6.0 ANALYSIS OF FISHING AND NON-FISHING IMPACTS

6.1 Analysis of Fishing Impacts

The Magnuson-Stevens Act and the EFH regulations require NMFS to identify fishing activities that may adversely affect EFH and to minimize adverse effects on EFH from fishing activities to the extent practicable. Adverse effects from fishing may include physical, chemical, or biological alterations of the substrate, and loss of, or injury to, benthic organisms, prey species and their habitat, and other components of the ecosystem. Based on an assessment of the potential adverse effects of all fishing equipment types used within an area identified as EFH, NMFS must propose measures to minimize fishing impacts if there is evidence that a fishing practice is having more than a minimal and not temporary adverse effect on EFH.

In deciding whether fishing gears are having a negative effect, and if minimization of an adverse effect from fishing is practicable, NMFS must consider: (1) whether, and to what extent, the fishing activity is adversely impacting EFH and the fishery; (2) the nature and extent of the adverse effect on EFH; and, (3) whether the management measures are practicable, taking into consideration the long and short-term costs as well as the benefits to the fishery and its EFH, along with other appropriate factors consistent with National Standards of the Magnuson Stevens Act. The best scientific information available must be used as well as other appropriate information, as available.

NMFS completed the original analysis of fishing and non-fishing impacts in the 1999 FMP. Additional information gathered during a comprehensive five-year review was presented in the 2006 Consolidated HMS FMP, including a review of all fishing and non-fishing impacts. Each HMS gear, along with all other state and Federally managed fishing gears, the means by which they are fished, and their potential impacts on HMS and other species' EFH were described in the 2006 Consolidated HMS FMP, and are not repeated here.

The analysis in the 2006 Consolidated HMS FMP indicated that most HMS gears are fished in the water column and the impacts on EFH are generally considered negligible. HMS gears do not normally affect the physical characteristics that define HMS EFH such as salinity, temperature, dissolved oxygen, and depth. Similarly, most HMS gears are not expected to impact other fisheries' EFH, with the possible exception of shark BLL gear, depending on the area where it is fished. In the 2006 Consolidated HMS FMP, a preliminary determination was made that HMS gears, other than shark BLL, were not having a negative impact on EFH. Similarly, other state and Federally managed gears were also determined not to have an impact on HMS EFH, with the possible exception of some bottom-tending gears in shark nursery areas in coastal bays and estuaries. However, NMFS anticipates that any impacts resulting from these gears would be minimal and only temporary in nature.

In the following section, NMFS provides further analysis of the impacts of BLL gear as used in the shark fishery on benthic habitats to determine whether or not adverse impacts on EFH are occurring by shark BLL gear. NMFS has analyzed the impacts specific to the shark BLL fishery and not all BLL gear in general. In addition, NMFS has evaluated the impact of bottom tending gears on shark nursery areas for species of sharks (blacktip, spinner, blacknose, and finetooth) where certain substrates, such as mud bottom and seagrasses in the specific areas of Apalachicola and Apalachee Bays, have been identified as EFH. These analyses are given below.

Shark Bottom Longline Gear Impacts

The shark BLL fishery is active in the U.S. Atlantic Ocean and Gulf of Mexico from Virginia through Texas. Vessels in the fishery are typically fiberglass and average 50 feet in length (Hale *et al*., 2007). Longline characteristics vary regionally with gear normally consisting of about 8-24 km of longline and 500-1500 hooks (Hale *et al*., 2007). Gear is set at sunset and allowed to soak overnight before hauling back in the morning (Hale *et al*., 2007). As of 2007, there were approximately 143 active directed permit holders out of the 231 commercial shark directed permits holders (NMFS, 2008). These vessels historically made 4000 to 9000 sets a year (Hale *et al*., 2007). The shark BLL fishery targets large coastal sharks (LCS) but small coastal sharks (SCS), pelagic sharks, and dogfish species are also caught. The number of active permit holders is likely to decline as a result of Amendment 2 to the Consolidated HMS FMP which was implemented in July 2008 to reduce fishing effort. Specifically, landings of sandbar sharks were prohibited beginning in 2008, other than under the auspices of the shark research fishery, which will include approximately 11 vessels. Reduced quotas for non-sandbar LCS were also implemented. Many of the shark permit holders also hold Gulf of Mexico reef fish permits, dolphin-wahoo permits, king and Spanish mackerel permits, and snapper-grouper permits.

The impacts of shark BLL gear on the benthic habitat have not been specifically researched. In addition, habitat types where commercial shark fishermen set BLL gear have not been extensively studied, however, shark BLL sets are generally placed in sandy and/or muddy habitats where gear will not be entangled and lost. Bottom longline gear has less of an impact on mud and sandy sediments as opposed to complex coral reef bottom. The 1999 NMFS EFH Workshop categorized the impact of BLL gear on mud, sand, and hard-bottom as low (Barnette, 2001). Since there have not been extensive studies on the impacts of shark BLL gear on the benthic environment, NMFS is relying on information regarding impacts from BLL gear in other fisheries and other regions. However, given the differences in habitats among regions and how gear is fished in different fisheries, the associated impacts in these studies may not be applicable to impacts from shark BLL gear in the Southeast region of the United States. The following information has been excerpted from the GMFMC's 2004 FEIS on EFH (GMFMC, 2004) and Barnette (2001).

> "Anchors or weights, hooks, and the mainline are the principal components of BLL gear that can produce seabed effects (ICES, 2000). When a vessel is retrieving BLL gear it may be dragged across the bottom for some distance. The substrate penetration, if there were any, would not be expected to exceed the breadth of the fishhook, which is rarely more than 50/mm (Drew and Larsen, 1994). Based on these observations, it is assumed that longline gear would have a minor impact to sandy or muddy habitat areas. More important is the potential effect of the BLL itself, especially when the gear is employed in the vicinity of complex vertical

habitat such as sponges, gorgonians, and corals. Observations of halibut longline gear off Alaska included in a North Pacific Fishery Management Council Environmental Impact Statement (NPFMC, 1992) provide some insight into the potential interactions longline gear may have with the benthos. During the retrieval process of longline gear, the line was noted to sweep the bottom for considerable distances before lifting off the bottom. It snagged on whatever objects were in its path, including rocks and corals. Smaller rocks were upended and hard corals were broken, though soft corals appeared unaffected by the passing line. Invertebrates and other lightweight objects were dislodged and passed over or under the line. Fish were observed to move the groundline numerous feet along the bottom and up into the water column during escape runs, disturbing objects in their path. This line motion has been noted for distances of 15.2 m (50 ft) or more on either side of the hooked fish. Longline gear in the southeast is substantially lighter (often with monofilament groundlines) than the halibut longline gear in Alaska (generally 5/16th inch nylon or polyester rope as groundline), so southeast longlines should cause less damage than Alaskan longlines. However, the Alaskan marine ecosystem is much different from that in the southeast in that there are no tropical coral reefs, so specific damage assessment in Alaska may not apply to the Southeast Region. But the Alaskan marine ecosystem does have sponges and other vertical relief, which makes it somewhat analogous to the southeast conditions, and therefore, may give some insight to the type of damage BLL gear can cause. For instance, the shearing action of the longlines under tension would have similar results on sensitive vertical structure (Barnette, 2001). Due to the vertical relief that hard bottom and coral reef habitats provide, it would be expected that longline gear may become entangled, resulting in potential impacts to habitat. Based on this evaluation, Barnette (2001) suggested excluding the use of BLL gear in sensitive habitats, such as coral reefs."

It should also be noted that due to differences in ocean currents and environmental conditions in different regions, the Alaskan study may not be applicable to how BLL gear is fished and the impacts associated with the BLL gear in the Southeast region. However, since there have been no other published studies investigating the impact of BLL gear on benthic habitats, it is the only study to draw upon at this time.

Lost or abandoned longline gear can also cause potential problems with ghost fishing and grappling to retrieve gear. Fishermen generally maintain as much control as practicable over the gear to prevent losses. However, gear sometimes becomes lost because of weather or accidents, and may be abandoned by fishermen in closed areas trying to avoid detection by enforcement. Longline gear continues to catch fish and possibly catches sea turtles if bait or fish parts remain on the hooks, and self-baits if captured fish subsequently attract and catch other fish. The gear stops fishing when all hooks are bare. Cumulative effects of lost longline gear could be significant. Retrieval of lost or abandoned gear typically occurs by dragging a grappling hook across the bottom to snag the line. Grappling would cause minimal habitat damage to soft or unstructured bottom, but could cause severe local damage to fragile habitat such as coral. The magnitude of the potential problems from lost gear has not been evaluated in the southeast.

Gulf of Mexico

A detailed description of the benthic habitat in the Gulf of Mexico region can be found in Chapter 3 of the Final Environmental Impact Statement (FEIS) for the GMFMC's 2004 Generic Essential Fish Habitat Amendment (GMFMC, 2004) (Figure 6.1). The description is not repeated in this Amendment. Shark BLL gear used for directed shark fishing in the Gulf of Mexico region is configured differently than what is found in other regions and other fisheries. Shark BLL vessels in the Gulf of Mexico had a mainline length that ranged from 12.9 to 31.4 km with an average of 18.1 km (Hale *et al*., 2007). The average bottom depth fished was 25.4 m and the number of hooks ranged from 228 to 1067 hooks with an average 602.5 hooks fished (Hale *et al*., 2007). The most commonly used hook was 18/0 circle hooks with 14/0 J hooks used in about 20 percent of the sets (Hale *et al*., 2007). The average soak duration was 10.9 hours (Hale *et al*., 2007).

To evaluate the impacts of shark BLL gear to sensitive habitats, such as coral reefs, NMFS analyzed the extent to which shark BLL gear is fished on coral reef habitats in the Gulf of Mexico. Most shark fishermen report their catch in the logbook for Gulf of Mexico Reef Fish, South Atlantic Snapper–Grouper, King and Spanish Mackerel, Shark, Atlantic Dolphin, and Wahoo (*i.e*., the Coastal Fisheries logbook). However, the Coastal Fisheries logbook does not include specific latitude and longitude information on the location of individual sets. Rather, fishermen report on a trip basis and indicate the statistical area where they were fishing on a given trip. Conversely, NMFS' scientific observers on shark fishing vessels record the latitude and longitude coordinates of each observed set. Therefore, NMFS used individual set data taken from the Commercial Shark Fishery Observer Program (CSFOP) from 1994 through the 1st trimester of 2005, and set data taken from the shark BLL fishery observer program operating out of the NMFS Southeast Fisheries Science Center (SEFSC) in Panama City from the 2nd trimester of 2005 through 2006. From 2005 to the present, the shark BLL fishery observer program has randomly selected vessels possessing a current valid directed shark fishing permit for observer coverage with target coverage of 4-6 percent of the fishing fleet. However, from 1994 to 2003, observer coverage was 1.9 percent based on landings. NMFS used coral reef habitat maps provided by the GMFMC to evaluate the number of observed sets that overlapped coral reef habitat within the Gulf of Mexico.

NMFS plotted individual observed set locations using the coordinates from the beginning and end points of the set connected with a straight line. NMFS then overlaid the set locations on coral reef habitat layers in the Gulf of Mexico, focusing primarily in the Florida Keys where the majority of coral reef structure is located. Only 17 observed sets intersected coral reef areas in the Gulf of Mexico and Florida Keys from 1994-2006. Of the 17 sets, most intersected only a small portion of the reef, and many of those sets were actually made in areas between the reefs. Based on the observer coverage of 5 percent in the shark BLL fleet in 2007 (higher observer coverage rates are in effect for the shark gillnet fishery), it is estimated that approximately 340 sets (17 sets / 5 percent observer coverage) intersected coral reef habitat. Based on observer coverage of 1.9 percent from 1994 to 2003, this would equate to 894 sets (17 sets / 1.9 percent observer coverage). This gives a range of approximately 26 sets per year (340 sets / 13 years) to 68 sets per year (894 sets / 13 years) on coral reef habitat, depending on the level of observer coverage. Given the potentially low number of sets that intersected coral reef habitat, NMFS anticipates the impact of shark BLL gear on coral reefs would be minimal and temporary in nature. This is similar to the finding by the GMFMC, which determined that the fishing impact index for shark BLL was low for shark BLL gear around the Florida Keys (Figure 6.2 taken from GMFMC, 2004). In addition, with the implementation of Amendment 2 to the Consolidated HMS FMP on July 24, 2008 (73 FR 35778 and corrected on July 15, 2008, 73 FR 40658), NMFS anticipates that the level of directed shark fishing effort will decrease in light of quota reductions, reduced trip limits, and the prohibition of sandbar sharks outside of a shark research fishery.

NMFS also overlaid the number of shark BLL observed sets in relation to closed areas in the Gulf of Mexico region (Figure 6.3). These areas have been closed for various reasons, including closures for sensitive habitats. In the Gulf of Mexico, there are two closed areas to shark BLL gear: Madison-Swanson and Steamboat Lumps closed areas. The Madison-Swanson and Steamboat Lumps closed areas were implemented in 2006 and are closed to all HMS gears, except for trolling gear from May through October. These areas are closed to protect spawning gag grouper (*Mycteroperca microlepis*) as well as to protect the male gag grouper population year round.

Table 6.1 shows the number of observed BLL sets that intersected the different Gulf of Mexico closed areas. Tortugas South and Pulley Ridge have had the most observed sets with 7 and 9 observed sets intersecting these closed areas from 1994-2006, respectively. Based on an average 5 percent observer coverage, it is estimated that 140 shark BLL sets have intersected the Tortugas South closed area (7 observed sets / 5 percent observer coverage) and 180 shark BLL sets have intersected the Pulley Ridge closed area (9 observed sets / 5 percent observer coverage). Based on observer coverage of 1.9 percent, this would equate to 368 sets intersecting the in Tortugas South closed area (7 sets / 1.9 percent observer coverage), and 473 sets intersecting the Pulley Ridge closed area (9 sets / 1.9 percent observer coverage). This gives a range of approximately 11 sets (140 sets / 13 years) to 28 sets (368 sets / 13 years) per year in the Tortugas South closed area, and 14 sets (180 sets / 13 years) to 36 sets (473 sets / 13 years) per year in the Pulley Ridge closed area. Given the small number of sets each year in these areas, NMFS anticipates the impact of shark BLL gear in these areas would be minimal and only temporary in nature. In addition, with the implementation of Amendment 2 to the Consolidated HMS FMP, NMFS does not anticipate shark BLL fishing effort to increase in these areas; rather, it would most likely decrease due to quota reductions, reduction in trip limits, and the prohibition of fishing for sandbar sharks outside of a shark research fishery. As such, NMFS is not implementing any additional management measures for shark BLL gear in the Gulf of Mexico region to minimize adverse impacts on EFH at this time.

Table 6.1 The number of observed sets within the different Gulf of Mexico closed areas. Source: Shark BLL fishery observer program (1994-2006).

Area	Observed BLL Sets Intersecting Area
Alabama SMZ	0
East Flower Garden Bank	0
Florida Middle Grounds HAPC	2
Madison Swanson*	3
McGrail Bank HAPC	0
Pulley Ridge HAPC	9
Steamboat Lumps*	2
Stetson Bank	0
Tortugas North	0
Tortugas South	7
West Flower Garden Bank	0

*note: shark BLL sets in these areas occurred before closure in 2006.

U.S. Caribbean

While coral reefs are prevalent in the Caribbean region (see Figures 2.6-2.15 in the Caribbean Fishery Management Council's (CFMC) Generic Essential Fish Habitat Amendment (CFMC, 2004)), due to the absence of directed shark permit holders in the U.S. Virgin Islands and Puerto Rico, NMFS does not have logbook information on fishing effort or observer data from these areas. Typically, fishing effort data for fisheries in the U.S. Caribbean are not sufficiently accurate to map spatial distribution (CFMC, 2002). Some information is available on the number of fishing trips, but this is incomplete, has no spatial resolution, and there is great uncertainty about the validity of the data due to missing gear codes and use of multiple gears on a single trip (CFMC, 2004). Therefore, NMFS is unable to evaluate where shark BLL gear is used in the U.S. Caribbean region and assess its potential impact, and no additional management measures for BLL gear in the U.S. Caribbean are being proposed at this time. NMFS is currently working on an amendment to the 2006 Consolidated HMS FMP to help increase reporting and permitting compliance in this area that will allow for more accurate and spatially explicit descriptions of fishing effort in the future. In the meantime, NMFS has backstopped management measures implemented by the Caribbean Fishery Management Council, which closed six areas to protect EFH of mutton snapper, red hind, and other reef-dwelling species. NMFS has closed these six areas in the U.S. Virgin Islands and Puerto Rico to HMS BLL gear (Figure 6.4) (February 7, 2007, 72 FR 5633).

South Atlantic

A detailed description of the different marine habitats in the South Atlantic region can be found in Chapter 3 of 1998 Final Habitat Plan for the South Atlantic Region (SAFMC, 1998). The description is not repeated in this Amendment. Shark BLL gear used for directed shark fishing in the South Atlantic region is configured differently than what is found in other regions and other fisheries. Shark BLL vessels in the Atlantic had a mainline length that ranged from 5.6 to 50.0 km with an average of 21.1 km (Hale *et al*., 2007). The average bottom depth was 40.2 m and the number of hooks ranged from 96 to 1075 hooks with an average of 587 hooks fished (Hale *et al*., 2007). The most commonly used hook was 12/0 J hooks with 18/0 circle hook used about 20 percent of the time (Hale *et al*., 2007). The average soak duration was 11.0 hr (Hale *et al*., 2007).

In the South Atlantic, there are several closed areas to shark BLL gear. These include the Mid-Atlantic shark area closure for sandbar and dusky sharks that is closed to BLL gear from January 1 through July 31 of each year, and the eight marine protected areas (MPAs) that NMFS implemented at the request of the South Atlantic Fishery Management Council. These MPAs are closures throughout the year to most gear types with the exception of trolling gear for HMS and other coastal pelagic species that is allowed. The primary purpose of the closures is to protect the population and habitat of slow- growing, long-lived deepwater snapper grouper species (speckled hind (*Epinephelus drummondhayi*), snowy grouper (*Epinephelus niveatus*), Warsaw grouper (*Epinephelus nigritus*), yellowedge grouper (*Epinephelus flavolimbatus*), misty grouper (*Epinephelus mystacinus*), golden tilefish (*Lopholatilus chamaeleonticeps*), and blueline tilefish (*Caulolatilus microps*)).

