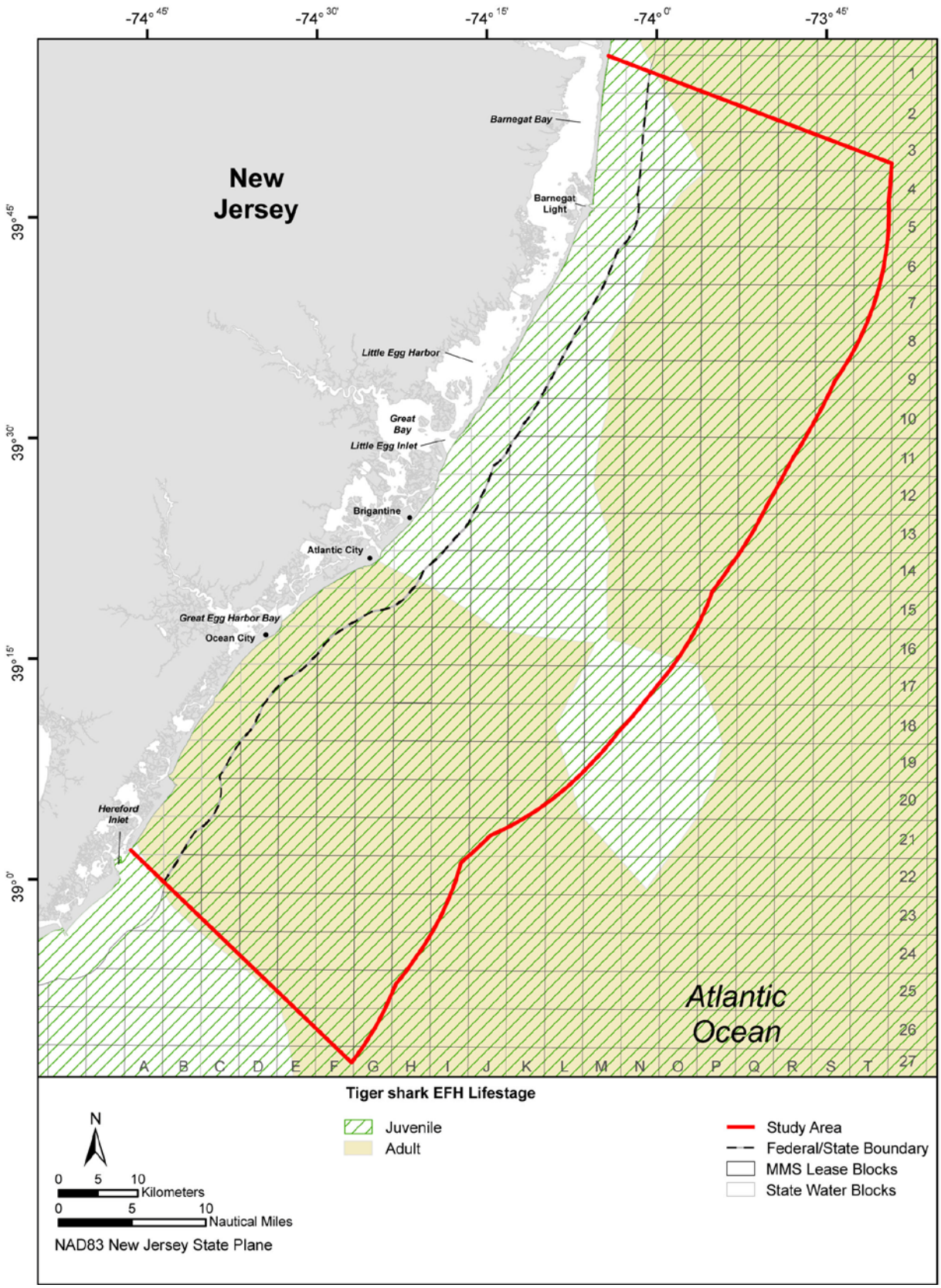

Figure A-37. Essential fish habitat designated in the New Jersey Study Area for juvenile and adult lifestages of tiger sharks. Source data: NMFS (2009).[8]

