

### **3.0 PROJECT IMPACT ASSESSMENT**

Primary (direct) impacts from the proposed work is expected to occur in the following habitats: the intertidal flats and subtidal environments in Bogue Inlet, the nearshore and beach environments of The Pointe shoreline; 6,096 m (20,000 linear feet) of the nearshore and beach environment of Emerald Isle; and 2,438 m (8,000 linear feet) along the nearshore environment of Bear Island.

Temporary secondary (indirect) impacts to the estuarine system surrounding Bogue Inlet are expected from the increase in turbidity due to the displacement of sediment. The grain size data collected from the proposed inlet location indicated an average mean grain size 0.27mm (fine to medium sand) with a low silt content of 1.25%. Analysis of this data indicates that the suspension time for the discharged sediment will be low. Therefore sediment transport to the estuarine systems along the west end of Bogue Sound, the landward side of Bear Island and Dudley Island is expected to be minimal.

Engineering and geotechnical studies of Islands 1 and 2 for the Bogue Inlet Channel Erosion Response Project indicate that the two islands appear to be eroding in response to the westward movement of the Eastern Channel as a result of the growth of the Bogue Banks Spit. Therefore, temporary or indirect impacts from the project on these features will be difficult to determine.

### **4.0 ESSENTIAL FISH HABITAT DESIGNATION**

The Magnuson Fishery Conservation and Management Act of 1976, amended Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) on October 1996 and also referred to as the Sustainable Fisheries Act, was enacted by the U.S. Congress to protect marine fish stocks and their habitat, prevent and stop overfishing and minimize bycatch. Congress defined Essential Fish Habitat as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." The MSFCMA requires that EFH be identified for all fish species Federally managed by the Fishery Management Councils and the National Marine Fisheries Service (NMFS).

Eight Fishery Management Councils (FMCs) were established under the MSFCMA to manage living marine resources within the federal limit water boundary and are required to describe and identify EFH designations in their respective regions. Each of these councils are responsible for developing a Fishery Management Plan (FMP) to achieve specified management goals for fisheries. The FMP includes data, analyses, and management measures (including guidelines for harvest) for a fishery.

#### **4.1 Fishery Management**

The South Atlantic Fisheries Management Council (SAFMC) and the Mid-Atlantic Fisheries Management Council (MAFMC) manage marine fisheries in the federal water limits of the North Carolina coast. The federal water limit is referred to as the Exclusive Economic Zone (EEZ) to include the federal waters that extend offshore from the state water boundary (3 nautical miles offshore) to 200 nautical miles.

The SAFMC is responsible for the conservation and management of fish stocks within the federal limit of the Atlantic Ocean along the coasts of North Carolina, South Carolina, Georgia, and along the east coast of Florida south to Key West. The seven Fishery Management Plans developed by the Council include: Calico Scallop FMP; Coastal Migratory Pelagic (includes King and Spanish Mackerel) FMP; Coral FMP; Golden Crab FMP; Shrimp (including rock shrimp) FMP; Snapper/Grouper Complex FMP; and Spiny Lobster FMP. According to the MSFCMA, all FMC managed species under Federal FMPs must have EFH identified. The areas designated as EFH by the SAFMC are listed in Table 4.1.

The MAFMC is responsible for the conservation and management of fish stocks in the federal waters off the coasts of New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, and North Carolina. The MAFMC has 25 members of the council representing both State and Federal agencies, as well as the public. The MAFMC has developed six FMPs to manage fisheries of the Mid-Atlantic States. The management plans include the following: Summer Flounder, Scup, Black Sea Bass FMP; Bluefish FMP; Dogfish FMP; Surfclam and Quahog FMP; Atlantic Mackerel, Squid and Butterfish FMP; Tilefish FMP. According to the MSFCMA, MAFMC must identify EFH for these 11 species. The EFH designated by the MAFMC are included in Table 4.1.

Table 4.1 identifies the EFH habitats identified by the SAFMC and the MAFMC within the federal waters of North Carolina.

**Table 4.1**  
**Essential Fish Habitat Identified in FMP Amendments of the**  
**South Atlantic and Mid-Atlantic FMC's**

<b>SAFMC</b>
<b>Estuarine Areas</b>
Estuarine Emergent Wetlands
Estuarine Scrub/Shrub Mangroves
Submerged Aquatic Vegetation
Oyster Reefs and Shell Banks
Intertidal Flats
Palustrine Emergent and Forested Wetlands
<b>MAFMC</b>
<b>Estuarine Areas</b>
Seagrass
Creeks
Mud Bottom
Estuarine Water Column
<b>Marine Areas</b>
Water Column

NMFS federally manages the classified "highly migratory species" (HMS) and has developed FMPs for each species. HMS include Atlantic tunas, billfish, coastal sharks, and swordfish. NMFS geographically defines EFH for each of the HMS species along the Atlantic coast. The defined EFH areas are species-specific and include: shallow coastal waters, offshore waters inside the EEZ, offshore waters outside the EEZ, and inshore waters along the Atlantic coast.

#### **4.2 Managed Species**

Bogue Inlet is located along the mid-Atlantic Ocean between two barrier island systems. The largest of the two barrier islands is the Bogue Banks to the east that is separated from the mainland by Bogue Sound. West of the inlet is Bear Island (Hammocks Beach State Park), a shorter barrier island feature approximately 3.2 miles long (4.8 km). A total of 89 fish species have been recorded from offshore coastal waters (including nearshore, surf zone and beach habitat); intertidal and shallow water environments; subtidal habitats (i.e., White Oak River); shellfish and seagrass habitats; bays and lagoon environments (including Bogue Sound); inshore sandy and/or muddy bottom habitats; and estuarine and salt marsh environments.

The fish species listed in Table 4.2 and their EFH are managed under MSFCMA and are species that can occur in, or in the vicinity of Bogue Inlet. Table 4.2 includes the affiliated management Council and/or Commission; expected life stage in the project area; fish habitat associated with the species; and associated habitat that may be found in the project area.

Tables 4.3 (A-F) lists fish species that are likely or expected to occur in the project area. These fish species and their habitats require special consideration to promote their viability and sustainability.

#### **4.3 Habitat Areas of Particular Concern**

Habitat Areas of Particular Concern (HAPC) are subsets of identified EFH based on one or more of the following considerations: 1) the importance of the ecological function, 2) extent to which the habitat is sensitive to human-induced degradation, 3) whether and to what extent, development activities are stressing the habitat type, or 4) rarity of habitat type (50 CFR 600.815(a)(8)). HAPC may include high value intertidal and estuarine habitats, offshore areas of high habitat value or vertical relief, and habitats used for migration, spawning and rearing of fish and shellfish.

HAPC have been identified in the project area and although not all of these species or habitats may be impacted by the project, they may occur in, or in the vicinity of the project area. The listed habitats and the likelihood of their occurrence are listed in Table 4.4.

**TABLE 4.2**  
**ESSENTIAL FISH HABITAT SPECIES OF THE ATLANTIC WATERS**  
**BOGUE INLET, NORTH CAROLINA**

NMFS - National Marine Fisheries Service; SAFMC - South Atlantic Fisheries Management Council; MAFMC - Mid-Atlantic Fisheries Management Council;;  
 NM - Nautical Mile; / = not likely to occur in area

Taxa	Common Name	NMFS (Highly Migratory Species)	SAFMC (3-200NM)	MAFMC (3-200 NM)	Probable Life Stage in Project Area	Fish Habitat Ecology	Estuarine Emergent Wetlands	Submerged Aquatic SAV (SAV) and Seagrass Beds	Oyster Reefs and Shell Banks	Intertidal Flats	Estuarine, Marine Water Columns, and Creeks (Subtidal)	Shallow Sand and Muddy Bottoms	Feeding Habits
<i>Seriola rivoliana</i>	Almao jack		X		Juvenile/Adult	Pelagic; rarely near shoreline, 15 to 160 m (49 to 525 ft); Juv. around floating objects ( <i>Sargassum</i> )							fish, invertebrates
<i>Chaetodipterus faber</i>	Atlantic spadefish		X		Juvenile/Adult	Juv: estuarine, shallow water; Adult: sandy beaches, shallow coastal waters, artificial reefs; 3-35 m. (10-115 ft)	X			X	X		invertebrates, plankton
<i>Seriola zonata</i>	Banded rudderfish		X		Juvenile/Adult	Coastal waters, inshore around structures, anywhere from surface to seafloor				X	X		fish, shrimps
<i>Centropristis ocyurus</i>	Bank sea bass		X		Juvenile/Adult	Hardbottom, shipwrecks to 55 m (180 ft), deep water							small fish, benthic invertebrates
<i>Thunnus obesus</i>	Bigeye tuna	X			Juvenile/Adult	Oceanic							fish, cephalopods, crustaceans
<i>Myxeroperca bonaci</i>	Black grouper		X		Juvenile/Adult	Adult: offshore, over 18 m (60 ft); Juv: may occur inshore in shallow water			X				fish, cephalopods, crustaceans
<i>Anisotremus sarginensis</i>	Black margate		X		Juvenile/Adult	Over rocky bottoms, ledges, wrecks, nearshore reefs, surf areas, around groins					X		crustaceans, urchins, molluscs, fish
<i>Centropristis striatus</i>	Black sea bass		X	X	Juvenile/Adult	Adult: Offshore over wrecks, rubble reefs, rocky bottoms; Juv: estuaries and offshore	X						fish, crustaceans, shellfish
<i>Apsilus dentatus</i>	Black snapper		X		Juvenile/Adult	Rocky bottoms; Shallow waters around reefs and SAV		X					fish, cephalopods, tunicates
<i>Lutjanus buccanella</i>	Blackfin snapper		X		Juvenile/Adult	Deeper waters over rocky bottoms, near drop-offs and ledges							fish
<i>Callinectes sapidus</i>	Blue crab				Juvenile/Adult	Highly migratory, ocean waters, freshwater, sounds, rivers					X		plankton, invertebrates, fish, plants, mollusks, crustaceans, organic debris
<i>Makaira nigricans</i>	Blue marlin	X			Juvenile/Adult	Oceanic							fish, cephalopods
<i>Haemulon scirus</i>	Blue stripe grunt		X		Juvenile/Adult	Juv: <i>Thalassidroma</i> ; Adults: migrate to offshore reefs		X					crustaceans, bivalves, small fish
<i>Thunnus thynnus</i>	Bluefin tuna	X			Juvenile/Adult	Oceanic, seasonally comes close to shore					X		small schooling fish, squids, red crabs
<i>Pomatomus saltatrix</i>	Bluefish			X	Juvenile/Adult	Juv: estuaries, bays, coastal waters; Adult: open ocean, large embayments, estuaries	X				X		fish, crustaceans, polychaetes
<i>Caulolatilus microps</i>	Blueline tilefish		X		Juvenile/Adult	Surf beaches, estuaries, brackish water; shallow coastal waters	X				X		benthic invertebrates, fish
<i>Scomberomus regalis</i>	Cero		X		Juvenile/Adult	Over wrecks, along ledges at depths 1-20 m (3.3 - 66 ft); over coral reefs							crabs, fish, squid
<i>Rachycentron canadum</i>	Cobia		X		Juvenile/Adult	Over mud, sand, and gravel bottoms, inshore and offshore, estuaries	X			X	X		crabs, fish, squid
<i>Epinephelus fuscus</i>	Coney		X		Juvenile/Adult	Shallow and deep water, hides in caves or under ledges							small fish, crustaceans, shrimp
<i>Lutjanus cyanopterus</i>	Cubera snapper		X		Juvenile/Adult	Juv: inshore in SAV; adult: offshore or nearshore over wrecks, reefs, and ledges		X					fish, shrimps, crabs
<i>Lutjanus jaco</i>	Dog snapper		X		Juvenile/Adult	Juv: estuaries, rivers; adult: offshore rocky reefs	X				X		fish, benthic invertebrates, gastropods, cephalopods
<i>Coryphaena hippurus</i>	Dolphin fish		X		Juvenile/Adult	Juvs: found near the coast, with floating <i>Sargassum</i> ; Pelagic, deep water, close to surface					X		fish, zooplankton, crustaceans, squid
<i>Haemulon flavolineatum</i>	French grunt		X		Juvenile/Adult	Juv: nearshore SAV; Adults: rocky reefs, under ledges		X					small crustaceans

**TABLE 4.2 (Cont.)**  
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 NM - Nautical Mile; / = not likely to occur in area