As in the Gulf of Mexico, shark BLL gear in the South Atlantic is also typically placed in sandy or muddy habitats where expected impacts would be minimal or low (Barnette, 2001). However, BLL use in vertical or complex habitats could result in adverse effects to the benthic substrate. Unfortunately, there are no habitat maps for the South Atlantic region analogous to the coral reef maps available for the Gulf of Mexico region. As such, NMFS cannot assess the amount of shark BLL effort occurring on coral reef habitat in the South Atlantic. Anecdotal information from the shark fishery observer program, however, noted that of the 61 observed sets in 2007, only five sets had snagged pieces of coral and/or sponges on the line upon haulback. While this does not give an indication of the impact that the gear is having on the benthic environment (*i.e.*, the gear can be impacting the benthic habitat and not have coral or sponges on the line upon haulback), it indicates that at least some of the shark BLL sets are placed on coral or sponge habitat. Based on the average observer coverage of 5 percent in 2007, approximately 100 sets (5 sets / 5 percent observer coverage) out of the 1220 total sets (61 total observed sets / 5 percent observer coverage) made in 2007 were placed on coral and sponge habitat in that particular year. NMFS will continue to work with the Regional Fishery Management Councils and Atlantic States Marine Fisheries Commission to assess the impacts of BLL gear on the benthic environment and will evaluate the need for potential closures to BLL gear in the South Atlantic as more explicit habitat information becomes available. In the meantime, as in the Gulf of Mexico, NMFS anticipates that the directed shark BLL effort will decrease in the future with the implementation of Amendment 2 to the Consolidated HMS FMP. Thus, potential impacts to the benthic environment by shark BLL gear experienced in 2007 and prior years may not be realized after the implementation of Amendment 2. Therefore, NMFS is not implementing any additional management measures for BLL gear in the South Atlantic region at this time.

<u>North Atlantic</u>

There is essentially no BLL fishing for sharks in the North Atlantic. Most BLL shark fishing efforts occurs from Virginia to Florida in the Atlantic Ocean. In the North Atlantic, most sharks are caught on PLL gear; PLL gear has been determined to not have an impact on EFH in the 2006 Consolidated HMS FMP (NMFS, 2006) because it floats in the water column and does not impact benthic habitat. In addition, the Northeast Region Essential Fish Habitat Steering Committee (NREFHSC) found that there was little scientific information that evaluates the effects of BLL gear on benthic marine habitats, and no information which evaluates these effects in the Northeast Region (NREFHSC, 2002). The panel concluded that BLL gears cause a low degree of impacts in mud, sand, and gravel habitats (NREFHSC, 2002). As such, given the lack of fishing effort using shark BLL in the North Atlantic, and the low degree of impact this gear would have in the habitats where shark BLL gear is usually set, NMFS anticipates any impact of shark BLL gear in these areas would be minimal and only temporary in nature. As such, NMFS is not implementing any additional management measures for BLL gear in the North Atlantic region at this time.

Conservation measures

The following NMFS conservation recommendations are meant as precautionary measures, and should be used whenever possible in the event that impacts to coral reef or other hard bottom EFH habitat may be occurring but unverified.

- Vessels fishing with BLL gear should avoid or reduce BLL effort on corals, gorgonians, or sponge habitat in order to minimize risk of habitat damage to these areas.

- Vessels fishing with BLL gear should take appropriate measures to identify bottom obstructions and avoid setting gear in areas where it may become entangled.

- If gear is lost, diligent efforts should be undertaken to recover the lost gear.

Non-HMS Gear Impacts

Nearly all HMS EFH is defined according to the geographic boundaries of a given area and water column characteristics, as opposed to specific benthic habitat types that might be affected by fishing gears, particularly bottom-tending gears such as shrimp trawls or fish traps. However, for some species of sharks (blacktip, spinner, blacknose, and finetooth), certain substrates, such as mud bottom and seagrasses in specific areas of Apalachicola and Apalachee Bays, have been identified as EFH (see Chapter 5). For these specific coastal and estuarine habitats, there may be an impact on benthic habitats from bottom-tending gears in state waters.

Trawl fisheries that scrape the substrate, disturb boulders and their associated epiphytes or epifauna, re-suspend sediments, flatten burrows and disrupt seagrass beds have the potential to alter the habitat characteristics that are important for survival of early life stages of many targeted and non-targeted species. According to the GMFMC (2004), bottom tending gears in the Apalachicola and Apalachee Bay areas consist of shrimp trawls (Figure 6.5), stone crab pots (Figure 6.6), and fish traps (Figure 6.7). These three gears are the most likely gears to have an adverse effect on HMS EFH in the Apalachicola and Apalachee Bay areas. The GMFMC calculated a fishing sensitivity index for all gears managed by the FMC using fishing effort and habitat sensitivity. For a full description of the methods, please see Section 2.1.5.2.2 (GMFMC, 2004).

The overall fishing sensitivity for Apalachicola Bay was listed as low in the GMFMC's (2004) analysis but moderate for Apalachee Bay area due to the presence of seagrasses (Figure 6.8). However, the overall fishing impact of shrimp trawls in these areas was indicated as low and almost non-existent for stone crab pots and fish traps (GMFMC, 2004). Therefore, any adverse effects of these gears on these shark species' EFH are expected to be minimal and temporary in nature. As such, NMFS is not implementing management measures to minimize adverse impacts to EFH from fishing gears in the Apalachicola and Apalachee Bay areas; however, NMFS would continue to work with the regional Fishery Management Councils and interstate Marine Fisheries Commissions to evaluate measures to minimize adverse impacts in these areas if the impacts of bottom-tending gear should become more than minimal and not temporary in nature. As data becomes available to NMFS, NMFS will make the determination of whether or not these or additional gears have adverse effects on HMS EFH and if those effects are more than minimal and not temporary in nature.

No other benthic habitat types have been identified as EFH for neonate, young-of-the-year, or juvenile sharks (*i.e.*, neonate and juvenile shark EFH has been designated based on depth, and/or isobath; Chapter 5). Should additional benthic habitat types be identified as EFH in the future, then NMFS would need to conduct additional analyses to determine whether any fishing impacts are occurring in that particular habitat. Until such habitat types are identified and the degree of overlap and the extent to which habitat is altered by various bottom tending gears is known, NMFS cannot assess the impact of such gears on neonate and juvenile shark EFH.

Aquaculture and Mariculture Impacts

Landings or possession of fish in the EEZ from commercial marine aquaculture production of species managed under FMPs constitutes "fishing" as defined in the Magnuson-Stevens Act [Sec. 3(16)] (GMFMC, 2009). Fishing includes activities and operations related to the taking, catching, or harvesting of fish. Any FMP prepared by a Council, or by the Secretary, must include provision specified in Sec 303(a) of the Magnuson-Stevens Act (GMFMC, 2009). Additionally, numerous discretionary provisions may be prescribed, including measures, requirements, or conditions and restrictions determined to be necessary and appropriate for the conservation and management of a fishery (Sec. 303(b)(14) of the Magnuson-Stevens Act) (GMFMC, 2009). Based on this decision, NMFS has moved aquaculture and mariculture activities into the "Fishing Impacts" section of this FEIS. These activities were previously in the "Non-Fishing Impacts" section of the DEIS.

Inshore Activities

Aquaculture is an expanding industry in the United States, with most facilities currently located in farmland, tidal, intertidal and coastal areas. Aquaculture related impacts that adversely affect the chemical and biological nature of coastal ecosystems include the discharge of excessive waste products and the release of exotic organisms and toxic substances. Problems resulting from the introduction of food and fecal wastes may be similar to those resulting from certain agricultural activities. However, greater nutrient input and localized eutrophic conditions are currently the most probable environmental effects of aquaculture activities. Extremely low oxygen levels and fish kills, of both natural stocks and cultured fish, have been known to occur in impounded wetlands where tidal and wind circulation are severely limited and the enclosed waters are subject to solar heating. In addition, there are impacts related to the dredging and filling of wetlands and other coastal habitats, as well as other modifications of wetlands and waters through the introduction of pens, nets, and other containment and production devices.

Offshore Activities

Offshore aquaculture is the rearing of aquatic organisms in controlled environments (*e.g.*, cages or net pens) in federally managed areas of the ocean. Offshore aquaculture is desirable for several reasons. First, there are fewer competing uses (*e.g.*, fishing and recreation) farther from shore. Second, the deeper water makes it a desirable location with more stable water quality characteristics for rearing fish and shellfish. The stronger currents offshore also mitigate environmental effects such as nutrient and organic loading (GMFMC, 2009).

Currently, there are no commercial finfish offshore aquaculture operations in U.S. federal waters. There are currently 25 permit holders for live rock aquaculture in the U.S. EEZ. There are also several aquaculture operations conducting research and commercial production in state waters, off the coasts of California, New Hampshire, Hawaii, Washington, Maine, and Florida (GMFMC, 2009).

The GMFMC is developing a final programmatic environmental impact statement (FPEIS)/FMP for offshore aquaculture in the Gulf of Mexico. A final rule for this plan is expected in early 2010. If this Aquaculture FMP is approved and implemented, an estimated 5 to 20 offshore aquaculture operations would be permitted in the Gulf over the next 10 years (GMFMC, 2009). The objectives of the Aquaculture FMP are: 1) to provide for the development of environmentally sound and economically sustainable aquaculture fishery to increase the potential yields of the fishery, consistent with the goals and objectives of the Magnuson-Stevens Act; 2) to achieve optimum yield (OY), without adversely affecting wild stocks, protected resources, and essential fish habitat; 3) to conserve and protect essential fish habitat through proper aquaculture facility siting; 4) to obtain necessary data and information for issuing aquaculture permits and monitoring potential impacts of aquaculture operations; 5) to minimize user conflicts among aquaculture permit operations, commercial fishermen, and recreational anglers; 6) to prevent or mitigate to the extent practicable adverse impacts to wild stocks, protected resources, and essential fish habitat resulting from aquaculture activities; 7) to reduce the nation's dependence on imports by supplementing the harvest of domestic fisheries with cultured products to meet growing U.S. consumer demand; and, 8) to promote and facilitate effective enforcement of the aquaculture management program (GMFMC, 2009).

The Aquaculture FMP would provide NMFS authority to issue a Gulf Aquaculture Permit that authorizes the deployment and operation of an offshore aquaculture facility in the Gulf of Mexico EEZ; and the sale of allowable aquaculture species cultured at an offshore aquaculture facility in the Gulf of Mexico EEZ (GMFMC, 2009). In addition, persons issued a Gulf Aquaculture Permit would also be authorized to: 1) harvest (or designate hatchery personnel or other entities to harvest) wild broodstock of an allowable aquaculture species native to the Gulf of Mexico for aquaculture purposes; and 2) possess or transport allowable aquaculture species in, to, or from an offshore aquaculture facility in the EEZ (GMFMC, 2009).

The Aquaculture FMP includes monitoring, recordkeeping and reporting requirements to assist NMFS in administering and reviewing aquaculture permits and evaluating environmental impacts (GMFMC, 2009). Permit applicants would be required to conduct a baseline environmental assessment of the proposed site prior to permit review by NMFS (GMFMC, 2009). If a permit is authorized, permittees would have to conduct routine monitoring of a site based on NMFS protocols and procedures developed in coordination with other federal agencies (GMFMC, 2009). Aquaculture operations would also be required to report to NMFS within 24 hours of discovery: major escapement; entanglements or interactions with marine mammals, endangered species and migratory birds; and findings or suspected findings of pathogens (GMFMC, 2009). Recordkeeping requirements for monitoring environmental impacts include, but are not limited to, maintaining and making available feed invoices and daily records of cultured animals introduced or removed from allowable growing systems (GMFMC, 2009). Permittees would also have to comply with reporting requirements specified in their valid Army Corps of Engineers and Environmental Protection Agency permits (GMFMC, 2009).

Marine aquaculture would be prohibited in Gulf of Mexico EEZ habitat areas of particular concern, marine reserves, marine protected areas, Special Management Zones, permitted artificial reef areas, and coral reef areas as specified in 50 CFR 622, and coral reef areas as defined in 50 CFR 622 (GMFMC, 2009). Additionally, prior to permit review applicants would have to conduct a baseline environmental assessment at the proposed site in accordance with NMFS protocols and procedures (GMFMC, 2009). These procedures will be developed in consultation with Army Corp of Engineers (ACOE), Environmental Protection Agency (EPA), and other federal agencies (GMFMC, 2009). Additional criteria for siting an aquaculture facility (*e.g.*, depth, current speeds, substrate, etc.) would also be evaluated on a case-by-case basis by NMFS (GMFMC, 2009).

The Aquaculture FMP would allow all species native to the Gulf of Mexico that are managed by the GMFMC to be used for offshore aquaculture, except shrimp and corals (GMFMC, 2009). Examples of allowable species include: snappers, groupers, jacks, cobia, and red drum (GMFMC, 2009).

Potential impacts resulting from offshore aquaculture may include increased nutrient loading, habitat degradation, fish escapement, competition with wild stocks, entanglement of endangered or threatened species and migratory birds, spread of pathogens, user conflicts, economic and social impacts on domestic fisheries, and navigational hazards (GMFMC, 2009). The preferred alternatives selected by the GMFMC in the Aquaculture FMP are intended to prevent or mitigate to the extent practicable these potential adverse environmental impacts (GMFMC, 2009).

Conservation measures

- Aquaculture operations should be located, designed and operated to avoid or minimize adverse impacts on estuarine and marine habitats and native fishery stocks. Those impacts that cannot be eliminated should be fully mitigated.
- Aquaculture facilities should be operated in a manner that minimizes impacts on the local environment by utilizing water conservation practices and effluent discharge standards that protect existing designated uses of receiving waters.
- Federal and state agencies should cooperatively promulgate and enforce measures to ensure that diseases from aquaculture operations do not adversely affect wild stocks. Animals that are to be moved from one biogeographic area to another or to natural waters should be quarantined to prevent disease transmission.
- To prevent disruption of natural aquatic communities, cultured organisms should not be allowed to escape; the use of organisms native to each facility's region is strongly encouraged.
- Commercial aquaculture facilities and enhancement programs should consider the genetic make-up of the cultured organisms in order to protect the genetic integrity of native fishes.
- Aquaculture facilities should meet prevailing environmental standards for wastewater treatment and sludge control.

6.2 Analysis of Non-Fishing Impacts

The EFH regulations (50 CFR 600.815(a)(3)) require FMPs to identify non-fishing related activities that may adversely affect EFH. According to the regulations, FMPs must identify activities other than fishing that may adversely affect EFH. Broad categories of such activities include, but are not limited to: dredging, filling, excavation, mining, impoundment, discharge, water diversions, thermal additions, actions that contribute to non-point source pollution and sedimentation, introduction of potentially hazardous materials, introduction of exotic species, and the conversion of aquatic habitat that may eliminate, diminish, or disrupt the functions of EFH. For each activity, the FMP should describe known and potential adverse effects to EFH.

NMFS conducted a thorough review of non-fishing impacts in the 2006 Consolidated HMS FMP which is not repeated here. The intent of the current non-fishing impacts analysis is to consider those impacts that are most likely to have an adverse effect on HMS EFH and for which new information may be available. While difficult to quantify, there are a number of non-fishing activities with the potential to adversely affect EFH, and those activities are considered in more detail in the following section. For any development project that has the potential to adversely affect EFH, the regulations at 50 C.F.R. § 600.920 set forth the consultation process, which allows NMFS to make a determination of a project's effects on EFH and provide conservation recommendations on actions that would adversely affect such habitat pursuant to section 305(b)(4)(A) of the Magnuson-Stevens Act. When the federal action agency determines that an action may adversely affect EFH, the federal action agency must initiate consultation with NOAA (16 U.S.C. §1855(b)(2)). In order to carry out this EFH consultation, the EFH regulations at 50 C.F.R. § 600.920(e)(3) call for the federal action agency to submit to NMFS an EFH assessment containing "a description of the action; an analysis of the potential adverse effects of the action on EFH and the managed species; the federal agency's conclusions regarding the effects of the action on EFH; and proposed mitigation, if applicable." NMFS may request the federal action agency include additional information in the EFH assessment such as results of on-site inspections, views of recognized experts, a review of pertinent literature, an analysis of alternatives and any other relevant information per 50 C.F.R. § 600.920(e)(4). Depending on the degree and type of habitat impact, compensatory mitigation may be necessary to offset permanent and temporary effects of the project. Should the project result in substantial adverse impacts on EFH, an expanded EFH consultation may be necessary (50 C.F.R. §600.920(i)). Adverse effects on EFH are defined in 50 C.F.R. 600.810 (a) as "any impact that reduces the quality and/or quantity of EFH." Adverse effects may include "site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions."

Section 305(b)(4)(B) of the Magnuson-Stevens Act calls for the federal action agency to provide NMFS with a detailed written response to any EFH conservation recommendations, including a description of measures adopted by the federal action agency for avoiding, mitigating, or offsetting the impact of the project on EFH. In the case of a response that is inconsistent with NMFS recommendations, Section 305(b)(4)(B) of the Magnuson-Stevens Act also indicates that the federal action agency must explain its reasons for not following the recommendations. Included in such reasoning would be the scientific justification for any disagreements with NMFS over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects pursuant to 50 CFR 600.920(k).

Following is a discussion of non-fishing impacts based largely on the 1999 HMS FMP and the 2006 Consolidated HMS FMP, and augmented primarily with information presented in the NMFS document "Impacts to Marine Fisheries Habitat from Non-Fishing Activities in the Northeast United States" (NMFS, 2007), and also information presented in the GMFMC's "Final

Environmental Impact Statement for the Generic Essential Fish Habitat Amendment (GMFMC, 2004)."

Land-based Activities That May Impact HMS EFH

Coastal Development

Coastal development activities include urban, suburban, commercial, and industrial construction, along with development of corresponding infrastructure. These activities may result in erosion and sedimentation, dredging and filling (see following sub-section), point and non-point source discharges of nutrients, chemicals, and cooling water into streams, rivers, estuaries and ocean waters.

Industrial point source discharges include discharges from commercial and industrial development, including sewage discharges. These result in the contamination of water and degradation of water quality by introducing organics and heavy metals or altering other characteristics such as pH and dissolved oxygen. Dissolved oxygen, pH, nutrients, temperature changes and suspended materials, particularly when acting synergistically, are considered to have the greatest effect on coastal habitats. Improperly treated sewage treatment effluent has been shown to produce changes in water quality as a result of chlorination and increased contaminant loading, including solids, phosphorus, nitrogen and other organics, and human pathogens and parasites. This can result in alterations in the diversity and productivity of ecosystems and their respective communities. Thermal effluents from power plant cooling water discharges also can have a pronounced effect on coastal habitats, causing changes in the community structure.