- **White Shark (*Carcharodon carcharias*)**

***Management*—**White shark is managed under the Prohibited Species MU through the Final Consolidated Atlantic HMS FMP (NMFS 2006a)**.**

Status—Currently, white shark is not classified as overfished nor is overfishing occurring. In 1997, the U.S. implemented a catch-and-release only recreational fishery, while prohibiting possession of the species (NMFS 2009d). In addition, Baum et al. (2003) reported an 80% decline in longline CPUE suggesting a decrease in population size over time. The 2009 IUCN Red List classifies white shark as vulnerable or facing a high risk of extinction in the wild.[20]

Distribution—White sharks are found worldwide in temperate and subtropical regions, including all major ocean basins, the Mediterranean Sea, and several tropical locations (Bruce 2008). In the northwest Atlantic, it occurs from Newfoundland to Florida, the northern Gulf of Mexico, the Bahamas, and Cuba as well as from Brazil to Argentina (Castro 1983; Compagno 1984a). The white shark is rare south of Cape Hatteras, North Carolina, and in the Gulf of Mexico except during the winter (Castro 1983). White sharks (individuals <200 cm [78.8 in.]) are more abundant in the MAB (Cape Hatteras, North Carolina to Cape Cod, Massachusetts) on the continental shelf from April through December than any other region in the western North Atlantic (Casey and H.L. Pratt Jr. 1985).

Habitat Associations—White sharks are an epipelagic shark, but can be found utilizing depths over 250 m (820 ft) (Compagno 2002). They primarily inhabit coastal and offshore waters of continental and insular shelves occurring from the shoreline (including coastal bays, lower reaches of estuaries, surf zone, and continental islands) to shelf and slope waters (Castro 1983; Compagno 1984a; Martins and Knickle 1999). This shark is commonly found in areas of small coastal archipelagos inhabited by pinnipeds (main prey items), offshore reefs, banks, and shoals, as well as rocky headlands where deeper water is closer to shore (Martins and Knickle 1999). Larger individuals are more common in subtropical and tropical waters than smaller white sharks (<3 m [9.8 ft] in length), which typically are confined to temperate waters (Compagno 1984a) with 15˚C (27°F) isotherm being their northern latitude limit (Casey and H.L. Pratt Jr. 1985).

Life History—Very little is known of the white shark's reproductive behavior and habitat association, but records indicate that live young are born in warm temperate neritic shelf waters during the spring to late summer (Martins and Knickle 1999). This species is known to be oophagous and can carry 7 to 10 embryos (NMFS 2009a). The white shark inhabits waters over the continental shelf in the summer and migrates to warmer waters during the winter months (Castro 1983). Bonfil et al. (2005) reported that white sharks undergo coastal migrations as well as transoceanic return migrations. In addition, foraging juveniles may occur in the mixed layer and near the surface at night, however; daytime dive patterns suggest diurnal feeding occurs at or near the bottom (Dewar et al. 2004). The occurrence of small and intermediate size white sharks (male and female) in the continental shelf waters of the MAB up through the coastal waters of Massachusetts suggest this area serves as a nursery area for juveniles (Skomal 2007; NMFS 2008b).

Forage Species—White sharks feed on a wide spectrum of prey, including pelagic and demersal finfish, various other chondrichthyans, sea turtles, pinnipeds, cetaceans, cetacean carrion, some invertebrates (e.g., squids and crustaceans), and occasionally sea birds such as cormorants (Casey and H.L. Pratt Jr. 1985; Compagno 2002; Bruce 2008).

EFH Designations—(NMFS 2009a; NMFS 2009b) [8] (**Figure A-38**)

- **<u>Neonate/YOY, Juveniles, and Adults</u>**—Designated EFH includes areas along the mid- and southern west coast of Florida in the Gulf of Mexico and along the mid- and northern east coast of Florida, South Carolina, and North Carolina and from Maryland to Cape Cod, Massachusetts in the Atlantic.

HAPC Designations—There are no HAPC identified for this species.