Taxa	Common Name	NMFS (Highly Migratory Species)	SAFMC (3-200NM)	MAFMC (3-200 NM)	Probable Life Stage in Project Area	Fish Habitat Ecology	Estuarine Emergent Wetlands	SAVs	Oyster Reefs and Shell Beds	Intertidal Flats	Estuarine, Marine Water Columns, and Creeks (Subtidal)	Shallow Sand and Muddy Bottoms	Feeding Habits
<i>Myceteroperca microlepis</i>	Gag grouper		X		Juvenile/Adult	Juv. larvae: estuaries and SAV; Adults: offshore on rocky bottom, inshore on rocky or SAV bottom	X	X					fish, crabs, shrimp, cephalopods
<i>Chaceon ferrerii</i>	Golden crab		X			Deep ocean, waters over continental shelf, EFH areas							zooplankton
<i>Lopholatilus chamaeleonticeps</i>	Golden tilefish		X	X		Over mud, rock, sand bottom; continental shelf, 80-540 m (262-1772 ft), ledges							shrimp, crabs, fish, squid, bivalves, holothurians
<i>Epinephelus itajara</i>	Goliath grouper		X			Shallow, inshore areas, rock or mud bottoms, brackish estuaries; not common north of Florida							crustaceans, turtles, fish, stingrays
<i>Lutjanus griseus</i>	Gray snapper		X		Juvenile/Adult	Coastal and offshore waters; rocky areas, estuaries, rivers (juv)	X				X		fish, shrimp, crabs, gastropods, cephalopods, plankton
<i>Balistes carolinensis</i>	Gray triggerfish		X		Juvenile/Adult	Bays, harbors, lagoons, reefs; Juv. among <i>Sargassum</i>	X				X		benthic invertebrates; mollusks, crustaceans
<i>Epinephelus cruentatus</i>	Graysby		X		Juvenile/Adult	Inhabits SAV, coral reefs, rocky reef ledges		X					shrimp, fish
<i>Seriola dummerli</i>	Greater amberjack		X		Juvenile/Adult	Deep water, will enter coastal bays					X		fish, invertebrates
<i>Lachnolaimus maximus</i>	Hogfish		X		Juvenile/Adult	Over open bottoms or coral reef areas; lagoons					X		molluscs, crabs, sea urchins
<i>Calamus bajonado</i>	Jolthead porgy		X		Juvenile/Adult	Coastal waters, vegetated sand bottoms		X			X		sea urchins, crabs, molluscs
<i>Scomberomorus cavalla</i>	King mackerel		X		Juvenile/Adult	Along beaches and near mouths of inlets and coastal rivers				X	X		fish, penaeid shrimp, squid
<i>Calamus nodosus</i>	Knobbed porgy		X			Over reefs, ledges, wrecks and other hard bottom areas							gastropods, crabs, sea urchins, bivalves, other invertebrates
<i>Lutjanus synagris</i>	Lane snapper		X		Juvenile/Adult	Over all types of bottoms, but mainly coral reefs and SAV sandy areas		X				X	fish, crabs, shrimp, worms, gastropods, cephalopods
<i>Seriola fasciata</i>	Lesser amberjack		X			Coastal pelagic or demersal							squid, fish
<i>Euthynnus alletteratus</i>	Little tunny		X		Juvenile/Adult	Neritic waters close inshore					X		crustaceans, fish, squid, heteropods, tunicates
<i>Lutjanus mehogni</i>	Mahogany snapper		X		Juvenile/Adult	Shallow waters over rocky bottoms, sandy or SAV areas		X		X		X	fish, shrimps, crabs, cephalopods
<i>Haemulon album</i>	Margate		X		Juvenile/Adult	SAV, sand flats, wrecks		X		X		X	benthic and subsurface invertebrates
<i>Epinephelus mystacinus</i>	Misty grouper		X			Deep water, 100-400 m (328-1312 ft); juv. sometimes 30m (98 ft) inshore out to depths greater than 800 m (2625 ft); most common in depths 70 to 100 m (230-328 ft)							fish, crustaceans, squid
<i>Lophius americanus</i>	Monkfish		X	X	Juvenile/Adult	Continental Shelf; Adults: among rocks; Juv. over sandy, SAV bottoms		X			X		fish, sharks, sea birds
<i>Lutjanus analis</i>	Mutton snapper		X		Juvenile/Adult	From shoreline to at least 90 m (295 ft) depth, close to caves; Juv. SAV		X			X		fish, crabs, crustaceans, molluscs
<i>Epinephelus striatus</i>	Nassau grouper		X		Juvenile/Adult	Over rocky reefs, sand and SAV areas		X			X	X	benthic invertebrates
<i>Canthidermis sufflamen</i>	Ocean triggerfish		X		Juvenile/Adult	Estuarine, palustrine, intertidal marshes and flats, subtidal flats, SAV	X	X		X			algae, worms, fish, crabs, other shrimp
<i>Penaeus setiferus</i>	White shrimp		X		Juvenile/Adult	Estuarine, palustrine, intertidal marshes and flats, subtidal flats, SAV	X	X		X			algae, worms, fish, crabs, other shrimp
<i>Penaeus aztecus</i>	Brown shrimp		X		Juvenile/Adult	Estuarine, palustrine, intertidal marshes and flats, subtidal flats, SAV	X	X		X			algae, worms, fish, crabs, other shrimp

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<i>Penaeus duorarum</i>	Pink shrimp		X		Juvenile/Adult	Estuarine, palustrine, intertidal marshes and flats, subtidal flats, SAV	X	X		X	X		algae, worms, fish, crabs, other shrimp
<i>Etelis oculatus</i>	Queen snapper		X		Juvenile/Adult	Offshore over rocky bottoms of continental shelf to 137 m (450 ft)						X	small fish, squid
<i>Balistes vetula</i>	Queen triggerfish		X		Juvenile/Adult	Rocky or coral areas, sand and SAV areas		X				X	benthic invertebrates
<i>Sciaenops ocellatus</i>	Red drum		X	X	Juvenile/Adult	Sand and sandy mud bottoms in coastal waters and estuaries; surf zone; oyster reefs and shell banks	X		X		X	X	crustaceans, molluscs, fish
<i>Epinephelus morio</i>	Red grouper		X		Juvenile/Adult	Rocky and muddy bottoms; juv: shallow water						X	fish, invertebrates
<i>Epinephelus guttatus</i>	Red hind		X		Juvenile/Adult	Shallow reefs and rocky bottoms; wrecks and ledges; 18 to 110 m (59-361 ft); rare north of Florida							crustaceans, fish, and octopods
<i>Pagrus pagrus</i>	Red porgy		X		Juvenile/Adult	Rock, rubble, or sand bottoms; Juv: SAV		X				X	crustaceans, fish, molluscs
<i>Lutjanus campechanus</i>	Red snapper		X		Juvenile	Rocky bottoms; Juv: shallow waters, over sand or muddy bottoms						X	fish, shrimp, crabs, worms, cephalopods, plankton
<i>Epinephelus adscensionis</i>	Rock hind		X			Rocky inshore areas or deep reef bottoms, to depths of 76.2 m (250 ft); wrecks, ledges; rare north of Florida							crabs, fish
<i>Centropomus philadelphicus</i>	Rock sea bass		X			Offshore sandy and muddy bottoms; hardbottom, rocks, jetties, and ledges							invertebrates, fish, squid, plankton, crustaceans
<i>Sicyoptera japonica</i>	Rock shrimp		X			Sand bottom habitats; 18 -182 m (59-597 ft) in depth							algae, worms, fish, crabs, other shrimp
<i>Istiophorus platyterus</i>	Sailfish	X			Juvenile/Adult	Oceanic epipelagic; waters close to coasts					X		fish, crustaceans, cephalopods
<i>Calamus calamus</i>	Saucer-eye porgy		X		Juvenile	Juv: SAV sandy bottoms; Adults: coral areas		X				X	molluscs, benthic invertebrates, crustaceans
<i>Myxerperca phoenax</i>	Scamp		X		Juvenile	Adults: deeper waters; inshore and offshore reefs, ledges; outer coral reefs, depths of 30 to 100m (98-328 ft) in N. Carolina; Juv: estuaries, bays	X				X		fish, squid, crustaceans
<i>Lutjanus apodus</i>	Schoolmaster		X		Juvenile	Shallow, clear water over coral reef, near corals / gorgonians; Juv: sand bottoms with or without SAV, muddy bottoms of lagoons, brackish water	X	X			X	X	crustaceans, fish, invertebrates
<i>Stenodermus chrysops</i>	Scup		X	X	Juvenile/Adult	Intertidal and subtidal habitats, over sand, silty-sand, shell, mud, mussel beds and eelgrass, wrecks, artificial reefs, on or near structures	X	X	X	X	X	X	crustaceans, benthic invertebrates, squid, zooplankton, fish
<i>Carcharhinus obscurus</i>	Dusky shark	X			Juvenile/Adult	Surf zone to well offshore, surface to 400 m (1312 ft) depths					X		bony fish, sharks
<i>Carcharhinus brevipinna</i>	Spinner shark	X			Juvenile/Adult	Nearshore to offshore, over continental shelf					X		fish, octopods, squids, cuttlefish, small sharks
<i>Galeocerdo cuvier</i>	Tiger shark	X			Juvenile/Adult	Near surface to depths of 140 m (459 ft), on or adjacent to continental shelves, river estuaries, lagoons	X				X		fish, sharks, rays, marine mammals, sea turtles, seabirds, more
<i>Carcharias taurus</i>	Sand tiger shark	X			Juvenile/Adult	Nearshore from the surf zone, shallow bays to at least 191 m (627 ft) on the outer continental shelves					X		fish, small sharks, rays, squids, crabs, and lobsters
<i>Carcharhinus plumbeus</i>	Sandbar Shark	X	X		Juvenile/Adult	Inshore and offshore, bays, river mouths, harbors					X		bony fish, sharks, cephalopods, shrimp
<i>Rhizoprionodon terraenovae</i>	Atlantic sharpnose	X			Juvenile/Adult	Continental shelves, from the intertidal to deeper waters, surf zone off sandy beaches, estuaries, bays, river mouths	X			X	X		fishes, shrimps, crabs, segmented worms and molluscs
<i>Squalus acanthias</i>	Spiny dogfish			X	Juvenile/Adult	Inshore and offshore, enclosed bays and estuaries, can enter freshwater					X		fish, molluscs, crustaceans, other invertebrates
<i>Archosargus probatocephalus</i>	Sheepshead		X		Juvenile/Adult	Bays and Estuaries, brackish water, freshwater, around pilings, jetties	X				X		molluscs, crustaceans
<i>Lutjanus vivanus</i>	Silk snapper		X		Juvenile/Adult	Near edge of continental shelf; deeper waters, below 200 m (656 ft), shallow water at night							fish, crustaceans, gastropods, cephalopods, unchlorates

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<i>Epinephelus niveatus</i>	Snowy grouper		X		Juvenile	Adults: well offshore on rocky bottoms, deep as 244 m (800 feet); Juv: can be found inshore							fish, gastropods, cephalopods, brachyuran crustaceans
<i>Paralichthys lethostigma</i>	Southern flounder				Juvenile/Adult	Estuarine dependent, nearshore waters; Juv: inlets, muddy bottoms, estuaries	X			X	X	X	fish, crabs, shrimp
<i>Scorpaenopsis maculatus</i>	Spanish mackerel		X		Juvenile/Adult	Inshore, nearshore, and offshore, especially over SAV beds and reefs		X			X		fish, shrimp, cephalopods
<i>Epinephelus drummondhayi</i>	Speckled hind		X		Juvenile/Adult	Offshore rocky bottoms, common between 60 and 120 m (197 and 394 ft)							fish, crabs, shrimp, molluscs
<i>Parulichthys agius</i>	Spiny lobster		X		Juvenile/Adult	Oceanic, shallow subtidal, seagrass, unconsolidated bottom, Laurencia/algal communities, coral live hardbottom		X			X	X	benthic scavengers
<i>Paralichthys dentatus</i>	Summer flounder			X	Juvenile/Adult	Estuarine dependent, coastal waters; Juv: inlets, sandy bottoms in higher-salinity areas of estuaries	X			X	X	X	fish and shrimp
<i>Xiphias gladius</i>	Swordfish	X			Juvenile/Adult	Oceanic but sometimes found in coastal waters					X		fish, crustaceans, squid
<i>Mycteroperca tigris</i>	Tiger grouper		X		Juvenile/Adult	Coral reefs and rocky areas							fish, crustaceans
<i>Haemulon aurolineatum</i>	Tomtate		X		Juvenile/Adult	SAV, sand flats, and patch reefs		X		X		X	crustaceans, molluscs and other invertebrates, plankton, algae
<i>Rhombopites aurorubens</i>	Vermilion snapper		X		Juvenile/Adult	Moderately deep waters, over rock, gravel or sand bottoms near edge of cont. shelf; Juv: shallower depths below 25 m (82 ft)							fish, shrimp, crabs, benthic invertebrates, plankton, cephalopods, plankton
<i>Acanthocybium Solanderi</i>	Wahoo		X		Juvenile/Adult	Oceanic, epipelagic, coastal					X		fish, squid
<i>Epinephelus nigritus</i>	Warsaw grouper		X		Juvenile/Adult	Rocky bottoms; Juv: jetties, shallow reefs							crabs, shrimp, lobster, fish
<i>Haemulon plumieri</i>	White grunt		X		Juvenile/Adult	Adults: patch reefs, coral heads, sandy bottoms; Juv: SAV		X				X	crustaceans, fish, molluscs
<i>Tetraodon albidus</i>	White marlin	X			Juvenile/Adult	Deep water, over 100 m (328 ft)							fish, squid
<i>Calamus leucosteus</i>	Whitebone pogy		X		Juvenile/Adult	Fairly deep water, 10-100 m (33-328 ft), over rocks, reefs or patchy bottom							crustaceans, molluscs
<i>Polyprion americanus</i>	Wreckfish		X		Juvenile/Adult	Inhabit caves and shipwrecks; Juv: congregate below floating objects							crustaceans, cephalopods and benthic fishes
<i>Mycteroperca venenosa</i>	Yellowfin grouper		X		Juvenile/Adult	Juv: shallow SAV; Adults: rocky and coral reefs, mud bottoms, 2 to 137 m (6.6-450 ft)		X					fish, squid
<i>Thunnus albacares</i>	Yellowfin tuna	X			Juv/Sm Adult	Oceanic							fish, crustaceans, squid
<i>Mycteroperca interstitialis</i>	Yellowmouth grouper		X		Juv/Sm Adult	Rocky or coral bottoms from shoreline to at least 55 m (609 ft) depth; smaller fish: lagoons					X		fish
<i>Ocyrops chrysurus</i>	Yellowtail snapper		X		Juvenile/Adult	Coastal water, coral reefs; Juv: SAV		X			X		plankton, fish, crustaceans, worms, gastropods, cephalopods