Non-point source pollution - that which results from land runoff, atmospheric deposition, drainage, groundwater seepage, or hydrologic modification - results in the deposition of pathogens, nutrients, sediments, heavy metals, pesticides, oxygen demanding substances road salts, hydrocarbons and other toxics. These materials can have a greater impact on coastal habitats than point source pollutants.

Oxygen demanding substances can result in instances of hypoxia, or dead zones, whereby dissolved oxygen concentrations are below those necessary to sustain most animal life. Dead zones form when freshwater inflows bring excessive nitruent loads into coastal waters, providing favorable conditions for excessive algae growth that utilizes the water's oxygen supply when decomposing in bottom waters (Carlisle, 2000). This can be a direct threat to EFH. Direct mortality, altered migration, reduction of suitable habitat, increased susceptibility to predation, changes in food resources, and susceptibility of early life stages occur for fishes during hypoxic events. Benthic fauna are most susceptible to the effects of the hypoxic conditions; fishes and other motile fauna may leave the area when oxygen levels fall below 1.5-2.0 mg/l. Changes in distribution and abundance of fish species can result in loss of commercial and recreational fishing opportunities and reduced catch rates.

A zone of hypoxia affecting thousands of square kilometers (sq km) of continental shelf bottom water in the Gulf of Mexico from the Mississippi River delta to the upper Texas coast occurs during summer months due to nutrient loading from the Mississippi River outflow. The extent of this zone varies year by year, but in 2002 it reached 22,000 sq km (8,494 sq mi) (Krug, 2007). The source of the hypoxia is primarily excess nitrate delivered from the Mississippi-Atchafalaya River Basin. In addition to agricultural waste, inadequately treated or untreated sewage and other urbal pollution is also discharged into these waters (Carlisle, 2000). The dead zone first appears in the spring as conditions for algal blooms become more favorable, and is broken up in late August or September by hurricanes and tropical storms. Decreasing storms in late spring and early summer result in calmer water, which prevents the bottom strata of low oxygen water from mixing with oxygenated surface water. Researchers have expressed concern that this zone may be increasing in frequency and intensity. Should nutrient loading increase, the hypoxic zone may expand and further threaten the coastal and marine ecosystem, including EFH, although the extent to which these factors may influence HMS EFH is unknown.

Certain environmental conditions such as nutrient enrichment from coastal discharges and warm water temperatures may cause the development of algal blooms. Some algal blooms are toxic and cause significant harm to other marine life and humans when transferred through the food web. Others are harmful due to high biomass accumulation which may lead to hypoxia, anoxia, and shading of submerged vegetation, each of which can lead to a multitude of negative environmental consequences. Some harmful algal bloom (HAB) species also have physical structures, such as spines, that can lodge in the gills of fish (Gilbert, 2007). Algal blooms can be a natural phenomena; however, many sources of nutrients (nitrogen and phosphorus) can stimulate HABs, including sewage and animal wastes, atmospheric deposition, and groundwater inflow, as well as agricultural and other fertilizer runoff, and coastal aquaculture (Anderson *et al.*, 2002). The effects of nutrient inputs are not always direct, as there are indirect pathways by which nutrients are consumed and transformed and in the process may make nutrients more bioavailable for HABs (Gilbert,2007).

Examples of dinoflagellates or algae that are known to cause HABs include *Karenia breve,* the dinoflagellate that causes neurotoxic shellfish poisoning, dinoflagellates of the genus *Alexandrium,* which causes paralytic shellfish poisoning, *Aureococcus anophagefferens,* the algae which causes "brown tides", and diatoms of the genus *Pseudo-nitzschia* which cause amnesic shellfish poisoning. *Pfiesteria piscicida* is a recently-described toxic dinoflagellate that has been documented in the water column in coastal areas of Delaware, Maryland, and North Carolina. Algal blooms are a serious coastal issue with direct economic consequences for fisheries stocks and sales.

Hydrological modifications associated with coastal development alter freshwater inflow to coastal waters, resulting in changes in salinity, temperature, and nutrient regimes, thereby contributing to further degradation of estuarine and nearshore marine habitats. The variety of pollutants and the severity of their effects from coastal development activities depend upon a number of factors, such as the nature of the construction, physical characteristics of the site involved, and proximity of the pollutant source to the coastline. However, all of these factors ultimately serve to degrade estuarine and coastal water quality to some degree in terms of dissolved oxygen levels, salinity concentrations, and contaminants. The result can be losses of important flora and fauna.

Conservation measures

- Adverse impacts resulting from construction should be avoided whenever practicable alternatives are identified. For those impacts that cannot be avoided, minimization through implementation of Best Management Practices (BMPs) should be employed. For those impacts that can neither be avoided nor minimized, compensation through replacement of equivalent functions and values should be required.

- Flood control projects in waterways draining into EFH should be designed to include mitigation measures and constructed using BMPs. For example, stream relocation and channelization should be avoided whenever practicable. However, should no practicable alternatives exist, relocated channels should be of comparable length and sinuosity as the natural channels they replace to maintain the quality of water entering receiving waters (*i.e.*, HMS EFH).

- Watershed protection/site development should be encouraged. Comprehensive planning for development on a watershed scale (and for small-scale site development as well) should be undertaken, including planning and designing to protect sensitive ecological areas, minimizing land disturbances and retaining natural drainage and vegetation whenever possible. To be truly effective, watershed planning efforts should include existing facilities even though they are not subject to EFH consultation.

- Pollution prevention activities, including techniques and activities to prevent non-point source pollutants from entering surface waters, should be implemented. Primary emphasis should be placed on public education to promote methods for proper disposal and/or recycling of hazardous chemicals, management practices for lawns and gardens, onsite disposal systems (OSDSs), and commercial enterprises such as service stations and parking lots.

- Construction erosion/sediment control measures should be used to reduce erosion and transport of sediment from construction sites to surface waters. A sediment and erosion control plan should be developed and approved prior to land disturbance.

- Runoff from new development should be managed so as to meet two conditions: 1) the average annual total suspended solids loadings after construction is completed are no greater than pre-development loadings; and, 2) to the extent practicable, post-development peak runoff rate and average volume are maintained at levels that are similar to pre-development levels.

- Construction site chemical control measures should address the transport of toxic chemicals to surface water by limiting the application, generation, and migration of chemical contaminants (*i.e.*, petrochemicals, pesticides) and providing proper storage and disposal.

- New OSDSs should be built to reduce nutrient/pathogen loadings to surface waters. OSDSs should be designed, installed and operated properly and to be situated away from open waterbodies and sensitive resources such as wetlands, and floodplains. Protective separation between the OSDS and the groundwater table should be established. The OSDS unit should be designed to reduce nitrogen loadings in areas where surface waters may be adversely affected. Operating OSDSs should prevent surface water discharges and reduce pollutant loadings to ground water. Inspection at regular intervals and repair or replacement of faulty systems should occur.

- Roads, highways, bridges and airports should be situated away from areas that are sensitive ecosystems and susceptible to erosion and sediment loss. The siting of such structures should not adversely impact water quality, should minimize land disturbances, and should retain natural vegetation and drainage features.

- Construction projects of roads, highways, bridges and airports should implement approved erosion and sediment control plans prior to construction to reduce erosion and improve retention of sediments onsite during and after construction.

- Construction site chemical control measures for roads, highways, and bridges should limit toxic and nutrient loadings at construction sites by ensuring the proper use, storage, and disposal of toxic materials to prevent significant chemical and nutrient runoff to surface waters.

- Operation and maintenance activities for roads, highways, bridges, and airports should be developed so as to reduce pollutant loadings to receiving waters during operation and maintenance.

- Runoff systems should be developed for roads, highways, bridges, and airports to reduce pollutant concentrations in runoff from existing roads, highways, and bridges. Runoff management systems should identify priority pollutant reduction opportunities and schedule implementation of retrofit projects to protect impacted areas and threatened surface waters.

- The planning process for new and maintenance channel dredging projects should include an evaluation of the potential effects on the physical and chemical characteristics of surface waters that may occur as a result of the proposed work, and should reduce undesirable impacts. When the operation and maintenance programs for existing modified channels are reviewed, they should identify and implement any available opportunities to improve the physical and chemical characteristics of surface waters in those channels.

- Bridges should be designed to include collection systems which convey surface water runoff to land-based sedimentation basins.

- Sewage treatment discharges should be treated to meet state water quality standards. Implementation of up-to-date methodologies for reducing discharges of biocides (*e.g.*, chlorine) and other toxic substances is encouraged.

- Use of land treatment and upland disposal/storage techniques of solid waste from sewage treatment should be implemented where possible. Use of vegetated wetlands as natural filters and pollutant assimilators for large scale wastewater discharges should be limited to those instances where wetlands have been specifically created for this purpose. The use of such constructed wetlands for water treatment should be encouraged wherever the overall environmental and ecological suitability of such an action can been demonstrated.

- Sewage discharge points in coastal waters should be located well away from critical habitats. Proposals to locate outfalls in coastal waters must be accompanied by hydrographic studies that demonstrate year round dispersal characteristics and provide proof that effluents will not reach or affect fragile and productive habitats.

- Dechlorination facilities or lagoon effluent holding facilities should be used to destroy chlorine at sewage treatment plants.

- No toxic substances in concentrations harmful (synergistically or otherwise) to humans, fish, wildlife, and aquatic life should be discharged. The EPA's Water Quality Criteria Series should be used as a guideline for determining harmful concentration levels. Use of the best available technology to control industrial waste water discharges should be required in areas adjacent to habitats essential to HMS. Any new potential discharge that will influence HMS EFH must be shown not to have a harmful effect on HMS or their habitat.

- The siting of industries requiring water diversions and large-volume water withdrawals should be avoided in areas influencing HMS EFH. Project proponents should demonstrate that project implementation will not negatively affect HMS, their EFH, or their food supply. Where such facilities currently exist, best management practices should be employed to minimize adverse effects on the aquatic environment.

- All NPDES permits should be reviewed and strictly enforced in areas affecting HMS EFH.

- Hazardous waste sites should be cleaned up (*i.e.*, remediated) to prevent contaminants from entering aquatic food chains. Remedial actions affecting aquatic and wetland habitats should be designed to facilitate restoration of ecological functions and values.

Agriculture (and Silviculture)

Cropland, livestock rangeland, and commercial nursery grounds can be connected to coastal waters and inland tributaries. Agricultural and silvicultural practices can affect estuarine, coastal and marine water quality through nutrient enrichment and chemical contamination from animal wastes, fertilizers, pesticides and other chemicals via non-point source runoff or via drainage systems that serve as conduits for contaminant discharge into natural waterways. Pesticides can adversely affect EFH through direct toxicological impact on the health or performance of exposed fish, an indirect impairment of the productivity of aquatic ecosystems, and a loss of aquatic vegetation that provides physical shelter for fish. In addition, uncontrolled or improper irrigation practices can contribute to non-point source pollution, and may exacerbate contaminant flushing into coastal waters. Major impacts also include nutrient over-enrichment with subsequent deoxygenation of surface waters, and algal blooms, which can also produce hypoxic or anoxic conditions and stimulation of toxic dinoflagellate growth. Excessively enriched waters often will not support fish, and may also not support food web assemblages and other ecological assemblages needed to sustain desirable species and populations. Agricultural activities also increase soil erosion and associated sediment transport in adjacent water bodies, resulting in high turbidity. Many of these same concerns may apply to silviculture as well.

Conservation measures

- Federal agencies, in conjunction with state agencies, should establish and approve criteria for vegetated buffer strips in agricultural areas adjacent to estuarine and coastal HMS EFH in order to minimize pesticide, fertilizer, and sediment loads to these areas critical for HMS survival. The effective width of these vegetated buffer strips should vary with the slope of the terrain and soil permeability.

- Concerned Federal agencies (*e.g.*, Natural Resources Conservation Service) should conduct or contribute to programs and demonstration projects to educate farmers on improved agricultural practices that would minimize the use and wastage of pesticides, fertilizers, and top soil, and reduce the adverse effects of these materials on HMS EFH.

- Delivery of sediment from agricultural lands to receiving waters should be minimized. Land owners have a choice of one of two approaches: 1) apply the erosion component of the U.S. Department of Agriculture's Conservation Management System through such practices as conservation tillage, strip cropping, contour farming, and terracing; or 2) design and install a combination of practices to remove settleable solids and associated pollutants in runoff for all but the largest storms.

- New and existing confined animal facilities should be designed to limit discharges to waters of the United States by storing wastewater and runoff caused by all storms up to and including the 25-year frequency storms. For smaller existing facilities, the management systems that collect solids, reduce contaminant concentrations, and reduce runoff should be designed and implemented to minimize the discharge of contaminants in both facility wastewater and runoff caused by all storms up to and including 25-year frequency storms.

- Stored runoff and solids should be managed through proper waste utilization and the use of disposal methods which minimize impacts to surface and ground water.

- Development and implementation of comprehensive nutrient management plans should be undertaken, including development of a nutrient budget for the crop, identification of the types and amounts of nutrients necessary to produce a crop based on realistic crop yield expectations, and an identification of the environmental hazards of the site.

- Pesticide and herbicide management should minimize water quality problems by reducing pesticide use, improving the timing and efficiency of application (not within 24 hours of expected rain or irrigation), preventing backflow of pesticides into water supplies, and improving calibration of pesticide spray equipment. Improved methods should be used such as integrated pest management (IPM) strategies. IPM strategies include evaluating current pest problems in relation to the cropping history, previous pest control measures, and applying pesticides only when an economic benefit to the producer will be achieved (*i.e.*, application based on economic thresholds). If pesticide applications are necessary, pesticides should be selected to minimize environmental impacts such as persistence, toxicity, and leaching potential.

- Livestock grazing should protect sensitive areas, including streambanks, wetlands, estuaries, ponds, lake shores, and riparian zones. Protection is to be achieved with improved grazing management that reduces the physical damage and direct loading of animal waste and sediment to sensitive areas (*i.e.*, by restricting livestock access or providing stream crossings).

- Upland erosion should be reduced by either applying the range and pasture components of a Conservation Management System, or maintaining the land in accordance with the activity plans established by either the Bureau of Land Management or the Forest Service. Such techniques include the restriction of livestock from sensitive areas through locating salt, shade, and alternative drinking sources away from sensitive areas, and providing livestock stream crossings.

- Irrigation systems that deliver necessary quantities of water yet reduce non-point pollution to surface waters and groundwater should be developed and implemented.

- BMPs should be implemented to minimize habitat impacts when agricultural ditches are excavated through wetlands that drain to HMS EFH.

- NPDES/SPDES permits, in consultation with state fishery agencies, should be required for agricultural ditch systems that discharge into areas adjacent to HMS EFH.

Coastal and Offshore Activities That May Impact HMS EFH

Dredging and Disposal of Dredge Material

Coastal development can involve dredging operations for shoreline, commercial and residential development. Dredging operations also occur in order to maintain certain areas for activities such as shipping, boating, construction of infrastructure (*e.g.*, offshore oil and gas pipelines), and marine mining. Coastal development involving dredging and filling can also result in the destruction of coastal wetlands. This results not only in the loss and alteration of wetland vegetation, and altered hydrologic and temperature regimes, but also in the elimination of protective buffer zones that serve to filter sediments, nutrients, and contaminants - such as heavy metals and pesticides - that are transported to the coastal zone in ground and surface waters. All of these factors result in significant effects on coastal ecosystems, particularly the loss of important habitat for early life stages of many fishery species, including sharks.

Disposal of the dredged material takes place in designated open water disposal areas, often near the dredge site. These operations often result in negative impacts on the marine environment. Of particular concern regarding HMS EFH is the temporary degradation of water quality due to the resuspension of bottom materials, resulting in water column turbidity, potential contamination due to the release of toxic substances (metals and organics), and reduced oxygen levels due to the release of oxygen-consuming substances (*e.g.*, nutrients, sulfides). Even with the use of approved practices and disposal sites, ocean disposal of dredged materials is expected to cause environmental harm since contaminants will continue to be released, and localized turbidity plumes and reduced oxygen zones may persist.

Conservation measures

- Coastal development traditionally has involved dredging and filling of shallows and wetlands, hardening of shorelines, clearing of riparian vegetation, and other activities that adversely affect the habitats of living marine resources. Mitigation measures should be required for all development activities with the potential to influence HMS EFH.

- Destruction of wetlands and shallow coastal water habitats should not be permitted in areas adjacent to HMS EFH. Mitigating or compensating measures should be employed where destruction is unavoidable. Project proponents should demonstrate that project implementation will not negatively affect HMS, their habitat, or their food sources.

- Seasonal restrictions should be imposed and enforced so as to avoid operations during critical life history stages (*e.g*., shark pupping), depending the habitats affected, environmental conditions, and species requirements.

- Best engineering and management practices (*e.g*., seasonal restrictions, modified dredging methods, and/or disposal options) should be employed for all dredging and in-water construction projects. Such projects should be permitted only for water dependent purposes when no feasible alternatives are available. Mitigating or compensating measures should be employed where significant adverse impacts are unavoidable. Project proponents should demonstrate that project implementation will not negatively affect HMS, their EFH, or their food sources.

- Project guidelines should make allowances to cease operations or take additional precautions to avoid adversely affecting HMS EFH during seasons when sensitive HMS life stages might be most susceptible to disruption (*e.g.*, seasons when spawning is occurring).

- When projects are considered and in review for open water disposal permits for dredged material, Federal permitting agencies should identify the direct and indirect impacts such projects may have on HMS EFH.

- Uncontaminated dredged material may be viewed as a potentially reusable resource if properly placed and beneficial uses of these materials should be investigated. Materials that are suitable for beach nourishment, marsh construction or other beneficial purposes should be utilized for these purposes as long as the design of the project minimizes impacts on HMS EFH.

- "Beneficial Use" proposals in areas of HMS EFH should be compatible with existing uses by HMS. If no beneficial uses are identified, dredged material should be placed in contained upland sites. The capacity of these disposal areas should be used to the fullest extent possible. This may necessitate dewatering of the material or increasing the elevation of embankments to augment the holding capacity of the site. Techniques could be applied that render dredged material suitable for export or for use in re-establishing wetland vegetation.

- No unconfined disposal of contaminated dredge material should be allowed in HMS EFH.

- Disposal sites should be located in uplands when possible.