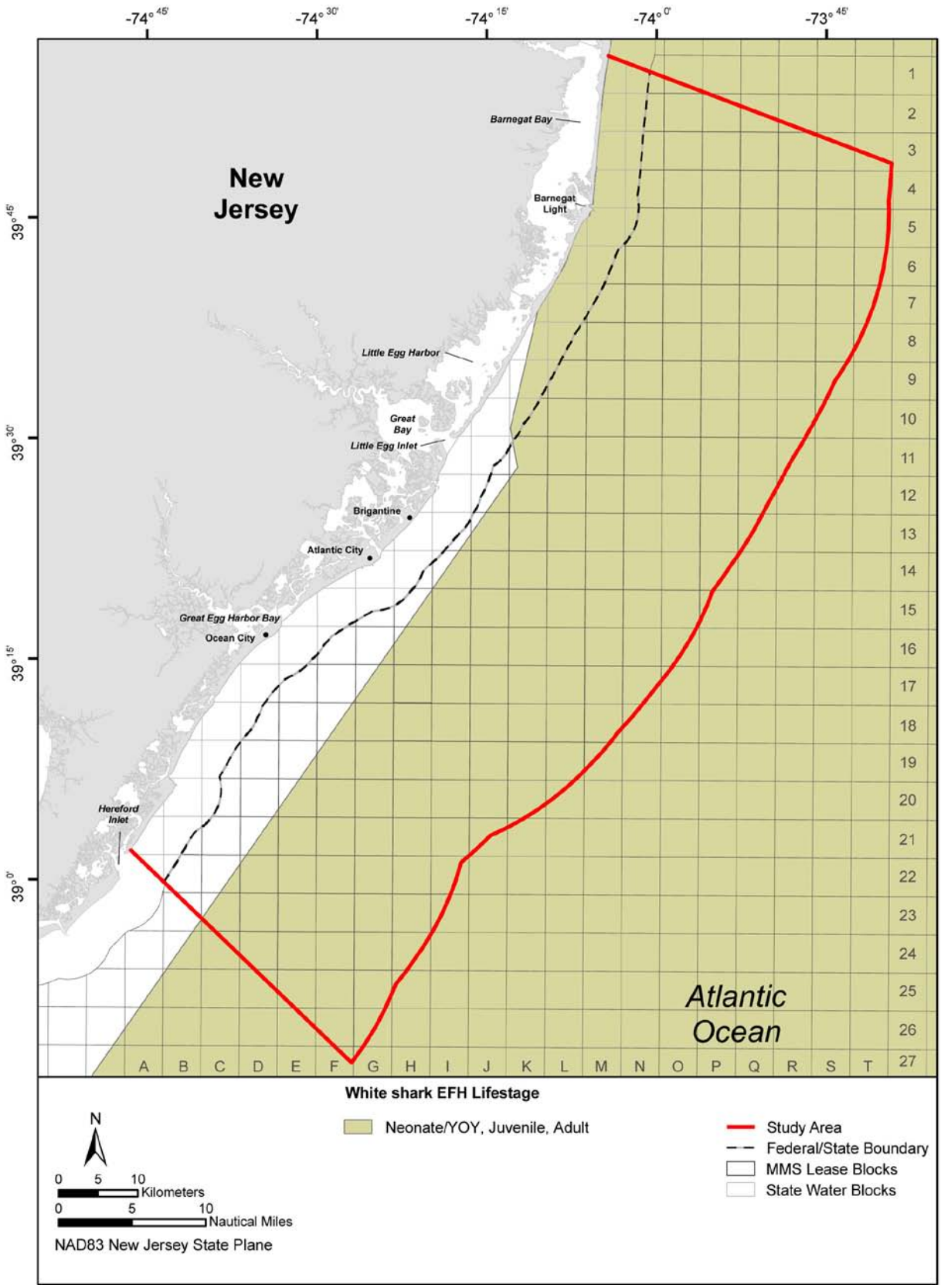

Figure A-38. Essential fish habitat designated in the New Jersey Study Area for all lifestages of white sharks. Source data: NMFS (2009).[8]

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