**Table 4.3 A**  
**ESSENTIAL FISH HABITAT SPECIES IN BOGUE INLET, NORTH CAROLINA**  
**ESTUARINE EMERGENT WETLANDS**

Taxa	Common Name	Probable Life Stage in Project Area	Fish Habitat Ecology	Feeding Habits
<i>Chaetodipterus faber</i>	Atlantic spadefish	Juvenile/Adult	Juv: estuarine, shallow water; Adult: sandy beaches, shallow coastal waters, artificial reefs; 3-35 m (10-114 ft)	invertebrates, plankton
<i>Centropristis striatus</i>	Black sea bass	Juvenile	Adult: Offshore over wrecks, rubble, reefs, rocky bottoms; Juv: estuaries and offshore	small fish, crustaceans, shellfish
<i>Pomatomus saltatrix</i>	Bluefish	Juvenile/Adult	Juv: estuaries, bays, coastal waters Adult: open ocean, large embayments, estuaries	fish, crustaceans, polychaetes
<i>Caulolatilus microps</i>	Blueline tilefish	Juvenile/Adult	Surf beaches, estuaries, brackish water, shallow coastal waters	benthic invertebrates, fish
<i>Rachycentron canadum</i>	Cobia	Juvenile/Adult	Over mud, sand, and gravel bottoms, inshore and offshore, estuaries	crabs, fish, squid
<i>Lutjanus jocu</i>	Dog snapper	Juvenile	Juv: estuaries, rivers adult: offshore rocky reefs	fish, benthic invertebrates, gastropods, cephalopods
<i>Myceteroperca microlepis</i>	Gag grouper	Juvenile/Adult	Juv: estuaries and seagrass beds; Adults: offshore on rocky bottom, inshore on rocky or grassy bottom	fish, crabs, shrimp, cephalopods
<i>Lutjanus griseus</i>	Gray snapper	Juvenile/Adult	Coastal and offshore waters; rocky areas, estuaries, rivers (juv)	fish, shrimp, crabs, gastropods, cephalopods, plankton
<i>Penaeus setiferus</i>	White shrimp	Juvenile/Adult	Estuarine, palustrine, wetlands (intertidal marshes), SAV	algae, worms, fish, crabs, other shrimp
<i>Penaeus aztecus</i>	Brown shrimp	Juvenile/Adult	Estuarine, palustrine, wetlands (intertidal marshes), SAV	algae, worms, fish, crabs, other shrimp
<i>Penaeus duorarum</i>	Pink shrimp	Juvenile/Adult	Estuarine, palustrine, wetlands (intertidal marshes), SAV	algae, worms, fish, crabs, other shrimp
<i>Sciaenops ocellatus</i>	Red drum	Juvenile/Adult	Sand and sandy mud bottoms in coastal waters and estuaries; surf zone; oyster reefs and shell banks	crustaceans, molluscs, fish
<i>Myceteroperca phenax</i>	Scamp	Juvenile	Adults: deeper waters; inshore and offshore reefs, ledges, <i>Oculina</i> coral reefs, depths of 30-100 m (99-328 ft) in N. Carolina; Juv: estuaries, bays	fish, squid, crustaceans
<i>Lutjanus apodus</i>	Schoolmaster	Juvenile	Shallow, coral reefs, near elkhorn corals and gorgonians; Juv: sand bottoms with or without seagrass, muddy bottoms of lagoons, brackish water	fish, shrimp, crabs, worms, gastropods, cephalopods
<i>Galeocerdo cuvier</i>	Tiger shark	Juvenile/Adult	Near surface to depths of 140 m (459 ft), on or adjacent to continental shelves, river estuaries, lagoons	fish, sharks, rays, marine mammals, sea turtles, seabirds, more
<i>Rhizoprionodon terraenovae</i>	Atlantic sharpnose shark	Juvenile/Adult	Continental shelves, from the intertidal to deeper waters, surf zone off sandy beaches, estuaries, bays, river mouths	fishes, shrimps, crabs, segmented worms and molluscs
<i>Archosargus probatocephalus</i>	Sheepshead	Juvenile/Adult	Bays and Estuaries, brackish water, freshwater, around pilings, jetties	molluscs, crustaceans
<i>Paralichthys dentatus</i>	Summer flounder	Juvenile/Adult	Estuarine dependent, coastal waters; Juv: inlets, sandy bottoms in higher-salinity areas of estuaries	fish and shrimp

**TABLE 4.3 B**  
**ESSENTIAL FISH HABITAT SPECIES IN BOGUE INLET, NORTH CAROLINA**  
**SUBMERGED AQUATIC VEGETATION AND SEAGRASS BEDS**

Taxa	Common Name	Probable Life Stage in Project Area	Fish Habitat Ecology	Feeding Habits
<i>Apsilus dentatus</i>	Black snapper	Juvenile/Adult	Rocky bottoms; Shallow waters around reefs and SAV	fish, cephalopods, tunicates
<i>Haemulon sciurus</i>	Blue stripe grunt	Juvenile	Juv: <i>Thalassia</i> beds; Adults: migrate to offshore reefs	crustaceans, bivalves, small fish
<i>Lutjanus cyanopterus</i>	Cubera snapper	Juvenile	Juv: inshore in SAV; adult: offshore or nearshore over wrecks, reefs, and ledges	fish, shrimps, crabs
<i>Haemulon flavolineatum</i>	French grunt	Juvenile	Juv: nearshore SAV; Adults: rocky reefs, under ledges	small crustaceans
<i>Myceteroperca microlepis</i>	Gag grouper	Juvenile/Adult	Juv, larvae: estuaries and SAV; Adults: offshore on rocky bottom, inshore on rocky or SAV bottom	fish, crabs, shrimp, cephalopods
<i>Epinephelus cruentatus</i>	Graysby	Juvenile/Adult	Inhabits SAV ( <i>Thalassia</i> ), coral reefs, rocky reef ledges	shrimp, fish
<i>Calamus bajonado</i>	Jolthead porgy	Juvenile/Adult	Coastal Waters, SAV sand bottoms	sea urchins, crabs, molluscs
<i>Lutjanus synagris</i>	Lane snapper	Juvenile/Adult	Over all types of bottoms, but mainly coral reefs and SAV sandy areas	fish, crabs, shrimp, worms, gastropods, cephalopods
<i>Lutjanus mahogani</i>	Mahogany snapper	Juvenile/Adult	Shallow waters over rocky bottoms, sandy or SAV	fish, shrimps, crabs, cephalopods
<i>Haemulon album</i>	Margate	Juvenile/Adult	SAV, sand flats, wrecks	benthic and subsurface invertebrates
<i>Lutjanus analis</i>	Mutton snapper	Juvenile	Continental Shelf, Adults: among rocks; Juv: over sandy, SAV bottoms	fish, shrimp, crabs, cephalopods, gastropods
<i>Epinephelus striatus</i>	Nassau grouper	Juvenile/Adult	From shoreline to at least 90m (295 ft) depth, close to caves; Juv: SAV	fish, crabs, crustaceans, molluscs
<i>Canthidermis sufflamen</i>	Ocean triggerfish	Juvenile/Adult	Over rocky reefs, sand and SAV areas	benthic invertebrates
<i>Penaeus setiferus</i>	White shrimp	Juvenile/Adult	Estuarine, palustrine, intertidal marshes and flats, subtidal flats, SAV	algae, worms, fish, crabs, other shrimp
<i>Penaeus aztecus</i>	Brown shrimp	Juvenile/Adult	Estuarine, palustrine, intertidal marshes and flats, subtidal flats, SAV	algae, worms, fish, crabs, other shrimp
<i>Penaeus duorarum</i>	Pink shrimp	Juvenile/Adult	Estuarine, palustrine, intertidal marshes and flats, subtidal flats, SAV	algae, worms, fish, crabs, other shrimp

**TABLE 4.3 B Ø**  
**ESSENTIAL FISH HABITAT SPECIES IN BOGUE INLET, NORTH CAROLINA**  
**SUBMERGED AQUATIC VEGETATION AND SEAGRASS BEDS**

Taxa	Common Name	Probable Life Stage in Project Area	Fish Habitat Ecology	Feeding Habits
<i>Balistes vetula</i>	Queen triggerfish	Juvenile/Adult	Rocky or coral areas, sand and SAV areas	benthic invertebrates
<i>Pagrus pagrus</i>	Red porgy	Juvenile/Adult	Rock, rubble, or sand bottoms; Juv: SAV	crustaceans, fish, molluscs
<i>Calamus calamus</i>	Saucereye porgy	Juvenile	Juv: SAV ( <i>Thalassia</i> ) sandy bottoms; Adults: coral areas	molluscs, benthic invertebrates, crustaceans
<i>Lutjanus apodus</i>	Schoolmaster	Juvenile	Shallow, clear water over coral reef, near elkhorn corals and gorgonians; Juv: sand bottoms with or without SAV, muddy bottoms of lagoons, brackish water	crustaceans, fish, invertebrates
<i>Stenotomus chrysops</i>	Scup	Adult/Juvenile	Intertidal and subtidal habitats, over sand, silty-sand, shell, mud, mussel beds and eel SAV, wrecks, artificial reefs, on or near structures	crustaceans, benthic invertebrates, squid, zooplankton, fish
<i>Scomberomorus maculatus</i>	Spanish mackerel	Juvenile/Adult	Inshore, nearshore, and offshore, especially over SAV beds and reefs	fish, shrimp, cephalopods
<i>Panulirus argus</i>	Spiny lobster	Juvenile/Adult	Oceanic, shallow subtidal, SAV, unconsolidated bottom, <i>Laurencia</i> algal communities, coral live bottom	benthic scavengers
<i>Haemulon plumieri</i>	White grunt	Juvenile/Adult	Adults: patch reefs, coral heads, sandy bottoms; Juv: SAV ( <i>Thalassia</i> )	crustaceans, fish, molluscs
<i>Mycteroperca venenosa</i>	Yellowfin grouper	Juvenile/Adult	Juv: shallow SAV ( <i>Thalassia</i> ) beds; Adults: rocky and coral reefs, mud bottoms, 2 - 137 m (6.6 - 449 ft)	fish, squid
<i>Ocyrus chrysurus</i>	Yellowtail snapper	Juvenile/Adult	Coastal water, coral reefs; Juv: SAV	plankton, fish, crustaceans, worms, gastropods, cephalopods

**TABLE 4.3 C**  
**ESSENTIAL FISH HABITAT SPECIES IN BOGUE INLET, NORTH CAROLINA**  
**OYSTER REEFS AND SHELL BANKS**

Taxa	Common Name	Probable Life Stage in Project Area	Fish Habitat Ecology	Feeding Habits
<i>Sciaenops ocellatus</i>	Red drum	Juvenile/Adult	Sand and sandy mud bottoms in coastal waters and estuaries; surf zone; oyster reefs and shell banks	crustaceans, molluscs, fish
<i>Stenotomus chrysops</i>	Scup	Juvenile/Adult	Intertidal and subtidal habitats, over sand, silty-sand, shell, mud, mussel beds and eelgrass, wrecks, artificial reefs, on or near structures	crustaceans, benthic invertebrates, squid, zooplankton, fish