Navigation

Navigation-related threats to estuarine, coastal, and offshore environments that have the potential to affect HMS EFH include navigation support activities such as excavation and maintenance of channels (including disposal of excavated sediments) which result in the elevation of turbidity and resuspension of contaminants; construction and operation of ports, mooring and cargo facilities; construction of ship repair facilities; and construction of channel stabilization structures such as jetties and revetments. In offshore locations the disposal of dredged material is the most significant navigation related threat, resulting in localized burial of benthic communities and degradation of water quality. In addition, threats to both nearshore and offshore waters are posed by vessel operation activities such as the discharge and spillage of oil, other hazardous materials, trash and cargo, all of which may result in localized water quality degradation and direct effects on HMS, especially eggs, larvae, and neonates that may be present. Wakes from vessel operation may also exacerbate shoreline erosion, effecting habitat modification and potential degradation.

Conservation measures

- Permanent dredged material disposal sites should be located in upland areas. Where long-term maintenance is anticipated, upland disposal sites should be acquired and maintained for the entire project life.

- Construction techniques (*e.g.*, silt curtains) should minimize turbidity and dispersal of dredged materials into HMS EFH.

- Prop washing should not be used as a dredging method.

- Channels and access canals should not be constructed in areas known to have high sediment contamination levels. If construction must occur in these areas, specific techniques, including the use of silt curtains, are needed to contain suspended contaminants.

- Alignments of channels and access canals should utilize existing channels, canals and other deep water areas to minimize initial and maintenance dredging requirements. All canals and channels should be clearly marked to avoid damage to adjacent bottoms from prop washing.

- Access channels and canals should be designed to ensure adequate flushing to avoid creating low dissolved oxygen conditions or sumps for heavy metals and other contaminants. Widths of access channels in open water should be minimized to avoid impacts to aquatic substrates. In canal subdivisions channels and canals within the development should be no deeper than the parent body of water and should be a uniform depth or become gradually shallower inland.

- To ensure adequate circulation confined and dead-end canals should be avoided by utilizing bridges or culverts that ensure exchange of the entire water column. In general, depths of canals should be minimized, widths maximized, and canals oriented towards the prevailing summer winds in order to enhance water exchange.

- Consideration should be given to the use of locks in navigation channels and access canals which connect more saline areas to fresher areas.

- To the maximum extent practicable, all navigation channels and access canals should be backfilled upon abandonment and restored to as near pre-project condition as possible. Plugs, weirs or other water control structures may also be necessary as determined on a case-by-case basis.

- All vessels transporting fuels and other hazardous materials should be required to carry equipment to contain and retrieve the spill.

- Dispersants should not be used to clean up fuels and hazardous materials unless approved by the EPA/Coast Guard after consultation with fisheries agencies.

Marinas and Recreational Boating

Marinas and recreational boating are increasingly popular uses of coastal areas. As marinas are located at the water's edge, there is often no buffering of associated pollutants released into the water column. Impacts caused by marinas include lowered dissolved oxygen, increased temperatures, bioaccumulation of pollutants by organisms, toxic contamination of water and sediments, resuspension of sediments and toxics during construction, eutrophication, change in circulation patterns, shoaling, and shoreline erosion. Pollutants that result from marina activities include nutrients, metals including copper released from antifouling paints, petroleum hydrocarbons, pathogens, and polychlorinated biphenyls. Also, chemicals commonly used to treat timber used for piers and bulkheads (*e.g.*, creosote, copper, chromium, and arsenic salts) are introduced into the water. Other potential impacts associated with recreational boating are the result of improper sewage disposal, fuel and oil spillage, cleaning operations, and disposal of fish waste. Propellers from boats can also cause direct damage to multiple life stages of organisms, including eggs, larvae/neonates, juveniles and adults; destratification; elevated temperatures, and increased turbidity and contaminants by resuspending bottom materials.

Conservation measures

- Water quality must be considered in the siting and design of both new and expanding marinas.

- Marinas are best created from excavated uplands that are designed so that water quality degradation does not occur. Applicants should consider basin flushing characteristics and other design features such as surface and waste water collection and treatment facilities. Marina siting and design should allow for maximum flushing of the site. Adequate flushing reduces the potential for the stagnation of water in a marina and helps to maintain the biological productivity as well as reduce the potential for toxic accumulation in bottom sediments. Catchment basins for collecting and storing runoff should be included as components of the site development plan.

- Marinas should be designed and located so as to protect against adverse impacts on important habitat areas as designated by local, state, or Federal governments.

- Where shoreline erosion is a non-point source pollution problem, shorelines should be stabilized. Vegetative methods are strongly preferred.

- Runoff control strategies, which include the use of pollution prevention activities and the proper design of hull maintenance areas, should be implemented at marina sites.

- Marinas with fueling facilities should be designed to include measures for reducing oil and gas spillage into the aquatic environment. Fueling stations should be located and designed so that in the case of an accident spill contaminants can be contained in a limited area. Fueling stations should have fuel containment equipment as well as a spill contingency plan.

- To prevent the discharge of sewage directly to coastal waters new and expanding marinas should install pumpout, pump station, and restroom facilities where needed. Pumpout facilities should be maintained in operational condition and their use should be encouraged to reduce untreated sewage discharges to surface waters.

- Solid wastes produced by the operation, cleaning, maintenance, and repair of boats should be properly disposed of in order to limit their entry to surface waters.

- Sound fish waste management should be part of the project design, including a combination of fish cleaning restrictions, public education, and proper disposal facilities.

- Appropriate storage, transfer, containment, and disposal facilities for liquid materials commonly used in boat maintenance, along with the encouragement of recycling of these materials, should be required.

- The amount of fuel and oil leakage from fuel tank air vents should be reduced.

- Potentially harmful hull cleaners and bottom paints (and their release into marinas and coastal waters) should be minimized.

- Public education/outreach/training programs should be instituted for boaters, as well as marina operators, to prevent improper disposal of polluting materials.

Marine Sand and Minerals Mining

Mining for sand (*e.g.*, for beach nourishment projects), gravel, and shell stock in estuarine and coastal waters can result in water column effects by changing circulation patterns, increasing turbidity, and decreasing oxygen concentrations at deeply excavated sites where flushing is minimal. Ocean extraction of mineral nodules is a possibility for some non-renewable minerals now facing depletion on land. Such operations are proposed for the continental shelf and the deep ocean proper. Deep borrow pits created by mining may become seasonally or permanently anaerobic. Marine mining also elevates suspended materials at mining sites, creating turbidity plumes that may move several kilometers from these sites. Resuspension of sediments can affect water clarity over wide areas, and could also potentially affect pelagic eggs and larvae. In addition, resuspended sediments may contain contaminants such as heavy metals, pesticides, herbicides, and other toxins.

There is also interest in non-energy Outer Continental Shelf (OCS) resources (*e.g.*, sand) for beach re-nourishment projects. The Minerals Management Service 's (MMS) Marine Minerals Program provides policy direction and guidance for the development of marine mineral resources on the OCS. The Marine Minerals Program works with coastal states to identify sand deposits in federal waters suitable for beach nourishment. One such example is a lease agreement made that MMS provided the city of Jacksonville, Florida, with access to 1.24 million cubic yards of sand on the OCS. Other states have also entered into cooperative agreements with MMS (http://www.gomr.mms.gov/homepg/offshore/atlocs/atlocs.html). Depending on the scale, duration, and timing of the re-nourishment project, there is potential to impact coastal habitats that may include EFH for HMS. Dredging may cause water turbidity, siltation, and changes to water column characteristics that could affect habitat use for a number of HMS.

Conservation measures

- Sand mining and beach nourishment should not be allowed in HMS EFH during seasons when HMS are utilizing the area, particularly during spawning and pupping seasons.

- Gravel extraction operations should be managed to avoid or minimize impacts to the bathymetric structure in estuarine and nearshore areas.

- An integrated environmental assessment, management, and monitoring program should be a part of any gravel or sand extraction operation, and encouraged at Federal and state levels.

- Planning and design of mining activities should avoid significant resource areas important as HMS EFH.

- Mitigation and restoration should be an integral part of the management of gravel and sand extraction policies.

- Given the increase in sea level rise and potentially growing need to re-nourish beaches, this activity needs to be closely monitored in areas that are adjacent to or located in HMS EFH.

Ocean Dumping

The disposal of dredged sediments and hazardous and/or toxic materials (*e.g.*, industrial wastes) containing concentrations of heavy metals, pesticides, petroleum products, radioactive wastes, pathogens, etc., in the ocean degrades water quality and benthic habitats. These effects may be evident not only within the immediate vicinity of the dumping activity, but also at farther locations, as well, due to current transport and the potential influence of other hydrographic features. Disposal of hazardous and toxic materials by U.S. flag vessels and vessels operating in the U.S. territorial sea and contiguous zone is currently prohibited under the Marine Protection Research and Sanctuaries Act (MPRSA), although under certain circumstances the Environmental Protection Agency may issue emergency permits for dumping industrial wastes into the ocean. Major dumping threats to the marine environment are therefore limited mostly to illegal dumping and accidental disposal of material in unauthorized locations. However, given the amount of debris that is deposited along the Nation's beaches every year, including hazardous materials such as medical wastes, it is evident that effects from such dumping may be substantial.

Conservation measures

- Federal and state agencies mandated with ocean dumping enforcement responsibilities should continue to implement and enforce all legislation, rules and regulations, and consider increasing monitoring efforts where warranted.

- Disposal of hazardous materials within areas designated as EFH for HMS should not be allowed under any circumstances, including emergency permit situations.

Petroleum Exploration and Development

One of the major activities with the potential to impact HMS EFH is oil and gas development on the outer continental shelf (OCS). Currently there are approximately 4,000 oil and gas platforms in the Gulf of Mexico (Figure 6.9) and fewer than 100 in the Atlantic (Figure 6.10). Most of the structures are in waters shallower than 1,000 feet (~300 m), however, there are efforts to expand oil drilling to deeper areas of the Gulf. Approximately 72 percent of the Gulf of Mexico's oil production comes from wells drilled in 1,000 feet (305 meters) of water or greater (Figure 6.11) (MMS, 2008(b)). In 2007, 54 percent of all Gulf of Mexico leases were located in water depths greater than 1,000 feet. In the two 2007 lease sales, Western Gulf Lease Sale 204 and Central Gulf Lease Sale 205, almost 70 percent of the tracts receiving bids were in water depths of 1,312 feet or greater (400 meters) (Figure 6.12). Additionally, 94 exploratory wells and 48 development wells were drilled in 2007. Of the 48 development wells drilled, 60 percent were in ultra-deepwater, water depths greater than 5,000 feet. Eight new deepwater discoveries were announced by oil and gas operators in 2007 with the deepest in 7,400 feet of water (MMS, 2008). Many of the shallower sites and most of the deepwater sites fall within HMS EFH, particularly for bluefin tuna. Many of the deeper sites are also located within the proposed HAPC for bluefin tuna.

The continued expansion of deep water oil exploration is detailed in the MMS report, Deepwater Gulf of Mexico 2008: America's Offshore Energy Frontier*,* which chronicles the activities of the oil and gas industry in the deepwater (1,000 feet of water or more) Gulf over the past sixteen years (MMS, 2008(b)).

In the Atlantic, ten oil and gas lease sales were held between 1976 and 1983. Fifty-one wells were drilled in the Atlantic OCS; five Continental Offshore Stratigraphic Test (COST) wells between 1975 and 1979, and 46 industry wells between 1977 and 1984 (Figure 6.13). Five wells offshore New Jersey had successful drillstem tests of natural gas and/or condensate. These five wells were abandoned as non-commercial. Reports on each of the eight exploratory and two COST wells drilled in the North Atlantic Planning Area are available and reports on 10 of the 34 wells drilled in the Mid-Atlantic Planning Area are available on the MMS webpage at http://www.gomr.mms.gov/homepg/atlantic/georges_bank.html.

For oil platforms, there are direct and indirect impacts to the environment such as disturbance created by the activity of drilling, associated pollution from drilling activities, discharge of wastes associated with offshore exploration and development, operational wastes from drilling muds and cuttings, potential for oil spills, and potential for catastrophic spills caused by accidents or hurricanes, and alteration of food webs created by the submerged portions of the oil platform, which attract various invertebrate and fish communities. Anecdotal information suggests that some recreational fishermen may target various fish species, including HMS, in the vicinity of oil platforms due to increased abundance and availability near platforms. The apparent increase in abundance of a number of species may be due to increased prey availability resulting from various fish and invertebrate communities that are attracted to or attach directly to the structures and submerged pilings. While the apparent increase in abundance of fish near oil platforms may appear to be beneficial, little is known about the long term environmental impacts of changes caused by these structures to fish communities, including potential changes to migratory patterns, spawning behavior, and development of early life stages. Currently there is debate about whether the positive effects of the structures in attracting fish communities would be harmed by removal of the platforms when they are decommissioned.

Conservation measures

- A plan should be in place to avoid the release of hydrocarbons, hydrocarbon-containing substances, drilling muds, or any other potentially toxic substance into the aquatic environment. Storage of these materials should be in enclosed tanks whenever feasible or, if not, in lined mud pits or other approved sites. Equipment should be maintained to prevent leakage. Catchment basins for collecting and storing surface runoff should be included in the project design.

- The impacts of all exploratory and development activities on the fisheries resources should be determined prior to MMS approval of any applications for permits to drill, including effects of seismic survey signals on fish behavior, eggs and larvae.

- Exploration/production activities and facilities should be designed and maintained in a manner that will maintain natural water flow regimes, avoid blocking surface drainage, and avoid erosion in adjacent coastal areas.

- Activities should avoid wetlands. Drilling should be conducted from uplands, existing drill sites, canals, bayous or deep bay waters (greater than six feet), wherever possible, rather than dredging canals or constructing board roads. When wetland use is unavoidable, work in previously disturbed wetlands is preferable to work in high quality or undisturbed wetlands. If this is not possible, temporary roads (preferably board roads) to provide access are more desirable than dredging canals because roads generally impact less acreage and are easier to restore than canals. If the well is a producer, the drill pad should be reduced to the minimum size necessary to conduct production activities and the disturbed area should be restored to pre-project conditions.

- Upon completion or abandonment of wells in wetlands, all unnecessary equipment should be removed and the area restored to pre-project elevations. The well site, various pits, levees, roads and other work areas should be graded to pre-project marsh elevations and then restored with indigenous wetland vegetation. Abandoned canals frequently need plugging and capping with erosion-resistant material at their origin to minimize bank erosion and to prevent saltwater intrusion. In addition, abandoned canals will frequently need to be backfilled to maximize fish and wildlife production in the area and to restore natural sheet flows. Spoil banks containing uncontaminated materials should be backfilled into borrow areas or breached at regular intervals to re-establish hydrological connections.

- In open bays maximum use should be made of existing navigable waters already having sufficient width and depth for access to the drill sites.

- An oil spill response plan should be developed and coordinated with federal and state resource agencies.

- Activities on the OCS should be conducted so that petroleum-based substances such as drilling muds, oil residues, produced waters, or other toxic substances are not released into the water or onto the sea floor: drill cuttings should be shunted through a conduit and discharged near the sea floor, or transported ashore or to less sensitive, NMFS-approved offshore locations; drilling and production structures, including pipelines, generally should not be located within one mile of the base of a live reef.

- Prior to pipeline construction, less damaging, alternative modes of oil and gas transportation should be explored.

- State natural resource agencies should be involved in the preliminary pipeline planning process to prevent violations of water quality and habitat protection laws and to minimize impact of pipeline construction and operation on aquatic resources.

- Pipeline alignments should be located along routes that minimize damage to marine and estuarine habitats. Buried pipelines should be examined periodically for maintenance of adequate earthen cover.

- All vessels transporting fuels and other hazardous materials should be required to carry equipment to contain and retrieve the spill. Dispersants shall not be used to clean up fuels and hazardous materials unless approved by the EPA/Coast Guard and fishery agencies.

- NPDES permit conditions such as those relating to dissolved oxygen, temperature, impingement and entrainment, under the Clean Water Act should be monitored and strictly enforced in areas that could affect HMS EFH.

- NPDES permits should be reviewed every five years for all energy production facilities.

Liquefied Natural Gas

Several liquefied natural gas (LNG) facilities have been proposed in the Gulf of Mexico (Figure 6.14). For LNG facilities, a major concern is the saltwater intake system used to heat LNG and regasify it before piping to shore. LNG facilities sometimes have open loop, once-through heating systems known as open rack vaporizers, which require large amounts of sea water to heat LNG. One such project, Main Pass LNG, which was proposed to be located in the Gulf of Mexico 37 miles east of Venice, LA, included a water intake system that would require an average of 180 million gallons of sea water per day (MGD) to heat and regasify LNG. Short-term, maximum sea water use for this facility would have been over 200 MGD. As described in the Main Pass LNG DEIS, the use of the sea water intake system would subject early life stages of marine species to entrainment, impingement, thermal shock, and water chemistry changes, potentially causing the annual mortality of hundreds of billions of zooplankton, including fish and shellfish eggs and larvae. Depending on the location of the facility, this could have an adverse effect on EFH for HMS or other species. The proposal was amended to include a closed loop system after receiving comments from a number of agencies, including NOAA, that mitigating measures such as a closed loop system should be considered.

Closed loop systems are currently being used in the United States to regasify LNG and are proposed for multiple onshore and offshore LNG terminals throughout the nation, with the notable exception of the offshore waters of the Gulf of Mexico. These systems, which do not rely on an external saltwater intake source and thus do not require large amounts of seawater, have considerably lower impacts on fish eggs, larvae, and zooplankton than open loop systems.

Conservation measures

- Use of closed loop systems should be recommended over open loop systems to minimize the level of impingement and entrainment of marine organisms; design intake structures to minimize entrainment of impingement.
- Locate facilities that use surface waters away from estuaries, embayments and other coastal areas that are use for spawning, pupping and nurseries.
- Avoid the use of biocides to prevent fouling if possible; if necessary, use the least damaging antifoulants.
- Schedule dredging activities to avoid times of spawning and pupping and when vulnerable life stages are otherwise present
- Ensure that facilities have appropriate gas spill response plans and protocols in place.

Renewable Energy Projects

Other activities that may affect HMS EFH include renewable offshore energy projects. The Energy Policy Act of 2005 authorized MMS to establish the OCS Alternative Energy and Alternate Use (AEAU) Program. Under this authority, MMS will regulate alternative energy projects and projects that involve the alternate use of existing oil and gas platforms on the OCS. Alternative energy includes, but is not limited to wind, wave, solar, underwater current and generation of hydrogen. Alternate uses of existing facilities may include aquaculture, research, education, recreation, or support for offshore operations and facilities.