**TABLE 4.3 D**  
**ESSENTIAL FISH HABITAT SPECIES IN BOGUE INLET, NORTH CAROLINA**  
**INTERTIDAL FLATS**

Taxa	Common Name	Probable Life Stage in Project Area	Fish Habitat Ecology	Feeding Habits
<i>Chaetodipterus faber</i>	Atlantic spadefish	Juvenile/Adult	Juv: estuarine, shallow water; Adult: sandy beaches, shallow coastal waters, artificial reefs, 3-35 m (10-114 ft)	invertebrates, plankton
<i>Seriola zonata</i>	Banded rudderfish	Juvenile/Adult	Coastal waters, inshore around structures, anywhere from surface to seafloor	fish, shrimps
<i>Myceteroperca bonaci</i>	Black grouper	Juvenile	Adult: offshore, over 18 m (60 ft); Juv: may occur inshore in shallow water	fish, cephalopods, crustaceans
<i>Rachycentron canadum</i>	Cobia	Juvenile/Adult	Over mud, sand, and gravel bottoms, inshore and offshore, estuaries	crabs, fish, squid
<i>Lutjanus mahogoni</i>	Mahogany snapper	Juvenile/Adult	Shallow waters over rocky bottoms, sandy or SAV areas	fish, shrimps, crabs, cephalopods
<i>Haemulon album</i>	Margate	Juvenile/Adult	SAV, sand flats, wrecks	benthic and subsurface invertebrates
<i>Penaeus setiferus</i>	White shrimp	Juvenile/Adult	Estuarine, palustrine, intertidal marshes and flats, subtidal flats, SAV	algae, worms, fish, crabs, other shrimp
<i>Penaeus aztecus</i>	Brown shrimp	Juvenile/Adult	Estuarine, palustrine, intertidal marshes and flats, subtidal flats, SAV	algae, worms, fish, crabs, other shrimp
<i>Penaeus duorarum</i>	Pink shrimp	Juvenile/Adult	Estuarine, palustrine, intertidal marshes and flats, subtidal flats, SAV	algae, worms, fish, crabs, other shrimp
<i>Stenotomus chrysops</i>	Scup	Juvenile/Adult	Intertidal and subtidal habitats, over sand, silty-sand, shell, mud, mussel beds and SAV, wrecks, artificial reefs, on or near structure	crustaceans, benthic invertebrates, squid, zooplankton, fish
<i>Rhizoprionodon terraenovae</i>	Atlantic sharpnose shark	Juvenile/Adult	Continental shelves, from the intertidal to deeper waters, surf zone off sandy beaches, estuaries, bays, river mouths	fishes, shrimps, crabs, segmented worms and molluscs
<i>Paralichthys lethostigma</i>	Southern flounder	Juvenile/Adult	Estuarine dependent, nearshore waters; Juv: inlets, sandy bottoms in higher-salinity areas of estuaries	fish, crabs, shrimp
<i>Paralichthys dentatus</i>	Summer flounder	Juvenile/Adult	Estuarine dependent, coastal waters; Juv: inlets, sandy bottoms in higher-salinity areas of estuaries	fish and shrimp
<i>Haemulon aurolineatum</i>	Tomtate	Juvenile/Adult	SAV, sand flats, and patch reefs	crustaceans, molluscs and other invertebrates, plankton, algae

**TABLE 4.3 E**  
**ESSENTIAL FISH HABITAT SPECIES IN BOGUE INLET, NORTH CAROLINA**  
**ESTUARINE /MARINE WATER COLUMN AND CREEK**

Taxa	Common Name	Probable Life Stage in Project Area	Fish Habitat Ecology	Feeding Habits
<i>Chaetodipterus faber</i>	Atlantic spadefish	Juvenile/Adult	Juv: estuarine, shallow water; Adult: sandy beaches, shallow coastal waters, artificial reefs; 3-35 m (10-115 ft)	invertebrates, plankton
<i>Seriola zonata</i>	Banded rudderfish	Juvenile/Adult	Coastal waters, inshore around structures, anywhere from surface to seafloor	fish, shrimps
<i>Anisotremus surinamensis</i>	Black margate	Juvenile/Adult	Over rocky bottoms, ledges, wrecks, nearshore reefs, surf areas, around groins	crustaceans, urchins, molluscs, fish
<i>Callinectes sapidus</i>	Blue crab	Juvenile/Adult	Highly migratory; ocean waters, freshwater, sounds, rivers	plankton, invertebrates, fish, mollusks, crustaceans and organic debris
<i>Thunnus thynnus</i>	Bluefin tuna	Juvenile/Adult	Oceanic, seasonally comes close to shore	small schooling fish, squids, red crabs
<i>Pomatomus saltatrix</i>	Bluefish	Juvenile/Adult	Juv: estuaries, bays, coastal waters Adult: open ocean, large embayments, estuaries	fish, crustaceans, polychaetes
<i>Caulolatilus microps</i>	Blueline tilefish	Juvenile/Adult	Surf beaches, estuaries, brackish water, shallow coastal waters	benthic invertebrates, fish
<i>Rachycentron canadum</i>	Cobia	Juvenile/Adult	Over mud, sand, and gravel bottoms, inshore and offshore, estuaries	crabs, fish, squid
<i>Lutjanus jocu</i>	Dog snapper	Juvenile	Juv: estuaries, rivers adult: offshore rocky reefs	fish, benthic invertebrates, gastropods, cephalopods
<i>Coryphaena hippurus</i>	Dolphin fish	Juvenile	Juvs: found near the coast, with floating <i>Sargassum</i> ; Pelagic, deep water, close to surface	fish, zooplankton, crustaceans, squid
<i>Lutjanus griseus</i>	Gray snapper	Juvenile/Adult	Coastal and offshore waters; rocky areas, estuaries, rivers (juv)	fish, shrimp, crabs, gastropods, cephalopods, plankton
<i>Balistes carolinensis</i>	Gray triggerfish	Juvenile/ Adult	Bays, harbors, lagoons, reefs; Juv: among <i>Sargassum</i>	benthic invertebrates; mollusks, crustaceans
<i>Seriola dummerili</i>	Greater amberjack	Juvenile/ Adult	Deep water, will enter coastal bays	fish, invertebrates
<i>Lachnolaimus maximus</i>	Hogfish	Juvenile/ Adult	Over open bottoms or coral reef areas; lagoons	molluscs, crabs, sea urchins
<i>Calamus bajonado</i>	Jolthead porgy	Juvenile/ Adult	Coastal waters, vegetated sand bottoms	sea urchins, crabs, molluscs
<i>Scomberomorus cavalla</i>	King mackerel	Juvenile/ Adult	Along beaches and near mouths of inlets and coastal rivers	fish, penaid shrimp, squid
<i>Euthynnus alletteratus</i>	Little tunny	Juvenile/ Adult	Neritic waters close inshore	crustaceans, fish, squid, heteropods, tunicates
<i>Epinephelus striatus</i>	Nassau grouper	Juvenile/ Adult	From shoreline to at least 90 m (295 ft) depth, close to caves; Juv: SAV	fish, crabs, crustaceans, molluscs

**TABLE 4.3 E Ø**  
**ESSENTIAL FISH HABITAT SPECIES IN BOGUE INLET, NORTH CAROLINA**  
**ESTUARINE /MARINE WATER COLUMN AND CREEK**

Taxa	Common Name	Probable Life Stage in Project Area	Fish Habitat Ecology	Feeding Habits
<i>Sciaenops ocellatus</i>	Red drum	Juvenile/ Adult	Sand and sandy mud bottoms in coastal waters and estuaries; surf zone; oyster reefs and shell banks	crustaceans, molluscs, fish
<i>Istiophorus platypterus</i>	Sailfish	Juvenile/ Adult	Oceanic epipelagic; waters close to coasts	fish, crustaceans, cephalopods
<i>Mycteroperca phenax</i>	Scamp	Juvenile	Adults: deeper waters; inshore and offshore reefs, ledges, <i>Oculina</i> coral reefs, depths of 30 to 100m (98-328 ft) in N. Carolina; Juv: estuaries, bays	fish, squid, crustaceans
<i>Stenotomus chrysops</i>	Scup	Juvenile/Adult	Intertidal and subtidal habitats, over sand, silty-sand, shell, mud, mussel beds and SAV, wrecks, artificial reefs, on or near structures	crustaceans, benthic invertebrates, squid, zooplankton, fish
<i>Lufjanus apodus</i>	Schoolmaster	Juvenile	Shallow, clear water over coral reef, near corals / gorgonians; Juv: sand bottoms with or without SAV, muddy bottoms of lagoons, brackish	crustaceans, fish, invertebrates
<i>Rhizoptilonodon terraenovae</i>	Atlantic sharpnose shark	Juvenile/Adult	Continental shelves, from the intertidal to deeper waters, surf zone off sandy beaches, estuaries, bays, river mouths	fishes, shrimps, crabs, segmented worms and molluscs
<i>Carcharhinus obscurus</i>	Dusky shark	Juvenile/ Adult	Surf zone to well offshore; surface to 400 m (1312 ft) depths	bony fish, sharks
<i>Carcharhinus taurus</i>	Sand tiger shark	Juvenile/ Adult	Nearshore from the surf zone, shallow bays to at least 191 m (627 ft) on the outer continental shelves	fish, small sharks, rays, squids, crabs, and lobsters
<i>Carcharhinus plumbeus</i>	Sandbar Shark	Juvenile/Adult	Inshore and offshore, bays, river mouths, harbors	bony fish, sharks, cephalopods, shrimp
<i>Carcharhinus brevipinna</i>	Spinner shark	Juvenile/ Adult	Nearshore to offshore, over continental shelf	fish, octopods, squids, cuttlefish, small sharks
<i>Galeocerdo cuvier</i>	Tiger shark	Juvenile/Adult	Near surface to depths of 140m, on or adjacent to continental shelves, river estuaries, lagoons	fish, sharks, rays, marine mammals, sea turtles, seabirds, more
<i>Archosargus probatocephalus</i>	Sheepshead	Juvenile/ Adult	Bays and Estuaries, brackish water, freshwater, around pilings, jetties	molluscs, crustaceans
<i>Penaeus aztecus</i>	Brown shrimp	Juvenile/Adult	Estuarine, palustrine, intertidal marshes and flats, subtidal flats, SAV	algae, worms, fish, crabs, other shrimp
<i>Penaeus duorarum</i>	Pink shrimp	Juvenile/Adult	Estuarine, palustrine, intertidal marshes and flats, subtidal flats, SAV	algae, worms, fish, crabs, other shrimp
<i>Penaeus setiferus</i>	White shrimp	Juvenile/Adult	Estuarine, palustrine, intertidal marshes and flats, subtidal flats, SAV	algae, worms, fish, crabs, other shrimp
<i>Paralichthys lethostigma</i>	Southern flounder	Juvenile/ Adult	Estuarine dependent, nearshore waters; Juv: inlet, muddy bottoms, estuaries	fish, crabs, shrimp
<i>Scomberomorus maculatus</i>	Spanish mackerel	Juvenile/ Adult	Inshore, nearshore, and offshore, especially over SAV beds and reefs	fish, shrimp, cephalopods
<i>Panulirus argus</i>	Spiny lobster	Juvenile/Adult	Oceanic, shallow subtidal, seagrass, unconsolidated bottom, <i>Laurencia</i> SAV communities, coral live bottom	benthic scavengers

**TABLE 4.3 E Ø**  
**ESSENTIAL FISH HABITAT SPECIES IN BOGUE INLET, NORTH CAROLINA**  
**ESTUARINE /MARINE WATER COLUMN AND CREEK**

Taxa	Common Name	Probable Life Stage in Project Area	Fish Habitat Ecology	Feeding Habits
<i>Paralichthys dentatus</i>	Summer flounder	Juvenile/ Adult	Estuarine dependent, coastal waters; Juv: inlets, sandy bottoms in higher-salinity areas of estuaries	fish and shrimp
<i>Xiphias gladius</i>	Swordfish	Juvenile/ Adult	Oceanic but sometimes found in coastal waters	fish, crustaceans, squid
<i>Acanthocybium Solanderi</i>	Wahoo	Juvenile/ Adult	Oceanic, epipelagic, coastal	fish, squid
<i>Mycteroperca interstitialis</i>	Yellowmouth grouper	Juv/Sm Adult	Rocky or coral bottoms from shoreline to at least 55 m (509 ft) depth; smaller fish: lagoons	fish
<i>Ocyurus chrysurus</i>	Yellowtail snapper	Juvenile/ Adult	Coastal water, coral reefs; Juv: SAV	plankton, fish, crustaceans, worms, gastropods, cephalopods

**TABLE 4.3 F**  
**ESSENTIAL FISH HABITAT SPECIES IN BOGUE INLET, NORTH CAROLINA**  
**SHALLOW SANDY AND MUDDY BOTTOMS**

Taxa	Common Name	Probable Life Stage in Project Area	Fish Habitat Ecology	Feeding Habits
<i>Myceteroperca bonaci</i>	Black grouper	Juvenile	Adult: offshore, over 18 m (60 ft); Juv: may occur inshore in shallow water	fish, cephalopods, crustaceans
<i>Apsilus dentatus</i>	Black snapper	Juvenile/Adult	Rocky bottoms; Shallow waters around reefs and SAV	fish, cephalopods, tunicates
<i>Caulolatilus microps</i>	Blueline tilefish	Juvenile/Adult	Surf beaches, estuaries, brackish water, shallow coastal waters	benthic invertebrates, fish
<i>Rachycentron canadum</i>	Cobia	Juvenile/Adult	Over mud, sand, and gravel bottoms, inshore and offshore, estuaries	crabs, fish, squid
<i>Lutjanus synagris</i>	Lane snapper	Juvenile/Adult	Over all types of bottoms, but mainly coral reefs and SAV sandy areas	fish, crabs, shrimp, worms, gastropods, cephalopods
<i>Lutjanus mahogoni</i>	Mahogany snapper	Juvenile/Adult	Shallow waters over rocky bottoms, sandy or SAV areas	fish, shrimps, crabs, cephalopods
<i>Haemulon album</i>	Margate	Juvenile/Adult	SAV, sand flats, wrecks	benthic and subsurface invertebrates
<i>Lutjanus analis</i>	Mutton snapper	Juvenile	Continental Shelf; Adults: among rocks; Juv: over sandy, SAV bottoms	fish, shrimp, crabs, cephalopods, gastropods
<i>Canthidermis sufflamen</i>	Ocean triggerfish	Juvenile/Adult	Over rocky reefs, sand and SAV areas	benthic invertebrates
<i>Balistes vetula</i>	Queen triggerfish	Juvenile/Adult	Rocky or coral areas, sand and SAV areas	benthic invertebrates
<i>Sciaenops ocellatus</i>	Red drum	Juvenile/Adult	Sand and sandy mud bottoms in coastal waters and estuaries; surf zone; oyster reefs and shell banks	crustaceans, molluscs, fish
<i>Epinephelus morio</i>	Red grouper	Juvenile/Adult	Rocky and muddy bottoms; juv: shallow water	fish, invertebrates
<i>Pagrus pagrus</i>	Red porgy	Juvenile/Adult	Rock, rubble, or sand bottoms; Juv: SAV	crustaceans, fish, molluscs
<i>Lutjanus campechanus</i>	Red snapper	Juvenile	Rocky bottoms; Juv: shallow waters, over sand or muddy bottoms	fish, shrimp, crabs, worms, cephalopods, plankton
<i>Lutjanus apodus</i>	Schoolmaster	Juvenile	Shallow water, coral reef, near corals / gorgonians; Juv: sand bottoms, SAV, muddy bottoms, lagoons, brackish water	crustaceans, fish, invertebrates

**TABLE 4.3 F Ø**  
**ESSENTIAL FISH HABITAT SPECIES IN BOGUE INLET, NORTH CAROLINA**  
**SHALLOW SANDY AND MUDDY BOTTOMS**

Taxa	Common Name	Probable Life Stage in Project Area	Fish Habitat Ecology	Feeding Habits
<i>Stenotomus chrysops</i>	Scup	Juvenile/Adult	Intertidal and subtidal habitats, over sand, silty-sand, shell, mud, mussel beds and SAV, wrecks, artificial reefs, on or near structures	crustaceans, benthic invertebrates, squid, zooplankton, fish
<i>Paralichthys lethostigma</i>	Southern flounder	Juvenile/Adult	Estuarine dependent, nearshore waters; Juv: inlet, muddy bottoms, estuaries	fish, crabs, shrimp
<i>Panulirus argus</i>	Spiny lobster	Juvenile/Adult	Oceanic, shallow subtidal, seagrass, unconsolidated bottom, <i>Laurencia</i> SAV communities, coral live bottom	benthic scavenger
<i>Paralichthys dentatus</i>	Summer flounder	Juvenile/Adult	Estuarine dependent, coastal waters; Juv: inlets, sandy bottoms in higher-salinity areas of estuaries	fish and shrimp
<i>Haemulon aurolineatum</i>	Tomtate	Juvenile/Adult	SAV, sand flats, and patch reefs	crustaceans, molluscs and other invertebrates, plankton, algae
<i>Haemulon plumieri</i>	White grunt	Juvenile/Adult	Adults: patch reefs, coral heads, sandy bottoms; Juv: SAV ( <i>Thalassia</i> )	crustaceans, fish, molluscs

**Table 4.4  
Geographically Defined Habitat Areas of Particular Concern (HAPC) Identified in  
the FMP Amendments Affecting the South Atlantic<sup>1</sup>**

<b>South Atlantic HAPC Regions</b>	<b>Project Area Habitat</b>
Council-Designated Artificial Reef Special Management Zones	N/A
Hermatypic Coral Habitat and Reefs	N/A
Hard Bottoms	N/A
Hoyt Hills	N/A
Sargassum Habitat	N/A
State-Designated Areas of Importance to Managed Species	Primary, Secondary and Special Nursery Areas north of the Project Area
Submerged Aquatic Vegetation	Identified in project area in June 2003 with digital imagery and ground truth investigations in September 2003 (Appendix No. 3)
<b>North Carolina HAPC Regions</b>	<b>Project Area Habitat</b>
Big Rock	N/A
Bogue Sound	Western edge of Project Area
Pamlico Sound at Hatteras/Ocracoke Inlets	N/A
Capes Fear, Lookout & Hatteras (sandy shoals)	N/A
New river	N/A
The Ten Fathom Ledge	N/A
The Point	N/A

<sup>1</sup> Areas listed above are identified in the Essential Fish Habitat: New Marine Fish Habitat Conservation Mandate for Federal Agencies

The SAFMC and the MAFMC have designated HAPC areas to focus on conservation priorities on specific habitat areas that play a particularly important role in the life cycles of federally managed fish species.

#### **4.4 Nursery Areas**

The NCDMF has designated a total of 147,008 acres of fishery nursery areas throughout North Carolina. The state has developed three categories of nursery areas: Primary, Secondary and Special Secondary Nursery Areas. Figure 4.1 shows the Primary Nursery Areas northwest of the Swansboro bridge and in Dick's Creek. Secondary nursery areas are typically located in the lower portions of creeks and bays and have been identified in the creeks and bays of the project area. State designated secondary nursery areas are geographically defined as EFH for the blue crab.

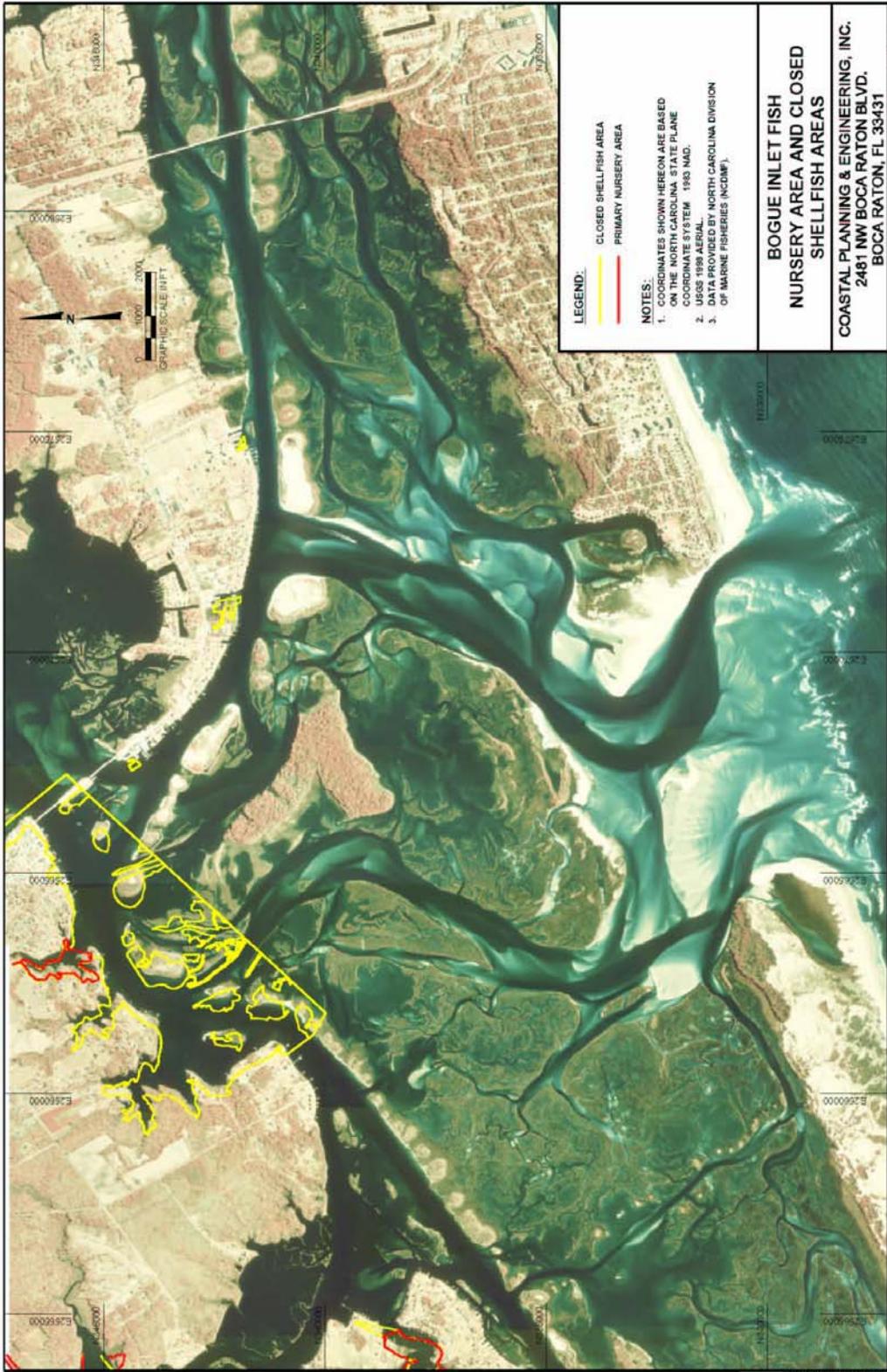


FIGURE 4.1

## **5.0 ESTUARINE EMERGENT WETLANDS HABITATS**

Some of the most productive and valuable wetlands are coastal marshes. Coastal marsh environments of the project area are located in the western end of Bogue Sound, Dudley Island, and the estuarine system north of Bear Island. These marshes are regularly flooded lands where plants species such as salt marsh cordgrasses (*Spartina alterniflora* and *S. patens*), glasswort (*Salicornia* spp.), salt grass (*Distichlis spicata*), and sea lavender (*Limonium carolinanum*) can be found. These habitats are important for fish spawning and juvenile development. Acquisition of digital aerial imagery, along with the field investigations of the low and high marsh, was conducted in June 2003 and September 2003, respectively, and provide definitive boundaries of the marsh environments of Bogue Inlet (Appendix Nos. 3 and 4).

Table 4.3A lists the EFH species that are expected to occur in estuarine emergent wetlands of the Bogue Inlet project area. This list includes the Penaeid shrimp, coastal sharks, cobia, summer flounder and others. Provided below is a detailed description of the representative fish species of greater concern most likely to be found in the project area.

### **5.1 Penaeid Shrimp**

Marine and estuarine emergent wetlands along with several other habitats are identified as EFH for the white (*Penaeus setiferus*), pink (*P. duorarum*) and brown (*P. aztecus*) shrimps. In addition, the SAFMC has designated all coastal inlets, all Primary Nursery Areas and Secondary Nursery Areas, and State-identified overwintering areas for shrimp as HAPC. The three species of shrimp have also been found to recruit into creek and river bottoms and grassbeds where they feed on plant and animal material.

Penaeid shrimp are known to spawn offshore in the winter, moving into estuaries during post-larval stage during the early spring. As the shrimp grow larger in size, they migrate to the upper reaches of the smaller creeks and deeper, higher salinity rivers and sounds. Come late summer and fall, they return to the deep oceans to spawn. (NCDMF, 2002)

Shrimp migrations reported along the western Atlantic found a major southerly migration from North Carolina to Cape Canaveral in fall, and a northerly migration from Cape Canaveral in the spring (USFWS, 1984).

#### **5.1.1 Effect Determination**

The varying life stages of penaeid shrimp support the winter construction schedule where the shrimp will be offshore spawning during the winter season. Since the work will occur in the nearshore zones and intertidal area of Bogue Inlet, it is not anticipated that the work will affect the spawning or post-larval stage of the shrimp in the early spring. Furthermore, the environmental cues used for spawning and migration, such as temperature and salinity, are not expected to be affected by this project. Increases in turbidity caused by dredging will return to pre-construction conditions soon after project completion.

## 5.2 Coastal Sharks

All six coastal shark species identified in Tables 4.2 and 4.3 are designated as Highly Migratory Species by NMFS since these species are found throughout the Atlantic Ocean.

EFH for adult tiger sharks (*Galeocerdo cuvier*) are offshore areas from Maryland south to Fort Lauderdale, Florida (NMFS, 1999). EFH for neonate/early juveniles and late juveniles/sub-adult tiger shark, designated by NMF, includes shallow coastal waters from Cape Canaveral, FL to Long Island, NY. The tiger shark is found throughout the world's temperate and tropical waters, with the exception of the Mediterranean Sea. It is a wide-ranging species that is home to both the open oceans, as well as, shallow coastal waters. This shark has a notable tolerance for many different kinds of marine habitat, but generally prefers murky waters in coastal areas. It is commonly found in river estuaries, harbors, and other inlets where runoff from the land may attract a high number of prey. Shallow areas around large island chains and oceanic islands including lagoons, are also part of the tiger shark's natural environment. It is often seen at the water surface, but has also been reported to depths of 350 m (1,148 ft).