MMS has proposed five locations offshore of New Jersey, Delaware, Georgia, Florida, and California for alternative energy development (Figure 6.15-6.18). Since these projects fall within current EFH for HMS and a number of other federally managed fish stocks, MMS has initiated the consultation process with NOAA. MMS is proposing limited, temporary leases in these areas for data collection and technology testing related to wind, wave and ocean current energy development. According to MMS, at this time, there is no commercial energy production associated with the proposed leases. Prior to any leases actually being issued or consideration of specific project proposals, MMS will need to determine if competitive interest exists for research in the five areas. MMS must also evaluate other information related to those areas such as environmental factors and current commercial activities such as fishing and shipping. The MMS issued a Federal Register Notice (72 FR 62673, November 6, 2007) that provides details about the five areas along with instructions for the public to provide comments. NMFS has provided comments to MMS on the potential impacts of the projects and will continue to consult with MMS as the projects proceed. Conservation recommendations include:

Conservation measures

- Employ bubble curtains or cofferdams where possible.
- Utilize appropriate work windows to avoid impacts during sensitive times of the year (*e.g.*, anadromous fish runs and spawning, larval, and juvenile development periods).
- Use any other new technologies and methods that may minimize impacts to fish and fish habitat.
- Contingency plans should be in place to respond to spills associated with service platforms.
- Barrage-type tidal facilities should not be permitted due to the potential impacts on migratory species (*e.g.*, HMS).

6.2.1 Cumulative Impacts

According to the regulations (50 CFR 600.815(a)(5)) FMPs should analyze the cumulative impacts of both natural and man-made causes on EFH. In addition, in accordance with NEPA, cumulative impacts are defined as the impacts on the environment that result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions, regardless of who undertakes such actions. Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time. To the extent feasible and practicable, FMPs should analyze how the cumulative impacts of fishing and non-fishing activities influence the function of EFH on an ecosystem or watershed scale. An assessment of the cumulative and synergistic effects of multiple threats, including the effects of natural stresses (such as storm damage or climate-based environmental shifts), and an assessment of the ecological risks resulting from the impact of those threats on EFH, should also be included. This cumulative impact analysis addresses cumulative impacts as required for EFH identification and designation and as required under NEPA.

The designation of EFH can result in cumulatively beneficial ecological impacts, as the designation would result in a need for federal agencies to consult with NMFS if their actions adversely affect EFH. However, the positive ecological impacts are realized only if the recommended conservation measures are implemented as a part of the action proposed by the consulting agency, therefore, a detailed cumulative impact analysis of these future outcomes is speculative and cannot be considered "reasonably foreseeable" for detailed analysis in this EIS.

Prior to the passage of the Magnuson-Stevens Act there was little or no emphasis or attention paid to anthropogenic influences on ocean habitats, and the important function of habitat in maintaining healthy fish stocks. Since the passage of the Magnuson-Stevens Act and the EFH provisions that require agencies to consult with NMFS when considering projects that may have an adverse effect on EFH, much greater attention has been focused on activities that are likely to affect fish habitat.

There are a variety of past, present, and reasonably foreseeable future actions that have the potential to affect HMS EFH. They range, among other things, from coastal development and associated coastal runoff and non-point source pollution in coastal areas to OCS oil and gas development, and global climate change. Since most HMS EFH is comprised of open ocean environments occurring over broad geographic ranges, large-scale impacts such as global climate change that affect ocean temperatures, currents, and potentially food chain dynamics, are most likely to have an impact and pose the greatest threat to HMS EFH. Anecdotal information suggests that such changes may be occurring and influencing the distribution and habitat usage patterns of HMS and non-HMS fish stocks.

Temperature changes of a few degrees can disrupt upwelling currents that reduce or eliminate the nutrients necessary for phytoplankton and thereby could have potential repercussions throughout the food chain. As a result, changes in migratory patterns may be the first indication that large scale shifts in oceanic habitats may be occurring. Some have pointed to the shift in availability of bluefin tuna from fishing grounds off North Carolina to waters off Canada during the winter months as evidence of changes in oceanographic conditions that may be affecting historical distribution patterns. Although the evidence is still lacking, causative factors in the shift include preferences for cooler water temperatures and prey availability. A recent report by the Conservation Law Foundation indicated that low food availability had reduced growth rates in larval cod and haddock and that rising sea surface temperatures had the potential to further reduce productivity for these and other fish stocks off the New England coast (Bandura and Vucson, 2006).

Wetland loss is a cumulative impact that results from activities related to coastal development: residential and industrial construction, dredging and dredge spoil placement, port development, marinas and recreational boating, sewage treatment and disposal, industrial wastewater and solid waste disposal, ocean disposal, marine mining, and aquaculture. In the late 1970s and early 1980s the country was losing wetlands at an estimated rate of 300,000 acres per year. The Clean Water Act and state wetland protection programs helped decrease wetland losses to 117,000 acres per year, between 1985 and 1995. Estimates of wetlands loss vary according to the different agencies. The USDA estimates attributes 57 percent wetland loss to development, 20 percent to agriculture, 13 percent to deepwater habitat, and 10 percent to forest land, rangeland, and other uses. Of the wetlands lost to uplands between 1985 and 1995, the U.S. Fish and Wildlife Service estimates that 79 percent of wetlands were lost to upland agriculture. Urban development and other types of land use activities were responsible for six percent and 15 percent of wetland loss, respectively.

Nutrient enrichment has become a major cumulative problem for many coastal waters. Nutrient loading results from the individual activities of coastal development, non-point source pollution, marinas and recreational boating, sewage treatment and disposal, industrial wastewater and solid waste disposal, ocean disposal, agriculture, and aquaculture. Excess nutrients from land based activities accumulate in the soil, pollute the atmosphere, pollute ground water, or move into streams and coastal waters. Nutrient inputs are known to have a direct effect on water quality. For example, in extreme conditions excess nutrients can stimulate excessive algal blooms or dinoflagellate growth that can lead to increased turbidity, decreased dissolved oxygen, and changes in community structure, a condition known as eutrophication.

In addition to the direct cumulative effects incurred by development activities, inshore and coastal habitats are also jeopardized by persistent increases in certain chemical discharges. The combination of incremental losses of wetland habitat, changes in hydrology, and nutrient and chemical inputs produced over time, can be extremely harmful to marine and estuarine biota, resulting in diseases and declines in the abundance and quality of the affected resources.

Future investigations will seek to analyze cumulative impacts of chemicals and other discharges, as well as habitat alterations, within specific geographic locations (certain estuarine, coastal and offshore habitats) in order to evaluate the cumulative impacts on HMS EFH. Information and techniques that are developed for this process will be used to supplement future revisions of these EFH provisions as the information becomes available.

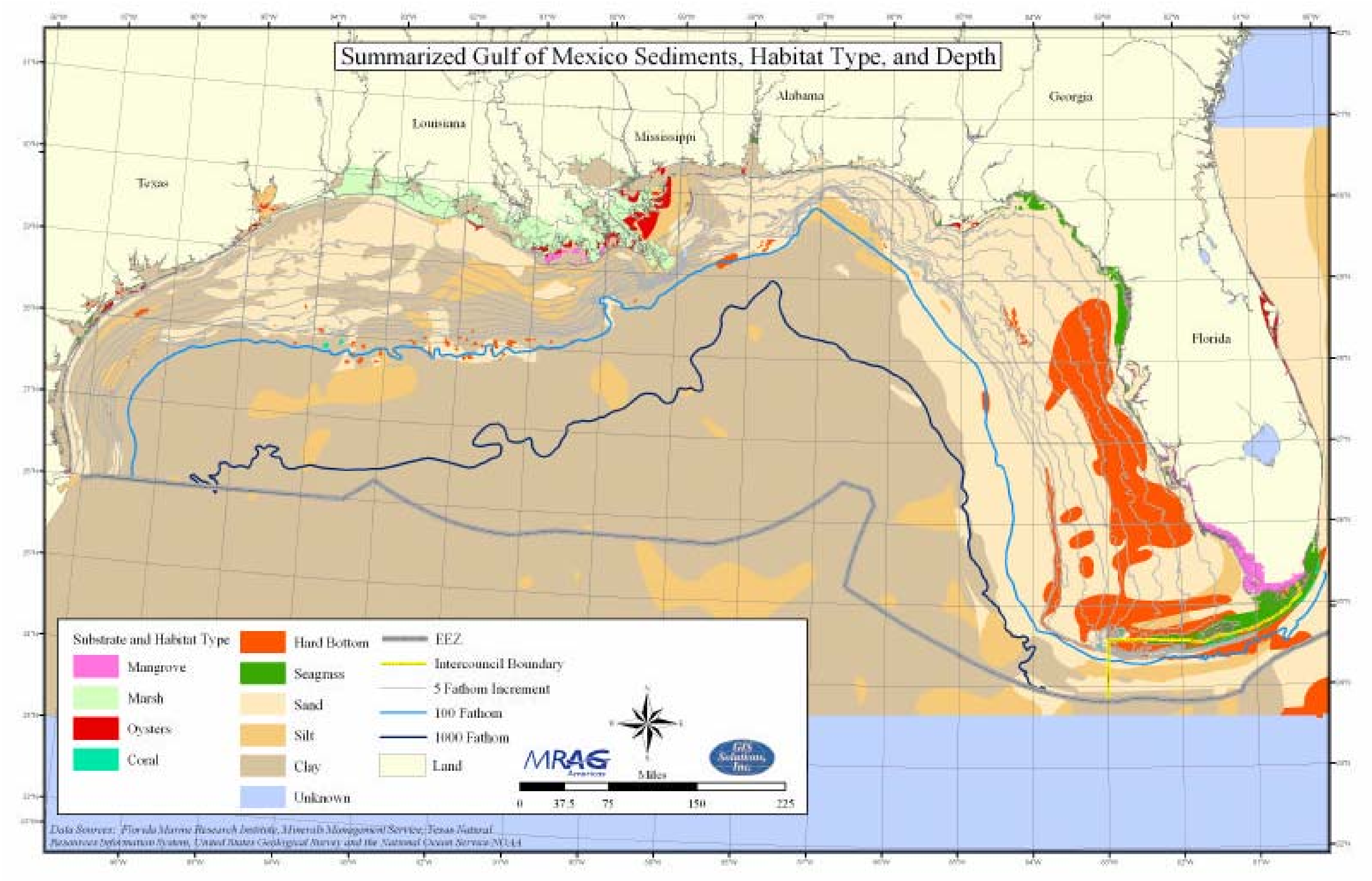

Figure 6.1 Distribution of substrate and habitat type in the Gulf of Mexico. Source: Figure 3.1.3 in GMFMC, 2004.

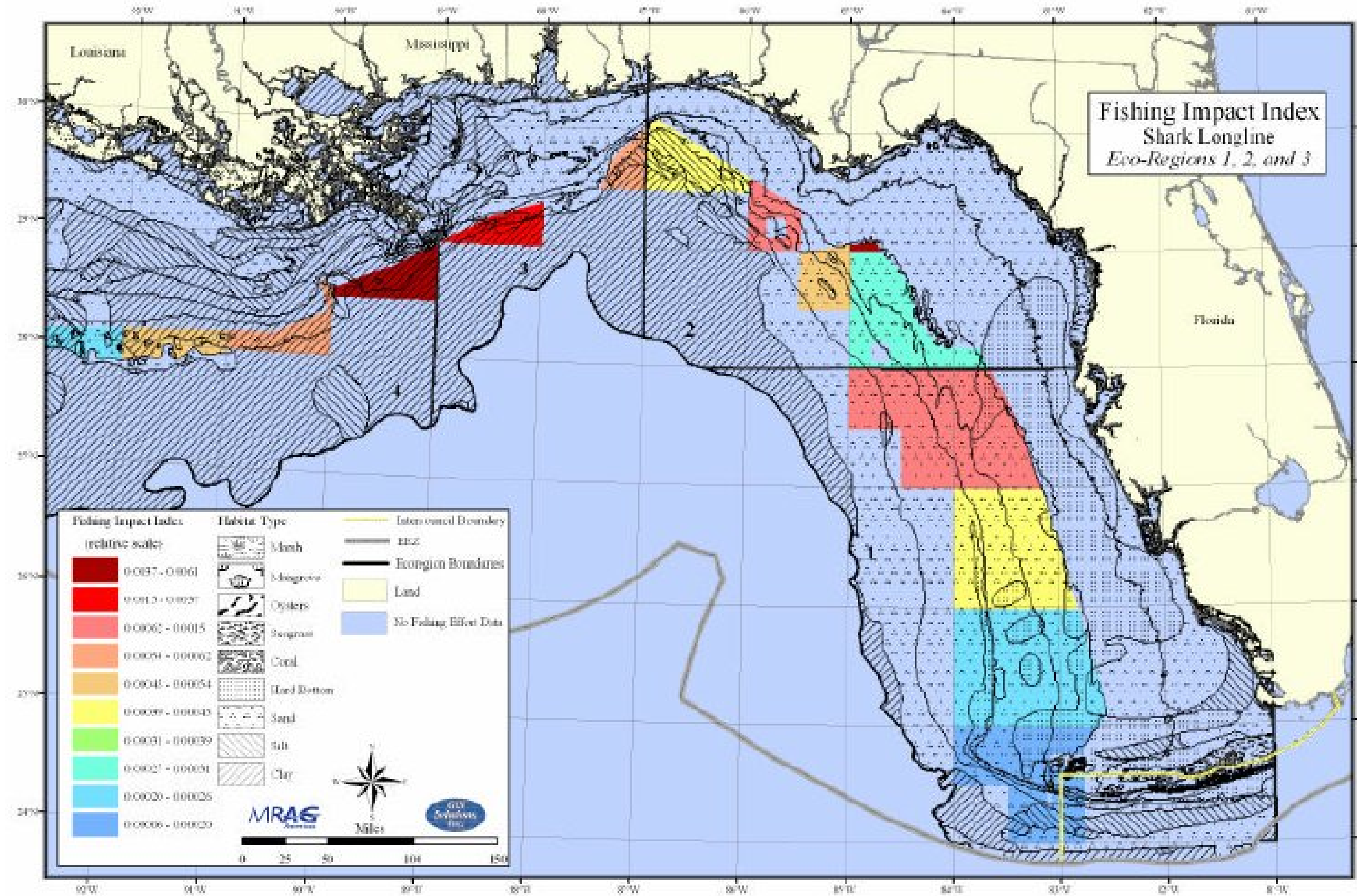

Figure 6.2 Fishing impact index for shark bottom longline gear in the Gulf of Mexico. Different colors indicate sensitivity to all fishing gears in the Gulf of Mexico. Higher sensitivity numbers (red color) indicate greater vulnerability to overall fishing impacts. Figure 3.5.26b in GMFMC, 2004.

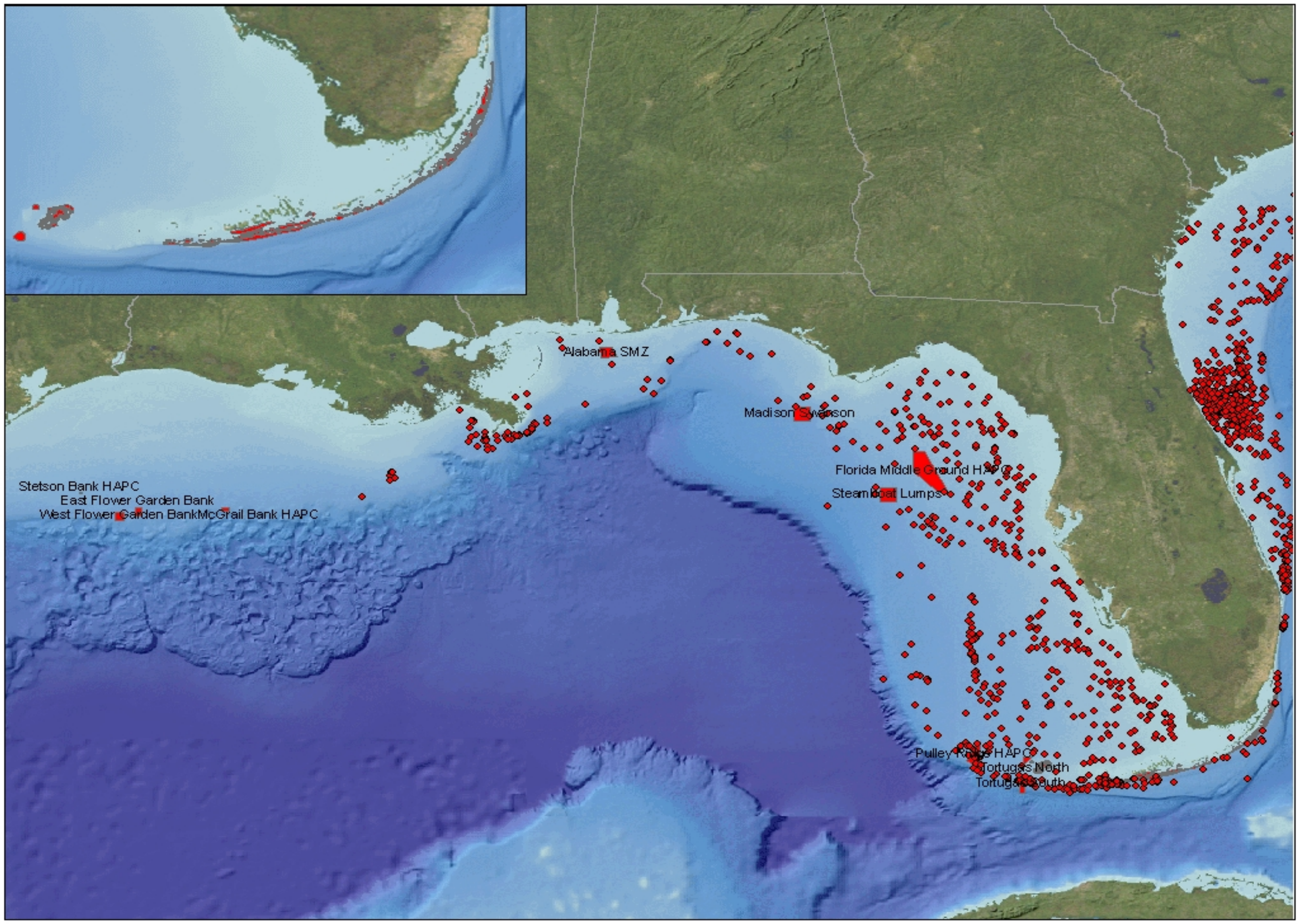

Figure 6.3 Location of sets from the CFSOP and shark BLL fishery observer program (1994-2006) in relation to closed areas in the Gulf of Mexico region. Source: CFSOP and shark BLL fishery observer program (1994-2006). Note: the insert shows the location of coral reef habitat around the Florida Keys.