Tiger sharks undergo seasonal migrations. They are known to move into temperate waters from the tropics for the warmer months and return during the winter. These sharks also make long oceanic migrations between islands and are capable of traveling long distances in a short amount of time. (FLMNH, 2003)

The Atlantic sharpnose shark (*Rhizoprionodon terraenovae*) is commonly found from New Brunswick, Canada, through the Gulf of Mexico as well as along the coast of Brazil, and is one of the most abundant fish in North Carolina waters. In North Carolina, *R. terraenovae* is found year-round along continental shelf waters and near the beaches from May-October (NCDMF, 2002). Shallow coastal areas, including bays and estuaries, from Daytona Beach, Florida north to New Jersey are designated by NMFS as EFH.

As winter approaches, the sharks move offshore into deeper water, returning inshore to mate in spring and give birth after a 10-11 month gestation period. They are found at depths to 280 m (918.6 ft), but mostly remain in waters less than 10 m (32.8 ft) deep. Along with being common residents of the surf zone, the Atlantic sharpnose shark is also found in estuaries and harbors. Although this shark is able to tolerate lower salinity levels, they do not venture into freshwater. (FLMNH, 2003)

### 5.2.1 Effect Determination

The tiger shark is commonly found in estuaries, where the Atlantic sharpnose sharks frequent less, as they do not tolerate changes in salinity. The occurrence of the tiger shark is not expected during the winter months of the project construction, as it has been reported to migrate to tropical waters during this time. Therefore, negative affects to this species are not expected.

The project will involve sediment nourishment to the nearshore zone of Emerald Isle during the winter months of 2004-2005. Effects to the Atlantic sharpnose shark are not

expected since this species frequents this area during the months of May through October.

### **5.3 Cobia**

Cobia (*Rachycentron canadum*) are managed by the SAFMC and can be found in the nearshore waters, intertidal flats, emergent wetlands and shallow sand/muddy bottoms of Bogue Inlet. This species is found world-wide in tropical, sub-tropical and temperate waters, occurring along the western Atlantic Ocean from Nova Scotia to the Caribbean. *R. canadum* are pelagic fish that are typically found swimming around structures, but can also be found in inlets and bays. EFH includes high salinity bays, estuaries, and seagrass habitat (NMFS, 2003).

During the fall and winter months, cobia migrate south to warmer waters 20°-30°C (68-86°F). In the early spring months (May-June), cobia will migrate to North Carolina to spawn during the daylight hours. Cobia have been observed spawning in estuaries and shallow bays. (FLMNH, 2003)

#### **5.3.1 Effect Determination**

Since migration and spawning periods will occur outside of the project area and construction timeframe, negative affects to cobia are not anticipated. Cobia that may be found in the area are capable of moving to other suitable habitat in and around Bogue Inlet outside of any direct influence from project construction.

### **5.4 Summer Flounder**

Summer flounder (*Paralichthys dentatus*) are managed by the MAFMC in a joint management plan that includes black sea bass and scup. In fact, the MAFMC designates the waters of the summer flounder as HAPC and estuaries where summer founder are identified as being commonly abundant or highly abundant (for adults) and all estuaries where flounder are present (juveniles and larvae) are designated as EFH (MAFMC, 1998). *P. dentatus* is most often found along the western Atlantic ocean from Maine to northern Florida. This species is an important commercial and recreational fish along the Atlantic coast, especially from Cape Hatteras south to Florida.

Summer flounder are bottom dwellers that prefer hard, sandy substrate, but can be found in bays, lagoons, and other shallow vegetated areas. This fish can usually be found in tidal inlets and in hypersaline estuaries. Adult summer flounders are seasonal in their range. During warmer seasons, summer flounder can be found in nearshore waters and coastal embayments. Cooler weather cues summer flounder to emigrate offshore to spawn. Spawning occurs at depths from 30 m (98 ft) to 200 m (656 ft) in shelf waters during late fall, winter, or early spring.

#### **5.4.1 Effect Determination**

Adult summer flounder spend warmer months in the project area and emigrate offshore to spawn in the winter. Juveniles first move into estuaries from February through April and emigrate from North Carolina's estuarine waters during their second fall of life. The project should not drastically influence the migrations of juveniles or adults out of

estuarine waters but may slightly influence juveniles immigrating into the estuaries. The end of the project may occur in February when juvenile summer flounder are approaching estuarine nursery areas. It has been shown that summer flounder tolerate a wide variety of physical and chemical conditions, as juvenile flounder are found in a wide range of salinities, usually over 7.4 ppt (Rogers and Van Den Avyle, 1983). Because of their tolerance to a wide range of conditions, effects are expected to be temporary and minimal to migrating and resident juveniles in the vicinities of the permit area. Furthermore, flounder are associated with sand flat areas and thus could be affected by sedimentation during dredging. Juvenile flounders' ability to move outside of the project area into vegetated areas will provide some protection for the fish. Sedimentation levels are anticipated to be low because of the low silt percentage and short suspension time of the sediment.

## **6.0 SUBMERGED AQUATIC VEGETATION**

Submerged Aquatic Vegetation (SAV) and seagrass habitats are essential to sediment stabilization and trapping, nutrient uptake and fishery habitats. Year-round coverage of seagrass species in North Carolina include both the eelgrass (*Zostera marina*) and Cuban shoal grass (*Halodule wrightii*).

In terms of their value for essential fish habitat, larvae and juvenile fishes utilize grass bed structures and trophic elements for foraging, spawning, and escaping from predation. In North Carolina, some fish species in their larval and juvenile stages are present in these beds all year-round. While other important commercial and sport fishes in their larval and juvenile stages, such as: gag grouper (*Mycteroperca microlepis*), gray snapper (*Lutjanus griseus*), bluefish (*Pomatomos saltatrix*), Flounder species (*Paralichthys* spp.), fish of the Clupeidae family and others are found in seagrass beds in the early spring and summer (ASFMC, 1997). Bay scallops (*Argopecten irradians concentricus*) are also typically found in SAV habitat.

Because of its use for foraging, spawning and shelter, SAV is designated as HAPC. The red drum is one species where SAV serves as an HAPC. Table 4.3B lists the fish species and their life stage that may occur in the SAV habitats in the project area.

### **6.1 Gray Snapper**

Gray snapper (*Lutjanus griseus*) are contained in the Snapper-Grouper Guild that includes 72 species of important reef fish. This guild is managed by the SAFMC which designates SAV along with coral reefs, live/hard bottom, and artificial reefs, and medium to high profile outcroppings as EFH. Young gray snapper are typically found close to the shore in areas with smooth, shallow surfaces like grass beds, tidal creeks and estuaries. As gray snappers mature, they move farther away from the shore and thus, more mature snappers are found at various depths between 6 and 91 m (20 and 300 feet) near underwater structures such as reefs, shipwrecks and rock ledges. Gray snappers feed mainly at night on small fishes, shrimps, crabs, gastropods, cephalopods, and some planktonic items. Between June and August, gray snappers travel in aggregations away from the coast to spawn.

### **6.1.1 Effect Determination**

Spawning of gray snapper (*Lutjanus griseus*) occurs offshore during the spring and summer and therefore, supports the winter project construction dates. The high mobility of the gray snapper can allow any fish present to move to other areas outside of the effects from construction.

## **6.2 Red Drum**

Red drum (*Scianops ocellatus*) utilize a wide variety of estuarine and oceanic habitats throughout their life cycle. Red drum are estuarine-dependent and can be found in coastal and estuarine waters of North Carolina year-round. Coastal inlets, spawning aggregation sites, and SAV are all areas that serve as essential fish habitat areas of particular concern (EFH-HAPC) for red drum. Red drum spawning is known to occur at night in or around major estuaries and estuarine passes and inlets. Spawning occurs in the fall in a wide variety of temperatures and salinities.

In the NCDMF FMP for Red Drum, its larval stage is noted as utilizing seagrass habitat during the spring and summer. Findings for the red drum in the ASMFC report indicate that the occurrence of red drum in SAV habitats vary from year-round residents to rare. The ASMFC has also reported that where seagrasses are absent, oyster reefs may replace seagrasses as important fish nursery habitat. The SAFMC, which manages red drum, designates SAV habitat as HAPC for the red drum.

### **6.2.1 Effect Determination**

During the spring, adult red drum are found along the beaches and inlets for one to two months as they move from offshore wintering grounds (NCDMF, 2001). Tagging studies of red drum report little movement from preferred habitat during the winter and few captures were obtained from inlet habitats during the winter months (NCDMF, 2001). Because red drum winter offshore and can rarely be found in the immediate vicinity of the project area during the winter, project construction is expected to have minimal, if any, adverse effect on the red drum species.

The project is not expected to negatively affect seagrass habitat utilized by the red drum. Digital aerial photographic imagery and ground-truthing prior to and after construction will provide the data needed to determine effect.

## **7.0 OYSTER REEFS AND SHELL BANKS**

Shellfish beds can be found in tidal creeks, rivers, and nearshore estuarine waters where shellfish such as oysters and clams live. In the Bogue Inlet permit area, there is approximately 185.22 acres of potential shellfish habitat (NCDMF Map C004). This potential shellfish habitat includes two different habitat strata in and around the inlet environment. Approximately 70.19 acres of intertidal hardbottom (sand) containing marsh grass or Submerged Aquatic Vegetation (SAV) without shell hash (Strata V) is located around the edges of marshes (Dudley Island) and on the eastern end of Bear Island. Nearly 15.03 acres of intertidal, hardbottom (sand), non-vegetated and with shell hash (Strata W) is located behind and throughout marsh environments of the Inlet.

According to the North Carolina Division of Marine Fisheries, Strata V is composed of 100% eastern oysters (*Crassostrea virginica*) and Strata W is composed of 98% eastern oysters and 2% hard clams (*Mercenaria mercenaria*) (Appendix 1). In Strata V, there are 24.06 shellfish per square meter and 76.82 shellfish per square meter in Strata W. The geotechnical studies for Bogue Inlet indicate that the south side of Dudley Island is eroding to the west and is exposed to erosional forces from the main ebb channel. Therefore, the Strata V habitat may no longer be conducive for the production of shellfish beds. Strata V habitat was found to have a direct correlation with low marsh habitat and was mapped as such.

According to the SAFMC, oyster reefs and shellfish banks are designated as EFH (Table 4.3C). The Magnuson-Stevens Act states that EFH includes "those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity." Therefore, shellfish banks and oyster reefs are of particular concern for fish that use these habitats as nursery areas, shelter, spawning, and foraging habitats. Three shellfish species are found in the vicinity of Bogue Inlet; the hard clam, the eastern oyster, and the bay scallop.

## **7.1 Red Drum**

In North Carolina, the SAFMC recognize oyster reefs and shell banks as EFH for the red drum. The red drum (*S. ocellatus*) is one of many important North Carolina inshore commercial and recreational species. Red drum are considered gamefish in Florida and South Carolina, but are available for sale in Georgia, North Carolina and Virginia. However, due to concerns about the stock, the SAFMC has closed the EEZ to harvest.

*S. ocellatus* utilize a wide variety of estuarine and oceanic habitats throughout their life cycle. Red drum are estuarine-dependent and can be found in coastal and estuarine waters of North Carolina year-round. All coastal inlets, spawning aggregation sites, and SAV are all areas that serve as EFH-HAPC for red drum. Shellfish habitats are important for red drum at various stages of development and may be used for such activities as nursery grounds and spawning areas. Red drum spawning is known to occur at night in or around major estuaries and estuarine passes and inlets. Spawning occurs in the fall in a wide variety of temperatures and salinities.

### **7.1.1 Effect Determination**

Section 6.2.1 discusses the effects determination for the red drum. Shellfish habitat, due to its complexity, can provide additional opportunities for the red drum. The project is not expected to negatively affect seagrass or oyster reef habitat for the red drum. Digital aerial photographic imagery and ground-truthing prior to and after construction will provide the data needed to determine effect.

## **8.0 INTERTIDAL FLATS**

The main intertidal zones of Bogue Inlet can be found at the swash platform within the mouth of the inlet, the south side of Dudley Island, and on the western end of Bogue Sound and are considered EFH (Table 4.3D). These areas are comprised mainly of sandy bottoms and are influenced by tidal changes. Intertidal habitats and resources will be better defined with a digital aerial imagery assessment and bathymetric and topographic

mapping, conducted during the summer of 2003. These assessments will quantify and identify the intertidal areas of the project area.

### **8.1 Southern Flounder**

Southern flounder (*Paralichthys lethostigma*) is not currently federally managed, but is a species that is of a concern in the state of North Carolina because it is overfished. Currently, a Fishery Management Plan for the southern flounder is being developed by the NCDMF and is scheduled for completion in July 2004. The fishery management plan should detail the EFH for this flounder species, but it is known that southern flounder can be found over sand bottoms, mud bottoms in estuaries, and coastal waters to about 40 m (130 ft) in depth. Southern flounder are estuarine dependent flounder found in the same family as the summer flounder.

Southern flounder can tolerate wide variations in environmental conditions, such as salinity levels and are frequently found in brackish bays and estuaries, marine waters, and occasionally freshwater. This species of flounder moves to offshore, deeper waters in the winter and early spring and inshore and north during late spring, summer, and fall. Spawning for the southern flounder is usually throughout continental shelf waters, from November through March. Unlike summer flounder, many adult southern flounder return to the estuaries of North Carolina after spawning (NCDMF, 2002).

#### **8.1.1 Effects Determination**

Southern flounder spend their winters spawning offshore from November to March, however, it has been reported that southern flounders “are easily accessible” in the winter (Frimodt, 1995). The species may still be present in the inlet as they emigrate to shelf spawning areas during the winter. Because the fish will be moving to waters outside of the direct influence of project construction, effects are expected to be temporary and minimal. Studies of southern flounder indicate that the species has temperature-dependent sex determination. Southern flounder eggs are found in offshore waters over the continental shelf and away from the project area. Considering that the temperature of inlet waters is not expected to change as a result of project construction, effects to sex determination of southern flounder should not occur.

## **9.0 ESTUARINE AND MARINE WATER COLUMNS AND CREEKS**

Estuarine waters, marine waters, and creeks consist of shallow subtidal areas in and around Bogue Inlet to continental shelf waters offshore of the project area. Soft-bottom, subtidal habitats consist of various percentages of sand, silt, and clay, depending upon sediment deposition patterns and exposure of the habitat to tidal flows and freshwater input. These habitats are influenced to a great extent by tides and thus have a variety of different salinities and water temperatures.

Marine water column environments and coastal waters in the project area include the beach areas and surf zones of Bear Island (Hammocks Beach State Park) and Emerald Isle. Fish species identified in this area are managed under the NMFS, SAFMC, and MAFMC. Species common in these habitats range from sharks to highly migratory tuna, and members of the snapper-grouper reef fish complex. Described below are

representative species found in marine waters that could be affected by project implementation.

Biological resources associated with water column environments include shrimp, crabs, clams, fish, and the pelagic and benthic communities that support them. Because of the variety in habitats in the project area, a variety of fish species inhabit these environments (Table 4.3E). Some representative species include blue crabs, spiny lobsters, and coastal sharks.

## 9.1 Blue Crab

The blue crab (*Callinectes sapidus*) is a highly migratory crustacean that moves among various habitats. Blue crab migration and movement are seasonal and depend on life stage, sex, maturity, and associated salinity preferences. Habitats range from high-salinity ocean waters to the lower-salinity and freshwaters of coastal sounds, rivers, and creeks. *C. sapidus* feed on plankton, invertebrates, fishes, mollusks, crustaceans and organic debris and mating and spawning occur at different times throughout the year. Blue crabs are managed by the state and are listed as species of concern by the NCDMF because of reduced fishery landings. Even though blue crabs are State managed, they have designated EFH which includes all State designated secondary nursery areas. Blue crab fisheries are North Carolina's number one fishery in value and number two fishery in pounds landed (NCDMF, 2002).

After mating, female blue crabs migrate to high-salinity waters in lower estuaries, sounds, tidal passes, and nearshore areas in order to spawn. Spawning occurs two to nine months after mating, usually from May through August, the following season. Blue crabs overwinter before spawning by burrowing into mud substrates.

### 9.1.1 Effects Determination

Due to the mobility of blue crabs, they could be present in the project area during construction. However, because of their ability to move to various habitats they can easily shift to zones outside of the project area. Therefore, influences from the project should be minimal.

Blue crabs enter areas of high salinities for spawning (usually from May through August) after first overwintering by burrowing in the mud. Blue crabs may gain added protection from influences of project construction by being buried in mud and thus, spawning and migrating blue crabs are not expected to be affected by dredging operations. Areas in direct influence by dredging operations are sand bottoms and do not contain mud bottom habitats.

## 9.2 Spiny Lobster

The spiny lobster (*Panularis argus*) are managed by the SAFMC. The EFH for spiny lobsters includes nearshore shelf/oceanic waters, shallow subtidal bottom, seagrass habitat, unconsolidated bottom, coral and live/hard bottom habitat, sponges, and *Laurencia* algal communities. Relatively stable, natural conditions are required for optimum survival of spiny lobsters which prefer habitats characterized by relatively

constant temperatures and salinities, low levels of suspended sediments, and few pollutants. Spawning season for the spiny lobster begins in February and extends through September and adults molt in February in preparation for the breeding season.

### **9.2.1 Effects Determination**

Spiny lobsters tend to avoid turbidity-prone substrates such as mud and sand bottom habitats. Since construction for the project will be in sand bottom habitats, the project is not expected to effect juvenile or adult lobsters. Furthermore, the project should have minimal effects on the spawning of spiny lobster in the project area. As stated previously, spiny lobster spawning season begins in February, which may be coincident with project construction. However, the primary time for spawning of spiny lobsters is in the summer. Additionally, spawning occurs in soft-substrate shelters, such as grass-bed ledges, since muddy and sandy bottoms are avoided. Spiny lobsters are also highly mobile and can therefore migrate to areas outside of the project influence.

## **9.3 Coastal Sharks**

The sandbar shark (*Carcharhinus plumbeus*) is one of the most abundant sharks of North Carolina and one of the most numerous of the large sharks of the mid-Atlantic. Sandbar sharks are known to seasonally migrate along the eastern seaboard (north in summer; south in fall). These sharks are known to be most abundant in North Carolina during the spring and fall months (NCDMF, 2002).

*C. plumbeus* is essentially a bottom-dwelling, shallow coastal water species that is seldom seen at the surface. The sandbar shark prefers waters on continental shelves, oceanic banks, and island terraces, but is also commonly found in harbors, estuaries, at the mouths of bays and rivers, and shallow turbid water. *C. plumbeus* is exclusively a marine species and does not venture into freshwater. It is believed that the sandbar shark favors a smooth substrate and will avoid coral reefs and other rough-bottom areas. It spends most of the time in water from 20 to 65 m (65.6 to 213 ft) deep but likely moves into deeper water during migration.

In the western North Atlantic, the bays and estuaries from Delaware to North Carolina are prime sandbar shark nursery areas. Juvenile sandbar sharks remain in the shallows until late fall at which time they form schools and move south and further offshore, then return during the summer months (FLMNH, 2003). Shallow coastal waters from Long Island, NY to Cape Canaveral, FL are designated EFH for neonatal/early juvenile sandbar sharks.

The sand tiger shark (*Carcharias taurus*) is found in the eastern and western Atlantic, the Pacific and Indian Oceans, and in the Mediterranean and Adriatic Seas. In the North Atlantic this species ranges from the Gulf of Maine to Florida and into the Gulf of Mexico.

*C. taurus* is often found in sandy coastal waters, shallow bays, estuaries and rocky or tropical reefs. Although most often found in shallow coastal waters, their range extends to water depths of 200 m (656 ft). In fact, shallow coastal waters of the east coast from

New Jersey south to Cape Canaveral, Florida are designated EFH for neonate/juvenile sand tigers and from New Jersey to Cape Lookout for adult sand tiger sharks. Sand tiger sharks have been observed resting on the bottom and have the ability to remain motionless while floating in the water column by use of buoyancy control (CSRL, 2003).

The dusky shark (*Carcharhinus obscurella*) occurs along continental shorelines where it ranges from shallow inshore waters to the outer reaches of the continental shelf and adjacent oceanic waters. Although generally a bottom feeder, it can be found from the surface to a depth of 400 m (1,312 ft). Adults of this species tend to avoid areas of low salinity and rarely enter estuaries. Young dusky sharks congregate in shallow coastal water nurseries in estuaries and bays from New Jersey to Cape Hatteras. NMFS has designated shallow coastal waters, inlets and estuaries at the Virginia/Maryland border to Jacksonville, FL as EFH for juvenile/sub-adult dusky sharks. EFH is offshore pelagic waters from the Virginia/North Carolina border to Ft. Lauderdale, Florida for adult dusky sharks.

The dusky shark is known to be highly migratory in the western Atlantic and eastern Pacific, moving north during the summer months and south in the winter. Males and females undertake these seasonal migrations separately.

The spinner shark (*Carcharhinus brevipinna*) is found nearly worldwide including the western Atlantic from North Carolina to Florida. *C. brevipinna* can be found in coastal to pelagic, warm-temperate and tropical regions of the continental and insular shelves. This species is common in shallow waters less than 30 m (98 ft), but has been found in water depths to 75 m (246 ft). EFH for spinner sharks includes shallow coastal waters from Cape Hatteras to the Florida Keys for neonate/early juveniles and off the coast of Florida for sub-adults and adults.

### **9.3.1 Effects Determination**

The sandbar shark is known to be in North Carolina waters during the spring and fall. Additionally, sandbar sharks prefer waters over the continental shelf and do not venture into freshwater. Juvenile sandbar sharks have been reported in bays and estuaries until the fall when they move offshore and to areas south of North Carolina. Therefore, it is not expected that the sandbar shark will be affected by the project.

Sand tigers may be affected by the project. However, these sharks are highly mobile and migratory and can easily move into areas outside of the project area. Due to their use of a variety of habitats and mobility, sand tiger sharks should only be minimally affected by the project.

Due to the high migration ability of coastal sharks, project effects on sharks should be minimal. Dusky sharks rarely enter estuaries and juveniles are mainly found in bays and estuaries north of the project zone.

Spinner sharks may be present during dredging in coastal and shallow waters of the project area. However, according to NMFS, important areas designated as EFH for sub-

adult and adults are coastal waters along Florida. Shallow coastal waters of Cape Hatteras south to Florida have been designated as EFH for neonate/early juvenile spinner sharks. Effects should be temporary and minimal, as spinner sharks can easily move to other acceptable areas outside of the project area.

#### **9.4 Bluefish**

Bluefish (*Pomatomus saltatrix*) are managed by the MAFMC and have life stage specific EFH designations. Applicable EFH includes all major estuaries from Penobscot Bay, Maine to the St. Johns River, Florida for juveniles and adult bluefish (MAFMC, 1998). Bluefish are an important commercial and recreational fishery in North Carolina and are most common in estuaries, estuarine water columns (sounds), surf beaches, and brackish waters. Bluefish are a voracious and aggressive species that school by size and make seasonal migrations north in the spring and south in the winter.

Bluefish migrations are complex and not completely understood as migrating fish move year-round between the South Atlantic Bight and the Mid-Atlantic Bight. Two major spawning aggregations comprise the mid-Atlantic bluefish fishery, a south-Atlantic spring-spawning stock and a mid-Atlantic summer-spawning stock. As the fish mature, they migrate to and from spawning areas located further offshore.

##### **9.4.1 Effects Determination**

North Carolina lies within both the Mid-Atlantic Bight and the South-Atlantic Bight. Juveniles in the Mid-Atlantic Bight begin to depart estuaries in October and migrate south to spend the winter months south of Cape Hatteras (the South-Atlantic Bight). Because Bogue Inlet is within the South-Atlantic Bight, but close to the Mid-Atlantic Bight, it is possible for bluefish to be in the project area year-round. However, juvenile bluefish are most common in embayments or along coastal waters, out of direct effects from the project. Adult bluefish migrate in coastal waters and offshore areas year-round and are occasionally found in embayments. Adult bluefish may be minimally affected by this project because implementation will occur during winter months when bluefish are offshore in their wintering grounds.

#### **9.5 Snapper-Grouper Complex**

Seventy-two species of reef fish comprise the Snapper-Grouper complex managed by the SAFMC. The SAFMC designates EFH for the Snapper-Grouper complex as “coral reefs, live/hard bottom, submerged aquatic vegetation, artificial reefs and medium to high profile outcroppings on and around the shelf break zone from the shore to over 600 feet” (NMFS, 1998). EFH includes the spawning area in the water column above the adult habitat, as well as the additional pelagic environment, including Sargassum, which is required for larval survival and growth.

Most of the fish contained in the Snapper-Grouper Complex are associated with coral reefs and live/hard bottom habitats. Several important species utilize Bogue Inlet for various behaviors such as nursery areas, foraging areas, and shelter areas. Some of these Snapper-Grouper complex species that may be found in Bogue Inlet include: black sea bass (*Centropristis striatus*), gag grouper (*Myctoperca microlepis*), gray triggerfish

(*Balistes caprisucus*), schoolmaster (*Lutjanus apodus*), scup (*Stenotomus chrysops*), spadefish (*Chaetodipterus faber*), and tomtate (*Haemulon aurolineatum*).

The black sea bass (*Centropristis striatus*) is a carnivorous bottom-feeder that eats crustaceans, fish, mollusks, and echinoderms (Mercer, 1989). They spawn from January to March or June in the offshore waters of the south Atlantic region. The sea bass stock south of Cape Hatteras are typically found inshore of snappers, groupers, grunts, and porgies, and known to be year-round residents. The MAFMC, as well as the SAFMC, manages the black sea bass in an offshore guild that includes the summer flounder and scup. The MAFMC designates the Atlantic coast to the limits of the EEZ from the Gulf of Maine south to Cape Hatteras, North Carolina as EFH for the black sea bass.

Sea bass are known to inhabit irregular hard-bottom areas such as shell bottoms, wrecks, artificial and natural reefs, and rock outcroppings. Juveniles and yearlings of North Carolina have been found to inhabit high salinity areas of estuaries as nursery grounds. It has been reported that the more productive nurseries were found in high salinity (>30 ppt) reef areas. (USFWS, 1989).