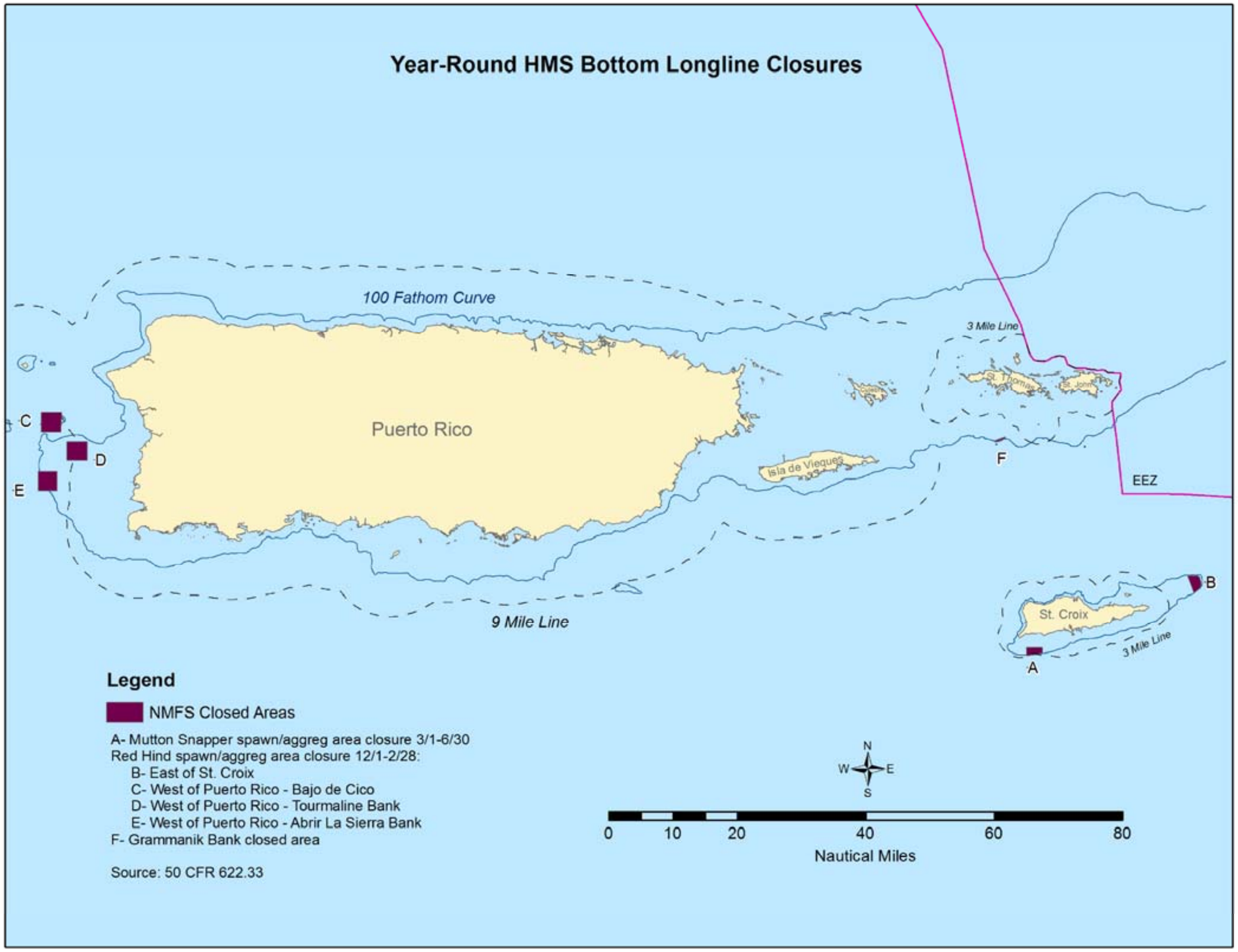

Figure 6.4 Six year round closures to bottom tending gear, including shark bottom longline gear, off Puerto Rico and the U.S. Virgin Islands.

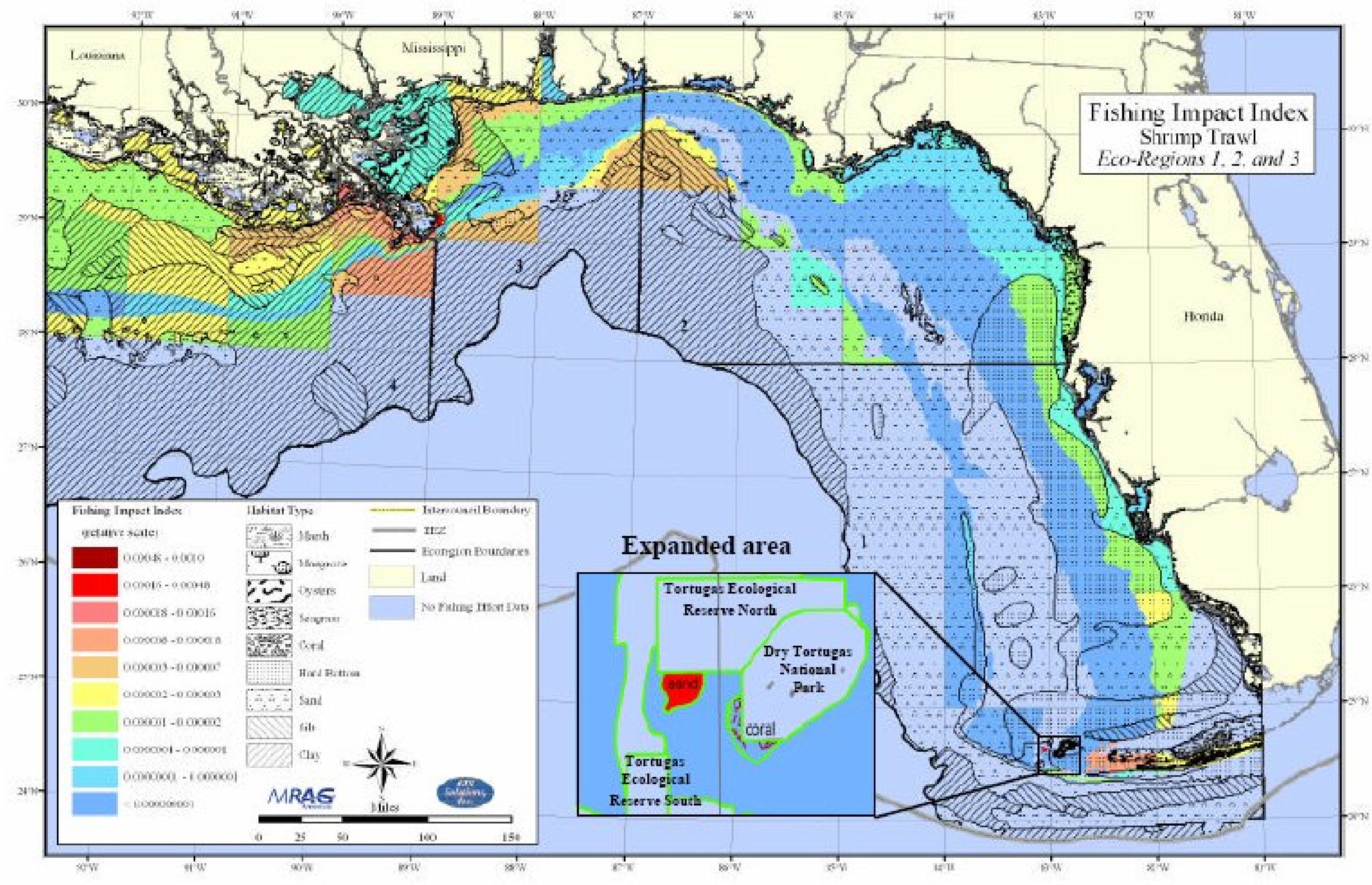

Figure 6.5 Fishing impact index for shrimp trawls in the Gulf of Mexico. Higher sensitivity numbers (red color) indicate greater vulnerability to overall fishing impacts. Source: Figure 3.5.23b in GMFMC, 2004.

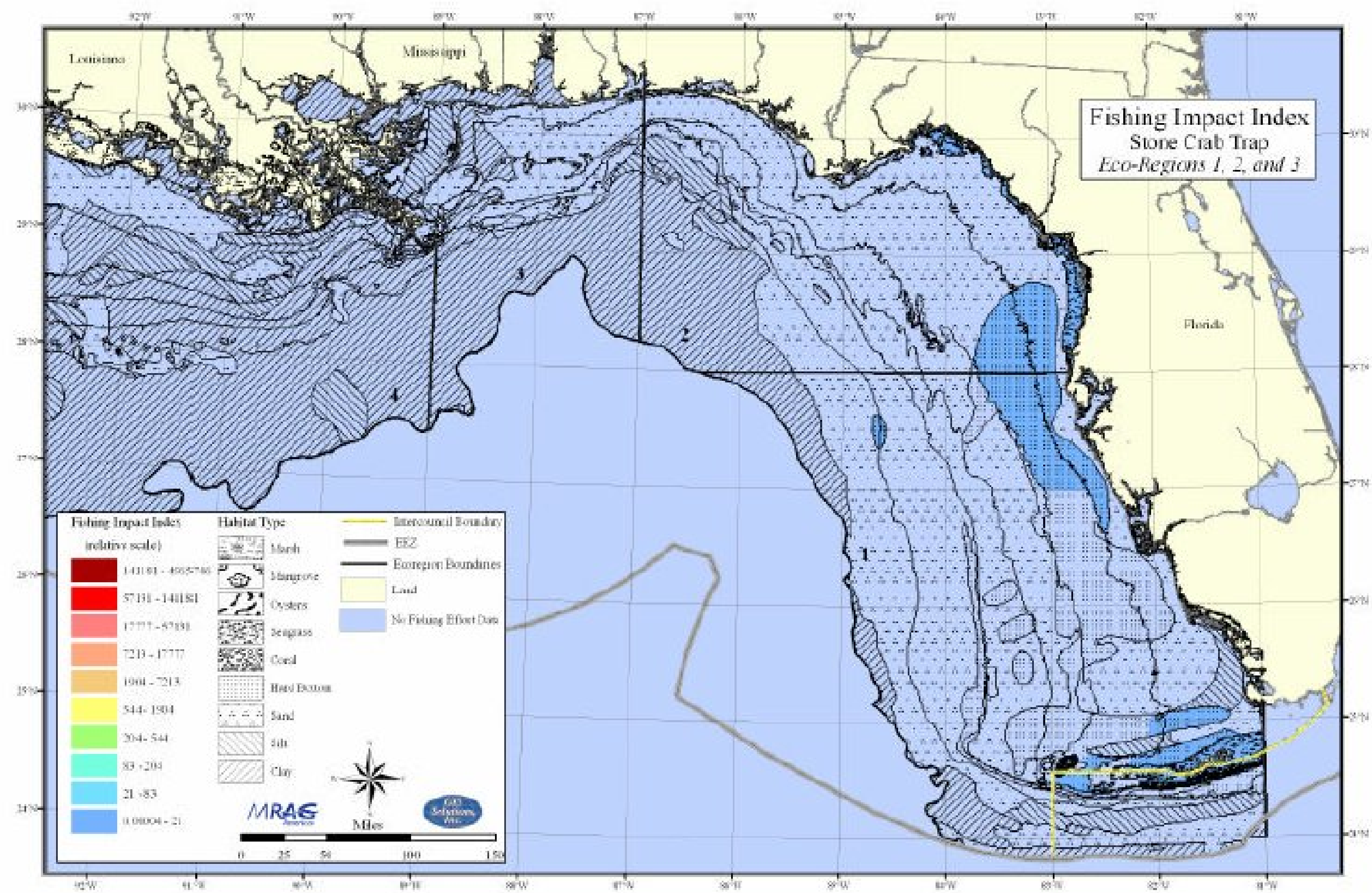

Figure 6.6 Fishing impact index from stone crab pots in the Gulf of Mexico. Higher sensitivity numbers (red color) indicate greater vulnerability to overall fishing impacts. Source: Figure 3.5.24 in GMFMC, 2004.

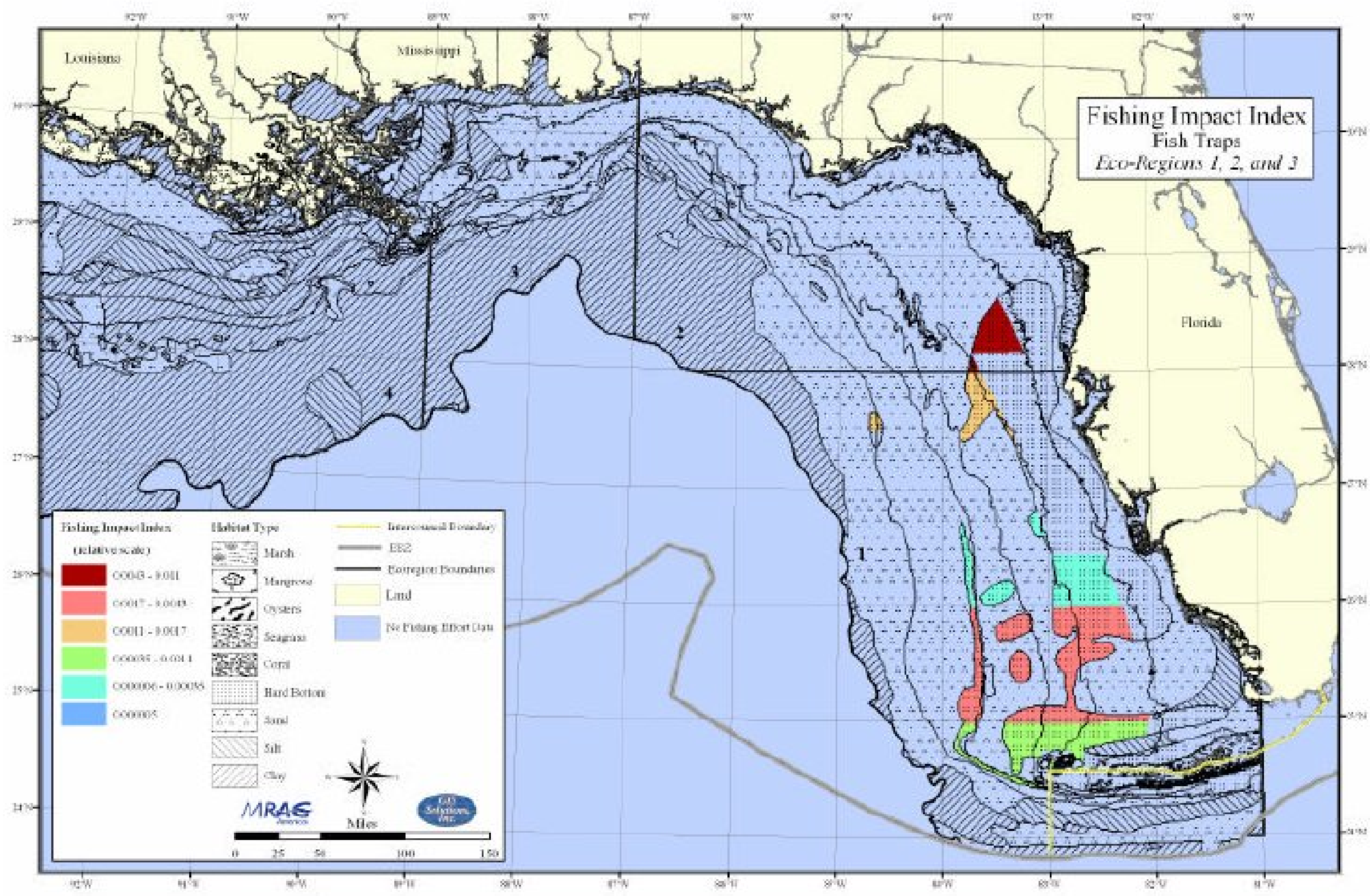

Figure 6.7 Fishing impact index from fish traps in the Gulf of Mexico. Higher sensitivity numbers (red color) indicate greater vulnerability to overall fishing impacts. Source: Figure 3.5.19 in GMFMC, 2004.

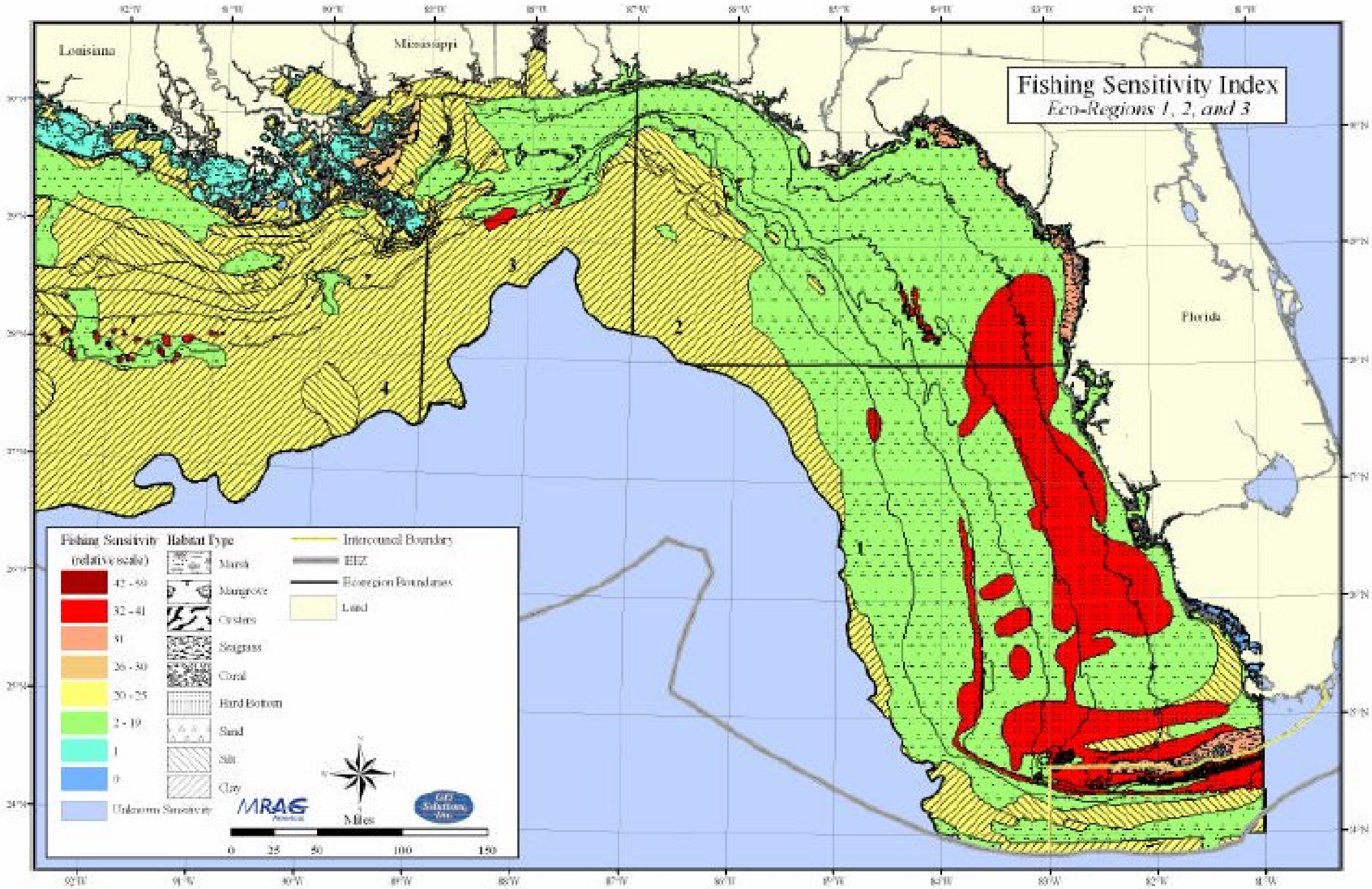

Figure 6.8 Habitat sensitivity to all fishing gears in the Gulf of Mexico. Higher sensitivity numbers indicate greater vulnerability to overall fishing impacts. Source: Figure 3.5.16b in GMFMC, 2004.