In general, adult gag groupers (*Myctoperca microlepis*) are found offshore on and around coral reefs typically ranging from 60 to 300 feet in depth. However, adult and juvenile gag groupers are can be found in estuaries and seagrass beds. Juvenile gags feed mainly on crustaceans living in shallow grass beds, while adult's diets consist mainly of fish such as sardines and snappers, as well as squid. Spawning of adult gag groupers occurs offshore from February to March.

Gray triggerfish (*Balistes caprisucus*) are sport fish for recreational fisheries and is also important in the commercial fisheries and aquarium trade. Gray triggerfish are known to inhabit bays, harbors, and lagoons, as well as artificial and natural reefs at depths below 10 m (32 feet). Juveniles can be found close to the surface living in *Sargassum*, and generally return to the reefs after three years. Adult and juvenile triggerfish feed on various benthic invertebrates such as mollusks and crustaceans. Gray triggerfish spawning begins in late spring and ends in the summer.

The schoolmaster (*Lutjanus apodus*) occurs in shallow, clear, warm coastal waters, with a preference for coral reefs. Juveniles are strictly found over shallow sand bottoms with or without seagrass and over mud bottom habitats of lagoons. Juveniles sometimes enter brackish water and can be found in large resting schools. This species feeds on smaller fishes, shrimps, worms, gastropods, and cephalopods. Spawning for the schoolmaster occurs throughout the spring and summer in open water.

The scup (*Stenotomus chrysops*) is commonly found in large estuaries and coastal waters. Scup are members of an offshore-wintering guild of fish whose movements, habitats, and food habits generally coincide (NOAA, 1999). This guild, managed by the MAFMC, includes the summer flounder (*Paralichthys dentatus*) and the black sea bass (*Centropristis striata*). Migrations begin around September, as schools of similarly sized fish move to deep offshore waters. Scup use several benthic habitats from open water to

structured areas for feeding and shelter. During warmer months, juvenile scup live inshore in a variety of coastal habitats and can dominate the overall fish population in large estuarine areas (NOAA, 1999). The presence of structure is important to scup, and juveniles have been known to possibly use shell beds for shelter in the winter. Adult habitats are similar to those used by juveniles, including areas with soft, sandy bottoms.

Atlantic spadefish (*Chaetodipterus faber*) are frequently found in 5 to 6 m (15 to 20 feet) of water along sandy beaches. Juvenile spadefish are common in estuaries and shallow water where they often lie on their side and resemble a dead leaf floating in the water. Spadefish can be found in large schools, with sometimes up to 500 individuals. Spadefish feed on various benthic invertebrates such as crustaceans, mollusks, annelids, and cnidarians and spawning season is during the spring and summer.

Tomtate (*Haemulon aurolineatum*) are the most abundant grunt within their range, which extends from Massachusetts to Brazil. Tomtate are more tolerant of cold water than other grunts and in their northern range can be found offshore. However, in portions of their range, such as North Carolina, tomtate can be found inhabiting seagrass beds, as well as sand flats, patch reefs, and hard rocky reefs to a depth of approximately 30 m (100 feet). Tomtate feed on small crustaceans, mollusks, plankton, and algae and spawning occurs from May through June, with eggs deposited directly into the open water.

The estuary and its marsh and seagrass habitats can be significant nursery grounds for many of the species of the complex. However, most adults and large juveniles are found in coastal and offshore marine waters.

**Table 9.1**  
**Spawning Times for Representative Fish in the Snapper-Grouper Complex**

Species	Spawning Events
Black Sea Bass ( <i>Centropristis striatus</i> )	January to March
Gag Grouper ( <i>Myctoperca microlepis</i> )	February to March
Gray Triggerfish ( <i>Balistes capriscus</i> )	Late spring to summer
Schoolmaster ( <i>Lutjanus apodus</i> )	Spring to summer (mainly July and August)
Scup ( <i>Stenotomus chrysops</i> )	May to August
Spadefish ( <i>Chaetodipterus faber</i> )	Spring and summer
Tomtate ( <i>Haemulon aurolineatum</i> )	May to June

### 9.5.1 Effects Determination

Black sea bass (*Centropristis striatus*) are generally found in estuaries from May through October (MAFMC, 1998) and are part of an offshore wintering guild that includes the summer flounder and scup. This supports the winter construction schedule since during construction, wintering adults are generally found offshore, outside the influence of project construction.

Gag groupers (*Myctoperca microlepis*), especially juveniles, can be found in estuaries and seagrass beds and are capable of moving to areas in and around Bogue Inlet, outside of project effects. Spawning of gag grouper occurs from February to March in offshore areas, in 36.6 m (120 feet) or deeper water depths. Therefore, gag grouper should not be affected by the project.

Gray triggerfish (*Balistes capriscus*) utilize a wide variety of habitats and can easily move to suitable habitat outside of project influences. Spawning times for the gray triggerfish occur from spring to summer in offshore areas near reefs, outside of the proposed dates of construction.

Juvenile schoolmasters (*Lutjanus apodus*) are primarily found inhabiting muddy bottoms of lagoonal systems, such as Bogue Sound. Schoolmasters near the mouth of the inlet are capable of moving to other suitable habitat within the sound or offshore to escape effects from project construction. Spawning for the schoolmaster occurs from the spring to summer and thus, will not be affected by construction.

Scup (*Stenotomus chrysops*) are most common during the summer and early fall in larger estuaries. As stated previously, scup are part of an offshore-wintering guild that moves to coastal and offshore waters of North Carolina in the winter. Some juveniles follow the adults while others remain in the deeper inshore and estuarine waters throughout the winter. Since spawning and migration periods occur outside of the construction timeframe (November 16<sup>th</sup> through March 31<sup>st</sup>) the project is not expected to affect the species.

Juvenile spadefish (*Chaetodipterus faber*) are common in shallow waters that include intertidal flats, subtidal creeks, and sounds. Atlantic spadefish may potentially be affected by this project, however, impacts are expected to be minimal. Juveniles are capable of swimming to other shallow water estuarine habitats outside of the project area. Adult spadefish are most common in coastal waters and around wrecks, at depths of 4.5 to 6 m (15 to 20 ft). The depths of the project areas are generally between 2.4 and 3.6 m (8 to 12 ft). Adult spadefish should only be minimally affected by this project. In addition, spadefish spawning (spring and summer) should not be affected because it is outside of project construction dates.

Tomtate (*Haemulon aurolineatum*) can tolerate a wider range of temperatures than many other species, and thus it is possible for this fish to be present in the project area during the winter months during construction. Effects are expected to be temporary and minimal based on the capability of tomtate to move to other suitable habitats outside the influence

of project construction. Tomtate can move to marine coastal waters, offshore marine waters, or to seagrass beds during construction. Spawning for the tomtate supports the winter project construction dates because it occurs from May to June, and thus will not be affected by the project.

Other species of the snapper-grouper complex could occur in Bogue Inlet during construction. However, since most species in the snapper-grouper complex are reef fish found in warmer waters near coral reefs, the effect of the project on these species is expected to be negligible. Those individuals found inshore usually occur near structure such as oyster reefs, seagrass beds, docks, and piers outside the direct boundaries of the project area. Furthermore, spawning events for the snapper-grouper complex usually occur offshore and outside of the project winter construction months. Therefore, effects to the snapper-grouper complex are expected to be minimal.

## **9.6 Bluefin Tuna**

Bluefin tuna (*Thunnus thynnus*) are highly migratory fish species that are managed under NOAA/NMFS. Bluefin tuna represent several species that encompass NOAA's designation of 'highly migratory' species. Bluefin tuna, like the other migrant species, seasonally come close to shore and can tolerate a wide range of temperatures. Spawning, eggs, and larvae of Bluefin tuna are found in pelagic and near coastal surface waters from the North Carolina/South Carolina border south to Cape Canaveral, Florida from 15 miles from shore to the 200 m (656 ft.) isobath (NMFS, 1999) although juvenile/sub-adult and adult Bluefin tuna have designated EFH in offshore pelagic waters. Bluefin tuna prey consists of small schooling fishes (anchovies, sauries, hakes), squids, and red crabs. Spawning has been reported to only occur in the Mediterranean Sea and the Gulf of Mexico.

### **9.6.1 Effects Determination**

Since Bluefin tuna are highly migratory and most often oceanic, occurring outside of shallow coastal waters, they can easily move to areas outside those affected by the project. Therefore, Bluefin tuna can be expected to be minimally affected by the project.

## **10.0 SHALLOW SAND AND MUDDY BOTTOMS**

The MAFMC classifies mud bottoms of estuarine areas as EFH (Table 4.3F). Muddy and sandy bottoms are characteristic of estuarine habitats. Mud and sand bottoms can be found throughout Bogue Inlet, and can contain important estuarine flora and fauna that utilize the areas for various behaviors. One of the most important uses is as a nursery area.

Fish, such as the red porgy, red snapper, and schoolmaster, can be found in habitats with sand or mud bottoms. Even though this habitat is designated by the MAFMC as EFH, NMFS does not recognize this habitat as EFH for the Federally managed species found in mud bottoms. For example, the species found in the Snapper-Grouper guild can be found over mud bottom habitat but instead NMFS recognizes marine waters as EFH for the snapper-grouper complex.

## 11.0 SUMMARY

Several mitigation and avoidance measures have been incorporated into the project to prevent and limit permanent impacts to EFH and HAPC. These measures include construction of the project during the winter months (November 16, 2004 through March 31, 2005); the use of a cutter suction dredge; the construction of a sand dike to immediately replace intertidal habitat; use of well-sorted sediment containing a low silt percentage and high sand content.

Conducting the project during the winter months will significantly reduce the effects to fish spawning periods, since most fish spawn either during the summer months or in offshore areas. Winter construction times also support most of the emigrations and immigrations of fishes through the inlet which occur outside or towards the end of the expected construction times.

The use of a cutter suction dredge is expected to lessen the effects of dredging on fish in the area. The noise and vibration created from the dredge should keep fish out of the project area. Finfish are capable of swimming to more suitable habitats outside of the project area to avoid the effects from dredging construction.

Due to the dredging of the new inlet channel, approximately 47.6 acres of habitat of the current ebb tide delta is expected to be impacted as it will be modified from shallow subtidal habitat to subtidal habitat. Impacts to the shallow sub-tidal habitat of the ebb tide delta are anticipated to be offset by the addition of 127.5 acres of shallow subtidal and intertidal habitat that will reform, over a period of 4 years, around the west end of The Pointe shoreline once the sand dike is installed. In addition, the accumulation of the reformed spit will provide an additional 101.9 acres of subtidal and intertidal habitat adjacent to the impact area. Supplementary supratidal and intertidal habitat along the existing channel location will replace approximately 20 acres of subtidal habitat with the construction of the sand dike. Approximately two acres of intertidal habitat, however, will become upland habitat at the Emerald Isle edge of the sand dike.

In addition to the immediate replacement of intertidal habitat at the sand dike location, the low percentage of silt is expected to yield a low suspension time of the relocated sediments. Low suspension rates mean that turbidity levels should remain low and limited to the construction area. If turbidity levels remain localized and well below the state standard of 25 NTU, effects to fish are expected to be minimal and temporary.

Previous digital aerial imagery was conducted in June 2003, however, the imagery did not meet the preferred quality (i.e. high glint on surface waters, reflection, and color). The images were still found to be adequate for usage in the pre-construction habitat mapping efforts. However, additional pre-construction digital aerial photographic imagery to assess changes in habitat types associated with the project is expected to occur in spring 2004. Post-construction aerial imagery will be obtained via fly-overs eighteen months after construction. Information provided from these efforts will be three-fold, to assist in identifying: 1) assist in identifying habitat changes and/or loss in intertidal and subtidal habitat; 2) loss and/or gain of SAV and 3) loss and/or gain of shellfish habitat.

Post-construction and project area mapping will assist in determining and quantifying possible impacts from the project to EFH and HAPC habitats.

Air space above Bogue Inlet is controlled by MCB Camp Lejeune, which severely limits time and availability of fly-overs for data collections in spring 2004. In the event that air space above Bogue Inlet is restricted to government issued airplanes, aerial imagery may not be available.

Ground-truth investigations of SAV and shellfish habitats will be supplemental to pre- and post-construction aerial photography. Bathymetric and hydrographic transect surveys will also be performed to document any significant impacts due to the conversion of the old channel to shallow subtidal and/or intertidal habitat from deep subtidal habitat.

Subtidal and intertidal habitat is known to provide an important food resource to finfish that utilize the area. Monitoring efforts will identify the infaunal species found in the subtidal and intertidal habitats of the existing and proposed channel alignments before construction. A benthic monitoring plan is currently in place to collect data during pre-construction and for 3 years post-construction. However, the Town of Emerald Isle is considering the benefits of working with local universities to evaluate a research orientated infaunal study in lieu of post-construction monitoring. The research conducted by local universities (namely UNCW) will provide a better understanding into the life history, seasonal recruitment, movement, success of adults and the recolonization of benthic invertebrates.

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