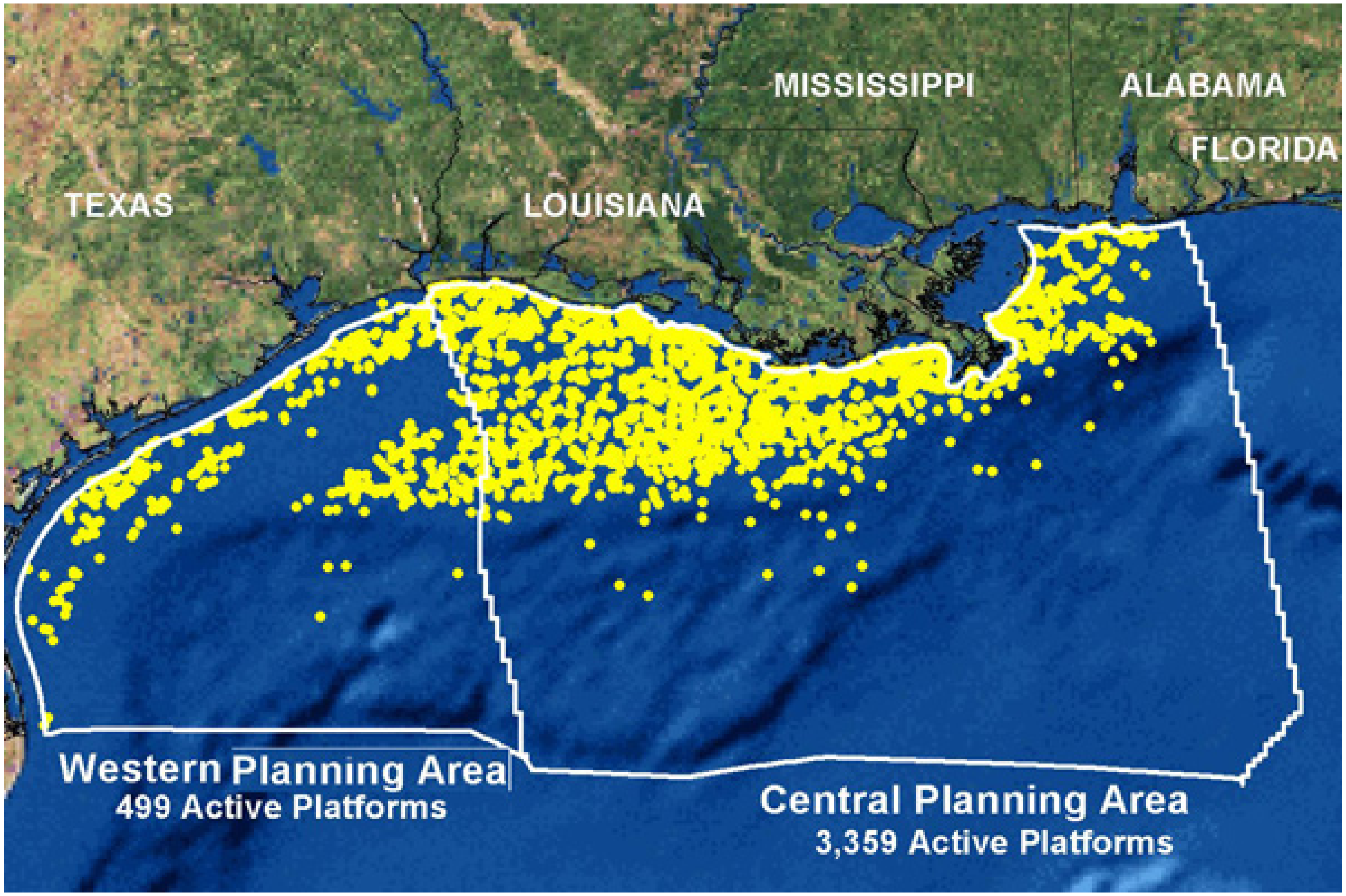

Figure 6.9 Oil and gas platforms in the Gulf of Mexico. Source: MMS and NOAA's Ocean Explorer webpage http://oceanexplorer.noaa.gov.

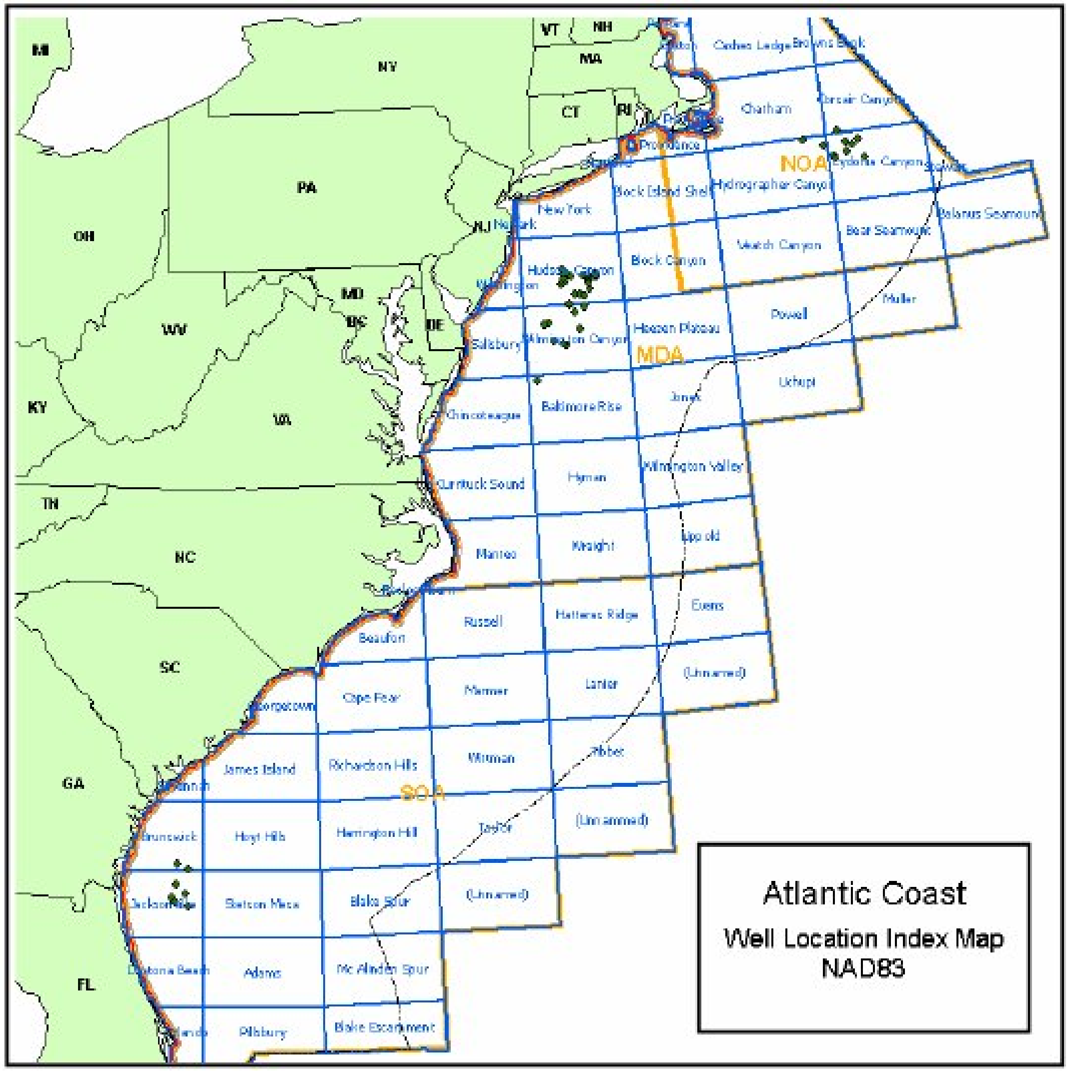

Figure 6.10 Oil platform locations (represented by points on the map) as well as lease grids in the Atlantic. Source: MMS

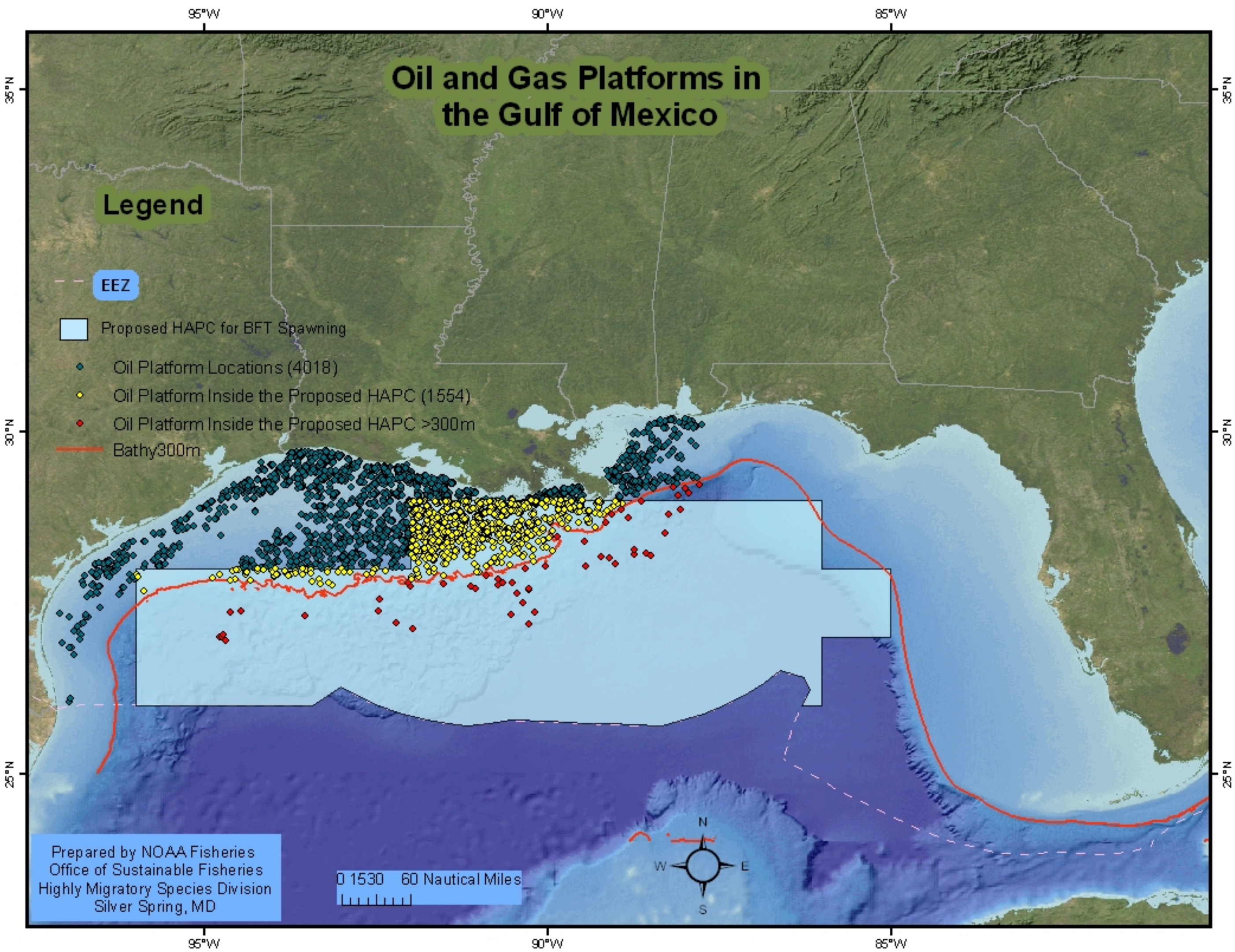

Figure 6.11 Oil and gas platforms in the Gulf of Mexico in relation to the proposed bluefin tuna HAPC and the 300m bathymetric line. Oil and gas platforms in the proposed HAPC are shown in yellow and red, the red locations are deeper than 300m. Source: MMS.

MMS Gulf of Mexico Region
Planning Areas and Active Leases
July 1, 2008

	Total Blocks	Total Acres	Blocks Leased	Acres Leased
Westen Planning Area	5,240	28,576,583	1,824	10,213,248
Central Planning Area	12,370	66,452,086	5,416	28,875,454
Eastern Planning Area	11,486	64,556,650	128	720,217
Totals	29,096*	159,585,319	7,368	39,808,919

* 7 blocks are split between the CPA and EPA

Figure 6.12 Total number of blocks, total acres, blocks leased and acres leased by planning area in the Gulf of Mexico. Source: MMS.

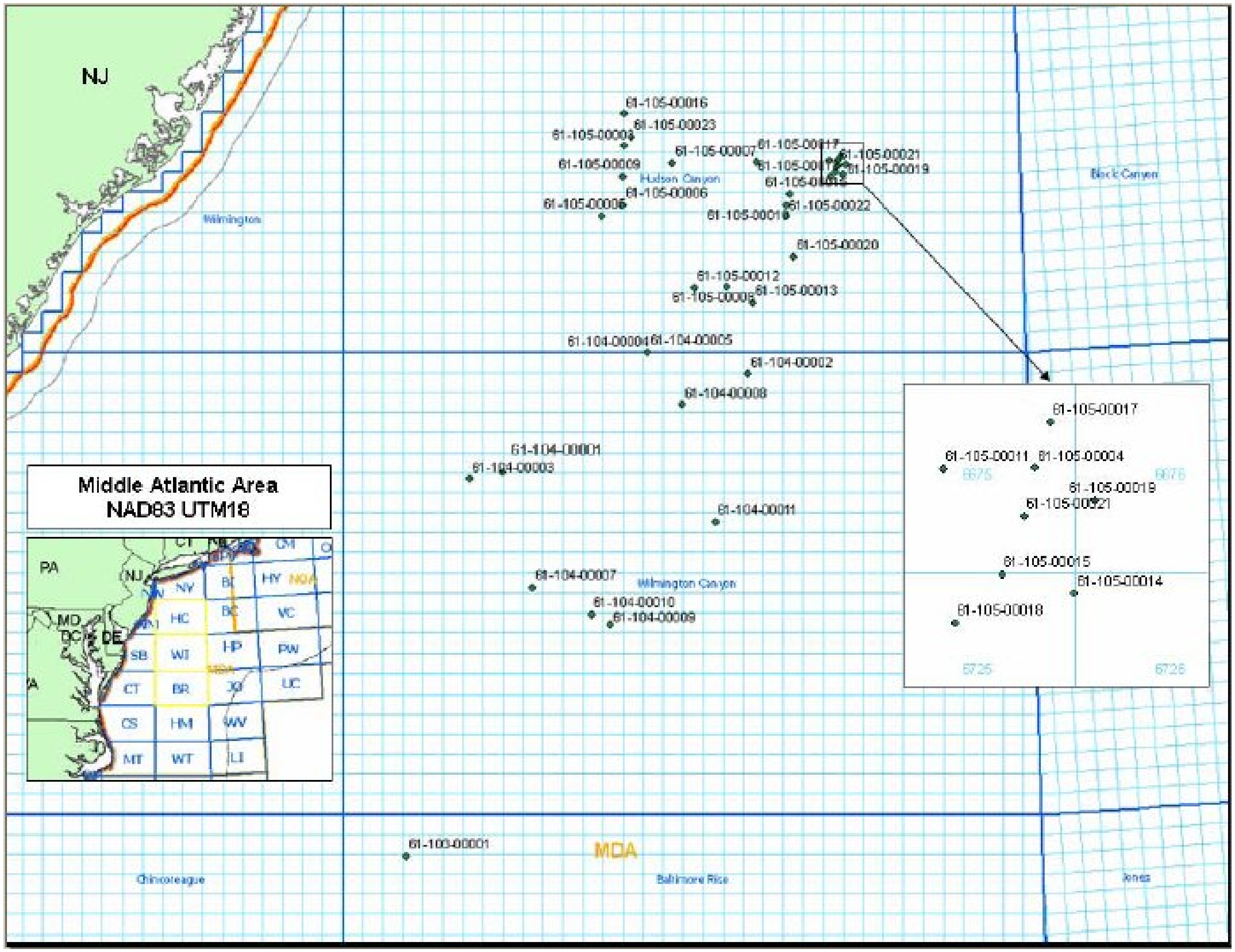

Figure 6.13 Oil platform locations in the mid-Atlantic. Source: MMS

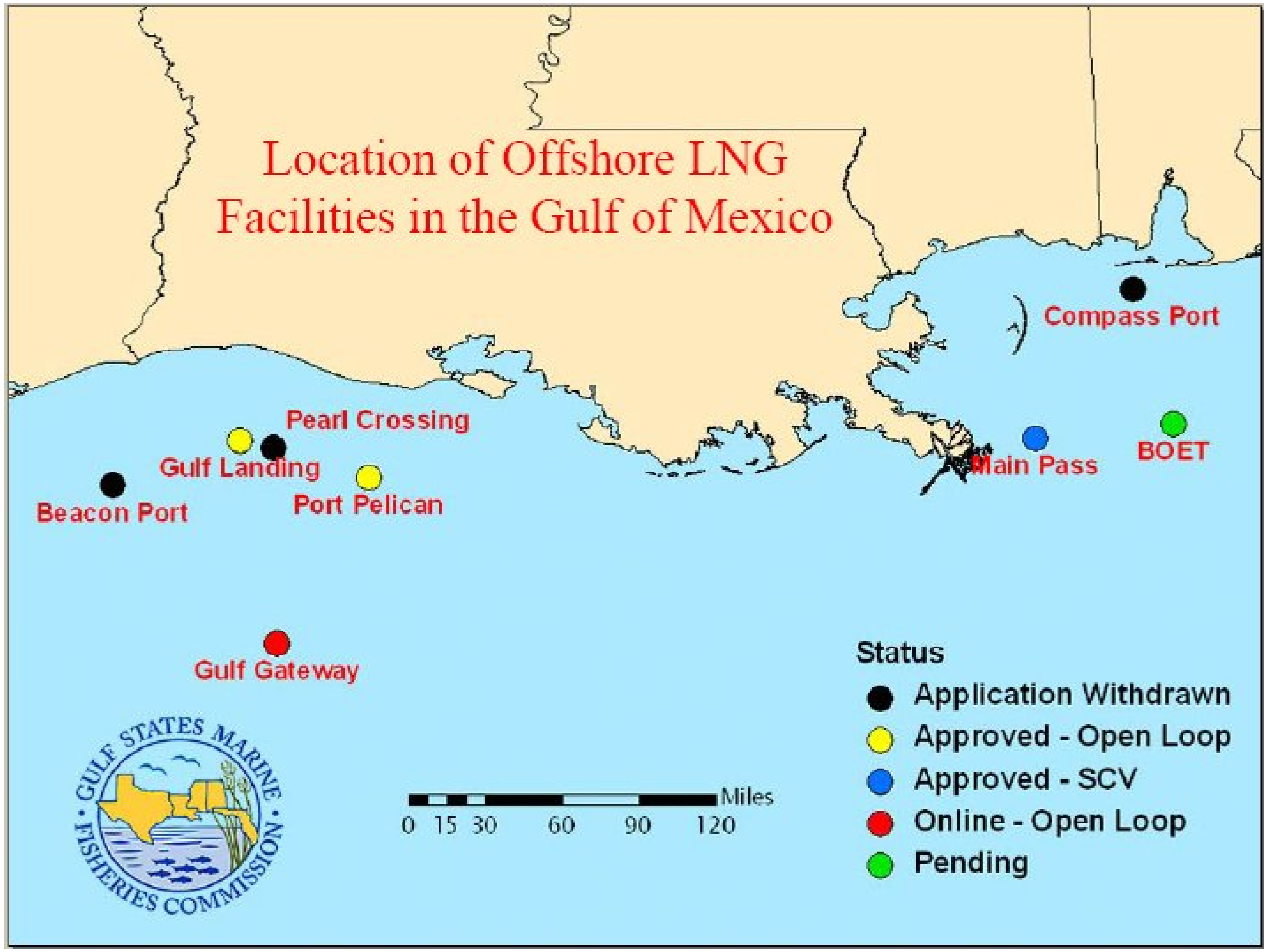

Figure 6.14 Proposed offshore liquefied natural gas (LNG) facilities in the Gulf of Mexico. Source: GSMFC.

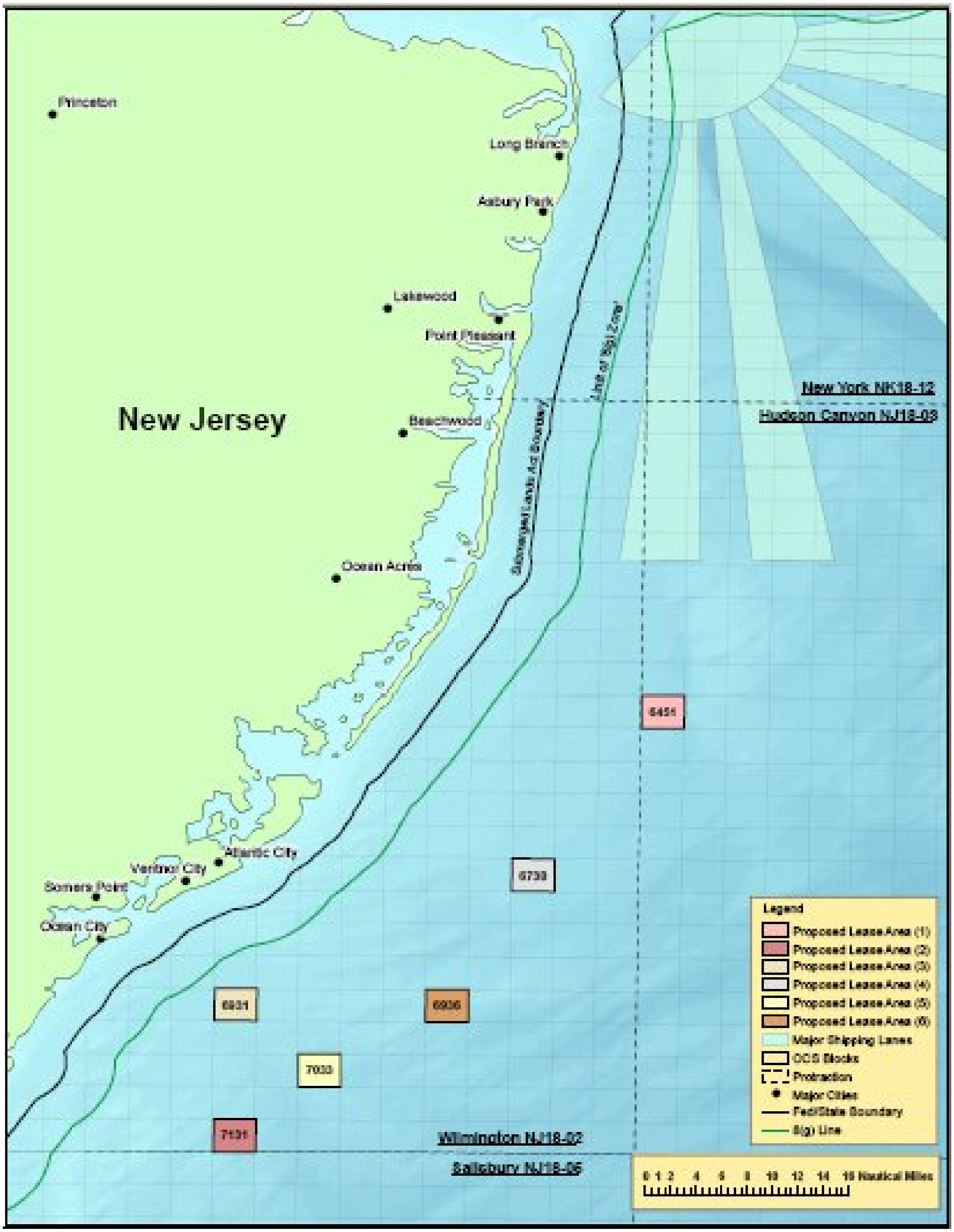

Figure 6.15 Locations for proposed renewable energy projects off New Jersey. Source: MMS

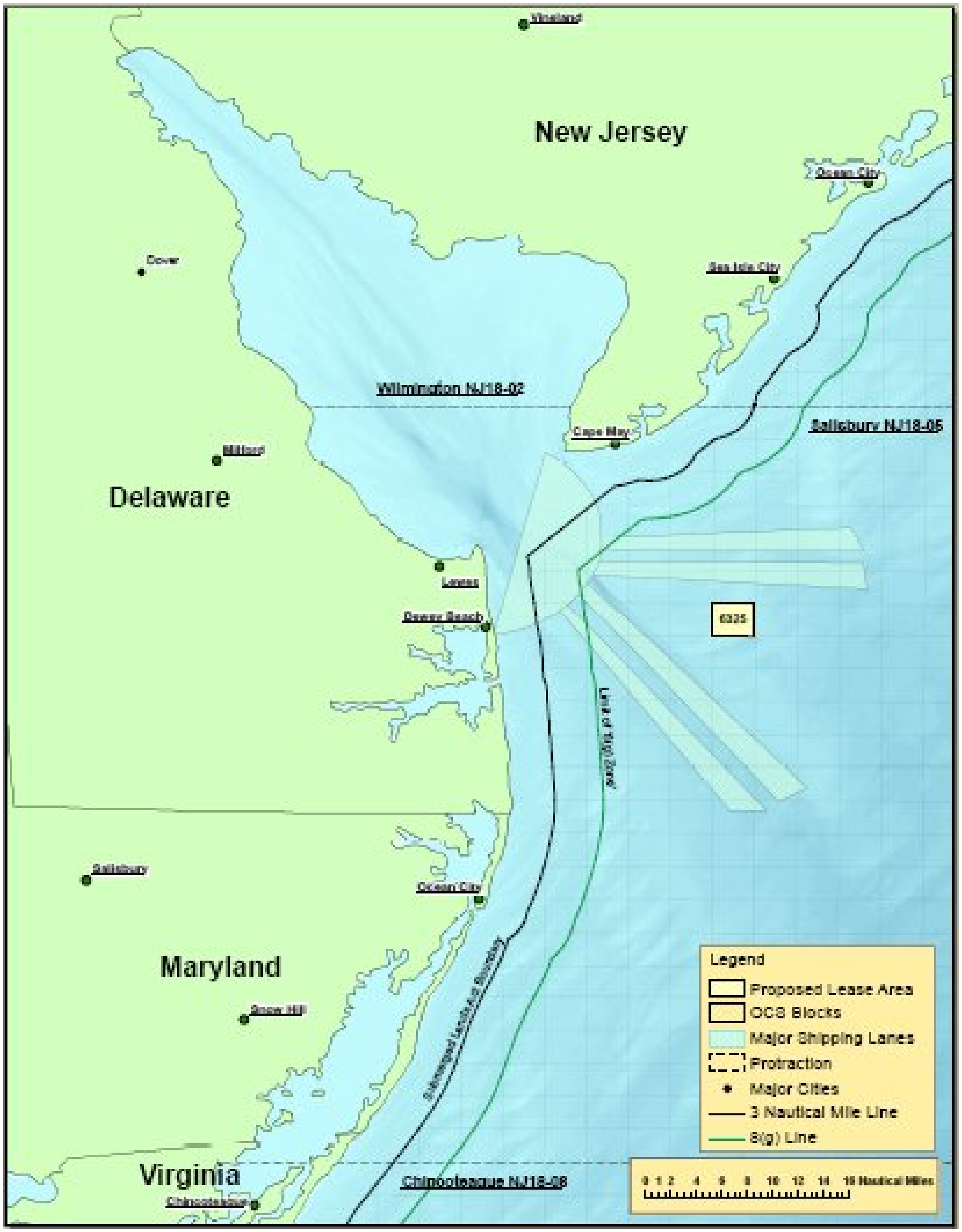

Figure 6.16 Locations for proposed renewable energy projects off Delaware. Source: MMS

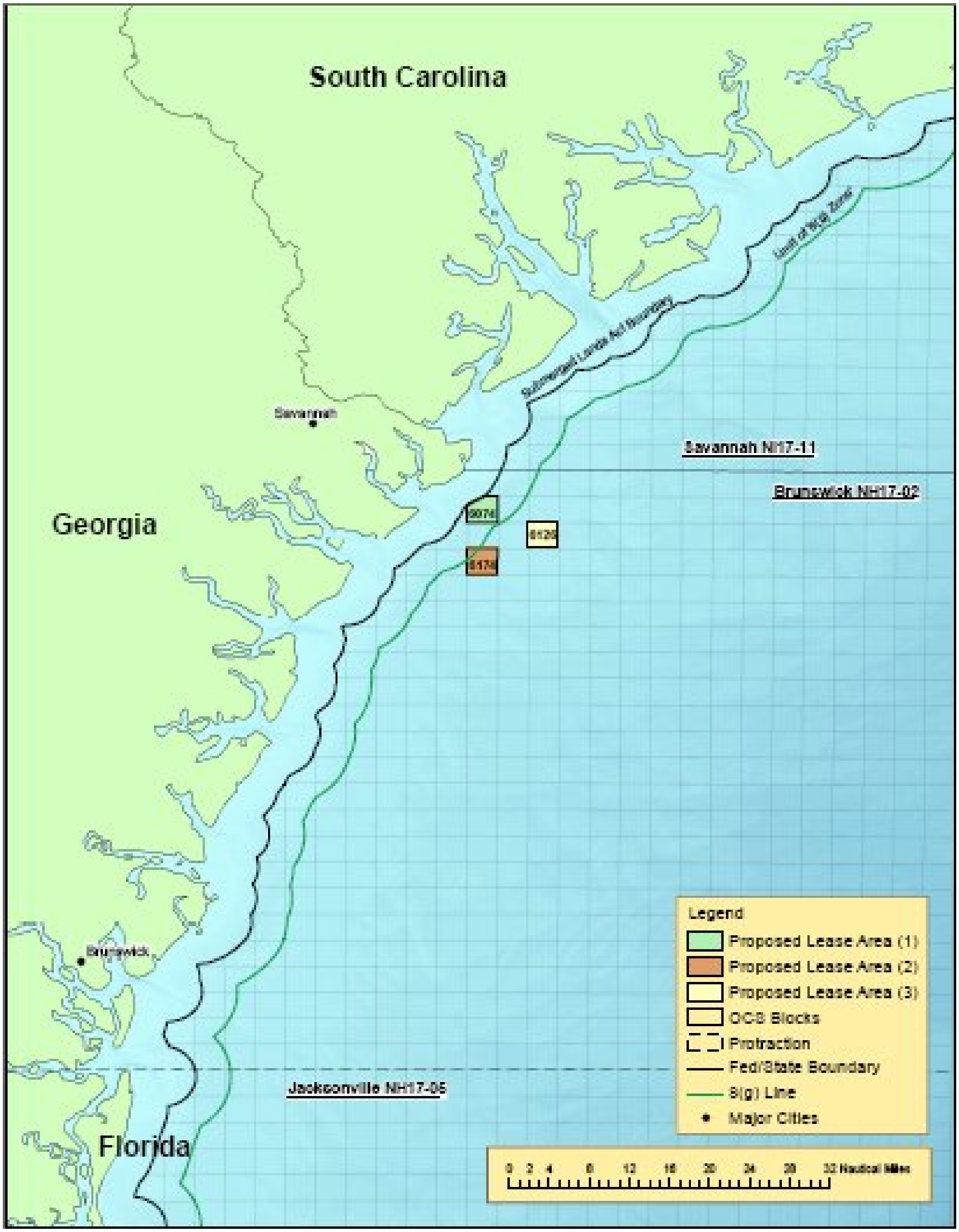

Figure 6.17 Locations for proposed renewable energy projects off Georgia. Source: MMS

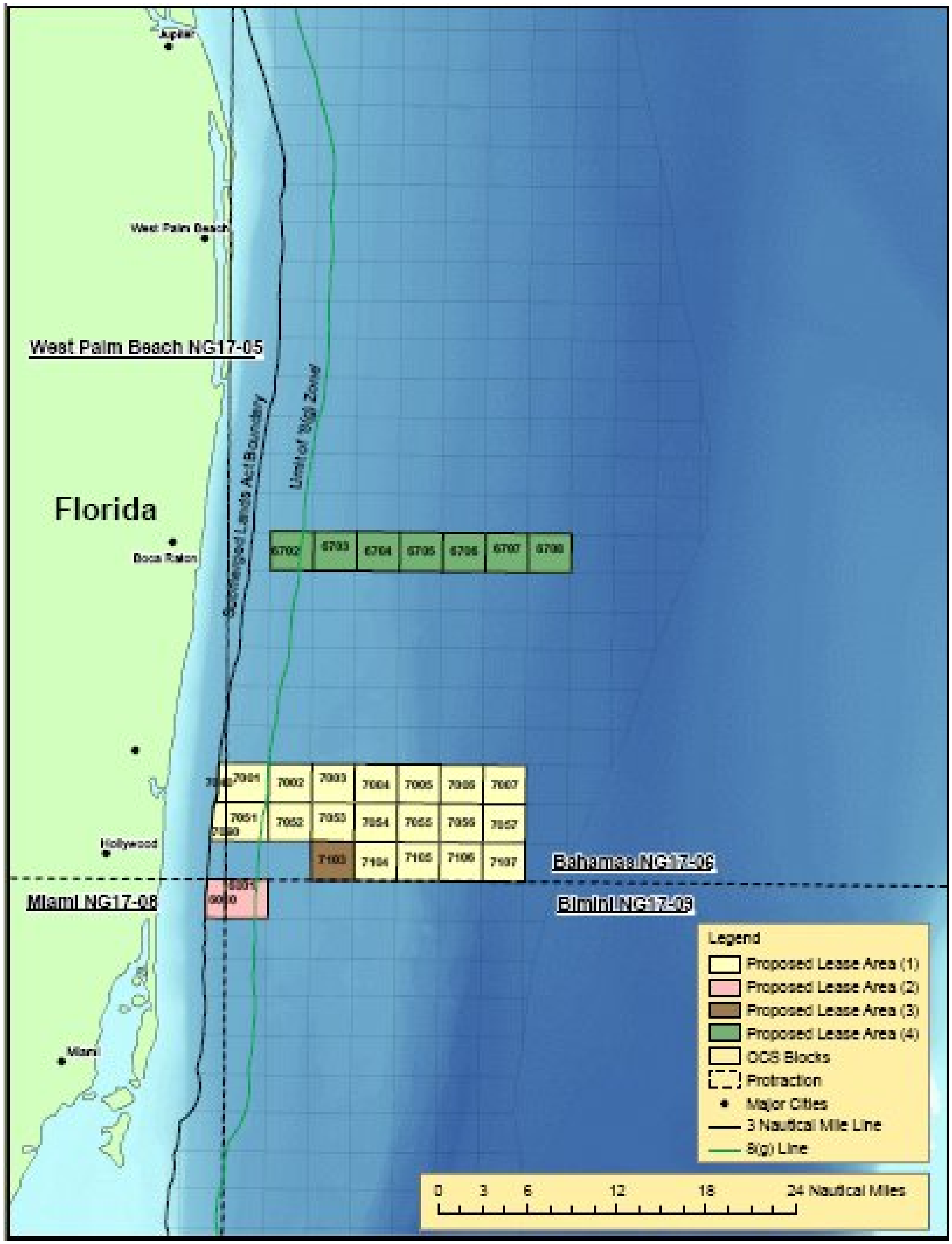

Figure 6.18 Locations for proposed renewable energy projects off Florida. Source: MMS

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